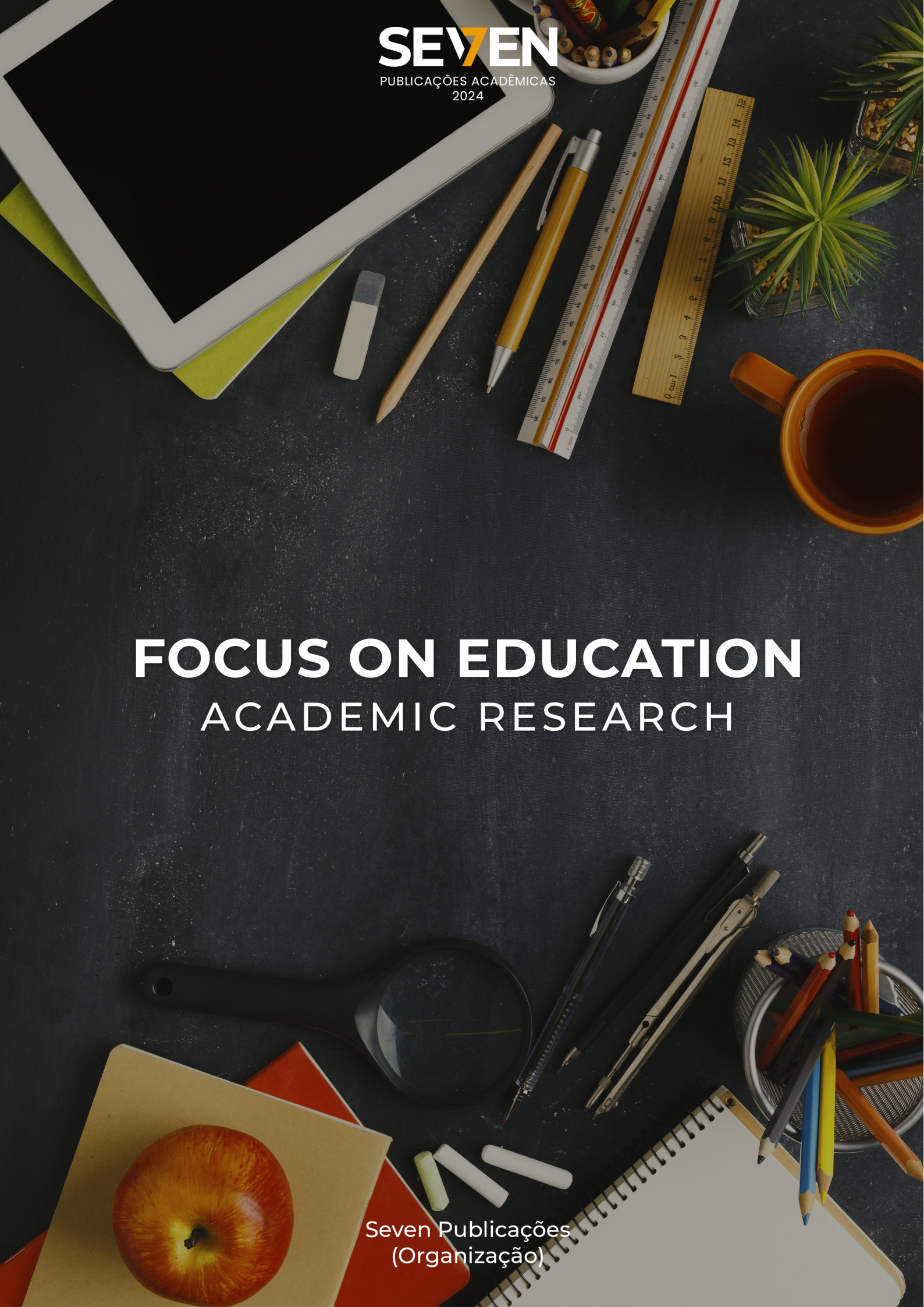


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Physiotherapy students at school: The challenges and potentialities of a collaborative action with elementary school children

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Rosana Niederauer Marques[1], Everton Ludke[2], Andressa Betat[3] and Cássio da Silva Quirino[4]

ABSTRACT

This article aimed to discuss the perceptions of students about training activities in the Physical Therapy course, as well as to analyze their ability to propose school activities that improve children's performance. The participants are 15 students of the Physical Therapy course at the Federal University of Santa Maria (UFSM) who, during the second semester of 2016, attended the discipline called Physical Therapy in Child Health, which aims to propose psychomotor activities that improve the performance of students. The practical work was developed in two Municipal Elementary Schools, with 19 children who attended these schools, located in the municipality of São João do Polêsine, central region of Rio Grande do Sul. The methodology of the work has a qualitative character, where the analysis is based on the principles of the narrative interview of Richardson (2011); Clandinin and Connely (2011); Jovchelovitch and Bauer (2004); Josso (2004). It was concluded that, in the perception of the students, the work developed is relevant in the professional training of physical therapists, mainly because they observed that it has generated positive impacts in the school community as well as in the academic community.

Keywords: Learning disorders, Attention, Stimulation.

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INTRODUCTION

The beginning of the school trajectory is fundamental for the development and construction of the child's identity and learning processes, considering that it is at this stage that values and beliefs are built in a significant way. From this perspective, it is the responsibility of the school and the teachers to develop activities that enable this construction, based on the development of the student's psychomotor skills to enhance feeling, thinking and acting.

On the other hand, it is observed that not all teachers are properly prepared for this task. It is in this bias that the contributions of specialized professionals, such as the physiotherapist, who studies and holds knowledge about neural and motor development, and can work in the field of child health, are inserted. When the knowledge of neuroscience and education is combined, it is to be expected that specific actions of psychomotricity can prevent learning disorders in school-age children. It is noteworthy that in the academic training of physical therapists, these aspects are incipient in view of the restricted literature on the subject.

Studies developed by Piaget (1976; 2003); Vygotsky (2003; 2005); Bee (1997); Mahoney and Almeida (2004); Berger (2003), Papalia and Olds (2000), among others, show the importance of child stimulation for the development of motor skills, with repercussions on school learning. Studies that show the importance of involving university students in research and extension work are also not new and there is a wide range of authors who write about this topic: Almeida and Soares (2003); Santos and Almeida (2001); Teixeira (2008); Benites and Boer (2015).

Santos (2000) points out that in an extremely competitive world, the university needs to be concerned with students, promoting their integral development in order to achieve the level of excellence that society demands. Almeida, Soares and Ferreira (2002) add that the establishment of an appropriate academic and social environment for the integration and development of the student will not be enough if it is not perceived by the student as a propitious context and as an opportunity to experience it actively. Your integration will be greater, as you perceive congruence between your expectations and what the university provides to achieve the intended objectives. However, only knowledge about the factors that involve this interaction can provide subsidies for the implementation of preventive and development actions. These arguments reinforce the understanding of the authors of this study regarding the need to integrate Physical Therapy students in extracurricular activities.

The National Curriculum Guidelines (DCNs) for the Physiotherapy course indicate that specific practical activities should be developed gradually from the beginning of the course, and should have increasing complexity. This document also determines that the contents of the course should include the study of man and his social relations, of the health-disease process in its multiple determinations, contemplating the integration of psychosocial, cultural, philosophical,

anthropological and epidemiological aspects guided by ethical principles. (BRAZIL, 2002).

In this study, we analyzed the perceptions of students regarding training activities in the Physical Therapy course that train the future professional in Child Health, in their curricular discipline, Physical Therapy in Child Health, whose objective in the Pedagogical Project of the Course, is to relate psychomotricity to cognitive acquisition and formal learning of children from 0 to 6 years old. proposing activities that optimize this objective. (UFSM, 2016)

METHODOLOGY

The research has a qualitative approach and is narrative in nature. The qualitative approach is anchored in Minayo (2013) who, according to this author, this type of research works with the universe of meanings, motives, aspirations, beliefs, values and attitudes, which corresponds to a deeper space of relationships, processes and phenomena that cannot be reduced to the operationalization of variables.

The participants were 15 students, 5 men and 10 women, with an average age of 20 years, students of the 5th semester of the Physical Therapy course at the Federal University of Santa Maria (UFSM) who, in the second semester of 2016, attended the discipline Physical Therapy in Child Health. The intervention was carried out in 19 children of 4th and 5th grade, from two elementary schools, located in the municipality of São João do Polêsine, central region of Rio Grande do Sul.

The *corpus* of analysis composes 5 narratives written by the students about the intervention carried out in the aforementioned schools. These narratives were selected according to criteria of significance, i.e., texts that best contemplated the content also manifested by other participants. In the denomination of the narratives, a pseudonym was assigned to the academics, and in the other references the participants are identified by A (academic) followed by a number.

Richardson (2011) considers the narrative as an unstructured interview in which the person exposes important points of the topic in focus. The researcher's role during this process is to guide and stimulate. Jovchelovitch and Bauer (2004) explain that, in narratives, people remember what happened, narrate their experiences in a sequence of facts, find possible explanations for it, and build a chain of events of a personal and social nature.

Nóvoa and Finger (1988) explain that a professional is constructed throughout his or her trajectory in such a way that learning is often related to teaching. With each new student, client or person served, new possibilities of getting to know the other and oneself arise.

Josso (2004) understands that narratives favor a set of learnings that go far beyond a process of self-knowledge, so that the writing of a narrative corresponds to a process of knowledge of the subject's formation throughout life. To highlight what is at stake in this writing are the two main axes that will organize the reconstitution of a set of reflections built from the observations made in favor

of a body of lived experiences.

The narratives, even if generated within subjectivity, are social models of the genre, valued by the narrator, points out Josso (2004). Thus, the challenge of writing the narrative raises questions about the writing of experiences and about the writer's positioning. According to the author, there are three axes that make it possible to explain the nature of these questions: (I) writing as an art of evocation; (II) writing as a construction of meaning; (III) writing as research. It is noteworthy that, in this study, the emphasis was on writing as research. There is, therefore, a reflection to be made on the choices of the episodes presented by the narrator according to the importance attributed to them in the training process.

Narrative research as a way of understanding personal and social experience is explained by Clandinin and Connely (2011). For these authors, the construction of narrative research should contemplate temporality, people, action, certainty and context, aspects that were observed in the description and analysis of the narratives. A brief explanation of certainty by the authors is that, in narrative thinking, interpretations of events can have a provisional meaning, usually expressed with a type of uncertainty, about the meaning of a given fact.

RESULTS AND DISCUSSIONS

The narratives presented in this text describe the perceptions of Physical Therapy students in relation to the application of Vitor da Fonseca's protocol (Psychomotor Battery – BPM) in a group of 19 children and the meanings attributed by them to the experience of dealing with formal education. In the course of the narratives, it is possible to identify common points regarding the events, challenges, obstacles and their possibilities of overcoming in view of the socio-environmental, historical and cultural context in which the work was developed.

NARRATIVE 1- WESLEY'S DISCOVERIES AND ADJUSTMENTS (A1)

This narrative is presented in three fragments of text. In the first fragment, A1 expresses satisfaction with his first experience in working with children and recognizes the importance of stimulation for the student's learning.

> During the time I lived at the school [...] I can say that I witnessed a new reality of work, because until now, I had not had contact with children, as a student of Physiotherapy at UFSM, so I consider the new experience very gratifying. I was able to notice that working with children involves many aspects related to motivation, playfulness and conversation. I also showed that patience and stimulation are very important factors with regard to the learning of students in the age group in which we work (A1).

In addition to the satisfactory appreciation of the work developed, A1 manifests its integration in the university context of UFSM. The analysis that is made here is that the way in which this

experience is lived depends both on the support of the university and on the individual characteristics of each student. Consequently, students may have different experiences concomitantly with the requirements of the course they attend, what the university can effectively offer, and personal characteristics (TEIXEIRA et al., 2008). In the specific case of A1, there seems to be agreement between feelings and thoughts in relation to the university and the course. It is understood that professional identity is built throughout the life trajectory of each person, but it begins, to a large extent, in university education, in the context of the undergraduate course, to the extent that the student is confronted with theories and practices. The practice allows us to recognize the importance of having studied certain authors in order to achieve effectiveness in the work, personal fulfillment and satisfaction of the public served.

In the following excerpt, A1 refers to the work developed at school, emphasizing aspects of motor skills in relation to children's cognitive activities.

> As for the psychomotor factors evaluated, I noticed that in the group studied, the activities that involved broad motor skills, as in the case of the assembled circuits, drew much more attention in relation to the cognitive activities, which often ended up generating a certain dispersion during the tasks that involved a little more concentration. With regard to the work developed, we tried our best to apply circuits and mixed activities so that in addition to the child feeling stimulated by activities of his liking, he worked on this combined with the mental side, so that his learning was as fun as possible (A1).

Several authors understand that an activity proposed in the form of games motivates children more because it is a pleasurable way to perform activities that involve cognition and concentration (FERNANDES, 2014).

Throughout the third fragment of the narrative, A1 highlights the relevance of playful activities in student learning, in this case, mathematical learning.

> I believe that if there is a work in which stimulation is the keyword, the tendency is that the student only grows with regard to his cognitive activities, because he demonstrates that he takes seriously any and all types of play that challenge him to seek new solutions and new means of solving problems. Therefore, it seems to be very valid to present the knowledge to him in a lighter and more interesting way. Speaking of the evaluative aspect, I believe that the collection of results with regard to mathematical activities is still very subjective due to the short contact time between us and the children. However, I affirm that with the progress of the activities, the children became more and more relaxed and, above all, competitive among themselves, which demonstrates that in the course of the work, the students took what was proposed to them more and more seriously (A1).

In this fragment, it is observed that A1 identifies psychomotor stimulation as a primary factor for the child's learning, as well as its subjective character. It also identifies the process of development and growth of students during the activities. These observations are in agreement with what Papalia and Olds (2000) say about motor skills. The authors understand that the basis for global and fine motor skills is established in the first years of schooling, and it is during this period that

children considerably increase their motor repertoire and acquire the models of movement coordination essential for later skills.

NARRATIVE 2- IMPORTANCE OF PSYCHOMOTRICITY IN JULIA'S UNDERSTANDING (A2)

> The so-called "traditional pedagogy" is based on a dualistic view of the human being, which divides it into two distinct parts: body and mind. With the study of psychomotricity and the experience acquired during the semester, it was possible to notice that this concept is wrong. Considering the individual as a whole is of great importance to the learning process. It was observed that the teaching of mathematics associated with the use of games and games is effective, making it more attractive and closer to the child's reality. It was noticeable that with each class, the children became more participative, and this work may have been the beginning of a change in their perspective in relation to mathematics (A2).

A2's statement "The so-called 'traditional pedagogy' is based on a dualistic view of the human being, which divides it into two distinct parts: 'body and mind'", finds theoretical support in the arguments of Kolinyak Filho (2010), when he states that the traditional school has separated the work in the classroom, which involves the mind and motor activities in physical education, performed outside the classroom, in larger spaces, intended for physical exercise to control and discipline the body. In this conception, the author argues, the body is a mere support for the mind, which represents the essence of the human being. However, psychomotricity studies show that the handling of these concepts, body and mind, used as distinct parts, is misguided. Considering the individual as a whole, as a unit, is a *sine qua non* condition for the effective learning process.

The dimension of the game, expressed in the proposition of A2: "It was observed that the teaching of mathematics associated with the use of games and games is effective, making it more attractive and closer to the child's reality", among other authors, can be explained by Vygotsky (2003); Boer and Oliveira (2014). Vygotsky (2003) understands that for children, the game has an important meaning when it corresponds to their age, their interests and, especially, when it includes elements that lead to the development of habits and skills. The author explains that in games with rules, children organize higher forms of behavior that are usually linked to problem solving, conjecture, wit, and creativity. Rosa (2008) states that the balance between the ludic function and the educational function becomes the objective of the game. The educational function of the game gives the student the opportunity to learn by playing and, for the teacher, the game is a didactic resource that he uses at different times. In the classroom context, learning with the game can involve the production of knowledge and this makes the environment rich in meanings, especially for the student. Boer and Rodrigues (2014) understand that pedagogical games, in addition to being learning resources, are also instruments for teaching and evaluating school content. The authors consider that playful education is important for the intellectual and moral development and sense of solidarity of the child, as well as for the development of motor skills and the acquisition of new knowledge.

> Finally, the semester had great relevance as a personal experience. In the evaluations, it was possible to put into practice Vítor da Fonseca's tests, previously seen in the classroom, and thus understand them more deeply. In each class, we were challenged to create and carry out activities, which stimulated our creativity and personal relationships, as well as the creation of bonds with the children. This was an experience that can be taken to academic and professional life, providing a basis for future care and providing a broader view of the individual, understanding how psychomotor factors influence development (A2).

This fragment of A2's narrative can be based on the Piagetian thought of cognitive development, considering that the children were in the age group of 9 to 12 years, therefore, in the concrete operative stage (PIAGET, 2003; LA TAILLE, 1992; RIES, 2001). The concrete operative stage comprises the age group from 7 to 11 years, in this period the child can solve problems logically in the present, but is not yet able to think in abstract terms. This period is based on real experience and the child's reversible internalized action, which is not observed in the preoperative stage (PIAGET, 2003; LA TAILLE, 1992; RIES, 2001). According to these same authors, in the operative stage, egocentrism decreases and the notion of conservation of the object's properties occurs: quantity, length, number, weight, density, area and volume. The child associates these interconnected concepts with the notions of time, speed and space, but always being observed and having tangible materials. The child is already able to make relationships between two or more objects, but following a sequence of facts to arrive at the total. At this stage, it is expected that the child will be able to combine, order, and transform objects and actions mentally.

NARRATIVE 3- CHALLENGES AND POSSIBILITIES FOR ROBERTA (A3)

> After all the evaluations that were made, it was clear that students are more interested in mathematics when they are stimulated in a different way than usual, the difficulties become easier to be solved when this "world" of the classroom becomes wider. Of course, it's a lot more fun to solve an addition account while kicking a ball on goal, than it is to solve it in class, sitting in class and often dispersing. I could see in the students I evaluated throughout this semester that their ability to interpret, the way they interact with their classmates were being modified, they began to pay more attention to what was being asked and began to show more interest in learning. It was very important to be able to see how much we can combine the two areas, health and education, which seemed to be so different, but which come together perfectly, thus being able to help children in their performance. Listening to the children's reports saying that they really enjoyed the activities and that they served not only for fun, but for each one's learning, this made it worth every second we spent together (A3).

A possible interpretation of what was observed by A3 in relation to the evolution of children can be explained by Erickson's (1998) theory of psychosocial development. Considering the age of the children who participated in the study, they are in the fourth stage of psychosocial development, a phase that is linked to constructivity *versus* inferiority. According to the author, at this stage, there is a positive resolution of the previous stages and corresponds to the period in which the child is being taught to read and write and attending school, which provides interaction with people who are not

their relatives, which will require greater sociability, teamwork, cooperativeness and other necessary skills.

In A3's statement, "hearing the children's report saying that they really liked the activities and that they served not only for fun, but for each one's learning, this made it worth every second we spent together" reinforces Erikson's (1998) idea that a child needs confidence to feel capable. autonomy and initiative. For this, the child requires an environment that allows socialization, teamwork and cooperativeness. Also, according to Erickson (1998), if the child has difficulties, the group itself may criticize him, starting to experience inferiority instead of constructivity. In that case, you may experience feelings that lead to cognitive blocks. However, according to the testimonies of the Physical Therapy students and not only from A3, these aspects were not identified, on the contrary, the intervention was carried out in a friendly and trusting environment, thus contributing to the social and cognitive development of the children.

NARRATIVE 4- EVELISE'S LEARNINGS AND DREAMS (A4)

> During the course I learned a lot from the students, I learned to be patient, to know how to listen to the little ones, to interpret their difficulties and gestures, to identify and analyze between the lines to be able to work around and try to improve certain situations that I was not used to. I liked the discipline because it took me out of my comfort zone, the students were very agitated and very smart, which forced us to be creative and dynamic with them. I learned that mathematical stimulation is essential for learning, not only mathematics, but also for the development of concentration, spatial-temporal notion, motor skills, among other aspects. I would very much like these children to continue to receive support and assistance, as the difference between the first and the last visit was remarkable. The students were more concentrated, more willing and receptive to carry out the activities, they were enjoying learning, which is extremely important in the construction of the human being. I am grateful for the opportunity to be able to participate in this educational circle in a city in the countryside, because this way we can identify social, cultural and educational differences (A4).

The statement of A4, "I learned that stimulus is essential for learning, not only mathematics, but also for the development of concentration, spatial-temporal notion, motor skills, among other aspects, can also be explained by Piaget's cognitivist theory.

Piaget (2003) understands that human phenomena are biological in their roots, social in their ends, and mental in their means. For this author, the changes that occur in the human being are due to cognitive functioning, it is related to the evolution of mental structures and how children adapt to their environment. Piaget (1976; 2003) explains that cognition develops in stages, which occur in due time, but depend on the correct stimulation that is given to the child. Thus, according to Piaget's theory, it can be understood that the learning process happens from the inside out and the more the child develops, the more he learns (PULASKI, 1986; RIES, 2001; LA TAILLE, 1992).

A4 also reinforces the feeling of satisfaction with the work developed "in a city in the countryside". This is in accordance with the appreciation of most academics and refers to one of the

functions of the university, which is to provide services to the community, articulating teaching, research and extension activities as part of the human work carried out by the university, in its institutional and social role. The university-school integration is, therefore, a methodological alternative to mediate intervention projects with interdisciplinary pedagogical practice in the field of education and health.

NARRATIVE 5 – MÁRCIO'S INTERVENTION (A5)

This narrative is analysed in three interrelated and complementary fragments. In the first fragment, A5 refers to the application of mathematics exercises to children.

> From the beginning, we seek to develop exercises related to mathematical and logical reasoning, concentration, attention, decision-making, creativity, among others. Through these exercises, we aim to identify these factors and develop them. Often, trying to guide the students was not an easy task, especially in activities that did not involve broad motor skills, however, all the proposed activities were carried out successfully. It can be said, with certainty, that some students presented greater difficulty for some activities performed, such as activities that involved logical and mathematical reasoning. I think that even if for a short period, the stimuli we offered to these children were beneficial (A5).

In the narrative "Often, trying to guide the students was not an easy task, especially in activities that did not involve broad motor skills, however, all the proposed activities were carried out successfully", it shows the challenges of the work developed with the children. For physiotherapy students, entering a classroom and coordinating teaching activities is something innovative and at the same time educational because it is a formative moment, of knowing the limits and characteristics of childhood. These aspects can also be identified in the following excerpt:

> Being able to experience the importance of different ways to stimulate an individual's learning, at the beginning of their training, was something that had not been provided to us until then. Knowing some tests, games, games and exercises aimed at psychomotor development was extremely significant. Identifying difficulties that the literature proposes to occur in a given age group if they materialize in practice was equally important and surprising (A5).

The activities developed in the school are related to the contents worked in the discipline Physiotherapy in Child Health. This type of work was offered for the first time and generated favorable impacts on academics, as already mentioned in this text. In this proposition, "Identifying difficulties that the literature proposes to occur in a certain age group, if they materialize in practice was equally important and surprising", A5 observes, in practice, theoretical information emphasized by the specific literature of the course.

In the following excerpt, A5 reaffirms a positive appreciation of the work developed and highlights the importance for the academic training of physical therapists.

> For a short time, we were able to interact with the students of the La Salle School and

> developed and mediated activities that proved to be important in their learning. I believe that all this experience was very valid and being receptive to new proposals and information is fundamental for the highest quality of our training as academics (A5).

Demo (2011) argues that those who teach should also do research and those who research should also teach. In this conception, the work reported here is coherent with teaching and research practices, showing that there is no rupture between them, even if research does not always have an immediate and direct application in society.

FINAL THOUGHTS

The objective of this study was to analyze the perceptions of students regarding training activities in the Physical Therapy course that enable future professionals in Child Health to propose school activities that improve student performance.

A general conclusion regarding the participation of Physical Therapy students in teaching activities confirms the need to relate theory to practice and the need to associate research with teaching. For the students, the experience allows the individual to have greater security regarding the choice of course and the opportunity to fulfill their aptitudes, interests and expectations in relation to the profession. In practical terms, the way in which this experience was experienced by the students had a positive impact on the school community, reinforcing the university-school integration.

The data collected in this study also corroborate a research carried out by Igue; Bariani and Milanesi (2008) in which a significant part of the students interviewed stated that they had begun to be interested in the course, to the extent that a broader knowledge of the field of activity and the type of work they could develop became clear. That is, to the extent that they knew and experienced certain practices of the course, they felt capable of continuing to explore it. The authors add that knowing the reality experienced by the students is a way that makes it possible to identify the patterns of experiences, consistent or not, to their success.

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Emotional health: A study with school managers in Santa Catarina

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ABSTRACT

This study aims to analyze the situations and demands experienced by school managers of public schools, who work in the Regional Coordination of Tubarão (CRE) of Santa Catarina (SC), in order to contribute to the improvement of their emotional health. Seeking to identify the responsibilities of the role and its importance for improving the quality of school education in their community. This is an applied research, with an exploratory approach, through bibliographic and documentary survey, with semi-structured interviews conducted with managers of the CRE of Tubarão/SC. In view of the information gathered by this research, it was possible to understand that the school manager assumes a significant role in the school context and that his performance has a considerable impact on the improvement, or not, of the teaching offered, as well as on the promotion of student learning and in all aspects of its development and in the formation of an educational environment favorable to teaching. The discussions presented demonstrate the complexity of the aspects that involve the administration of educational spaces in a democratic and participatory way. It is concluded that the managers participating in this study, even in the face of the challenges of their attributions and responsibilities placed in the role of school manager, do not measure efforts to carry out a work of excellence, which takes place through the constant search for improvement in the teaching offered and in the interaction with the entire school community with the objective of improving education. It was concluded that, necessarily, the function requires managers to be able to deal with pressure, strategic knowledge, and conflict resolution, but it is understood that the lack of professional support affects their emotional health and personal life. This study is extremely relevant, because an unmotivated manager will hardly be able to motivate his team. And actions should be thought of by the coordination in order to minimize the manager's work overload for a better quality in the educational process.

Keywords: School Management, Public School, Emotional Health.

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INTRODUCTION

The present work is interested in contextualizing the emotional health of school managers, a topic that has been little studied, but with great importance for school management professionals, especially in public schools, due to the most varied demands of the school environment. Managers need to verbalize their anxieties and concerns about the function, understanding the challenges that arise on a daily basis.

The interest in the theme of this study was due to issues experienced in the management practice of a public school. The author of this work has been working as a physical education teacher since 2007, at the Department of Education of the State of Santa Catarina (SED/SC), having become effective in the position in 2014, working at the João Teixeira Nunes Basic School - Tubarão (SC). In 2019, noticing many unmet desires of the school community in relation to democratic school management, and having an election process in that year, the author ran for the position and was appointed to be in charge of school management in 2020/2023.

However, in 2020 with the pandemic, it became an even greater challenge to occupy the position of "manager". The changes in educational service and guidance to parents and teachers online have brought a big difference in the manager's professional and personal growth. This period brought a certainty that any adversity ahead of school management can be overcome and each new challenge and decision to be made must be carried out with caution and wisdom.

Based on the experience with other managers, the exchange of group experiences, reflections and discussions in the face of bureaucratic demands and the daily demands of schools, a scenario of demotivation and emotional problems that can develop psychosocial diseases can be perceived, leading some professionals to take medication for anxiety and depression. Because, in addition to reconciling administrative and pedagogical practices, there are still health standards, social distancing and online and face-to-face classes resulting from the COVID-19 pandemic.

As stated by Silva (2021), the reality imposed on the organization of the school, in the period of the pandemic, requires new perspectives on the experience of school management, especially in the way pedagogical, administrative, financial and relational proposals are conducted.

Thinking rationally, the school manager, most of the time, is a teacher who has changed functions, and, when he takes office, he lives without knowing how to do, how to act in daily challenges. It is in practice that one really learns to be a manager, improving oneself and developing necessary skills, which the manager was not aware of before taking the position. This daily routine constantly affects the emotional health of the people who are in it.

It is understood that, in the exercise of his main function, the manager fulfills the function of mediating conflict situations in the school community, which leads to an emotional overload, which can lead to health problems. According to James (2015), emotional health is being able to

intentionally cultivate positive emotions, use personal strengths, know how to solve problems, develop habits to breathe correctly and, above all, recognize emotions in oneself and also in others. In short, emotional health is essential for the development of life, and those who work with education know that they need to have emotional health to deal with all the difficulties faced.

In view of the context presented, the research problem arises: how do school experiences and complexities affect the emotional health of managers who work in state schools in Santa Catarina (SC) in the Regional Education Coordination (CRE) of Tubarão? To answer this problem, the objective of this research is to analyze the situations and demands experienced by school managers who work in the CRE of Tubarão, in order to contribute to the improvement of their emotional health.

This work is justified due to the few studies found so far that analyze emotional health from the perspective of school managers, since "most research focuses on teachers" (MAZON, 2012, p.39). In this sense, it is necessary to research and debate this theme, as a way to broaden the discussions in relation to school management /education/emotional health.

THEORETICAL FRAMEWORK

DEFINITIONS OF DEMOCRATIC SCHOOL MANAGEMENT

To define school management, we resorted to the concept pointed out by Luck (2017), who states that school management is a process of mobilizing the competence and energy of collectively organized people so that, through their active and competent participation, that is, the associated and cooperative work of people in the analysis of situations in decision-making.

Still citing Luck (2017), the author conceptualizes management as part of the assumption that the success of a social organization depends in part on the mobilization of the constructive and joint action of its components, through the associated work, through reciprocity that creates a "whole" guided by the collective will. It is a fundamental condition for the complexity and importance of your goals and processes.

Also according to Luck (2017), like any organization, it is necessary to have management so that the objectives are achieved. In the educational field, school management is a pertinent subject for all those involved in the educational process.

Menezes (2018) states that management is a process, by which the organization is managed, and by which decisions are made considering the existing variables, such as environment and available resources. In this context, the term school management emerges, replacing the term school administration. Management means technique, hierarchy, and fragmentation, both of which are based on authority and power. Libâneo (2007) declares his preference for the term school management

because it comprises a socio-critical view of management, which proposes inter-relationships and brings people together.

"Considering the intentional nature of their actions and the social interactions they establish among themselves and with the socio-political context, in democratic forms of decision-making" (LIBÂNEO, 2007, p. 324).

For Oliveira and Menezes (2018), the school manager, in the political aspect, exercises a certain autonomy that demands a close relationship with the community, with parents and guardians, and with organizations that work in parallel to the school.

> School management was conceived in this way, in Brazil, after the Industrial Revolution, twentieth century, it was necessary to have sufficient and qualified labor to work in the labor market, which brought a technicist model of education to the country. After this demand, it took years for the Democratic Rule of Law to become responsible for education, in order to promote a "public, free and quality education" (VASQUES, 2018, p. 63).

In view of this conception, it is understood that, historically, education in Brazil has been linked to the economic model, seeking to conceive an education based on the needs of the market. Luck (2009) states that it was only at the end of the twentieth century, around the 1980s, that the term school manager emerged in the educational field to replace and surpass the term school administration.

Libâneo (2001) reveals that, due to the social and ideological advances in the country, school management, which had a conception with a scientific-rational focus, received another critical approach, driven by socio-political motives. In the first approach, the school organization is objective, neutral and rational, and can be organized and planned in order to achieve high levels in performance evaluations, being the most common model in the country. However, the second approach, of a critical nature, envisions the school as a living system, which brings people together, and the interactions as well as the social and political contexts of the nation are pertinent and important, which are the ones that make democratic management possible.

> Management consists of the involvement of all those who are directly or indirectly part of the educational process in the establishment of objectives, problem solving, decision-making, proposal of action plans, implementation, monitoring and evaluation aiming at the best results of the educational process (LUCK, 2005, p. 23).

According to Luck (2017), this participation gives people the opportunity to control their own work, assume authorship over it and feel responsible for its results, therefore, building and conquering their autonomy. That is why competent participation is the way to build autonomy. At the same time, they feel that they are an organic part of a reality and not just a complement to it, or a simple instrument to achieve institutional objectives determined by others.

According to Oliveira (2009), what is observed is that the management of the school and the work of the manager have become complex, incorporating new pedagogical practices and new management models. The consequence of this incorporation process is the expansion of the school manager's attributions, through the increase of the demands and responsibilities assumed by the school.

Regarding the expansion of the manager's attributions, Luck (2011) states that he has assumed an increasingly complex role due to some factors, since he has been assuming responsibilities that belonged to the family and society. The sum of functions, adverse situations exist and require a resolution or intervention by the manager, which ends up overloading him, thus contributing to the process of increased stress, and consequently the illness.

It is understood that the concept of health cannot be considered only the biological conception, according to Moreira and Rodrigues (2018), health can be considered by the influence of the environment, which permeates the work environment of a manager. That in the face of the current challenges of a pandemic, it has become very evident how stressful this role can be.

According to Shaw (2020), covid-19 caused several physical, mental, social, and economic losses. Bringing this reality to the educational environment in which professionals have become more vulnerable to mental illness, whether through news of morbidity and mortality of colleagues, family members, pressures from educational institutions, having to adapt to the use of technologies to continue classes, in addition to their personal life that attributes their relationships, children, domestic activities and other responsibilities that are provided to them.

Therefore, it is undeniable that the role of manager is an activity full of challenges and responsibilities and can often cause damage to emotional health. According to Moreira and Rodrigues (2018), in the work environment it is possible to develop some disorders and diseases, management is inserted in this context, the coexistence with other employees, and in addition to the constant pressures to develop work effectively in the educational environment.

Luck (2017) states that many managers have difficulties in meeting all the demand attributed to the position, because in addition to the responsibility to meet deadlines for documentation and determinations coming from the Department of Education and the Education Coordination, there is the daily wear and tear of having to solve structural problems of the school.

It is understood that, most of the time, these are pre-existing problems that have already been discussed in other instances of the school and, consequently, have not been solved, thus requiring the intervention of the manager. Theoretically, the manager is the one who solves or forwards the most complex situations to other instances. The lack of support professionals such as guidance counselors, supervisors, among other professionals, causes the school manager to have an overload of work far beyond what he can attend.

According to Luck (2017), despite the bureaucratic overload and the staff gap, the school manager must provide a pleasant work environment, analyze and identify the difficulties of teachers in the classroom and outside it, take into account the suggestions and opinions of teachers, ensure quality education, a pleasant work environment, motivated teachers, creating a sense of team, which as a consequence, brings the relationship between the manager and the teachers closer, which facilitates the progress of the teaching-learning and school administrative process.

THE EMOTIONAL HEALTH OF EDUCATION PROFESSIONALS

According to Gatti (2016), education is an event that comprises individuals in unequal sections of knowledge that together propose to share their knowledge for a common good. The school context presents characteristics of a managerial environment of one or more individuals, committing itself to directing the theoretical and practical construction on the cognitive, social, moral and affective aspects.

In this sense, it is understood that education is an instrument for human development, and according to the principle of the Federal Constitution of 1988, in article 205, it points out that "education, a right of all and a duty of the State and the family, will be promoted and encouraged with the collaboration of society, aiming at the full development of the person, his preparation for the exercise of citizenship and professional qualification" (BRASIL, 1988, p. 323), this fact represented a major milestone for the democratization of education in Brazil.

Gouvêa (2016) states that this process of school democratization has led to contemporary reflections on the working conditions faced by education professionals, since, despite the immeasurable benefits pertaining to universalization, its reproduction has impacted and continues to impact the workforce of education professionals, making illness due to working conditions increasingly common.

The health of education professionals has been the subject of several discussions, Gouvêa (2016) reports that, in addition to being frequently compromised by occupational activities, it is influenced by the educational structure and its quality, which means that between the health of professionals and the quality of education there is a mirror that reflects the benefits and impasses of a mutual and inseparable relationship.

According to Scliar (2007), the understanding of health has changed numerous times over time. It differs according to culture and customs in different peoples. In the past, to reflect on health was only to consider the physical aspect of the individual. Over the centuries, the contributions of numerous fields of knowledge, such as philosophy, sociology, and anthropology, have brought a new view to the subject.

Almeida Filho (2011) states that health should be understood by contemplating all aspects of the subjects' lives: physical, emotional, spiritual and social. The school is a very complex place, as there are individuals from different realities and cultures, whose dynamics show numerous challenges for managers.

> When discussing emotional health in teachers, we seek to understand the practice of school managers. School management is one of the areas of professional activity in education aimed at planning, organizing, leading, guiding, mediating, coordinating, monitoring and evaluating the processes necessary for the effectiveness of educational actions aimed at promoting student learning and training (LUCK, 2009, p. 23).

"The professional practice focused on education has exhibited a lag in the working conditions, due to the overload of responsibilities, resulting in greater pressure and over-effort of the activities" (GASPARINI; BARRETO; ASUNÇÃO, 2005, p. 45).

However, as stated by Silva and Guillo (2015), the health conditions of these professionals are compromised due to the intense and extensive work routine, triggering emotional and physical exhaustion, directly interfering with their quality of life. Inadequate and inconsistent working conditions are potential determinants of the reality experienced by education professionals.

In the research by Silva and Guillo (2015), the authors state that several problems were observed that interfere with the quality of life of teachers, the most common being: stress, psychological emotional diseases (panic attack, anguish, depression and nervousness), voice impairment, musculoskeletal disorders (back back pain, pain in lower and upper limbs), psychosomatic disorders, gastrointestinal disorders, migraine and cardiovascular disorders.

However, as stated by Silva and Nakano (2011), human personality traits are used to summarize and explain the conduct of an individual, suggesting the occurrence of a certain behavior, indicating that an internal process indicates this behavior.

From this perspective, the authors cited above warn that behavior is the essential condition for a person to be considered fit and perform their activities well. To this end, it is understood that studies in the area take place to offer support to these professionals, such as *Soft Skills*.

Soft Skills were defined by the World Health Organization (2018) as competencies that belong to the personality and professional behavior of each individual. They are mental, social and emotional aptitudes, particular skills and are improved according to the culture, experience and education of each person.

They are related to the form of social interaction and how the person expresses himself and reacts to the phases of his life. From this perspective, *Soft Skills* can be understood as socio-emotional skills, which according to the World Bank (2018) are "life" skills, necessary for a good conduct of existence and applies to a range of disciplines learned throughout life, including in the family environment, at school or at work.

The concept of *Soft Skills* is a new definition for the organizational environment, however, Andrade (2016) suggests that it is the set of behaviors originating from personality traits, stimulated or not according to the context of each individual and the stimuli he receives, considering, in addition, professional training. A person's education is linked to the stimuli of the organizational environment, influencing their personality traits and set of behaviors.

Andrade (2016) defines *Soft Skills* as a set of skills that encompass characteristics of communication, interpersonal, leadership, and problem-solving skills. These are some skills and talents that a person can use in their work, however, there are several other competencies that are associated with *Soft Skills*. These soft skills act in addition to *hard skills*, which are technical skills required for the job.

Still, Campos (2016) in his study describes the observation of a recruitment and selection (R&S) process in a particular specialized company, and states that in the second stage of the process, when interviewing a candidate, the company analyzes the academic background, professional path and social and technical competencies - *soft skills* and *hard skills.*

Soft Skills are associated with capacities and abilities that can be improved, because "although characteristics such as communication and interpersonal relationship skills constitute the individual's character, that is, natural characteristics for man, they can still be improved through personal development" (COSTA, 2015, p. 14). Transversal competencies can be improved throughout the professional career and shaped by the organizational context, stimulating the rate of success and recognition.

METHODOLOGY

It is an applied research, having as a way of approaching the problem the exploratory research, which seeks to provide a focus on the problem through the collection of information or the constitution of hypotheses, involving bibliographic and documentary survey, interviews with people, analysis of examples and others.

According to Gil (2008), bibliographic research is elaborated from the analysis and interpretation of the content of materials such as books, journal articles and Internet texts, leading the researcher to seek ideas relevant to the study, with a reliable record of sources.

According to Marconi and Lakatos (2003), it is a method used in social investigation in order to obtain information about a given subject for data collection or to help in the diagnosis or treatment of a social problem.

In the case of this study, semi-structured interviews were conducted, conducted via whatsapp application during the month of June 2022. The WhatsApp app has several features that make communication easier. According to Vieira de Lima et al. (2018), the ability to think, construct and

articulate opinions may not be so easy for everyone, participants in face-to-face interviews may have difficulties expressing in words what they feel. Therefore, being under the protection of the application helps you to respond by not seeing yourself in the presence of another person, by being able to remain calmly accommodated, in a place of your choice, recording your answers in audio and even using other resources that complement or replace verbal expressions, such as emojis, without having to explain what they mean.

The interview script was composed of 15 semi-open questions (available in the appendix of this article), the questions were elaborated based on questions pertinent to the daily life of a school manager, reflecting on all aspects related to the function. All of them were interviewed online, with previous contact where the purpose of the interview was exposed, making it clear that they would not be identified in the research. It is important to note that there was no face-to-face interview. The conversations lasted an average of 25 minutes per interviewee, the interviewee was free to choose the interview period, and the managers were identified as interviewees, 1, 2, 3, 4 and 5. The coordination is responsible for the management of 39 schools, totaling around 12.8% of the school managers interviewed.

For Manzini (1990), the semi-structured interview is focused on a subject on which a script is prepared with main questions, complemented by other issues inherent to the momentary circumstances of the interview. For the author, this type of interview can make information emerge more freely and the answers are not conditioned to a standardization of alternatives. A similar point, for both authors, refers to the need for basic and main questions to achieve the objective of the research.

The data were analyzed through the transcription of the interviews and discussion with the aspects presented in the theoretical framework. Gil (2008) mentions that the interpretation of data is understood as a procedure that comes through the author's analysis, stating that the analysis and interpretation of the processes must be closely related. In addition, this author states that in qualitative research, above all, there is no way to separate the two processes, which is one reason why many research reports do not include separate subdivisions to discuss the two processes.

PRESENTATION OF RESULTS

Regarding the education of the interviewed managers, all of them have a postgraduate degree in the area of education, and one of the interviewees, in addition to a postgraduate degree in the area of education, has a postgraduate degree in business management, which according to him provided him with subsidies to solve administrative issues of the school. In addition, the managers are between 35 and 45 years old.

As for the professional profile of the interviewees, all of them have been in the management position for more than three years. When asked about the requirements to run for the position of school manager at the Santa Catarina State Department of Education, the managers answered that it is necessary: to be effective, not to be in a probationary period and to present a management plan for the school community.

When asked about the specific preparation, or training, for the position after the election, the interviewees report having received a short course on the bureaucratic procedure and aspects related to pedagogical procedures, emphasizing that it is important to focus on emotional health in training.

> The initial training did not exceed the expectations of the practice of school management, where many subjects were not related, such as issues pertinent to the emotional (INTERVIEWEE 1).

Interviewees 2, 3 and 5 corroborated the statement of interviewee 1 that the initial training of managers left something to be desired by not dealing with daily and important issues, from the manager's point of view. They realized that the issues dealt with were related to the bureaucracy of the Department of Education. However, interviewee 4 revealed that in his first year as *a protempore manager*, he received "training" from the previous manager on all the work relevant to the function, which, according to him, was essential and became a differential for the exercise of the function (INTERVIEWEE 4).

In this way, the interviewee states that he felt safer when making decisions. It is noteworthy that there is no training or training course in the training agenda, on the part of the SED and, consequently, by the Regional Coordination, regarding aspects related to the function, such as administrative and pedagogical routine, interpersonal relationships. In this sense, all the managers interviewed emphasize that it is very important that there were changes, in this way, it would greatly facilitate their performance. As for interpersonal relationships and emotional health, nothing was mentioned in the training course and so far nothing has been offered.

When asked about the main challenges and difficulties that affect the emotional health of the school manager, it is noted:

> The biggest challenge I faced is the pedagogical team. In my view, when the manager has support and a team engaged with the pedagogical proposal, the work follows a satisfactory fluency. One of the biggest problems faced refers to the constant demand for teachers' assignments, such as punctuality, filling out the diaries in the *online teacher application*, this situation ends up wearing out the teacher-manager relationship, because teachers often do not accept charges, leaving the manager with the view of being authoritarian, compromising their autonomy in the school (INTERVIEWEE 1).

It is perceived that the relationships between colleagues can interfere in the resolution of conflicts that arise and depend on the ethical position of the manager. According to Rocha (2010), to

relate is to give and receive at the same time, it is to open oneself to the new, it is to accept and make oneself accepted, to seek to be understood and to understand the other. Acceptance begins with the ability to listen to the other, put yourself in their shoes, and be prepared to accept the other in your environment.

> Interpersonal relationships strengthen not only the performance of the professional, but also bring up good expectations for teams to achieve objectives and exceed goals that add value to the business, since the best relationship is not the one that unites perfect people, but the one in which each one accepts the defects of the other and achieves forgiveness for their own defects (GOMES, 2010, p. 45).

It is understood that interpersonal relationships at work are important because they contribute to a good environment in different institutions, which can result in increases in production and this result is only achieved when people know themselves and, therefore, are able to put themselves in the shoes of teammates while expressing their opinions.

According to Libâneo (2008), in order for the work to be successful in its operation, the members of the school need to learn certain skills, such as: communication and oral expression skills, teamwork skills, argumentation power, creativity in solving existing problems.

> My biggest challenge refers to the participation of parents in their children's school life, as well as the acceptance by parents of their children's problems with indiscipline, because it is a community with social vulnerability, several aspects interfere in this relationship between school and family. Therefore, the absence of the family in the care of their own children increases the school's workload (INTERVIEWEE 2).

"The benefits of a good integration between the family and the school are related to possible evolutionary transformations in the cognitive, affective, social and personality levels of the students" (POLONIA; DESSE, 2005, p. 305).

Cury (2008) states that the manager is responsible for involving families so that they become interested in their children's performance and results. And, at the same time, it has to establish a link with other realities of that community: the Guardianship Council, NGOs, etc. School management incorporated the triple division with the 1988 Constitution, which determined that public schools must be managed in a democratic way.

The school, by forming citizens, has not only the objective of the systematic transmission of contents, but also the participation of diversity, sought mainly through the participation of the family and community.

"Without transformation in people's practices, there is no society that transforms itself in a consistent and lasting way" (PARO, 2004, p. 19).

> My biggest challenge refers to the emotional balance of the management team in resolving conflicts, especially related to customer service. I understand that many times conflicts are not resolved due to the lack of training in conflict resolution, many parents arrive at school

> excited, and thus, the manager needs to first calm him down, and then expose the situation or listen to the report of the parent or guardian (INTERVIEWEE 3).

Berg (2012) states that conflict in current times is inevitable and always evident. However, understanding it, and knowing how to deal with it, is critical to your personal and professional success. Conflicts exist and are part of any work environment, because people think differently from each other, but it will depend on how the manager mediates this conflict and what strategies are used to solve it, learning to deal with it, all conflicts become beneficial and constructive for professional and personal growth.

It is understood that the dynamics of educational management is complex, as it is constantly dealing with people who have their own opinions, personality styles, beliefs, values and feelings. According to Libâneo (2005), the characteristics of a school manager are his form of self-evaluation, listening to those around him as a form of improvement, being willing to work collectively, being a mediator, having initiative, mastering technical, pedagogical, administrative and financial matters, being ethical, supportive, knowledgeable of reality.

> The biggest challenge is the lack of management power, I understand that the lack of autonomy in some points of management end up causing stressful moments. Many decisions need to go through the Coordination, which often makes the manager have a double job (INTERVIEWEE 4).

"The excessive workload is one of the factors that generate mental and physical exhaustion, causing damage to the health of the worker" (DEJOURS, 2006, p. 34).

As Ferreira (2011) points out, educational institutions should be constituted as autonomous units so that, together with their work teams, they can make decisions considering their priorities and reality, aiming to benefit the teaching and learning process.

> I see that my biggest challenge is the lack of support professionals in the management team such as the educational supervisor and the pedagogical advisor, with the absence of these professionals in the school, causes an extra volume of work for the manager. I understand that the school, as an institution socially constructed to carry out human formation in the different temporalities of life, it is visible that the school needs qualified professionals to offer support to students, parents, teachers. It is distressing not to be able to adequately meet the demands of the school community, due to the lack of professionals in the school (INTERVIEWEE 5).

According to Libâneo (1998), the educational advisor consists of the professional who makes up the management team, working directly with the students, helping them in their personal development in partnership with the teachers. It acts in order to understand the behavior of students, in order to act appropriately in relation to their actions. It also has the function of helping in the organization and development of the Political-Pedagogical Project with students and the community, guiding, listening and dialoguing with parents and guardians.

With the lack of support professionals for the manager, such as advisors, supervisors, among other professionals within the school, the school manager has an overload of work far beyond what he can handle. In addition, the team, as a consequence, is also overloaded, and is unable to perform tasks with excellence

According to Luck (2017), the manager's role is a person who performs a leadership role within the school, by developing and controlling certain activities, coordinating the institution's employees, so the manager needs a team to be able to support his demands.

Regarding emotional exhaustion and the strategies to cope with it, the interviewees report that they seek on their own initiative ways to try to alleviate this exhaustion a little. Three of the interviewees started using medication for anxiety, and all of them constantly sought out different physical activities to relieve tension.

The term tension refers to the "characteristics of a situation that may be problematic for the individual and that are equivalent to the demands of some kind of adaptation" (ALBRECHT, 1990, p. 51). For Arroba and James (1994), they have a complementary definition for pressure: "the set of all the demands placed on you". The pressure or source of tension can be caused by both external (environmental) and internal (intrapsychic) factors.

Rio (1995) asserts that human beings are subject to an infinity of stimuli, which come from their own body, from psychic life and from the external world. At all times, the body receives various stimuli from the most diverse means. Most of these stimuli are naturally integrated by the individual, not showing enough force to disturb their balance in a significant way. The stimuli are perceived. The individual reacts to them or simply ignores them, but does not need to have greater adaptive efforts at their disposal. However, some stimuli have higher degrees of potency and end up exerting a certain amount of pressure on the individual. Such stimuli, due to their intensity and disturbing capacity, are called "pressures" or "sources of tension".

The sources of voltage are numerous and varied. They always end up being present in everyone's life. According to Rio (1995), some are external sources and are easily recognized because they are located in the world around us. They can be made up of unresolved relationships, losses (sentimental, job, money, prestige, etc.), financial difficulties, overwork, societal expectations, prejudices, unequal treatment or too many responsibilities.

To cope with this pressure, Limongi-França and Rodrigues (2005) reveal that coping is the set of efforts that a person develops to manage or deal with external or internal demands, which are evaluated by him as excessive or above his possibilities." The coping reactions used by individuals will depend on their social, psychological, self-control and self-esteem resources" (HURREL JR; SAUTER, 2011, p.76).

There is no single coping reaction that fits all pressure situations. The larger and more varied the repertoire of strategies, the greater the chances of reducing or dodging pressures and feelings of tension. In the work environment, the greater the worker's control over his work process, the greater his possibilities of coping with stress.

When the interviewees were asked about the Coordination's support regarding psychosocial support to reduce, or solve or minimize the demands that appear in the school routine, all the interviewees were emphatic in declaring that there is no psychosocial support offered by the SED or the Coordination.

Stoner and Perrewé (2008) conducted a study in which they realized that, when healthy, the organization's internal relationship network can be favorable in the process of recovery from psychopathologies. It was also found that the social support of organizational superiors has a positive influence on established human relationships. Macik-Frey et al. (2009) conducted a study aimed at understanding the preventive methods of managing stress in successful executives. More specifically, they studied how they maintained their health and well-being under demanding and stressful conditions. It was found that important common denominators between stress management methods for these men and women were: self-confidence, secure attachments, and social supports. Thus, when there is a strong and positive bond between the members of such groups, the negative impacts of tensions and even of the stress already installed can be minimized.

Regarding the aspect of personal life, all the interviewees affirm that there was a radical change in their lives after assuming the position of manager. Starting with the vacation factor, all managers report that, since they took office, there is no vacation period being respected by the Coordination. This situation arises from demands of administrative orders in the month of January, the period of school holidays, such as the delivery of teaching materials and the cleaning of the school, which necessarily requires the presence of managers. This factor reflects on the manager's health, since they do not get a rest period.

As stated by Couto (1987), overload stress arises when the demands of the environment demand more than the individual's psychic structure is capable of supporting. It is common in contexts where responsibilities are required above the intellectual, psychological and physical competence of the individual, in permanently conflicting and tense work environments.

All of them also describe that the use of the *Whatsapp* application by the Coordination in extra hours to the school's operation is also a stressor factor, they also report that the technicians trigger duplicate work charges, considered a rework. The managers ensure that in this way the Coordination does not consider the personal side of the manager.

All were in unison in stating that the work of a manager does not end after normal school hours, the demands continue at night, at dawn, on weekends, which ends up causing conflicts in the

family. The interviewee (E1) says that this factor has made her rethink her permanence in the position several times. The interviewee (E5) draws attention to the change in routine after taking over the management, needing to wake up at 4:30 am to be able to have some time for herself, where she can calmly take a quiet shower, and have personal care that she cannot do at other times.

Work overload, according to Lipp (2005), is the most cited professional stressor in research on sources of stress and is an obstacle to dedicating more time to other environments, such as leisure and family. The same author warns that the amount of work, tasks and projects that a person can accept or even impose themselves without having the negative effects of stress will depend on two important variables: whether or not they are vulnerable to work overload; and whether or not she has adequate coping strategies to cope with stress.

"Lifestyle factors, such as physical fitness and exercise, nutrition, alcohol and smoking cessation, have the power to protect health against the effects of occupational stressors" (HURRELL JR; SAUTER, 2011, p. 54).

It is worth noting that the interviewees have a feeling of constant vigilance in their daily lives, which reflects on their own quality of life. In this sense, with the advent of the pandemic, many changes in the structural models of schools emerged, modifying management practices, which led to a considerable increase in the manager's work, such as charging the teacher to constantly update the online teacher application , among other attributions that previously did not exist.

Finally, during the interviews, the managers suggested some actions that, in their personal view, could alleviate the pressure and stress of the function, such as: the search for greater dialogue with the managers, on the part of the coordination; they could sometimes call the manager for a pleasant and pleasant conversation; Today, conversations, meetings, and meetings are based on bills and performance; offering support from a psychosocial care professional, as a way to reduce tensions; the search on the part of the professionals of the coordination to listen to the managers in relation to the demands related to the parents, because they are always heard and then the manager is already summoned and often cannot express the truths of the facts; autonomy in matters related to the administrative sector; that the technicians of the Coordination must have consensus on the attributions and demands presented to the manager.

In view of the results, it was noticed that the attributions currently imposed on managers generate a feeling of incapacity and impotence to perform all obligations in a timely manner, directly influencing the emotional health of managers who are currently in charge of Educational Institutions.

CONCLUSION

The objective of this study was to analyze the situations and demands experienced by school managers of public schools who work in the CRE of Tubarão (SC). The information captured by this

research made it possible to understand that the school manager assumes a significant role in the school context, and that his performance has a considerable impact on the improvement, or not, of the teaching offered, on the promotion of student learning and in all aspects of their development and on the formation of an educational environment favorable to teaching.

The discussions presented demonstrate the complexity of what it is to manage educational spaces in a democratic and participatory way through the implications that are characteristic of the human being from the political, pedagogical and technical point of view, as well as the historical and cultural ones. These discussions need to be deepened in view of the complexity of the subject.

In particular, the manager of Brazilian public schools, in the midst of so many responsibilities and attributions, must necessarily go through initial and continuing education processes along with the activities they develop on the school floor. Therefore, they need to be well informed about all the dimensions to which their function encompasses, especially the pedagogical dimension, which often takes a back seat due to the bureaucratic demand of the other dimensions, which end up taking up most of their time.

It was concluded that the support of the Education Coordination is important, with regard to the demands required of the managers, who, due to the great bureaucratic procedure, end up having to dedicate much more time to the school to the detriment of family and social coexistence, and it is urgent that some measure be taken in this sense.

It should be noted that the daily life of the public school is complex, requiring an emotional balance for decision-making, which ends up demanding exclusive dedication from this professional. It can be seen that the consequences of the work of school managers are numerous, and they follow educational guidelines and policies that enable them to be able to develop their functions with social quality, in order to fulfill the objective of education.

In view of the above, it is understood that a participatory democratic management needs involvement, participation, engagement, articulation and cooperation through dialogue in a plural way and with autonomy and transparency, without losing sight of the pedagogical act of teaching and learning, which is not an easy task, and thus ends up affecting the physical, emotional and psychological health of the manager.

It is concluded that the managers participating in this study, even in the face of the challenges of their attributions and responsibilities placed in the role of school manager, do not measure efforts to carry out a work of excellence, which takes place through the constant search for improvement in the teaching offered and in the interaction with the entire school community with the objective of improving education.

It was concluded that, necessarily, the function requires managers to be able to deal with pressure, strategic knowledge, and conflict resolution, but it is understood that the lack of

professional support affects their emotional health and personal life. This study is extremely relevant, because an unmotivated manager will hardly be able to motivate his team. And actions should be thought of by the coordination in order to minimize the manager's work overload for a better quality in the educational process.

Considering that they were interesting discussions, which certainly contributed, but do not end the debates to the understanding of this way of managing educational spaces, which theoretically seems so easy to us, but in practice, on the school floor its complexity was evident, the result of what it is to deal with the human being.

It is understood that the topic should be a reason for research and debate in the academic environment, so that future managers can have better support and preparation to perform the function, and thus, enjoy a quality of work where they will have skills and abilities to manage and mediate conflicts in a more balanced and conscious way, thus improving their emotional health and consequently their personal life. To this end, this theme can be developed in future master's research, as well as a research under the view of the Regional Coordination of Education, so that there is a possible understanding of the demands and situations cited in this work.

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SEMI-STRUCTURED INTERVIEW SCRIPT

1. What is your full name and age?
2. What is your professional background and complementary training?
3. In the school where you work as a manager, what levels of education are offered?
4. How long have you been in this position?
5. Do you have another profession concomitantly with school management?
6. What is the prerequisite established by the Department of Education for you to assume the position of school manager?
7. Was there any initial training aimed at preparing you for the role? If so, did it exceed your expectation? In this training, was there any approach related to emotional health?
8. What is the main challenge of the school manager in your point of view?
9. What are the difficulties that arise in your daily school life that shake your emotional state?
10. Do you notice emotional exhaustion in the exercise of your function? If so, what strategies do you use to cope with the emotional toll that your role requires?
11. With regard to psychosocial support, does the Coordination offer support to reduce or solve or minimize the demands that appear in the school routine?
12. What aspects of your personal life have changed since you took on the role of school manager?
13. How do you organize your time outside of work? Can you really rest?
14. During the exercise of this function, have you ever sought help from professionals in the field of emotional health (psychologist, therapist or psychiatrist)? Have you developed any syndromes? Do you use any medications? What?

What suggestions do you propose to the CRE to ease the demands of work and consequently reduce the emotional overload of your role?

Peace education and Physical Education: Inclusive practices associated with values in Elementary School I

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ABSTRACT

Physical Education has a primary function in school inclusion, promoting cultural diversity and interaction between students through varied body practices, capable of developing physical skills, the discipline can address in a practical way human values, Olympic and Paralympic values, going beyond the physical aspect and contributing to an inclusive and holistic education. Reviewing practice, seeking new pedagogical strategies is essential for the teaching-learning process in search of an inclusive environment. The present report aimed to apply inclusive pedagogical activities in Physical Education classes that aim at human values from the perspective of Education for Peace. For Callado (2004), peace education is a continuous process of education of values, which are manifested through the behavior of people or social groups. The pedagogical practice is characterized, in terms of purposes, as exploratory and qualitative, for which the following study themes were used as a bibliographic reference: Paralympic Modalities; Paralympic Values; Human Values; Cooperative Games. This work was developed in Physical Education classes in two different schools. The first being the Profª. Zahira Catta Preta Mello and had practice in an inclusive way, based on collaborative teaching, applying the contents of the curricular components focused in a transversal way to human values from the perspective of education for peace and activities. For the 1st cycle students, the practices were: Paralympic athletics, adapted bocce. On the other hand, the students of the 2nd cycle experienced the thematic unit sports through wheelchair basketball, goalball, wheelchair handball, sitting volleyball and poster making. In the second school, Dona Dilma Mafra School, it was applied to four classes of the 5th grade of elementary school, activities of games and games with a focus on the cooperative aspect, common good of the team, friendship, respect and excellence. In addition to sports activities adapted with rules that would allow emphasizing educational values, such as joy of effort, fair play, pursuit of excellence, and respect for others. The present research brought through the practice in Physical Education the vision of the student's development beyond intellectual capacities, expanding the discussion about human and educational values, in the bias of Education for Peace, in terms of seeing the student as an evolving being and valuing feelings and emotions, taking into account that education is carried out in different instances. However, it is concluded that the students in this period experienced the sports modalities and understood the importance of collaboration, cooperation and human values for a more inclusive society promoting education for peace.

Keywords: Inclusive Education, Peace Education, Inclusive Physical Education, Paralympic Modalities, Human Values.

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INTRODUCTION

The discipline of physical education is crucial for the integral formation of students, addressing not only their motor and physical capacities, but also the holistic, cultural and emotional aspects. Socialization during classes promotes an inclusive and less violent environment, contributing to education for peacebuilding at school. Thus, the object of the research is the inclusive pedagogical insertions in physical education classes, of the initial grades of elementary school of two public schools in different municipalities. The selection of the schools was due to the fact that they are the workplaces of the researchers, who are also participating in the professional master's degree in inclusive education network (PROFEI) at the State University of Ponta Grossa. The research was carried out during the execution of the disciplines of the master's program.

The general objective of this work is to apply inclusive pedagogical activities in Physical Education classes in the early grades of elementary school, which aim at human values from the perspective of Education for Peace. As a complement, there are the specific objectives of promoting an inclusive environment in Physical Education classes through Paralympic modalities; establish practices that encourage human values in Physical Education classes and foster a culture of peace through inclusive educational practices.

Physical Education plays a key role in school inclusion, promoting cultural diversity and interaction among students through varied body practices, according to the National Common Curriculum Base (2018). In addition to developing physical skills, the discipline can address in a practical way human values, Olympic and Paralympic values, going beyond the physical aspect and contributing to an inclusive and holistic education.

It is necessary to always think about good practices to be carried out in the school environment and the discipline of Physical Education cannot be left out of this scenario. For this, it is necessary to base the actions in the school on dialogue. Actions at work, thinking about the diverse, will be successful if we always seek to build them collectively and using dialogue and a liberating vision. Freire (1987, p.46) refers to dialogue and trust as a relationship, "when it is based on love, humility, faith in men, dialogue becomes a horizontal relationship, in which the trust of one pole in the other is an obvious consequence".

The school, when thinking about the collective, should seek interdisciplinary projects to meet the demand for content for all students, examples these are reading projects, arts projects, dance and music projects, sports projects, inclusive projects thinking about the relationship between students and teachers, students and families. Another possibility is projects involving the community in the school, being carried out during class hours or on weekends.

Based on this assumption, of working with interdisciplinary projects, it is important to address cross-cutting themes such as the Culture of Peace axis, based on education projects in human values,

always thinking about working with the various and providing equity in the school. As an effective project proposal, with results in the school, Salles Filho (2019, p.261) mentions two programs aimed at education in human values, the first of which is the Living Values in Education Program (Vive) and the second is the Human Values Education Program (PEVH). Both, with methodologies and practices grounded for educational work, integrated in a dialogical way, approaching values in a pedagogical way, enabling work with the diverse.

Among the values of the Vive Program, defined by Tillman (2004) are: peace, respect, love, tolerance, honesty, humility, cooperation, happiness, responsibility, simplicity, freedom, union. While the Olympic and Paralympic values are, respectively: excellence, friendship, respect, courage, determination, inspiration and equality. These values are easily applicable in Physical Education classes, and can be implemented in a practical way, with an effective practical perception of human values.

Therefore, Peace Education, approached from an inclusive perspective in Physical Education classes, plays a fundamental role in the formation of critical citizens, based on human values as a tool in search of an egalitarian society. For Callado (2004, p.53) "Peace Education is a continuous process of education of values, which are manifested through the behavior of people or social groups."

METHODOLOGY

The present research was developed as a result of studies of the Professional Master's Degree in Inclusive Education (PROFEI) with emphasis on the discipline of fundamentals of inclusive education, and because it is a national network program, the research was carried out in two municipal schools in different states. The Escola Municipal Professora Zahira Catta Preta Mello, in the city of Ponta Grossa, Paraná, is called ***school 1***, where the pedagogical interventions were carried out during Physical Education classes, in the early grades of elementary school. It had the participation of students from the age group of 6 to 10 years, in the classes from 1st to 5th grade, totaling approximately 450 students.

The second participant was Escola Básica Municipal Dona Dilma Mafra, located in the city of Bombinhas in Santa Catarina, called ***school 2***, where the interventions were carried out in the 5th grade classes of elementary school, in the discipline of Physical Education, totaling the participation of approximately 110 students divided into 4 classes.

The pedagogical practice was characterized, in terms of purposes, as exploratory and qualitative. To this end, the following study themes were used as bibliographic references: Inclusive Education; Peace Education; Paralympic Sports; Olympic Values; Paralympic Values; Human Values; Cooperative games. To obtain the necessary data, the following methodological instruments were

used: participant observation, photographic records, written and practical activities carried out during Physical Education classes.

RESULTS AND DISCUSSION

The practice was carried out in an inclusive manner and based on collaborative teaching, applying the contents of the curricular components focused in a transversal way to human values from the perspective of Education for Peace. In ***school 1*** for the students of the 1st cycle, the practices were: the various events of Paralympic athletics, adapted bocce. While the 2nd cycle students experienced the thematic unit sports through wheelchair basketball, blind football, goalball, wheelchair handball, sitting volleyball. In addition to the practical activities, the students carried out written activities, drawings and posters contextualizing the relationship of inclusion and the Olympic, Paralympic and human values.

The contents were applied during classes in the second semester of 2023 and are in accordance with the school cycle, according to the National Common Curricular Base (2018), following the table of contents and skills of the Ponta Grossa Curricular Reference (2020). The activities were adapted, but initially presented in a conventional way, according to the curricular framework, later performing the adapted sports, based on collaborative teaching, where the students carried out the practice of tutoring, helping others in the pedagogical practice and exercising human values, promoting mutual respect, solidarity, empathy and equality as fundamental values. In this way, collaborative teaching is a concrete way of providing school inclusion, whose characteristics consist in the fact that teachers work together, share the responsibility of planning, instructing and evaluating teaching procedures to a heterogeneous group of students and share objectives, expectations and frustrations in the teaching-learning process and schooling of students (Ferreira *et al*., 2007apud Zabaroski *et al*., 2017, p.126).

In ***school 2,*** the activities were carried out in the second semester of 2023, in Physical Education classes, aligned with the contents guided by the National Common Curricular Base (2018), and the Municipal Curriculum Proposal of Bombinhas, contemplating the annual planning of the Physical Education discipline in the components of *games and games of popular* culture: popular games and games from Brazil and the world (Indigenous and African games and games) and *sports*: field and bat sports, net/wall sports and invasion sports.

The activities of games and games gained focus on the cooperative aspect, which were carried out with the objective of generating the common good of the team, friendship, respect and excellence. In sports activities, they were adapted with rules that allowed them to emphasize educational values, such as the joy of effort, fair play, the pursuit of excellence, and respect for others. The importance of the experience of values is emphasized in order to collaborate for the

construction of attitudes that can be multiplied in the day-to-day, in the training of students and respect for ethical and social principles.

FINAL THOUGHTS

During the pedagogical practices and activities, several reports were made during the participant observation. However, it is important to highlight some records of the written works of students in the 4th and 5th years of school 1, in which they understood the importance of values and inclusion in Physical Education classes. Among the reports, it is important to highlight some of the students' phrases, among which: "inclusion is respecting people's difficulties and differences;" "Equality is putting oneself in the other's shoes and respecting, not judging but having respect and friendship;" "I learned that values such as peace, love, respect and cooperation are important to include everyone;" "Courage, respect and honesty are important, especially for the Paralympic Games, because everyone has equal rights."

In school 2, the students were able to understand the objectives of the activities, gradually, because at first they acted instinctively with competition. Gradually, they collaborated with the teams and in the end realized the value of cooperation. In feedback through a conversation circle, the students reported on the value of the team, everyone's participation, that one does not win in individuality, that it is necessary to contribute to the other for the common good. In a written record, carried out with the students of school 2, at the end of the research, the proposal was for them to describe the feelings, or impressions and learning about the experiences they experienced during the classes. Some highlights described by the participating students were: "the important thing is not only to win but to participate", "you cannot win alone", "it is important to help your colleague so that everyone wins in the end", "in the game you also make friends".

However, the present research brought through the practice in Physical Education the vision of the student's development beyond intellectual capacities, expanding the discussion about human and educational values, in the bias of Education for Peace, in terms of seeing the student as a being in evolution and valuing feelings and emotions, taking into account that education is carried out in different instances, For example, emotional and spiritual intelligence, that is, in order to educate with a "whole body" it is important to consider the human being in an integral way. Education, then, is made as a tool to concretize the human being as a value, of oneself and of others.

Finally, it is concluded that the students in this period, when experiencing the sports modalities, understood the importance of collaboration, cooperation and human values for a more inclusive society, promoting Education for Peace.

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National Curriculum Matrix as Theoretical-Methodological Orientation: The case of the Federal Highway Police

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ABSTRACT

The present work contextualizes the emergence of the National Curriculum Matrix (MCN) in the scenario of public security policies elaborated since the 2000s in Brazil. Based on this contextualization and considering the complexity of police work, the MCN emerged as a theoretical and methodological framework aimed at the professional training of state police (military and civil) and military firefighters. If these institutions were necessarily linked to the MCN, what about the influence of the MCN in a police institution that is not linked and has federal coverage? To answer this question, this paper analyzes, through a case study, the influence of the MCN on the Federal Highway Police – PRF.

Keywords: Public Security, National Curriculum Matrix, Police Training, Federal Highway Police.

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INTRODUCTION

The field of research is situated in the context of democratization and with security gaining more and more prominence in Brazil, where it is interesting to note that, only at the beginning of the twenty-first century, more systematic and profound approaches emerged, involving public security at various levels of governance in the country (PONCIONI, 2013).

It was up to the National Secretariat of Public Security – SENASP, created by Decree No. 2,315/1997 within the structure of the Ministry of Justice, to act as an inducer and articulator of public policies aimed at the implementation of national plans. For this reason, after two years, the National Public Security Plan (PNSP) emerged[6], entitled Brazil Says No to Violence, which was followed by several other plans: Public Security Plan for Brazil (2003); National Plan for Public Security with Citizenship – Pronasci (2007); Safer Brazil (2013); National Homicide Reduction Program (2015), which was never implemented; the 2017 National Public Security Plan and, soon after, the 2018 National Public Security Plan; until the current PNSP of 2021, which is expected to be in force until 2030.

These plans constituted a significant articulation whose main objective was to establish a democratic governance system for public security policies, with the purpose of reducing crime and violence, generating a sense of security in society. To this end, cooperation was stimulated between the different agencies involved, in all spheres of government, which included the definition of common goals and indicators, with priority given to meeting social demands.

Therefore, the performance of police institutions, as they are the front line in contact with the population, has always been at the center of discussions, and, as Lima, Bueno and Mingardi (2016) point out, the political democratization that occurred at the end of the 1980s marked the beginning of the change in the relations between the police and society, as a result of social pressures. demanding new models of politics and policing.

In 2003, during the National Seminar on Public Security, which aimed to disseminate and stimulate training actions within the scope of the Unified Public Security System, SENASP announced actions aimed at police education, with emphasis on the creation of the National Curriculum Matrix (MCN) for police education.

> The National Curriculum Matrix had the virtue of including the professional training of police officers in the governmental agenda, with the status of a public policy, considering the privileged place in the choice of alternatives and proposals for the problem that involves the performance of police officers for the effectiveness of a "citizen" public security in the country (PONCIONI, 2013, p. 50).

[6] The first PNSP after redemocratization dates back to 1991 with the Collor government.

In 2014, the Ministry of Justice/SENASP reissued the National Curriculum Matrix – For training actions for professionals in the area of public security. The novelty was due to the inclusion of a professional study and a mapping of competencies with the objective of outlining a profile of the positions of state public security institutions, clearly proposing a transition from the logic focused on content to a logic focused on competencies (cognitive – operative – attitudinal).

Thus, the National Curriculum Matrix emerged (2003) and was consolidated (2014) as a theoretical-methodological framework guiding the initial and continuing training actions of public security professionals in Brazil. The Military Police, the Civil Police and the Military Fire Brigades have been, from the beginning, linked to the MCN, regardless of the level or modality of education that is intended to be carried out. Its articulating axes and thematic areas began to guide the most diverse programs and projects carried out by the National Secretariat of Public Security (SENASP, 2014).

Although the Federal Highway Police (PRF) was not formally among the institutions linked to the obligation to adopt and implement the MCN, the fact is that the context and reality of action have always been exactly the same as those of the linked institutions, that is, the daily life of Brazilian society, since the PRF is present in all units of the Federation.

The mission of this work is to analyze the influence of the National Curriculum Matrix on the institutional teaching of the Federal Highway Police, even without mandatory linkage.

METHOD

Since there is a lack of explicit and systematic knowledge about the influence of the National Curriculum Matrix on the educational actions of the PRF, it is considered appropriate to have a structured analysis that connects the elements that make up this research question to the conceptual domain resulting from them.

This is a qualitative research, with descriptive purposes, through a case study, using document analysis techniques and interviews, with professionals from the organization studied, carried out in 2019, within a larger research developed with the University of Lisbon – UL.

All editions of the National Curriculum Matrix were analyzed, documents selected because they are the objects of study. This stage gave rise to the documentary reference.

In this context, "the reading operations essentially aimed to ensure the quality of the problematization, while the interviews and the complementary methods especially help the researcher to have a contact with the reality experienced by the social actors" (QUIVY; CAMPENHOUDT, 1992, p. 47).

The interviews were carried out in the semi-directive modality, which allowed the contextualization and deepening of the issues of interest, being pertinent and valid for the study in

question, as highlighted by Ludke and André (1986, p.34), "in this modality the interview unfolds from a basic scheme, but not rigidly applied, allowing the interviewer to make the necessary adaptations".

Thus, the following were interviewed: a) the Executive Director of the Federal Highway Police, one of the main stakeholders in the governance of institutional learning; b) a former coordinator of the National Academy of the Federal Highway Police, for his experience as a manager responsible for the management of the institution's teaching and; c) a PRF teacher with extensive experience in the coordination of institutional educational actions, due to practical experience directly related to professional, initial and continuing education.

It is important to highlight that the interviewees were explained the objectives of the research and the interview, the reasons that characterize them as relevant sources, and the ethical issues, especially the guarantee of anonymity and that the data collected will only be used for exclusively academic purposes. The procedures were previously analyzed and approved by the Ethics Committee of the Institute of Education of the University of Lisbon.

REFERENTIAL

To achieve the objective of this study, it is necessary to understand the curricular matrix construct, and its structuring role for teaching actions, allowing to situate the performance of the National Curriculum Matrix - for training actions of professionals in the area of public security. This chapter, based on a theoretical and documentary survey, proposes to follow this trajectory.

MATRIZ CURRICULAR

> A curricular matrix is a reference, a portion of what should be the curriculum taught in schools, and seeks, in theory, to establish common and consensual aspects about what should compose teaching in each of the curricular components or teaching areas. (BAUER, 2020)

Historically, educational institutions have begun to develop more structured curricula to ensure a standardized and consistent education that is able to adapt and evolve according to students' needs and interests, as well as social and cultural changes.

The origin of the concept of curriculum matrix arose with the evolution of formal educational systems, and many educators and researchers contributed to the development of this concept.

In this sense, it is worth highlighting Ralph Tyler, a renowned American educator, responsible for bringing significant contributions to the theme in the twentieth century. XX, and Hilda Taba, an Estonian-born educator who, in her book "Curriculum Development – Theory and Practice" (1962), was disruptive in considering that educational models should be based on cultural and social needs.

> The curriculum of the major general subjects is essentially an effort to overcome the compartmentalization and atomization of the curriculum by combining some specific fields within broader branches. History, geography and civics education were combined in social studies. Reading, spelling, composing, and writing have been combined within the Art of Language. The specialized sciences led to general fields such as the general sciences, humanities, and physical sciences. (TABA, 1962, p. 87)

Thus, although it is difficult to attribute a precise origin to the concept, it is possible to state that the idea of a curriculum matrix, as a formalized structure for planning and organizing the educational curriculum, has evolved over time and its adoption is common at various levels of education, from basic education to higher education and professional training.

For Pestana (1998) "the matrix seems to be a way of overcoming the division, perceptible in almost every curricular proposal, between the curricular objectives and the list of contents, since it concretizes, in each descriptor, the articulation between the curricular objective (or development objective) and the content" (p.70).

In Brazilian education, the use of curricular matrices is a constant, especially after the last decades, with the expansion of the debate to ensure more consistent educational processes aligned with the needs of society. An example of this are the national curriculum guidelines and specific legislation, with emphasis on Law No. 9,394/1996, which establishes the guidelines and bases of national education (LDB), which provide guidance on the structuring and organization of the curriculum at different levels and modalities of education.

Doll (2002) argues that the curriculum should allow the creation of meaningful connections between the different contents. For the author, the curriculum should be conceived as a flexible and dynamic representation of the curriculum, being able to adapt and evolve according to the needs and interests of students, as well as social and cultural changes.

NATIONAL CURRICULUM MATRIX – FOR TRAINING ACTIONS FOR PROFESSIONALS IN THE AREA OF PUBLIC SECURITY

Despite the Federal Constitution of 1988 and the introduction of more robust public security policies from the 2000s onwards, such as the strengthening of SENASP and successive PNSPs, the Brazilian perspective on public security continued to be strongly linked and restricted to the action of police forces and the focus on the repression of crimes, a result of outdated paradigms denounced by authors such as Vargas (2020) and Fabretti (2014).

Thus, even in recent history, police and criminal justice institutions have not undergone major reforms in their structures, and the public security system has continued to accumulate demands for its policies of incomplete changes.

In this scenario, it is worth highlighting the initiative of a standardized and humanized training policy presented by the National Curriculum Matrix – For training actions of professionals

in the area of public security, which represented a guiding advance in the educational actions of all state public security forces.

Miranda (2008, p. 70) points out that the implementation of the Curriculum Matrix

> [...] It raised the diagnosis of the conditions of police education, aiming at the progressive incorporation of theoretical-methodological references into the curricula and the effective transformation of professional and institutional performance. The aim was to integrate the theoretical principles into the specific contents of police work, which were traditionally associated with training.

The National Curriculum Matrix (MCN) was launched in 2003 and underwent its first revision in 2005, where two important documents were incorporated: the Pedagogical Guidelines for the Training Activities of Professionals in the Public Security Area, which provided guidelines for the planning, monitoring and evaluation of training activities, and the Curricular Network, composed of disciplines that covered content in a conceptual way. procedural and attitudinal.

In 2008, a second review of the MCN was carried out with the aim of updating and expanding it, driven by the need for support for its implementation in the states. In 2014, the current version of the MCN was presented, which brought as a novelty the focus on the competencies identified by the working groups based on the "reports of the Professional Study and Mapping of Competencies: Profile of the Positions of the State Institutions of Public Security, prepared by SENASP" (SENASP, 2014, p.20).

The realization of this mapping of competencies allowed not only the updating of the MCN, but also its improvement. It is noteworthy that the first edition, in 2003, used the Brazilian Classification of Occupations (CBO) to describe the characteristics of public security activity, an approach considered superficial and generalizing.

With the mapping of competencies, it was possible to incorporate more detailed and specific information, providing a more comprehensive and in-depth view of the needs and skills required by professionals in the area of public security.

In its 2014 version, the National Curriculum Matrix is presented as:

> [...] a theoretical-methodological framework to guide the training actions – initial and continuous – of professionals in the area of public security – Military Police, Civil Police, Military Fire Brigade, regardless of the level or modality of education that is expected to be served. Its articulating axes and thematic areas currently guide the most diverse programs and projects carried out by the National Secretariat of Public Security (SENASP, 2014, p. 11 - emphasis added).

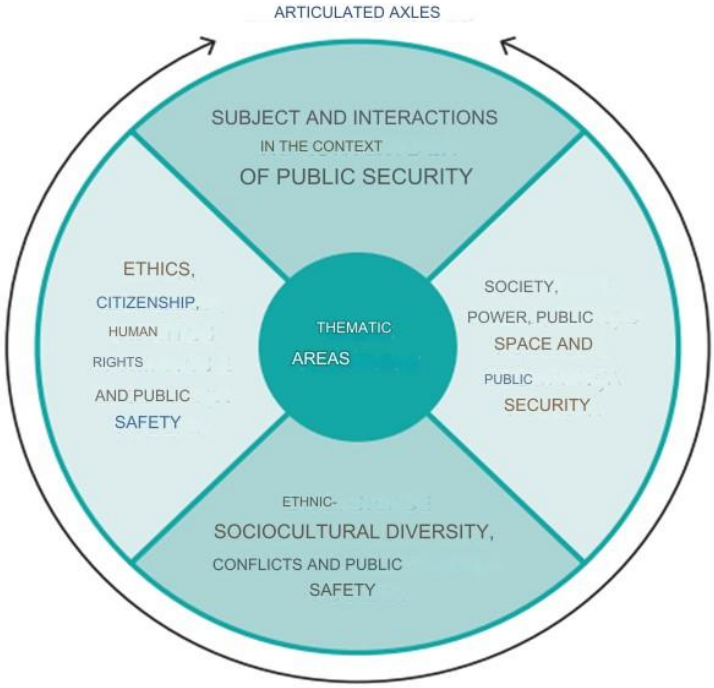
And it has the following general objective:

> The public security training actions, planned based on the Matrix, have the general objective of favoring the understanding of the exercise of public security activity as a practice of citizenship, professional, social and political participation in a Democratic State of Law,

> stimulating the adoption of attitudes of justice, cooperation, respect for the Law, human promotion and repudiation of any form of intolerance. (SENASP, 2014, p. 40).

To this end, the MCN is structured in articulating axes (figure 1), which establish a set of transversal contents relevant to the topics discussed in the area of public security. These contents address social problems of national scope and, therefore, should be incorporated into different disciplines, providing a reflection on the individual, social, historical and political role of professionals in training. This contributes significantly to the personal development of these professionals, stimulating moral and ethical conduct, in addition to encouraging them to constantly reflect on the professional practices they will adopt and the context in which they will be applied.

Figure 1 - Articulating Axes of the National Curriculum Matrix (SENASP, 2104, P.42)



The four articulating axes were already present in the first version of the MCN, in 2003; remained unchanged in the 2005 and 2008 revisions; and received a small increase in point four, in the 2014 version, which expanded the item to include ethnic-sociocultural diversity. All axes can be developed in curricular activities through seminars, lectures, round tables, workshops and other forms of facilitation of learning, which go beyond the logic of courses. These activities can take place both in the school environment and outside of it, related to specific subjects or to broader, contextualized projects.

The axes lead to reflection on the individual, social, historical and political roles of the professional and public security institutions. They are oriented towards personal development and moral and ethical conduct, referring to the general purposes of training actions, stimulating permanent and reflective questioning of professional and institutional practices in the social and political context in which they take place (SENASP, 2014, p. 41).

Thus, in the educational perspective adopted by the MCN, teaching is conceived as a process that demands an intentional intervention by the educator, aiming to promote learning, the construction/reconstruction of knowledge and the critical appropriation of the culture elaborated. In this context, it is essential to consider the need for quality and comprehensiveness standards that are based on ethical principles.

The intentional action of the educator encompasses the appropriate selection of teaching strategies, the creation of stimulating learning environments, and the establishment of relationships of partnership and dialogue with students. In this way, it seeks to foster the cognitive, affective and social development of students, enabling them to become critical, reflective and autonomous subjects in the construction of knowledge and in the development of skills. To do this,

> The processes of construction/reconstruction of knowledge are related to the ability to learn continuously and involve, among others, the capacities of analysis, synthesis, criticism and creation, based on the exploration of different perspectives in the interpretation of reality, in the face of challenges and problematizing situations related to the area of activity. (SENASP, 2014, p. 52)

The promotion of learning takes place through the articulation between the students' previous knowledge and the contents to be learned, with the mediation of the educator. In this process, it is relevant to consider the individual and collective experiences of students, stimulating active participation, investigation, problematization and the search for contextualized solutions. In addition, it is necessary to provide an environment that supports and encourages autonomy, respecting the diversity of skills, interests, and learning paces.

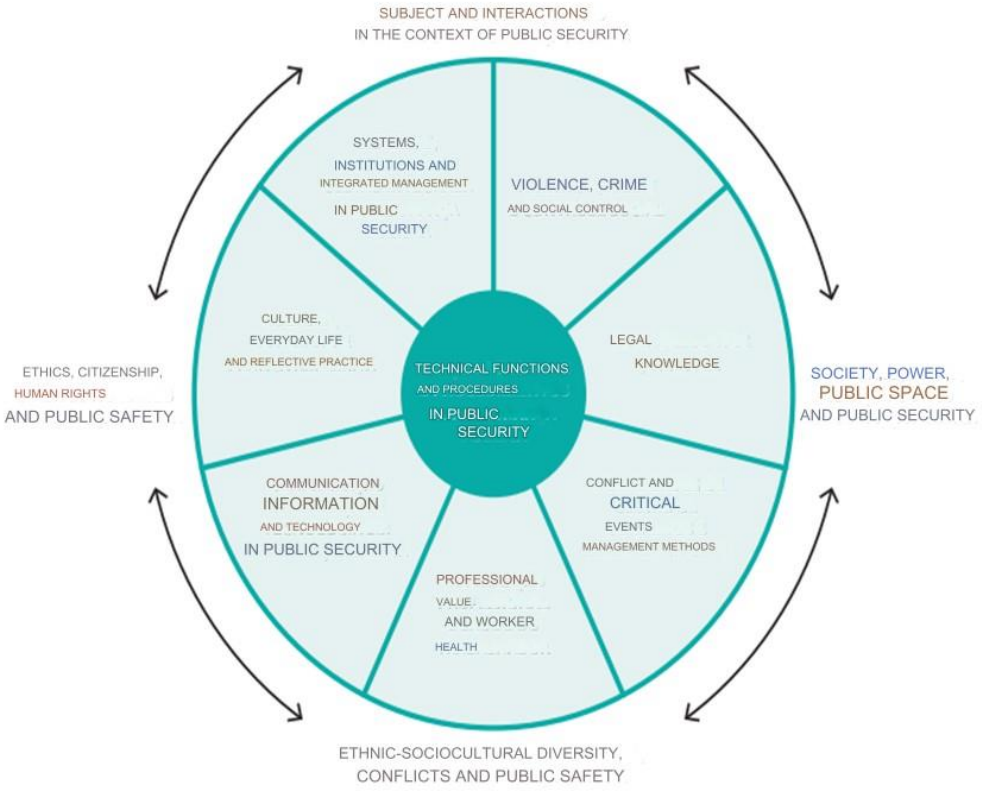
The critical appropriation of the elaborated culture implies not only the assimilation of knowledge accumulated throughout history, but also the ability to reflect and question the values, beliefs and cultural practices in force. This process of critical appropriation seeks to stimulate critical thinking, contextualized analysis, and reasoned positioning in the face of issues and dilemmas present in society.

Therefore, the educational vision adopted emphasizes the importance of intentional action in the promotion of meaningful learning and the construction of knowledge, as well as in the formation of critical and reflective subjects, capable of critically appropriating the culture elaborated and acting ethically and responsibly in society.

In this regard, it is worth mentioning Canário (2013) when he highlights that "adult education, as we know it today, is a recent phenomenon [...] Conceiving education as a broad and multiform process that is intertwined with the life process of each individual, [...]" (p. 11).

To facilitate the process, the MCN presented thematic areas (figure 2) that correspond to content spaces that should be worked on by the areas of knowledge, enabling adaptations that meet the expectations of the various institutions, careers, demands of society and local and/or regional peculiarities.

Figure 2 – Thematic areas of the National Curriculum Matrix (SENASP, 2014, p. 45)



Thus, through a dynamic of constant and intense relationship between the articulating axes and the thematic areas, a range of possible combinations for the contents is opened, which allows contributing to the unity of thought and action of professionals in the area of security, in harmony with regional peculiarities.

To this end, the MCN prescribes that,

> The thematic area Functions, Techniques and Procedures in Public Security corresponds to the final implementation of the entire training process aimed at equipping the public security professional for the performance of his function. The quality of this performance is, however, linked to the cognitive, operative and attitudinal competencies contemplated by the other thematic areas. (SENASP, 2014, p. 45).

Therefore, the results resulting from the training, as proposed by the MCN, must go beyond technical performance.

RESULTS

According to what is presented in the above-mentioned reference, it was in 2003, with the launch of the National Curriculum Matrix, that, as highlighted by Miranda (2008), for the first time attention was focused on the need for technical parameters to guide the performance of the Brazilian police, in order to enable the composition of theoretical and practical references according to the following democratic principles:

> - Citizenship and human rights are the ethical, normative, legal and practical references, so that training allows the construction of new cultural and structural paradigms;
> - The training of security professionals should be continuous and regular;
> - The pedagogical approach must enable the democratic construction of knowledge, so that the training process takes into account the representations and experiences of the actors;
> - Pedagogical policies should be based on a diagnosis of the needs, needs and demands of the institutions;
> - Training actions should focus on the principle of integration, encourage interdisciplinarity and cover the largest number of professionals;
> - Training actions must combine methods and content that respect both the universality of citizenship and the recognition of diversity (Miranda, 2008, p. 74).

In its current version, from 2014, the National Curriculum Matrix maintained, without changes, the dynamics of the articulating axes of the thematic areas and the pedagogical orientation, but included in its text the following points:

> - Professional skills extracted from the professional profile;
> - New curricular network (common core) that will guide the training and qualification curricula of Civil and Military Police Officers, as well as the curricular network specifically designed for the training and qualification of Military Firefighters; (SENASP, 2014, p. 13 – emphasis added).

As Rodrigues (2020) points out, although the military and civil police have different attributions, the greatest concern should lie in the aspect of how these institutions develop their actions, as "they are necessarily linked to constitutional and human rights principles and, at this point, the role of the educational process practiced in these institutions stands out as fundamental" (p. 51).

It is worth noting that until the emergence of Law 13,675 of 2018, the Federal Highway Police was not formally linked to the MCN, however, it has always been linked to the same constitutional principles as the state security forces, especially the respect and promotion of human rights.

The central point of the discussion, which now follows, is to ascertain, whether or not there was an influence of the MCN on the educational processes of the PRF, even before its obligation.

The first aspect to be considered is that the PRF, due to its capillarity, has always worked in partnership with all state police forces in Brazil, and this operational approach was naturally echoed in the integration in training actions. Thus, for the RB interviewee, it has always been common for federal highway police officers to participate in training conducted by other police forces. As it states:

> Another very common practice was the solicitation or occupation by offering vacancies in external courses, as a rule of the military forces and with an eminently operational focus, especially in special operations activities, police shooting techniques and the use of motorcycles in policing or in escort and scouting. Thus, when the graduates, when they returned, they ended up multiplying their knowledge, sometimes in an organized and intentional way, and at other times by observing daily practice. (RB Interviewee)

This statement leads to the understanding that the work techniques and doctrines adopted today by the PRF teaching were greatly influenced by what was learned, over time, in the educational actions in which its police officers participated with the state public security forces. Consequence of the learning process and application in the work context, which occurred, as highlighted by the interviewee, both intentionally and through the assimilation and replication of the practice.

With regard to the influence of the MCN, specifically and directly, on PRF teaching, the interviewee RB states that it has occurred since the PRF began its transition from content-based logic to competency-based logic:

> The National Curriculum Matrix, legally, it will base all the training, all the qualification, the education of military police officers, civil police officers, right..., [...], what not... it does not apply as a rule to the PRF or the Federal Police, because SENASP, which is the one that developed this Matrix, has a limitation in relation to this. It guides these police, but it has been used since the beginning, since the PRF, it is... in 2008 you started the competency-based work using the National Curriculum Matrix as your main reference, why? The first thing we have to work on is... with reference to other institutions, because we often work together, you know; secondly, because it is a job very well done and it was raised, of course, for a general reality [...] (RB Interviewee)

Interviewee JH also draws attention to competency-based teaching, especially to the competency mapping presented by MCN in 2014:

> [...] The profile of what it means to be a police officer is very close. I think that it (MCN) can be used and can be used a lot with this bias – of what is the desired profile, what are the minimum and common competencies for all public security professionals, how do you develop in these professionals the necessary attitudes to, in the environment of the Brazilian social pact, right? in the vision of state and society that we have in Brazil, how the police should act and should behave. So, I think it's an important element from that point of view. (Interview JH).

It was possible to observe that the interviewees highlight, as a major influencing factor, the mapping of competencies presented by the MCN. This, apparently, refers to the fact that the PRF, as

an institution with a horizontal and complex structure, has a mapping of strategic managerial competencies, but does not have a general and complete mapping of competencies.

The National Curriculum Matrix highlights that competencies have a close relationship with the ethical, legal and technical axes that,

> according to Balestreri (1998), they are present in the training of professionals in the area of public security; with the Four Pillars of Education proposed by UNESCO: learning to learn, learning to do, learning to be and learning to live together; and with the dimensions of knowledge: knowing, knowing how to do and knowing how to be" (SENASP, 2014, p. 20).

In addition, it is important to consider and reinforce the territorial scope of the PRF's action, constantly interacting with all other Brazilian police forces, in a scenario with similar characteristics, that is, Brazilian society as a whole.

In this context, cognitive and attitudinal skills, associated with the concept of transversal skills, become even more relevant and similar among different police forces. These competencies encompass skills and attitudes that are essential for the effective performance of police activities, as noted by the EW interviewee.

> The Curricular Matrix brought a greater load in the area of humanities, so greater attention was given mainly to the disciplines of human relations, human rights and ethics in police training. This was a gain in relation to the Curriculum Matrix. The Curricular Matrix brings a guideline that is based on state institutions, as it covers the civil police and the military police, a workload also in these training courses is much greater than in the PRF course, this workload is much greater, and also the execution time is longer. So, the Curricular Matrix brought this benefit and also the issue of interdisciplinarity, which began to be worked on in 2009, when this process of approximation and inclusion of the Curricular Matrix in the formation of the PRF (EW Interview) began.

It is important to highlight that the MCN itself states that the implementation of a curriculum requires a relationship of congruence between contextual intentionalities expressed in everyday facts (contextual dimension); the legal and conceptual contributions (political dimension) and the appropriate conditions for its operationalization on a day-to-day basis (technical-methodological dimension). This indicates that "the actions carried out in educational spaces should be aimed at the development of the professional competencies necessary for the performance of the public security professional in the context in which social needs and requirements are established" (SENASP, 2014, p. 16).

In this sense, Poncioni (2013) presents an interesting reflection:

> The Matrix offers, based on an institutional definition of the public security professional, in the case of police officers, the technical parameters for changing the theoretical-practical frameworks of professional training; proposes to break with the current paradigms of the professional training of police officers, fundamentally based on a "traditional police professional model", which mixes militaristic and legalistic principles for crime control, for the adoption of a "new" type of police professional model, which emphasizes public service, the discretion of the police officer informed by a high level of education and training, and

> the search for a closer relationship between the police and the community, characteristic of democratic societies (p. 50).

Still, in relation to the advantages and disadvantages of the influence of the MCN on the training actions of the PRF, the EW interviewee highlights the positive impact on the qualification of the institution's teaching staff:

> [...] I believe that we only had gains with the implementation of the Curriculum Matrix, mainly so that the training of the instructor himself had a...., a caution of the general administration in making a periodic update of the instructors, then the qualification of the instructors, so that they are better prepared for the execution of the activities in the classroom, both in training and in qualification. (EW interview).

Finally, it should be noted that the foundations for a new public security governance were laid in 2018, with Law 13,675, which disciplined the organization and functioning of the bodies responsible for public security in Brazil, under the terms of § 7 of article 144 of the Federal Constitution, created the National Policy for Public Security and Social Defense (PNSPDS) and instituted the Unified Public Security System (SUSP).

> Article 9 The Unified Public Security System (Susp) is hereby established, whose central body is the Extraordinary Ministry of Public Security [...]
> § 2 The operational members of Susp are: [...]
> II - Federal Highway Police;
> Article 10 [...]
> § 5 The exchange of technical and scientific knowledge for the qualification of public security and social defense professionals shall take place, among other ways, through reciprocity in the opening of vacancies in specialization, improvement and strategic studies courses, respecting the peculiarities and the legal regime of each institution, and observing, whenever possible, the national curriculum matrix. (LAW 13.675 - emphasis added)

CONCLUSION

Despite the complexity of Public Security in Brazil, it can be said that the National Curriculum Matrix, presented by the National Secretariat of Public Security – SENASP in 2003, plays a fundamental role in the professional training of Brazilian police officers. The importance of the MCN lies in the fact that it establishes guidelines and benchmarks for the construction of police training curricula throughout the country.

The MCN seeks to ensure the standardization and quality of the content and skills developed throughout the training of police officers, contributing to the construction of solid and comprehensive knowledge in the technical, operational, ethical, and social areas. In addition, MCN emphasizes the importance of developing transversal skills, such as teamwork, communication, professional ethics, and respect for human rights.

Although the MCN of 2014, version still in force, is expressly directed to the military police, civil police and military fire brigades, therefore, without binding power to the Federal Highway

Police, the fact is that, due to its consistency and amplitude, it ended up guiding, theoretically and methodologically, the training actions of the PRF, especially in the structuring of a teaching aimed at the development of skills. as verified in the present work.

From Law 13,675/2018, which instituted the Unified Public Security System – SUSP, a new perspective of application for the MCN emerged, broader, aimed at SUSP members and no longer directed to state, military and civil police, and military firefighters. Thus, the next editions of the MCN should undergo changes considering this new complexity.

It is important that new research be developed for the advancement of police professional training in Brazil, even as a basis for reviewing and updating the MCN.

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The importance of digital playful games for the teaching and learning process: A qualitative study

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ABSTRACT
This research aimed to analyze teachers' perceptions about the importance of digital playful games in the teaching and learning process. Using a qualitative approach, the research was conducted through in-depth interviews with fifteen teachers from a Brazilian public school. The interviews were recorded, transcribed and analyzed using the discourse analysis technique. The results revealed that teachers recognize the potential of digital playful games to promote student engagement, making classes more dynamic and attractive. Games were identified as facilitators for the exploration and understanding of complex concepts, in addition to stimulating cognitive and socio-emotional skills, such as critical thinking and collaboration among students. However, challenges related to specific teacher training and adequate school infrastructure were identified. Digital playful games have been found to be effective pedagogical tools to improve the quality of teaching and learning, promoting the holistic development of students. However, it is necessary to address the challenges associated with its implementation to maximize the benefits and minimize the negative impacts.

Keywords: Playful games, Technology, Education.

INTRODUCTION

In the context of contemporary society, digital technologies play an increasingly central role in various spheres of human life, influencing everything from communication to entertainment and education. With technological advancement and the popularization of devices such as smartphones, tablets, and computers, new forms of interaction and access to information have emerged, transforming the way people relate to the world around them. In this sense, digital technologies offer a diverse range of resources and tools that can be exploited to enrich educational processes, providing more dynamic and interactive learning opportunities (CONTE; HABOWSKI; RIOS, 2019).

In the field of digital playful games, there is a strand that capitalizes on these technological advances, combining elements of fun, entertainment and learning in a single virtual environment. Digital playful games are applications or software designed to provide interactive and immersive experiences, in which users can participate in narratives, solve challenges, and explore virtual environments. These games vary in complexity and theme, ranging from simple puzzles to sophisticated educational simulations, providing opportunities for the development of cognitive, social, and emotional skills in an engaging and motivating way (SENA et al., 2016).

In the educational context, digital playful games have stood out as an effective pedagogical tool to promote student engagement and enhance the teaching and learning process. By integrating elements of fun and challenge with educational content, these games become an attractive and motivating tool for students, stimulating curiosity, creativity, and interest in knowledge (CRUZ JÚNIOR, 2017).

In addition, digital playful games provide opportunities to practice skills such as problem-solving, decision-making, and collaboration, which are essential for the all-round development of students. With the possibility of personalizing and adapting the content according to the skill level and interest of each student, digital play games in education provide a more individualized and inclusive approach, meeting the diverse needs of students effectively (SENA et al., 2016).

In this context, the objective of this research was to analyze teachers' perceptions about the importance of digital playful games for the teaching and learning process. The study, with a qualitative methodological approach, was limited to fifteen teachers from a Brazilian public school.

METHODOLOGY

The research carried out was of the exploratory type, whose main objective is to explore a theme still little known or studied, seeking to understand its characteristics, contexts and possible relationships. This type of research was chosen due to the need to investigate in an initial and in-

depth way the integration of ludic games and digital technologies in education, an emerging and complex theme that still lacks in-depth studies.

As for the methodological approach, the qualitative approach was adopted, which is characterized, according to Lima, Domingues Junior, and Gomes (2023), by the search to understand the meanings, perceptions, and experiences of the participants. The choice of this approach is justified by the exploratory nature of the research and the need to understand in depth the perspectives and experiences of teachers in relation to the use of playful games and digital technologies in education.

The sample consisted of fifteen teachers from a Brazilian school, selected for convenience due to the ease of access and availability of the participants. The choice of teachers as participants in the research was due to their fundamental role in the implementation and use of educational resources in the classroom.

For data collection, in-depth interviews were conducted. Initially, contact was made with the school manager to request authorization and support in carrying out the research. After authorization, the interviews were scheduled with the participating teachers, being carried out individually and in person. During the interviews, tape recorders were used to ensure the fidelity of the information collected. Participants were informed of the objectives of the research and agreed to be recorded to ensure accurate transcription of interviews.

After data collection, the analysis of the participants' discourses was performed using the discourse analysis technique. This technique consists of identifying the linguistic and discursive elements present in the interviews, seeking to understand the underlying meanings and representations of the participants on the topic in question. Discourse analysis allowed for a deeper understanding of teachers' perceptions and experiences regarding the integration of playful games and digital technologies in education.

RESULTS AND DATA ANALYSIS

The results of the survey revealed a variety of perceptions and experiences of teachers regarding the integration of digital play games into the teaching and learning process. Most participants highlighted the potential of these resources to promote student engagement, making classes more dynamic and attractive. Many reported that digital play games stimulate students' curiosity and participation, creating an environment conducive to exploration and learning.

> Digital playful games have really transformed my classes, making complex concepts more accessible and motivating my students (E4).
>
> Implementing historical simulation games has breathed new life into my classes, encouraging my students to explore and better understand the events of the past (E8).

> The environmental simulation games were essential to engage my students with important sustainability issues, stimulating their critical thinking and environmental awareness (E11).

The analysis of the results reveals that teachers recognize the potential of digital playful games as effective tools to promote student engagement in the teaching and learning process. The widespread perception is that these resources make classes more dynamic and attractive, stimulating students' curiosity and participation. This suggests that digital play games offer an environment conducive to exploration and learning, allowing students to engage more actively and meaningfully with the content covered in the classroom.

Teachers' reports highlight the ability of digital playful games to make complex concepts more accessible and understandable to students. For example, the use of historical and environmental simulation games has been shown to bring new life to lessons, allowing students to explore historical events and environmental issues in a more engaging and immersive way. This suggests that digital play games not only promote student engagement but also facilitate the understanding and internalization of important concepts.

In addition, the teachers' reports show that digital playful games have the potential to stimulate cognitive skills, such as critical thinking and environmental awareness. By engaging students in simulation and decision-making experiences, these resources promote reflection and analysis, contributing to the development of a deeper and more critical understanding of the topics covered. This underscores the importance of digital play games not only as teaching tools, but also as instruments for developing essential life skills.

It is also noteworthy that the teachers emphasized the ability of digital playful games to develop students' cognitive and socio-emotional skills. Through solving challenges and collaborating with peers, students are encouraged to develop critical thinking, decision-making, and effective communication. Teachers reported that they observed an improvement in students' academic performance after the introduction of digital play games in the classroom.

> Digital playful games have been fundamental for the development of students' cognitive and socio-emotional skills, providing an environment conducive to the practice of critical thinking and collaboration among colleagues (E2).

> By using strategy games in my classes, I noticed a positive change in the students' behavior, who started to communicate more effectively and work as a team to solve the proposed challenges (E1).

However, some challenges were also identified by the participants. Among them, the need for specific teacher training for the effective use of these resources stands out, as well as the availability of adequate infrastructure in schools, such as internet access and technological devices.

In addition, some teachers expressed concerns about the excessive use of technology, stressing the importance of balancing the use of digital play games with other educational activities.

In the data analysis, it was possible to identify recurrent patterns in the teachers' perceptions, evidencing the importance of digital playful games as a pedagogical tool in the educational context. The results suggest that, when used appropriately and integrated into the school curriculum, digital play games can contribute significantly to improving the quality of teaching and learning, promoting the holistic development of students. However, it is necessary to consider the challenges and limitations associated with its implementation, in order to maximize the benefits and minimize the negative impacts.

FINAL THOUGHTS

The research highlighted a wide range of benefits associated with the integration of digital play games in the educational context, highlighting their ability to promote student engagement and make classes more dynamic and attractive. Teachers' reports highlight how these resources enable exploration and learning in an engaging way, making complex concepts more accessible and understandable for students. In addition, digital playful games have been recognized as effective tools for the development of cognitive and socio-emotional skills, stimulating critical thinking, decision-making, and collaboration among students. The overall perception of the participants was of an improvement in the academic performance of the students after the introduction of these resources in the classroom.

However, despite the evident benefits, some challenges were identified by teachers. The need for specific teacher training for the effective use of digital play games and the availability of adequate infrastructure in schools were highlighted as important issues to be considered. In addition, concerns about the excessive use of technology and the importance of balancing the use of these resources with other educational activities were also mentioned.

In short, the results of the research highlight the importance of digital playful games as a pedagogical tool in the educational context, evidencing their potential to promote the improvement of the quality of teaching and learning. However, it is crucial to address the challenges and limitations associated with its implementation, aiming to maximize the benefits and minimize the negative impacts.

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The contributions of playful games and digital technologies to education

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ABSTRACT
The study aimed to analyze the integration of playful games and digital technologies in education, investigating their impacts on the teaching and learning process. The method consisted of a bibliographic search, which involved the survey of scientific articles on the Scopus, SciElo and Google Scholar platforms. As a result, the historical and conceptual development of playful games and digital technologies in education was verified, from ancient civilizations to contemporary advances, highlighting their use as effective pedagogical tools to promote critical thinking, problem-solving and collaboration among students. The integration of these resources represents a revolution in the pedagogical field, offering opportunities to promote engagement, personalization, and inclusion in the teaching and learning process. Digital games and technologies enable a flexible and adaptive approach, allowing each student to progress at their own pace and style, while fostering collaborative and inclusive interactions. The importance of continuing to explore and enhance this integration was emphasized, aiming to create more dynamic, inclusive, and student-centered learning environments.

Keywords: Playful games, Digital technologies, Education.

INTRODUCTION

Playful games and digital technologies have become increasingly relevant elements in the contemporary educational context, reflecting a significant change in teaching and learning practices. While playful games provide immersive and engaging learning experiences, digital technologies offer innovative features that expand the possibilities of interaction and collaboration in the educational environment. The integration of these two elements in education has been driven by the search for more dynamic and adaptive pedagogical approaches, capable of meeting the diversified needs of students in the digital age (RÊGO; CRUZ JÚNIOR; ARAÚJO, 2017).

The emergence of playful games in education dates back many decades, with educators recognizing the potential of these activities to promote learning in a playful and meaningful way. From board games to outdoor activities, games have been used as effective pedagogical tools to encourage critical thinking, problem-solving, and collaboration among students. In recent years, technological advances have opened up new possibilities in the field of educational games, allowing for the creation of engaging and personalized virtual environments that meet the specific needs of each student (SOARES, 2017).

On the other hand, digital technologies have played an increasingly central role in education, transforming the way content is presented, explored and evaluated. From the emergence of the first computers to the proliferation of mobile devices and educational applications, digital technologies have provided new ways of accessing knowledge and interacting with content. The use of resources such as simulations, augmented reality, gamification, and online learning platforms has enriched the educational process, offering opportunities for more autonomous, collaborative, and personalized learning (GUARDA; GOULART, 2018).

Given this scenario, this research sought to analyze the integration of playful games and digital technologies in education, investigating their impacts on the teaching and learning process. Through a critical review of the existing literature, we seek to comprehensively understand how these resources can be used effectively to promote student motivation, engagement, and skills development. In addition, it is intended to identify challenges and opportunities associated with the adoption of these practices, aiming to contribute to the development of guidelines and strategies that promote a more effective integration of ludic games and digital technologies in education.

DEVELOPMENT

PLAYFUL GAMES AND DIGITAL TECHNOLOGIES

The use of playful games and digital technologies in education represents a significant evolution in the pedagogical field, which goes back to several historical and conceptual influences. Historically, games have played a key role in the learning process, from ancient civilizations to

modern educational systems. Ancient civilizations, such as the Greeks and Romans, recognized the value of games in the formation of cognitive, social and physical skills in young people (FELICIO; SOARES, 2018).

However, it was in the twentieth century that interest in games in education was reinvigorated, especially with technological advancements that made it possible to develop interactive digital games. At the same time, the emergence of digital technologies in the second half of the twentieth century brought with it new possibilities for education. The popularization of personal computers, the internet, and mobile devices has transformed the way information is accessed, shared, and assimilated. This digital revolution has provided an environment conducive to the creation of innovative educational resources, including educational games, interactive applications, and online learning platforms (ALMEIDA; OLIVE TREE; REIS, 2021).

Playful games are activities whose main objective is to provide entertainment, fun and learning simultaneously. They are characterized by their recreational nature and their educational potential, encouraging the active participation of players in a relaxed and motivating environment. These games can encompass a wide variety of formats, from traditional board games to interactive digital applications, and can be used in different contexts, such as education, personal development, and leisure activities (ALMEIDA; OLIVE TREE; REIS, 2021).

With the advent of the internet, playful games began to be made available on online platforms, which further expanded their reach and accessibility. Technological advances have allowed for the development of increasingly sophisticated educational games, which can be accessed on different devices, such as computers, tablets, and smartphones. This diversity of platforms and formats offers educators and students a wide range of options to integrate playful games into the teaching and learning process (SOUSA; CHUPIL, 2019; SENA et al., 2016).

THE CONTRIBUTIONS OF PLAYFUL GAMES AND DIGITAL TECHNOLOGIES TO EDUCATION

Playful games and digital technologies have offered significant contributions to education, transforming the way students learn and teachers teach. One of the main contributions is the increase in student engagement in the learning process. Games are naturally attractive and motivating, which makes learning more engaging and stimulating for students. Through challenges, rewards, and immersive interactions, games are able to capture students' attention and keep them focused for prolonged periods of time (SENA et al., 2016).

In addition, playful games and digital technologies promote active learning, in which students are encouraged to actively participate in the process of knowledge construction. By exploring virtual environments, solving problems, and making decisions within the game, students develop cognitive

skills such as critical thinking, logical reasoning, and problem-solving. This student-centered approach allows each individual to learn at their own pace and style, adapting to their specific needs and interests (CRUZ JÚNIOR, 2017).

Another contribution of games and digital technologies to education is the personalization of learning. Through data analysis and intelligent algorithms, games can tailor content and challenges according to each student's skill level and performance. This allows students to receive immediate and personalized feedback, directing them to areas that need more attention and offering challenges appropriate to their level of knowledge (NOBRE; FARIAS, 2016).

Additionally, playful games and digital technologies have the potential to make learning more accessible and inclusive for all students, regardless of their abilities, needs, or limitations. Through accessibility features such as subtitles, text narration, and adaptive control options, games can meet the needs of a wide range of learners, including those with physical, cognitive, or sensory disabilities (NOBLE; FARIAS, 2016).

In this scenario, playful games and digital technologies play a key role in school inclusion, ensuring that all students have access to meaningful and enriching learning opportunities. Through accessibility and adaptation features, these features can meet the individual needs of a wide range of students, including those with physical, cognitive, or sensory disabilities. For example, subtitles and text narration can make game content accessible to hearing-impaired students, while adaptive control options allow students with motor disabilities to actively participate in activities (RÊGO; CRUZ JÚNIOR; ARAÚJO, 2017).

Playful games and digital technologies offer a flexible and personalized approach to learning, allowing each student to progress at their own pace and style. This is especially beneficial for students with special educational needs, who can benefit from an individualized approach that is tailored to their abilities and interests. Games can be adjusted to provide challenges suited to each student's level, ensuring that everyone feels challenged and engaged in the learning process (CRUZ JÚNIOR, 2017).

Finally, playful games and digital technologies can help promote social inclusion by providing opportunities for collaborative interactions and teamwork among students. Through multiplayer games and cooperative activities, students can collaborate, communicate, and solve problems together, regardless of their individual abilities or limitations. Not only does this strengthen students' social and emotional skills, but it also creates a more inclusive and welcoming learning environment for all (SOARES, 2017).

FINAL THOUGHTS

Throughout this study, it was possible to explore the historical and conceptual development of playful games and digital technologies in education, from their origins in ancient civilizations to contemporary technological advances. It was found how these resources have been used as effective pedagogical tools to promote critical thinking, problem-solving, and collaboration among students, while providing a motivating and engaging learning environment.

The integration of playful games and digital technologies in education represents a revolution in the pedagogical field, offering innovative opportunities to promote engagement, personalization and inclusion in the teaching and learning process. The specific contributions of playful games and digital technologies to education were verified, highlighting their role in promoting engagement, active learning, personalization and school inclusion. These resources offer a flexible and adaptive approach to teaching and learning, allowing each student to progress at their own pace and style, while fostering collaborative and inclusive interactions among students.

Finally, the importance of continuing to explore and improve the integration of playful games and digital technologies in education is emphasized, identifying challenges and opportunities associated with this practice. By fostering a culture of innovation and experimentation in the classroom, one can harness the full potential of these resources to create more dynamic, inclusive, and student-centered learning environments, preparing students for the challenges and opportunities of the twenty-first century.

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Playfulness and digital games in education: Exploring the potential of technology for the teaching and learning process

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ABSTRACT
The objective of this research was to analyze the potential of playful games and digital technologies for the teaching and learning process. To this end, an integrative review research was carried out, which involved the survey of articles on the SciElo and Google Scholar platforms. During the search survey, search descriptors "AND" and "OR" were used in conciliation with specific keywords. In addition, only scientific articles in Portuguese published between 2022 and 2023 were selected. As a result, it was found that the implementation of playful games and technologies in the school environment reveals significant advantages for the teaching-learning process, especially for students with Attention Deficit Hyperactivity Disorder (ADHD). The analysis emphasizes the crucial role of these tools in promoting a dynamic and effective educational approach, although they face challenges such as a lack of technological skills and resources in institutions. The role of the educator in the diversification of teaching strategies is also highlighted, using games as a methodological resource to stimulate learning and increase student participation, resulting in improvements in class performance and dynamics. The continuing education of teachers is highlighted as essential to adopt innovative pedagogical practices, even in the face of obstacles in the implementation of playful activities. It is concluded that the integration of games and technologies in the educational context offers a promising way to improve teaching, highlighting the importance of the role of the educator and the investment in technological resources to provide a more effective and meaningful education.

Keywords: Digital games, Playful, Education, School inclusion, Technology.

INTRODUCTION

Playful games have been a fundamental tool in the cognitive, emotional and social development of children and adults. Playful games provide a dynamic learning environment where participants can explore, experiment, and learn interactively. With the advancement of digital technology, new ways to incorporate these playful elements have emerged, creating a range of electronic games and educational applications. This convergence between games and digital technology has revolutionized the way we learn and engage with knowledge, offering immersive and personalized experiences (DIONIZIO, 2019).

Utilizing digital technology in games provides a variety of benefits, including the ability to simulate complex scenarios, provide instant feedback, and adapt the difficulty level according to the player's progress. In addition, digital games allow for greater accessibility, reaching a wider and more diverse audience. In the educational context, they can be used to teach academic concepts, develop specific skills, and promote collaboration and teamwork (SANTOS; PEREIRA, 2019).

In education, the integration of playful games and digital technologies offers unique opportunities to engage students in meaningful and motivating ways. By creating interactive and engaging learning environments, educators can increase students' interest in content and promote more effective learning. In addition, the personalization of digital games makes it possible to adapt teaching to the individual needs of each student, providing a more personalized and efficient learning experience (GADELHA et al., 2019).

Thus, the objective of this research was to analyze the potential of playful games and digital technologies for the teaching and learning process. It is hoped that the results of this research will provide theoretical and practical subsidies for the understanding of the role of playful games and digital technologies in education. Understanding the potential of these tools is crucial for enhancing educational practices and promoting more meaningful and engaging learning.

METHODOLOGY

The research was conducted through an integrative review, a method that allows for a comprehensive and systematic analysis of the existing literature on a given topic, bringing together data from different studies to offer a holistic view of the subject. This approach was chosen due to the need to understand the potential of playful games and digital technologies in education, exploring diverse perspectives and evidence available in the literature.

To carry out the data collection, the Google Scholar and Scielo platforms were used, using specific keywords and search descriptors such as "educational games", "digital technologies in education", "learning through games", among others. The combination of Boolean operators "AND" and "OR" was employed to refine the results and ensure the relevance of the selected articles.

Inclusion criteria were established for the selection of articles, which included the choice of only scientific articles, Brazilian articles, articles in Portuguese, full articles, free articles, articles associated with the topic of interest, and articles published in the period between 2022 and 2023. Other types of studies, such as theses, conference abstracts, and reports, were excluded from the analysis to ensure the quality and relevance of the data obtained.

Data analysis was performed in two distinct stages. In the first stage, the abstracts and titles of the articles found were read, selecting those that met the established inclusion criteria. Then, in the second stage, the selected articles were read in full, allowing for a more in-depth analysis of the content. As a result, a final sample of three scientific articles was obtained for analysis and discussion.

RESULTS AND DATA ANALYSIS

As a result, it was possible to obtain a sample of 3 scientific articles, as shown in chart 1.

Based on the data obtained and the perception of the students surveyed, it was observed that a large majority recognize playful activities and games as facilitating instruments for new learning, in addition to contributing to the improvement of school performance. The difficulties encountered in carrying out the games, according to the academics, were minimal, one of them being related to the time needed to carry out this type of work, which can lead teachers to give up due to lack of knowledge about methodologies that go beyond the traditional model. In this sense, the importance of continuing education for teachers is highlighted. Although the adoption of these activities has contributed to the teaching and learning process of the various contents worked, there is still a long way to go to overcome traditional teaching in Brazil. However, the experience described demonstrates that it is possible for teachers to innovate teaching methods, promoting interaction, integration and collaboration in the development of knowledge in an efficient way, based on an interdisciplinary approach.

Authors	Objective	Methodology	Conclusion
Costa, Dias e Santos (2022)	Discuss the use of technology in learning with elementary school children who have ADHD	Bibliographic research	The implementation of playful games and technologies in the school environment presents several benefits for the teaching-learning process. Although some education professionals may feel discomfort due to a lack of technological skills and a scarcity of resources in institutions, the inclusion of these tools can provide a more dynamic and effective approach to education, especially for students with Attention Deficit Hyperactivity Disorder (ADHD). Studies show that the use of digital games can spark students' interest and help control symptoms such as hyperactivity and restlessness, facilitating engagement and completion of activities. Furthermore, investment in educational technology, including internet access and digital equipment, is essential to expand learning opportunities and raise education levels.
Sousa (2022)	Analyze the importance of a digital game for the teaching and learning process	Bibliographic research	The fundamental role of the educator in the teaching-learning process is evident at all stages, highlighting the importance of diversifying teaching techniques to make classes more attractive and productive. The use of games as a methodological resource aims to effectively stimulate learning, developing skills in students. In this sense, this project demonstrated that students felt motivated to learn mathematics in an interactive and enjoyable way, acquiring knowledge, problem-solving skills and promoting cooperation and teamwork. The results obtained using the application were positive, reflected not only in internal evaluations, but also external ones, demonstrating that mathematics classes have become more dynamic and effective. In conclusion, this study highlights the importance of teachers in proposing different strategies to disseminate knowledge to students, highlighting the relevance of everyday teaching practice to achieve success in teaching.

Lunkes et al. (2024)	Understand how the use of recreational resources, games, in the teaching and learning process, associated with the use of technologies, can help in the transposition of mathematical content	Experience report	Based on the data obtained and the perception of the students surveyed, it was observed that a large majority recognize recreational activities and games as facilitating instruments for new learning, in addition to contributing to improving school performance. The difficulties encountered in carrying out the games, according to the academics, were minimal, one of them being related to the time needed to carry out this type of work, which could lead teachers to give up due to a lack of knowledge about methodologies that surpass the traditional model. In this sense, the importance of continuing teacher training stands out. Although the adoption of these activities has contributed to the teaching and learning process of the different contents covered, there is still a long way to go to overcome traditional teaching in Brazil. However, the experience described demonstrates that it is possible for teachers to innovate teaching methods, promoting interaction, integration and collaboration in the development of knowledge efficiently, based on an interdisciplinary approach.

Source: Survey data (2024).

In view of the above, the benefits of implementing playful games and technologies in the school environment for the teaching-learning process are observed, especially highlighting their relevance for students with Attention Deficit Hyperactivity Disorder (ADHD). Costa, Dias, and Santos (2022) point out that, although some education professionals may experience discomfort due to a lack of technological skills and the scarcity of resources in institutions, the inclusion of these tools can provide a more dynamic and effective approach to education. The use of digital games is pointed out as an effective strategy to arouse students' interest and help control symptoms associated with ADHD, such as hyperactivity and restlessness, which facilitates engagement and completion of activities.

The analysis carried out by Costa, Dias and Santos (2022) highlights the importance of investing in educational technology, including access to the internet and digital equipment, as fundamental elements to expand learning opportunities and raise education levels. The survey highlights the need to overcome obstacles related to the lack of technological skills on the part of education professionals and the scarcity of resources in institutions, emphasizing the importance of continuous training and investments in technological infrastructure in schools.

Sousa (2022) highlights the essential role of the educator in the teaching-learning process, emphasizing the need to diversify teaching techniques to make classes more attractive and productive. The use of games as a methodological resource is pointed out as an effective strategy to stimulate learning, develop students' skills and promote interactivity in mathematics teaching. The study shows that the students felt motivated and engaged during the activities, acquiring knowledge, problem-solving skills and promoting cooperation and teamwork.

The positive results obtained with the use of the application demonstrate not only an improvement in the students' performance in internal assessments, but also external ones, indicating that mathematics classes have become more dynamic and effective. In conclusion, Sousa (2022)

highlights the importance of teachers in proposing differentiated strategies to disseminate knowledge to students, emphasizing that success in teaching requires a daily and innovative teaching practice.

Authors such as Lunkes et al. (2024) highlight that most students recognize playful activities and games as facilitating tools for new learning, associated with improved school performance. Despite this, the difficulties faced in the implementation of these activities were minimal, being mainly related to the time needed to carry them out and the lack of knowledge about alternative methodologies on the part of the teachers. These results highlight the importance of continuing education of teachers for the adoption of innovative pedagogical practices.

Although playful activities have contributed positively to the teaching and learning process, the study points out that there is still a long way to go to overcome traditional teaching in the Brazilian educational context. However, the experience described shows that it is possible for teachers to innovate in their teaching methods, promoting interaction, integration and collaboration in the development of knowledge in an effective way, through an interdisciplinary approach. This conclusion highlights the importance of investing in teacher training and in the promotion of pedagogical practices that encourage the active participation of students and the collaborative construction of knowledge.

FINAL THOUGHTS

In view of the evidence presented, it is noticeable that the introduction of playful games and technologies in the school environment offers significant advantages for the teaching-learning process. The analysis highlights the importance of these tools in promoting a more dynamic and effective educational approach, although there are challenges related to the lack of technological skills and resources in educational institutions.

In addition, the fundamental role of the educator in the diversification of teaching strategies is highlighted, including the use of games as a methodological resource to stimulate learning and foster student participation. The positive results obtained with the use of educational technologies reflect not only improvements in student performance, but also positive changes in the dynamics of classes.

Finally, the importance of continuing education of teachers for the adoption of innovative pedagogical practices is emphasized, even in the face of the challenges faced in the implementation of playful activities. Experience shows that it is possible to innovate in teaching methods, promoting interaction and collaboration among students, which contributes to the development of knowledge more effectively.

Therefore, it is concluded that the integration of playful games and technologies in the educational context offers a promising way to improve the teaching-learning process, emphasizing

the importance of the role of the educator, continuing education and investment in technological resources in schools to provide a more effective and meaningful education.

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The trajectory of fashion from 1980 to 2022: The view of women in a city in the Midwest of Minas Gerais

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ABSTRACT

Fashion is something that goes beyond covering the body, it conveys the individual's relationship with society and their individual perception of events in different contexts, environmental, social, religious and political. The study aims to verify the perception of women, ≥35 years old, regarding the influence of globalization on consumption behavior and accessibility to fashion and beauty in the 80s, 90s and also "millennia" (2000 - 2023); and thus understand how the people who live in the city of Santo Antônio do Monte - MG perceive fashion in each of these times. This is a cross-sectional study of a qualitative and quantitative nature. Initially, 133 individuals answered the questionnaire formulated on the Google Forms platform; After tabulating the results in Excel 2018 software, 127 individuals with a mean age of 44.77 (±8.05) years were analyzed and reported after following the exclusion criteria. In general, the globalization process has positively influenced the perception, desire and consumption of women in Santo Antônio do Monte - MG, where it can also be seen that the more information available there is, the greater the demand for fashion, hair and makeup trends. It is suggested that further studies be carried out in order to highlight how important it is to understand how political, economic, social and environmental contexts can influence fashion, consumption, accessibility, desire and perception of women, and audiences in general in inner cities.

Keywords: Fashion, Globalization, Millennia, Women.

INTRODUCTION

When we talk about fashion, we realize that it is constantly changing, and anthropologically there are some existential explanations for fashion such as: exhibitionism, modesty, communication and protection (SALVADOR. 2020). According to Coco Chanel (1965) "Fashion passes. The style remains." The movement of constant resurgence of fashion makes it difficult to define it, thus, conceptually, one can understand the difficulty of the existence of standards; contemporaneously, it can be seen that the fashion industry is consumed by different physical, economic, social, political, religious and cultural contexts that evolve in a timeline as the globalization process takes hold (SILVA; CARVALHO, 2015; SALVADOR, 2020).

The temporal movement has shaped the representations of fashion and how it has been perceived (SALVADOR, 2020). Positive or unpositive events during periods are reformulated and reified as militarism brought in as a style in the first year of the twenty-first century. It can be seen that the war theme is beginning to participate in fashion, being present in several fashion shows of already established names in the *fashion* world; among them are McQueen, Valentino, Dolce & Gabbana, Chanel, among others (SILVA; CARVALHO, 2015).

Fashion makes it possible for human beings, through the way they dress, to express their feelings and intentions that have been stimulated by the environment in which they are inserted. Thus, it is understood that fashion acts according to the preferences of individuals, typical of human behavior (SALVADOR, 2020). The concept of fashion is based on the need for adherence and replicability of large-scale innovation. However, after intra-individual evaluation of the invention, adherence to the new style occurs after aesthetic and preferential judgment; if the invention pleases the majority, it becomes fashionable (SANTOS, 2020).

Another concept about fashion can be perceived in a non-verbal way through the way of dressing, wearing, combing, and makeup, along with human sociocultural behavior. Thus, fashion mirrors the temporal moment in which society is inserted, and its clothes are cultural signs that imprint on the population values that it believes in (SILVA; CARVALHO, 2015).

However, it is of paramount importance to understand how the individual perception of daily events, political, economic and religious influence the desire and accessibility to fashion.

Studies that assess how globalization influences the behavior of individuals in large centers (capitals) are already well established (CAVALCANTI, 2016). In view of this, it is necessary to evaluate the perception of individuals regarding the influence of globalization on consumption behavior and accessibility to fashion and beauty of people from the countryside. However, the objective of the study was to verify the perception of women ≥35 years old regarding the influence of globalization on consumption behavior and accessibility to fashion and beauty in the 80s, 90s and also "millennia" (2000 - 2022).

THEORETICAL FRAMEWORK

The literature review presented is adequate to support different parts of the present study. The contents described refer to: Political and economic contextualization of the 80s, 90s and millennia (2000-2022); The influence of the political and economic context on fashion in the 80s, 90s and millennia (2000-2022); The importance of the 80s,90s to millennia (2000-2022) for clothing; The importance of the 80s, 90s and millennia (2000-2022) for makeup and accessories; The importance of the 80s, 90s and millennials for cosmetics and The importance of the 80s, 90s and millennia for hair color and shape.

HISTORICAL CONTEXT

Political and economic contextualization of the 80s, 90s and millennia (2000-2023)

In the 1980s, Brazil was marked by strong governmental transitions such as the end of the dictatorship, the return of democracy and a series of economic problems; so much so that this decade is known as the lost decade, there were several economically unsuccessful changes (Cruzado Plan, Cruzado Plan I, Cruzado Plan, Cruzado Plan II, Bresser Plan, Summer Plan), generating inflationary peaks (RIBEIRO, 2022). As such, the 1980s were known for economic downturn and constant price freezes. The breath of hope began to emerge in the 1990s, a period in which the reform of the economic structure for the improvement of future times took place. In 1993, the process of stabilizing the economy began; and in 1994, during the Itamar Franco government, the Real economic plan was implemented in order to solve one of the world's greatest financial crises (PINHEIRO; GIAMBIAGI; GOSTKORZEWICZ, 1999).

After 1994, there was an initial stability in the financial system, in prices and in market growth, which later, with the economic opening and the incentive to national and international investors, the economic advance began in some sectors. Thus, an imminent growth began in the production chain, even if starting from a moment of fragility. (PINHEIRO; GIAMBIAGI; GOSTKORZEWICZ, 1999).

With the stabilization of inflationary peaks after the new economic model, Brazil becomes more attractive to international investors. In the 90s, the opening of trade and economic stabilization became clear; The Brazilian market becomes attractive and accessible. According to De Carvalho (2000), in the country, foreign investments in the capital market were significantly leveraged to the detriment of these changes in this period.

With the arrival of the 21st century, on September 11, 2001, a terrorist act against the nation of the United States of America took place, two planes were launched against the twin towers (buildings with 110 floors considered at that time the largest buildings in the world) that were located

in the middle of the seven buildings of the *World Trade Center* in New York City (WELLAUSEN, 2002).

In Brazil, for the first time, a worker assumes the position of maximum power in a nation; Luiz Inácio Lula da Silva was elected president in 2002. The political left takes power in a democratic way, continuing the Real economic plan, which until then remained stable and with controlled inflation (BARBOSA, 2012). Many expected the new government to alter the economic plan, but it did not happen; It was the first government since 1986 not to develop its own financial plan. (BARBOSA, 2012).

Years later, the country would face economic stagnation, and, according to Couto and Couto (2021), the worst decade in the history of the economy was between 2011 and 2020; in this period, the growth of the Gross Domestic Product (GDP) was only 2.67%, while in the 80s the growth was 16.91%.

On December 31, 2019, the world is faced with a pandemic caused by the new Coronavirus declared by the World Health Organization (WHO), originating in the city of Wuhan, China. The impact of the pandemic was catastrophic, negatively affecting the social, economic, cultural, historical, political, and industrial environment. (SANTOS, 2021). Social isolation, limited mobility, and the need to create a vaccine in a short period of time made the world mobilize to solve this problem (DOMINGUES, 2021).

THE INFLUENCE OF THE POLITICAL AND ECONOMIC CONTEXT ON FASHION IN THE 80S, 90S AND MILLENNIA (2000-2022)

There is a lot of talk about fashion and the importance of dressing, but in fact, what is fashion? According to the free encyclopedia Wikipedia (2022) "Fashion is a form of self-expression and autonomy in a certain period, place and in a specific context, of clothes, footwear, lifestyle, accessories, makeup, hairstyle and body posture." However, it is clear that fashion goes far beyond the way of producing, it is an expression of human behavior that is influenced by the environment in which the subject is inserted. Fashion is constantly changing, and temporal, social, political, and economic events influence the way people express themselves and how fashion is created (SALVADOR, 2020).

Politics and economics in the 1980s were in a chaotic position surrounded by numerous changes and few results, but on the other hand, the textile sector advanced considerably. With all this rise, in the early 80's, in the capitals of the states of São Paulo (SP), Rio de Janeiro (RJ) and Minas Gerais (MG), the first professional fashion courses in Brazil were born, at the initiative of the sector itself and with the support of some educational institutions. And later, in 1988, in the city of São Paulo (SP), the first fashion college course was introduced. At the same time, in the state of Minas

Gerais, textile production and manufacturing was evidenced in this period in an overwhelming way, making the state become a national center of reference in fashion (PIRES, 2002).

In a single decade (1976-1986), the state of Minas Gerais grew considerably in the textile sector, in 1976, Minas Gerais had only 200 clothing factories, a number that jumped to more than 4,000; Such growth led the sector to organize itself to create the Grupo Mineiro da Moda and the extension course in Clothing Styling and Modeling at the Federal University of Minas Gerais (UFMG), becoming a national reference in the creation, production and distribution of fashion throughout the country (PIRES, 2002).

The considerable advance of the textile industry in the midst of the great crisis was due to the stimulus to exports; according to Baumann (2002, p. 105) "In addition, especially in the 1980s, the option to stimulate the export sector at virtually any cost was a result of the needs imposed by the service of the external debt." Thus, it is understood that the leverage of exports was fundamental for the growth of the textile industry and, consequently, directly or indirectly fostering the growth of fashion courses, due to the need for qualified professionals , but this reality slows down sharply in the following decade.

Although the stabilization of the economy is noticeable in the 90s and the period is marked by abundant international investors, the textile industry begins to retreat. Brazil goes from being a major producer of tree cotton to an importer of the product, this was due to the Boll Weevil Plague that attacked the crop at the end of the 80s. This factor, associated with the exemption from import taxes in the 90s, linked to financing terms and external interest coupled to imported cotton, made the textile park very obsolete. However, there is a considerable increase in imports and consumption of synthetic fabrics (HAGUENAUER et al., 2001). With the scarcity of raw materials and the advance of low-cost fabric imports, the industry tries to survive so as not to end its activities definitively.

Faced with the declining situation of the textile chain, in the second part of the 90s, measures were necessary to try to avoid large-scale layoffs and the closure of companies (HAGUENAUER et al., 2001).

Although the above-mentioned governmental improvement is evident, both in the economic and political spheres, the textile sector, which previously leveraged jobs and caused the birth of the first academic fashion courses, collapses.

In the mid-90s, in an attempt to reverse the situation of possible industrial closure, there was an incentive to cotton farming (cotton cultivation); and an increase in import rates with the intention of increasing the production of cotton internally in the country, avoiding the importation of the product due to the delicate financial situation of the textile sector. However, even with all the effort, technological investment, search for cheaper labor and drop in imports, financed by the main private companies in the country, the production chain remained in retraction (HAGUENAUER et al., 2001).

Another issue that became a problem for the Brazilian textile industry in the 90s was the globalization process, as there was no planning and such changes proved to be fragile, having as a striking and positive point the advance of the financial market with the opening to new investors. Brazil is faced with the need for knowledge and technology to strengthen the industry and thus be more competitive externally, such a problem could not be solved unilaterally by the textile sector. An intervention of economic and social policies is necessary, and it is also an opportunity for industrial development based on research that can be conducted by the scientific community (FUGITA; JORENTE, 2015).

Thus, it is clear that the globalization process, associated with the scarcity of the cotton crop and economic opening, led many companies in the textile industry to decline, but, on the other hand, leveraged fashion in an exorbitant way, bringing with it a reorganization of the production chain called *Fast-Fashion* (FF). started in the 90s, being a business strategy that aimed at the high turnover of goods in stores in a short period of time (TONIOL; ALBIERI, 2020). This system aimed to limit products and at the same time work with planned quantities, thus reducing losses in sales, stimulating consumption; since there is a high turnover and diversity of products taken to retail. Thus, it is clear that this reorganization of the production chain was a large-scale organized production, however, with fragmented distribution, favoring the production of few units of the same model, and consequently low inventory, which causes a feeling of exclusivity in the final consumer (TONIOL; ALBIERI, 2020).

The production flow of the FF sector, which goes from creation to the final consumer, is extremely accelerated; While the fashion sector launches collections twice a year (spring - summer, autumn - winter), the sector even has fortnightly productions. Something that contributes to the speed in the propagation of fashion is globalization, and, consequently, to the production of trends (TONIOL; ALBIERI, 2020).

The tragic terrorist event at the beginning of the 21st century also had repercussions on fashion, the reflection of this moment in the *fashion* world was the presence of military elements in clothing collections; a trend that extends to contemporaneity. It can be seen that the war theme begins to participate in fashion, being present in several fashion shows of already established names in *the fashion* world; among them are McQueen, Valentino, Dolce & Gabbana, Chanel, among others. After the moment of war and terror, the event was re-signified with the creation of militarism in fashion (SILVA; CARVALHO, 2015).

Between 2002 and 2012, in Brazil, there was a significant increase in fashion consumption, an increase of 153%; this was possible due to the ample supply of credit and economic growth in the fashion sector (BERLIN, 2014). Producing more fashion requires the use of more resources; So, in

order for the industry to sustain itself, the use of renewable resources is essential. One factor that becomes a cause for concern in the 21st century is sustainability.

It is known that the world has limited resources, so for the product to be sustainable, it is necessary that the raw material has a renewable origin, and an optimization for non-renewable resources is built. (ANICET; RÜTHSCHILLING, 2013). Natural and synthetic raw materials require human intervention, whether in the addition of chemicals in the production process or in water dispersion. (ANICET; RÜTHSCHILLING, 2013).

Thus, it is understood that if people consume more, it is necessary to produce more and use more resources, hence the need to worry about sustainability. Water is a vital commodity for human survival, and in some parts of the world water shortages are already predicted within a few years. Water scarcity is already a major concern of the European Union not only in terms of quantity, but also in quality, and the cause of scarcity is multifactorial, such as climatic conditions, population increase, industrial growth, among others. (MORENO; ORTIZ; ARACIL, 2022). The textile industry consumes a large amount of water to produce fabric, according to theBrazilian Association of the Textile and Apparel Industry (ABIT) to produce one kilogram (kg) of fabric it took 100 liters of water.

The Brazilian textile industry sought resources to solve this problem with regard to the use of natural resources. After the sector was extremely criticized by the media in the 90s, it sought ways to improve production, investing in technology, providing a reduction in water consumption and in the treatment of water used in textile production, returning it in perfect conditions to the environment. If previously it took 100 liters of water to produce 1 kg of fabric, since the 2000s the same amount of fabric has been produced with only 10 liters of water (ABIT, 2014). Technological advances are a powerful tool to solve contingencies in the production chain; It is plausible and admirable the evolution that the textile industry has achieved by investing in science and sustainability. It is known that Brazil is a vast country, full of finite resources to be exploited, however, it is extremely important that this is done in a sustainable way.

With the arrival of the new Coronavirus pandemic at the end of 2019, the textile industry, in an attempt to resume its production, unites and mobilizes to try to develop antibacterial technological raw materials and fabrics with the ability to eliminate the new Coronavirus; The intention was to eliminate the virus by contact and thus add safety to health. However, the sector went into decline due to the lack of raw materials, layoffs of workers, and difficulty in importing and exporting (SOARES, 2020). The world is still recovering from the damage caused by the new Coronavirus pandemic, which, so far (2023), has not ended.

THE IMPORTANCE OF THE 80'S,90'S TO MILLENNIA (2000-2022) FOR CLOTHING

In the 80's the great focus of individuals was on the desire for the ideal body for aesthetic purposes, this period was marked by the fever of workouts, gymnastics and body care. The growth of gyms was notable in large urban centers, and the way to dress well was a mere detail, as long as the body was shapely. With the fever of gyms, fabrics that were previously considered only for sports become popularized for everyday environments; among them are sweatshirts and lycra (LEMOS, 2011). Another item that became popular was the sneaker, gaining modern and urban tones, and several alternative options with different colors and shapes; with the popularization of sneakers, the *All-star* model became a fashion trend thanks to its comfort and style; and with a range of varied colors and prints, it became an innovative sneaker for the time and one of the most used by young people (LEMOS, 2011; MARTIN; DA SILVA, 2018)

An important milestone of the 80s was the influence of POP culture on fashion, among the big names that had a cultural impact on teenagers and young adults is Madonna; Entitled as the "Queen of Pop", the multiprofessional became an icon with her lifestyle, clothes and attitude (LEMOS, 2011)

An explosion of styles and colors was what marked the decade, for women high-waisted pants, sweaters, velvet blazer, flowing knee-length dresses, among others, and for men tighter shirts with looser pants marked this time, while the most popular outfits were straight-leg jeans, V-neck sweaters, sports shirts, and stripes in different sizes that was a trend that extended until the early 90s (LEMOS, 2011; MARTIN; DA SILVA, 2018).

In short, the 80s were marked by puffy jackets, shoulder pads and an obsession with designer clothes (LEMOS, 2011). In the mid-80s, the *grunge movement emerges in the city of* Seattle *in the United States (USA),* which is a mixture of *punk and heavy metal* extending until the 90s. The term *grunge* comes from English and in its original sense means dirt or filth (LEMOS, 2011). The style was marked by the use of old and loose clothes used by musical bands that produced music with a character of anguish and sarcasm (LEMOS, 2011; MARTIN; DA SILVA, 2018). In 1991, bands characterized as anarchist and noisy took over the world POP market, and the band *Nirvana,* with the album *Nevermind,* knocked *Michael Jackson* out of the first place of the American charts. In 1994, *grunge* began its decline with the suicide of its idol *Kurt Cobain*, the leader of *Nirvana*. But it wasn't the end, *grunge* lived on with *Dave Grohl,* former drummer of *Nirvana,* who founded the band *Foo Fighters* and the band *Pearl Jam* (LEMOS; 2011).

On March 27, 1990, Madonna released the song Vogue; in POP culture, Madonna becomes an example of how street style and popular culture are influential in fashion, according to experts the singer's use of fashion in the 90s was quite eclectic (MONTEIRO; DA SILVA, 2018).

With the arrival of the 90s, the way of dressing changes a lot, at this time people prefer low-maintenance garments, for teenagers fashion is a mix of formal clothes and sloppy cardigans, ripped jeans and caps with the brim turned back. For adults, turtlenecks, baggy T-shirts, with the emergence of high-waisted jeans. In the mid-90s, outerwear appeared with everything, they dragged on until the 2000s in the *Juicy Couture format* (CERINI, 2020). The color black gains prominence in fashion, influenced by the gothic style, known for abusing dark colors, and clothes with heavy materials, becoming a success among young people, going from the streets to the catwalk.

In the year 1997, high-waisted pants (above the navel) begin to go out of fashion, giving way to shorts and low-waisted pants (with an apparent belly button). By the end of the 90s (1999), high-waisted pants were already in disuse and considered outdated (MONTEIRO; DA SILVA, 2018).

In the 2000s, fashion began to happen without a defined standard that was followed by everyone, it emerges with the total freedom to be and to cause the effect it wanted on people. Thus, it can be understood that what is a trend in this period does not cover the population as a whole, precisely because of the freedom to express oneself. People start to transmit their own style through their clothes. There is a change in the way of dressing, where the important thing is not to wear a certain piece to be fashionable, but the label attached to the piece that gives people status. There is no longer a search for innovation, but for pieces produced by big names in fashion such as Louis Vuitton, Chanel, Dolce & Gabbana, Prada, among others (DA SILVA; ZOTARELI, 2018).

In the 2000s, fashion comes with a reinterpretation of the 70s, *bootcut* pants, also known as bell-bottom or flared pants, are back in trend. During this period, the "saint-tropez" pants (low-waisted pants) are also launched, which arrives with everything. The flared pants with the extremely low waist worn at this time are accompanied by baby look tops and shirts leaving the abdomen exposed. There are also the use of asymmetrical skirts, dresses and blouses with a V-neckline. For men, very wide low-waisted pants (with or without chains), high-necked cacharrel shirts, beach shirts with prints or in a single color. What is evident to the male audience, for this time, is a mixture of *hippie*, surfer and *punk-rock styles* (MONTEIRO; DA SILVA, 2018).

In the 2010s, POP culture spreads considerably around the world, and in Brazil there is a diffusion of musical styles such as funk and university sertanejo; through the popularization of these musical genres, *retro* fashion becomes part of the wardrobe of the young public. The style used at the end of the last century (80s and 90s) is back in fashion, the *grunge* fashion of the 90s with plaid flannel shirts, ripped jeans, dungarees and *oversized jackets*. The Gothic style reappears, but in a more well-behaved and lighter version with the denomination of "soft Gothic". The *hipster style,* which is a mix of styles and tastes. From the 70's flared pants reappeared, and from the 80's the neon clothes, shiny and very colorful, high-waisted pants, skirts and shorts. For men, shirts with the hem

turned, tights, leather jacket or jeans, checkered and flannel shirt, and ripped jeans (DA SILVA; ZOTARELI, 2018; MARTIN; DA SILVA, 2018).

THE IMPORTANCE OF THE 80S, 90S AND MILLENNIA (2000-2022) FOR MAKEUP AND ACCESSORIES

The 80s are always remembered as the decade of exaggeration and ostentation, makeup accompanied clothes, women wore eye shadows in very strong and very colorful colors. Everything was very colorful and extravagant, the lipstick was always used in very bright colors (MAXIMILIANO, 2016). All the products that are used contemporaneously were already available in the 80s, the first brush *kits* appear and many brands began to offer makeup kits. Also in this decade, the term supermodel began to circulate, which is the new beauty inspiration (MAXIMILIANO, 2016). The accessories used in the 80s were narrow multicolored belts, gloves, beaded necklaces, berets, brightly colored shoes with thin heels, and plastic bracelets (MAXIMILIANO, 2016).

In the 90s, the first anti-allergic makeup lines appeared, and cases that shared different makeup. At first, the makeup followed references from the previous decade, over the years it became more neutral with little or a lot of intensity. Stronger colors such as wine were widely used in lipsticks accompanied by lip contouring with pencils. At the end of the 90s, colors (such as blue and lilac) were once again part of the shadows, in the application two tones were chosen (MAXIMILIANO, 2016).

In the 90s, the accessories used are chokers, tiaras, platforms and closed clogs made of synthetic leather and wood, and temporary tattoos. With a more modern look, the *punk-rock* of the 80s reappears at the end of the decade in a more modern format popularized by the bands, with a very particular style with shin-length stockings, *piercings*, tattoos, hoods and caps (MAXIMILIANO, 2016).

In the current century (2000 to 2023), there is a greater freedom of expression when putting on makeup, so it is perceived that this time does not have a rigid concept of beauty, and it is possible for an individual to have a different style every day. However, the makeup that is most applied to this scenario in which we live consists of being simple, practical, quick and easy, which does not leave it with an exaggerated look as it was used in the 80s (MAXIMILIANO, 2016). On the other hand, more elaborate makeup techniques begin to emerge at this time, consisting of a heavier makeup, usually to be used at night; contouring techniques, *airbrush* and HD makeup, become part of the processes with the intention of corrections. Currently, the issue of sustainability has come strong, products that are not tested on animals and with natural characteristics are sought after more intensely (MAXIMILIANO, 2016).

At the beginning of the decade, tinted glasses became a trend among young people. Large and wide belts appear as fashion, accompanied by clogs, platform shoes and boots, pointed-toe shoes and thin heels, bandanas, hoop earrings, bracelets and berets. The use of navel *piercings* for women and also the use of ties for the most modern and casual became very popular at this time (MAXIMILIANO, 2016).

THE IMPORTANCE OF THE 80S, 90S AND MILLENNIA FOR COSMETICS

Hyaluronic acid (HA), found in the skin's extracellular matrix, has the important function of keeping alive the collagen fibers that are responsible for hydration and also for the elasticity of the skin. The biological process of aging causes the production of HA to be gradually reduced, leading to the appearance of wrinkles (DE ALMEIDA MILREU 2013; MORAES, 2017). Seeking means of production in larger quantities, in order to replace them in the body and in order to achieve an anti-aging effect; in the 80's, microbial production of HA occurs on an industrial scale. To this end, the *Streptococcus zooepidemicus* strain is used in a fermentation process, which provides a higher yield than conventional processes (MORAES, 2017).

The science that is dedicated to the study of the manipulation of matter is called nanotechnology, created in Japan, it is characterized by working with matter in an atomic and molecular size; it consists of the manipulation of structures in size 1 to 100 Nanometers (NM); technology available to be used in different body areas (BEZERRA, 2017). In cosmetics such as moisturizers and sunscreens, the use of nanotechnology was applied in the early 90s, an advance that extended to other cosmetics such as makeup bases, face creams and facial concealers. The advantage of having nanotechnology in cosmetics is the high permeation power in the skin, reaching the deepest layers with its small particles rich in active ingredients, increasing the effectiveness of the products. In addition, nanotechnology brings with it benefits, including increased stability of formulations and the gradual release of active ingredients (BEZERRA, 2017).

In the twenty-first century, new concepts of beauty products emerge, nutricosmetics, nutraceuticals and cosmeceuticals, the concepts used are very contemporary, the term nutricosmetics was mentioned for the first time in 2006 in scientific congresses and magazines (MACHADO, 2016).

The interaction between the food industry and the drug industry resulted in the birth of nutraceuticals; which are parts of foods or foods that provide health benefits, sometimes in the treatment of diseases, sometimes in prevention (MACHADO, 2016).

Cosmeceuticals are the result of interaction between the drug industry and the cosmetic industry, consisting of the use of products applied topically that are not merely cosmetics and are not medicines, but with the power to alter the skin. We can cite as examples whitening, antioxidants, sunscreens, collagen repairers, anti-inflammatories, among others (MACHADO, 2016).

The term nutricosmetics is based on the interaction between cosmeceuticals and nutraceuticals, however, in Brazil, the National Health Surveillance Agency (ANVISA), which is the body responsible for inspections, does not recognize the term. The fact that cosmetics are legally of topical use and action and, consequently, ingested products are not considered cosmetics, they end up being regulated in another category. In the country, the term nutricosmetics is classified as a functional food due to the fact that they produce physiological or metabolic effects.

Such products can be purchased easily because they do not require a prescription, but it is very important to start using these products with medical advice. Indiscriminate use without professional guidance with certain combinations of products and medicines brings unwanted results, as they can cancel the effect of the product, the medicine or even cause health risks. Therefore, it is extremely necessary to seek guidance from a trained professional to have beneficial results (MACHADO, 2016).

THE IMPORTANCE OF THE 80S, 90S AND MILLENNIA FOR HAIR COLOR AND SHAPE

The mullet *haircut*, or *pygmalion*, also popularly called in Brazil as "Chitãozinho and Xororó" (country duo born in the 70s), was very popular during the 80s to the early 90s. The cut consists of cutting the hair shorter in the front and sides, leaving it longer in the back. One of the pioneers to use this style was the singer *David Bowie*, an influential singer of *glam rock*, thanks to which the hairstyle became popular (GARCIA. 2010). In the 80s, voluminous and permed hair (a technique of curling and curling the hair definitively using chemicals) was popularized by music and movie stars.

Large bangs associated with curly and voluminous hair made up the heads of teenagers, university students and adult women. It was common to wear high and side ponytails with excessive amounts of gel to style the hair, make it shiny and with greater volume (DE ALMEIDA MILREU 2013; MORAES, 2017). A style widely used in the 80s, both for men and women who appreciate vintage culture, was the *pompadour hairstyle* (DE ALMEIDA MILREU 2013; MORAES, 2017). At the end of the decade (1989) the hair begins to decrease in volume, especially in Europe, but the rural regions and further away from the big centers still continue with the style for a while. For men, the *mullet* cut is associated with the stubble look (MORAES, 2017).

In the 90s, some hairstyles start to have references from previous decades, from the 60s there are shorter haircuts such as the famous "johnny", (using more technical words the *Le garçon* cut) accompanied by bangs. The cut, popularly known as "bowl" or surfer cut (solid layer cut made on lysotric hair), usually done on preschoolers, win over the teenage audience. By the end of the decade, long hair with *dreadlocks* (*Dreadlock* or *lock-dread),* which are a *hippie style,* gained the male audience (DE ALMEIDA MILREU 2013; MORAES, 2017).

In the 2000s, the trend among women was hair with very strong highlights. For men, on the other hand, it was very common to have uncut hair, a mohawk haircut, and the most upright hair, which could be accompanied by highlights (color) or not (DE ALMEIDA MILREU 2013; MORAES, 2017). In the 2000s, in 2006, the singer Madonna opts for the bob haircut, (straight cut that extends to the height of the jaw) which in the following year (2007) would also be used by the singer Rihanna in her music video for the song *Umbrella* (DE ALMEIDA MILREU 2013; MORAES, 2017).

In the 2010s, the popularization of the activism of the feminist and black movements pushed the women of this time to assume their afro hair wearing it in a natural way. For men's hair, there are reinterpretations from other decades, the *undercut* from the 50s and the afro hair from the 70s (DE ALMEIDA MILREU 2013).

METHODOLOGY

CHARACTERIZATION OF THE STUDY

This is a cross-sectional study, using a descriptive method of a qualitative-quantitative nature, carried out for convenience (DE MATTOS; JUNIOR; RABINOVICH, 2017).

SAMPLE

The sample consisted of women aged and years old, living in the city of Santo Antônio do Monte - MG. The participants were recruited from a Form (≥35 *Google Forms*) via social networks *WhatsApp* and *Instagram* throughout the city.

The inclusion criteria were: 1) women aged ≥35 years; 2) living in the city of Santo Antônio do Monte - MG.

The exclusion criteria were: 1) Women who did not correspond to the stipulated age group; 2) Reside outside the municipality of Santo Antônio do Monte - MG; 3) Do not agree with voluntary participation in the research.

RISKS AND BENEFITS

The possible risks were: 1) possibility of embarrassment when answering the data collection questionnaire; 2) fear of not knowing how to respond or of being identified; 3) stress; 4) breach of confidentiality 5) fatigue or embarrassment to respond or to be identified; 6) breach of anonymity of the researched. It is important to point out that some of the risks presented are inherent to all research involving the participation of human beings and that the data collection team had thorough training to surround and minimize all possible risks of the study.

The possible benefits were: 1) receiving information on components of the aspects of perception about the years (80, 90 and millennia 2000-2022); 2) the perceptual aspects found in the

research may provide a better understanding of how globalization over time has possibly added more accessibility, desire and consumption to women in a city in the interior (Santo Antônio do Monte - MG).

ASSESSMENT TOOL

THE PERCEPTION OF FASHION FROM THE 80S TO THE MILLENNIA (2000-2022)

The questionnaire called The Perception of Fashion from the 80s to the Millennia (2000-2022) (APPENDIX A) was applied through an online form (*Google Forms*). The proposal has 17 questions, divided into 3 sections. The form proposes to collect information from sociodemographic data (gender, age, address) found in section 1 (5 descriptive questions), in section 2 (7 multiple-choice questions) information about fashion (makeup, hair, clothing, accessories and footwear) and POP culture (Do you know Madonna? Is she a singer and world fashion influencer? In your perception, Madonna is a POP culture icon, which influenced the fashion of the 80s, 90s and millennia (2000 to 2022)?) In a temporal perceptual context (80s, 90s and millennia 2000-2022), section 3 includes 5 multiple-choice questions contextualizing the perception of technological advances and contexts of globalization through the ages. The form was formulated by the authors themselves.

Ethical precautions

The questionnaire submitted for the answers brought in its introduction the objective of the research in detail, making clear the participation of the individual voluntarily, making available the e-mail and contact data for the clarification of any doubts. Below is the original model available in digital format.

The purpose of this form is to produce a scientific research on people's perception of fashion and beauty in the 80s, 90s and millennia (2000 to 2022). **Your participation is voluntary**, by answering this questionnaire you collaborate directly to understand how globalization has influenced and influences fashion and beauty through the ages (80 to millennia). All personal data provided herein will be kept confidential and may not be used for other purposes under any circumstances. At any time, you may request the withdrawal of consent to participate in this survey by contacting us at the following e-mails: rogerio.itallianartístico@gmail.com, lucelhagoncalves@gmail.com. Or via WhatsApp at the following numbers: (31) 99292-3900 or (37) 3415-0001.

Data Collection Procedure

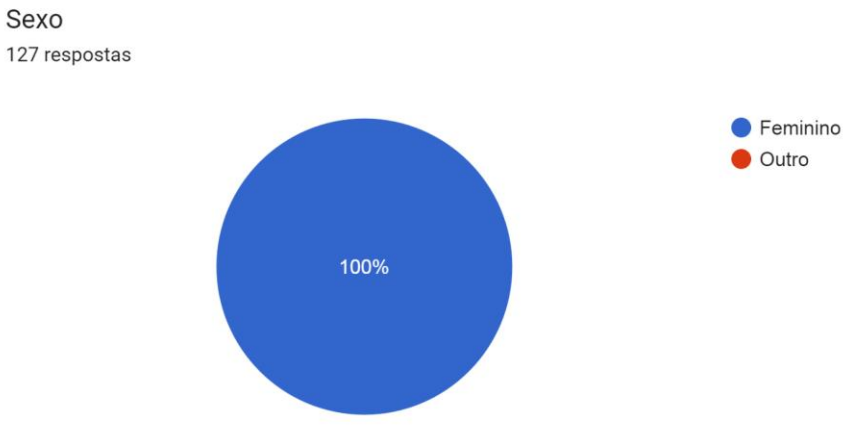
Initially, the questions were formulated by the authors in order to fill in the gaps about the perception of fashion through the times (80s, 90s and millennia 2000-2022) of women in Santo Antônio do Monte - MG (a city in the countryside), also seeking to understand if globalization and technological advances have increased the accessibility and desire for fashion. After formulating the questions and in agreement with the questionnaire application team, it was structured on the ≥35 *Google Forms platform*. The means of dissemination of the form were the social networks *WhatsApp* and *Instagram* and no physical contact with the evaluated was necessary for the application of the form. The survey began on December 20, 2022, and ended on January 8, 2023.

RESULTS

The results presented below correspond to the temporal perception of women in the city of Santo Antônio do Monte (in the interior of Minas Gerais). A total of 133 responses were obtained, and after peer analysis, responses that did not meet the inclusion criteria were discarded. Thus, the analysis of the results had a total of 127 responses. The answers to the 3 sections are described individually and/or together.

The surveyed public, composed of 100% women (Graph 1 - Section 1), represents individuals aged ≥35 years, with a mean age of 44.77 (±8.05) years. The purpose of researching the female audience is justified by the fact that it is evident in the literature that women have a greater tendency to desire and consume fashion when compared to men (ALMEIDA, 2013; DE ANDRADE, 2022).

GRAPH 1 - Section 1 - Demographic data according to the gender variable



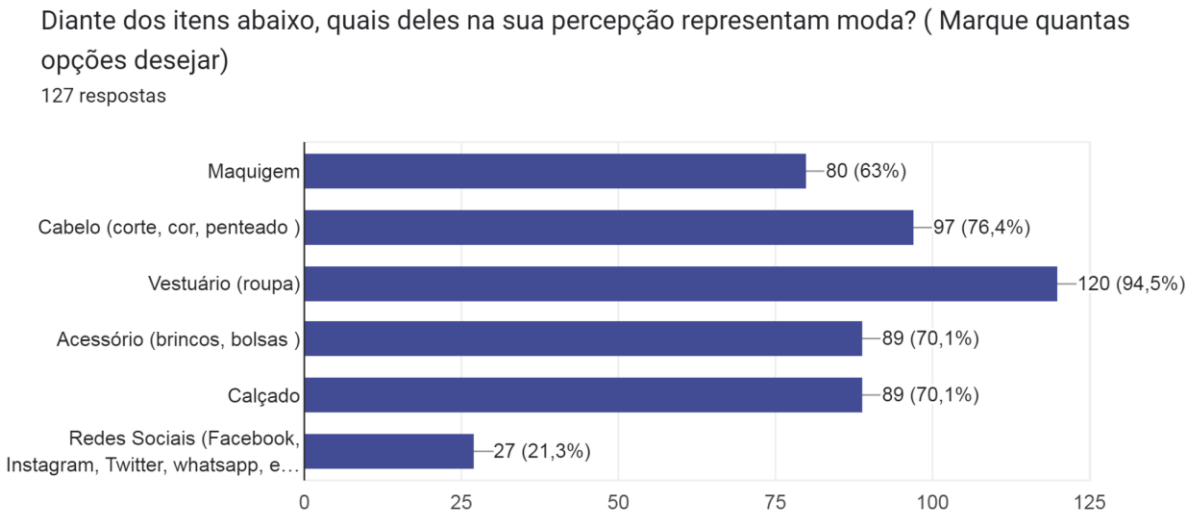
Source: Prepared by the authors themselves, 2023.

Section 2 is represented by 7 questions that, individually and together, comprise the perception of women in the interior city of Santo Antônio do Monte - MG about fashion and POP culture, section 3 addresses contexts of globalization comprising 5 questions.

Given the technological context and how it influences fashion, a response variable was added with the intention of perceiving whether people also recognize social networks as representatives of fashion, understanding in a contemporary way whether in fact women in a city in the interior of Minas Gerais perceive technologies (social networks) as belonging to fashion.

In response to the question, GRAF. 2 shows that, surprisingly, 21.3% (n=27) of the interviewees perceive that social networks represent fashion. Another considerable fact is that the majority of 94.5% (n=120) of people perceive clothing as representing fashion, followed by hair with 76.4% (n=97), with a considerable tie between the representativeness of fashion between accessories and footwear (70.1% (n=89). Thus, it is observed that for the vast majority of women, fashion comes down to the way they dress and change their hair.

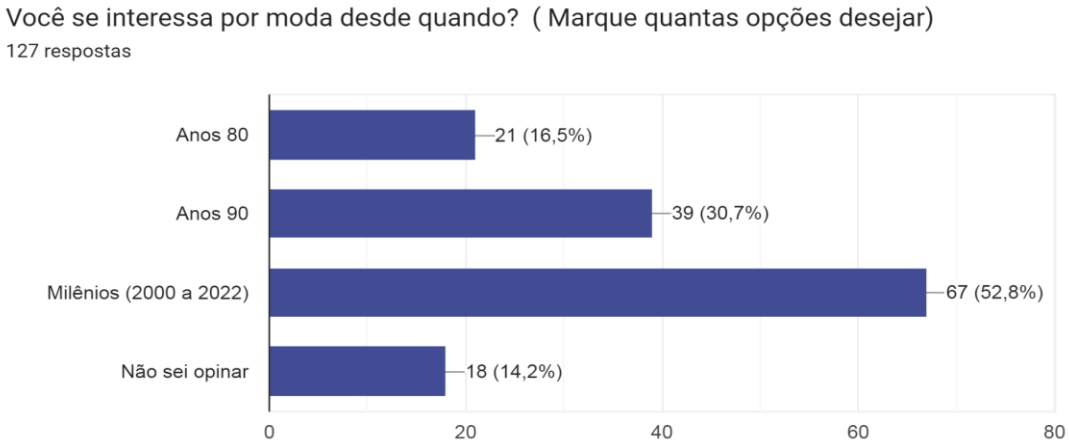
GRAPH 2 - Section 2 - Perception of what fashion represents



Source: Prepared by the authors themselves, 2023.

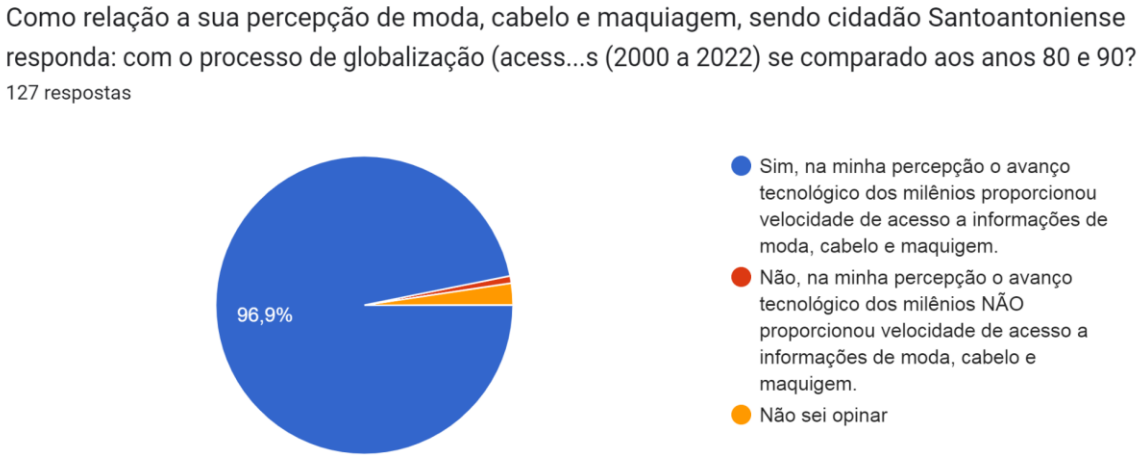
Knowing in which time period people were most interested/interested in fashion allows us to understand whether the globalization process and technological advances can enhance desire and accessibility. The information from GRAF. 3, related to section 2, reports that 52.8% (n=67) of the interviewees became more interested in fashion from the millennium (2000 - 2022). The information from GRAF. 4, also related to section 2, report that 96.9% (n=123) of women understand that the globalization process facilitated the accessibility of people from the countryside to fashion in the millennia (2000-2023) in a higher way compared to the 80s and 90s. Corroborating with the information provided in the GRAF. 3 of section 2, it is observed that the technological advances of the millennia (2000-2022) (social networks and the internet) made women more interested in fashion than in previous decades (80s and 90s), evidencing greater accessibility.

GRAPH 3 - Section 2 – Time of interest in fashion



Source: Prepared by the authors themselves, 2023.

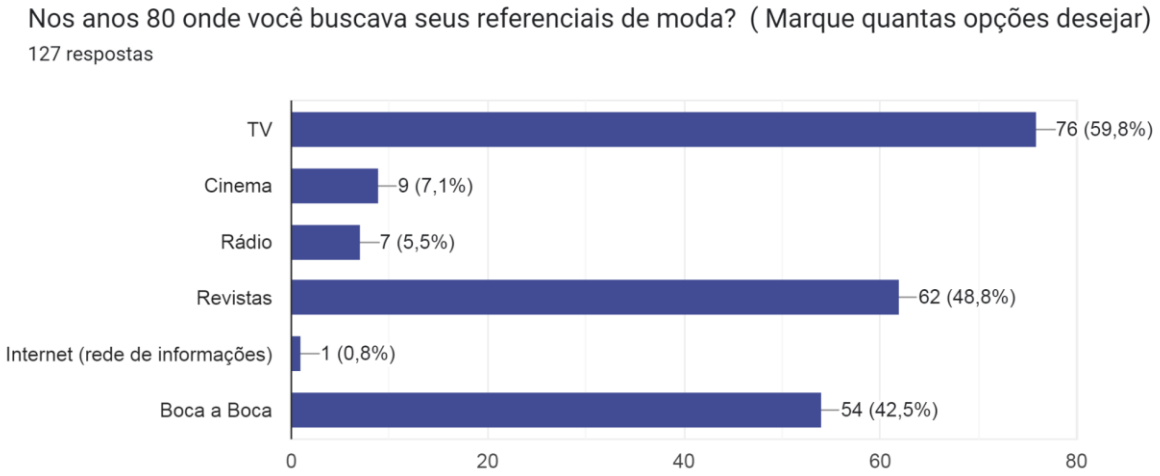
GRAPH 4 - Section 2 – Millennia's speed of access to fashion information



Caption: Question Graph 4 - Section 3 - "How do you relate to your perception of fashion, hair and makeup, as a citizen of Santo Antonio, answer: with the process of globalization (access to the internet and social networks) the countryside city started to have faster access to fashion information in the millennia (2000 to 2022) compared to the 80s and 90s?" Source: Prepared by the authors themselves, 2023.

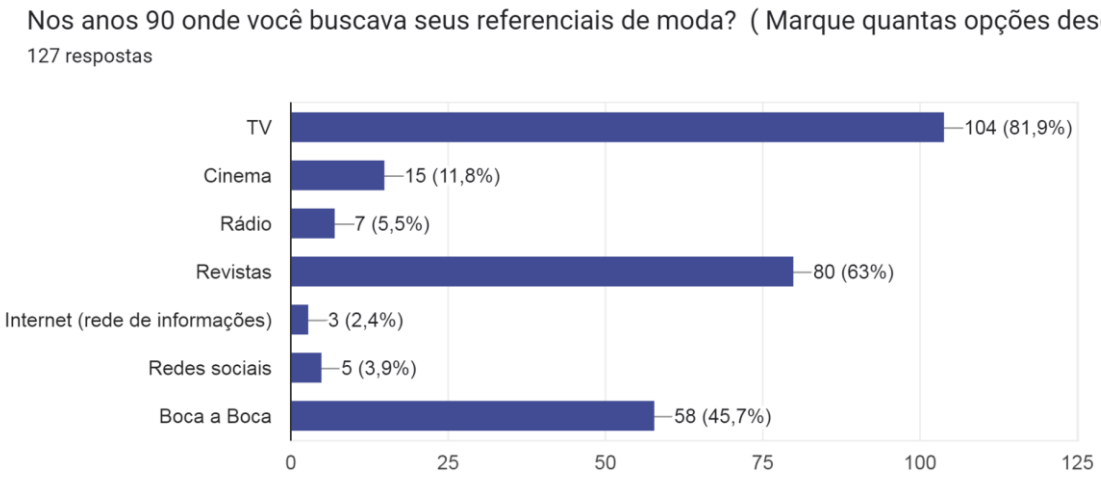
In the 80s and 90s, the interviewees looked for their fashion references on TV, magazines and word-of-mouth, according to the GRAF. 3 and 4 of section 2. It is identified that in these temporal slices that TV was the great referential tool of fashion. In the 1980s, 59.8% (n=76) of the individuals accessed this means of communication; This number grew to 81.9% (n=104) of the interviewees in the 1990s. On the other hand, it is observed that in the millennium (2000-2023), with the globalization process, the internet and social networks were leveraged as fashion references as observed in GRAF. Section 2(5). It is observed that in the millennia (2000 - 2023), 75.6% (n=96) of the interviewees had access to the internet and 62.2% (n=79) were already users of social networks.

CHART 5 - Section 2 – Place that was inspired by 80's fashion



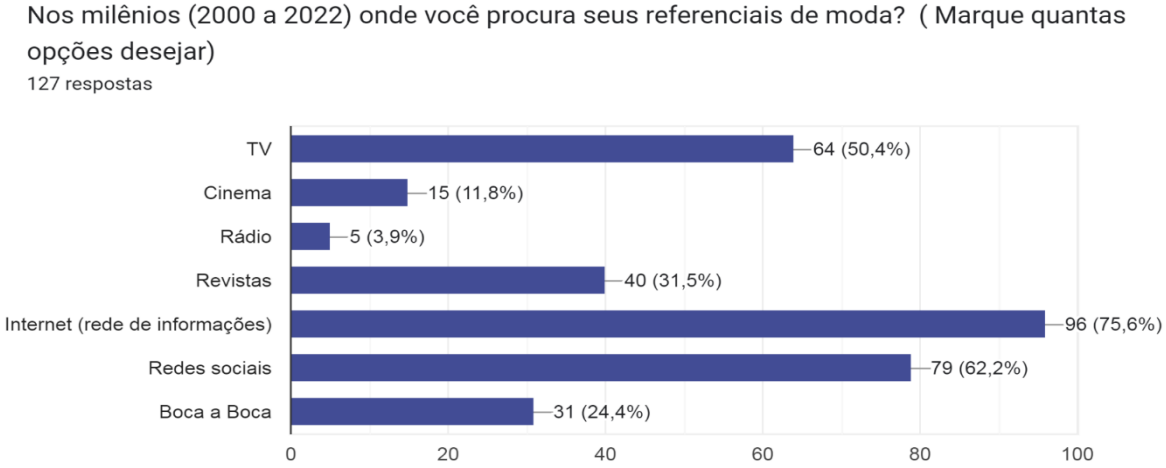
Source: Prepared by the authors themselves, 2023.

CHART 6 - Section 2 – Place where I looked for inspiration for 90's fashion



Source: Prepared by the authors themselves, 2023.

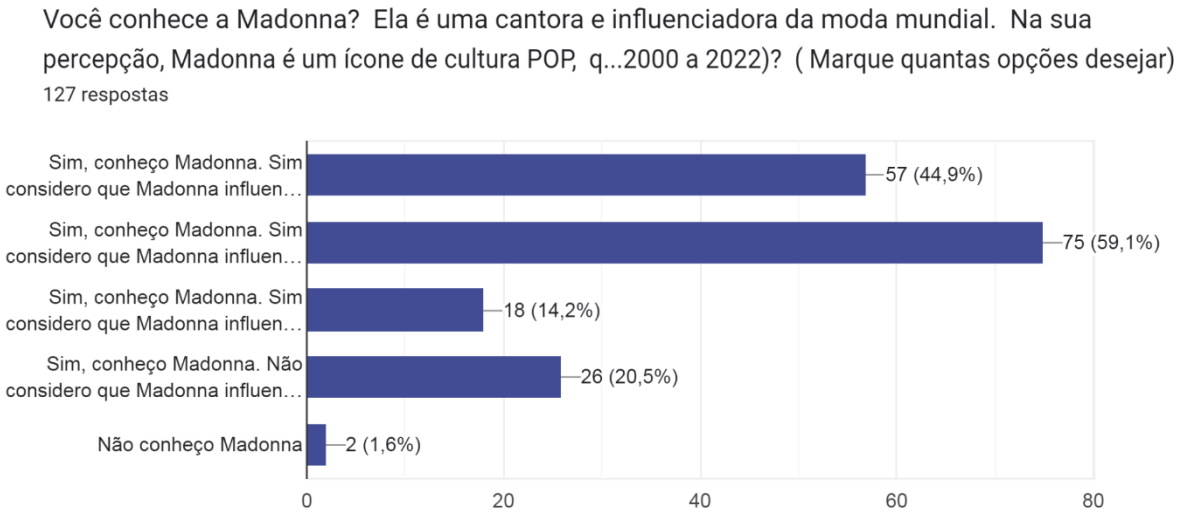
CHART 7 - Section 2 – Place where I looked for inspiration for millennial fashion



Source: Prepared by the authors themselves, 2023.

Analyzing the perception of the interviewees, it can be seen in the GRAF. 8 of section 2, that 59.1% (n=75) understand that the singer Madonna was more influential in the 90s than in the 80s and millennia (2000-2023); 20.5% (n=26) of respondents do not consider Madonna a fashion influence and 1.6% (n=2) do not know Madonna.

CHART 6 - Section 2 – Madonna's influence on fashion between the 80s and the millennia



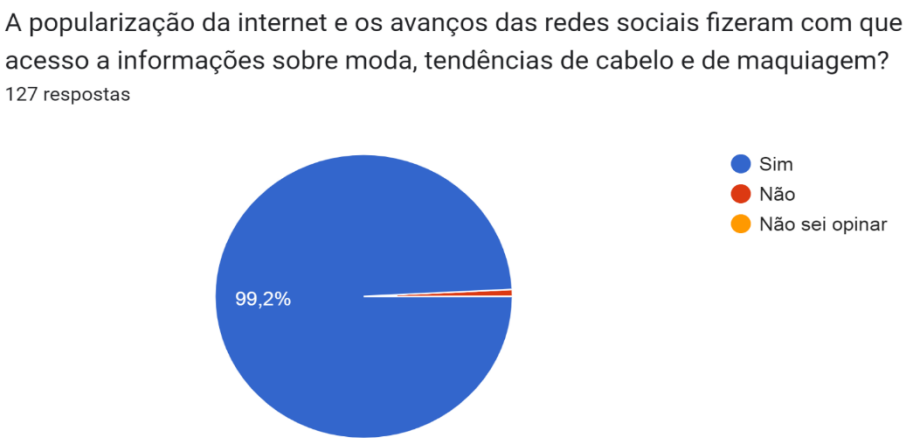
Legend: R: = answer; Graphic Question 6 - Section 2 - "Do you know Madonna? She is a singer and world fashion influencer. In your perception, Madonna is an icon of POP culture, which influenced the fashion of the 80s, 90s and millennia (2000 to 2022)?" A: 1) Yes, I know Madonna. Yes, I consider that Madonna influenced the fashion of the 80s. A: 2) Yes, I know Madonna. Yes, I consider that Madonna influenced the fashion of the 90s. A: 3) Yes, I know Madonna. Yes, I consider that Madonna influenced the fashion of the millennia (2000 to 2022). A: 4) Yes, I know Madonna. I don't think Madonna influenced fashion. A: 5) I don't know Madonna

Source: Prepared by the authors themselves, 2023.

Regarding fashion, hair and makeup at GRAF. 9, referring to section 3, where the period in which period (80s, 90s and millennia) women in the interior had greater access to information are reported in greater evidence; 95.3% (n=121) of the women answered that the period of greatest access to information was and is in the millennia, followed by 4.7% (n=6) representations in the 1990s and no representation at all in the 1980s.

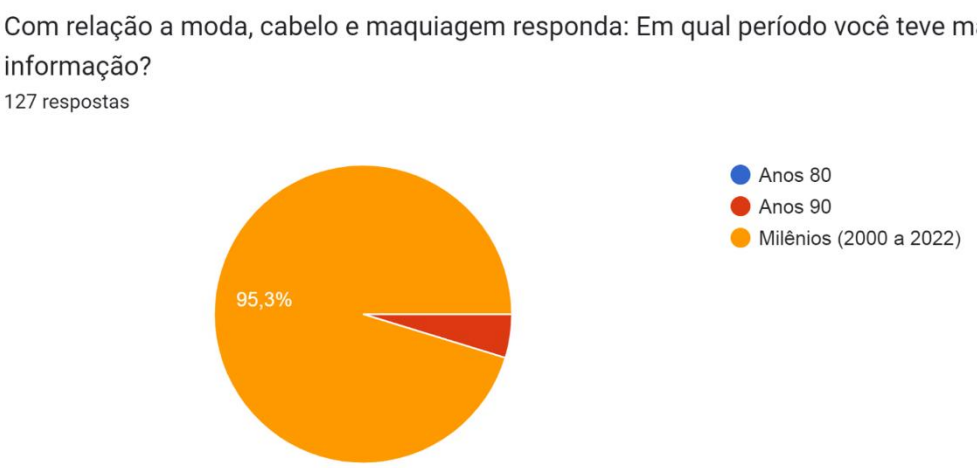
Against the information that was clearly evidenced in the GRAF. 3 and 4 of section 2, confirming that the variable accessibility is concentrated in the millennia, which may go against the possible justification of the speed of current globalization and the equipment (cell phones, TVs, computers, among others) that generally help this context.

GRAPH 9 - Section 3 – Period in which there was more access to fashion information



Source: Prepared by the authors themselves, 2023.

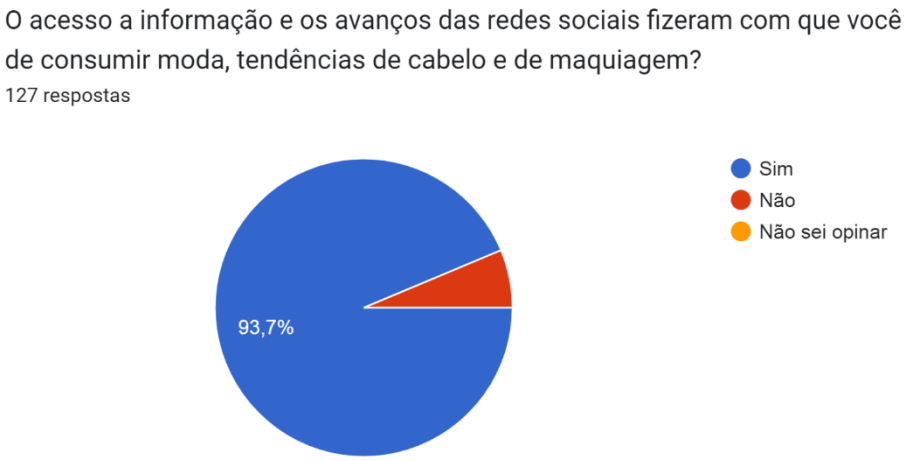
GRAPH 10 - Section 3 – The internet and social networks bring more access to fashion information



Source: Prepared by the authors themselves, 2023.

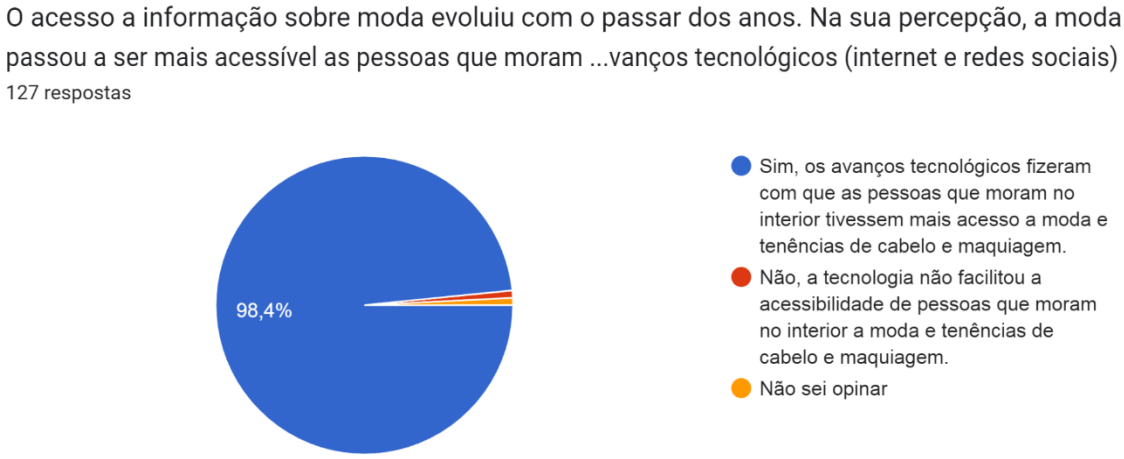
By observing the interviewees' answers, it was understood that the process of globalization and ease of dissemination of information in the millennia (2000-2022), through popularization via the internet and social networks, fueled the desire to consume fashion and hair and makeup trends; in accordance with the GRAF. 9 and 10 of section 3. Leading women from the countryside to consume more fashion, according to information in Graphs 11 and 12, referring to section 3; It is possible to identify greater consumption of these factors in the millennia (2000-2022).

GRAPH 11 - Section 3 – Access to information and willingness to consume fashion



Source: Prepared by the authors themselves, 2023.

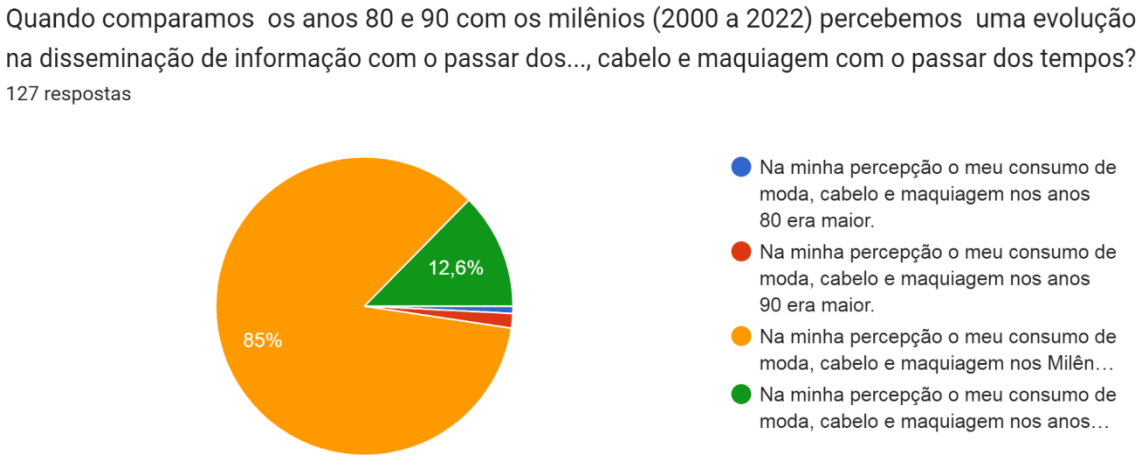
GRAPH 12 - Section 3 – Access to information for those who live in the countryside



Caption: Question Graph 12 - section 3 "Access to fashion information has evolved over the years. In your perception, has fashion become more accessible to people who live far from the big capitals with technological advances (internet and social networks)?"

Source: Prepared by the authors themselves, 2023.

GRAPH 13 - Section 3 – Access to information drives people to consume more fashion, hair and makeup



Caption: Question Graph 13 - section 3 "When we compare the 80s and 90s with the millennia (2000 to 2022), we notice an evolution in the dissemination of information over the years. In your perception, as a resident of the city of Santo Antônio do Monte, has access to information driven you to consume more fashion, hair and makeup over time?" Answers Graph 5 - section 3 1) In my perception, my consumption of fashion, hair and makeup in the 80's was higher. 2) In my perception, my consumption of fashion, hair and makeup in the 90's was higher. 3) In my perception, my consumption of fashion, hair and makeup in the Millennia (2000 to 2022) is higher. 4) In my perception, my consumption of fashion, hair and makeup in the 80s, 90s and millennia (2000 to 2022) is the same.
Source: Prepared by the authors themselves, 2023.

FINAL THOUGHTS

It can be seen that women in the municipality of Santo Antônio do Monte - MG understand fashion through the years (80, 90 and millennia 2000-2022) from the perspective of clothing being the one that most represents fashion in the context presented, where they are more interested in fashion in the millennia than in any other period researched, making it evident that the fashion references that were initially TVs, magazines and word-of-mouth during the 80s and 90s, differ largely in the millennia where the internet and social networks are interpreted by them as the strong and current fashion references, still highlighting the strong fashion reference that TVs are in the millennia.

Along with the fashion references, the artist Madonna is consistently considered by the women of Santo Antônio do Monte – MG, as being a fashion influencer of the 90s than in the other timelines referenced in the study. The process of globalization, access to the internet and social networks made women in the interior of the city better perceive access to fashion information, in a more agile way in the millennia when compared to the 80s and 90s; It is also perceived that the greater the access to information about fashion, hair and makeup trends, the greater the desire for consumption of women in the interior of the municipality.

By observing that the dissemination of information in the millennia is evidently greater than in the other decades (80 and 90), it can be seen that, over the years, women in the countryside, especially in the city of Santo Antônio do Monte – MG, began to consume more fashion, hair and

makeup trends over time. The more time passes, the greater the reported records of fashion consumption, hair and makeup trends, possibly justified by the globalization process that has occurred over the decades.

After analyzing the data, it is possible to perceive the importance and need to develop research, public and marketing policies aimed at the perception of women in municipalities in the countryside, since the access to information, desire and consumption for fashion, hair and makeup trends, has increased and diversified over time the economic, social, cultural and environmental parameters of cities such as Santo Antônio do Monte – MG, with potential growth and constant development.

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Study of the speeds of vehicles involved in collisions by means of analysis of mechanical deformations of structural parts

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ABSTRACT

This work aims to describe a method for calculating the speed of vehicles involved in traffic accidents by analyzing mechanical deformations in various parts of these vehicles. The method is not unheard of in the world, but in Brazil the studies are in the embryonic phase, being applied some methods such as the conservation of total energy and the conservation of the amount of movement, but in both the deformations of the parts are not taken into account, although a considerable part of the energy or the amount of movement is used to cause the deformation itself. Some authors describe in their scientific works each of these methods to calculate speed, but do not take into account, for example, the moment of inertia of each of the vehicles, when they consider it as an estimate to be added to the calculation of the speeds of each of the vehicles the damage observed in the vehicles, but do not take into account the mechanical deformations that occurred in their structures. The purpose of this is the analysis of deformations in structural parts of motor vehicles involved in traffic accidents and a possible way to determine or estimate the traffic speed of each of the vehicles before the collision. This study applies the knowledge about mechanical deformations in the practice of calculating collision speeds in traffic accidents, in the field of forensic engineering, and with that, seeks to point out, in many cases, the true cause of the speeding violation, or a more approximate calculation of the true value of speeds of the vehicles involved in a collision.

Keywords: Mechanical stress and strain, Calculation of speeds, Vehicular collisions, Crash Tests.

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INTRODUCTION

This scientific initiation project aims to lead the scholarship holder to academic evolution, that is, to expand their knowledge in the area of mechanical engineering, with regard to the applications of knowledge about deformations of vehicle parts and the energy responsible for causing these deformations. It is known that the evolution of the knowledge of solid mechanics has provided increasingly better applications, being one of the areas much studied the deformations of materials, leading such knowledge to be used in the field of forensic forensics, specifically in the determination of speeds of vehicles involved in traffic accidents.

According to a report published in November 2015 by the World Health Organization (WHO), in 2013 alone, more than 41,000 people lost their lives on Brazilian roads. Since 2009, the number of traffic accidents in the country has jumped from 19 per 100,000 inhabitants to 23.4 per 100,000 inhabitants, the highest record in South America.

In 2014, the death toll reached a record 52,226, only those who were compensated by the DPVAT insurance (Safe Roads, 2019).

Among the ten most populous countries in the world, however, Brazil appears as a highlight in the report, complying with four of the five main risk factors in traffic, which are: use of seat belts, helmets, speed limits, safety for children and prohibition of alcohol intake before driving. In the list of the ten most populous, there are also states such as China, the USA and India. These states account for 4.2 million people and 56% of deaths from traffic accidents (UNITED NATIONS BRAZIL, 2018).

In Brazil, in 2014, the number of people injured in traffic accidents reached 596,000. In the state of Amazonas, according to information from DENATRAN, the number of deaths in 2014 and 2015, respectively, reached the following amounts: 457 and 418 people (VIAS SEGURAS, 2019).

Traffic accidents are one of the leading causes of death in the world, victimizing 1.25 million people per year, accumulating deaths mainly in poor countries. According to the WHO, low- and middle-income countries account for 90% of road traffic deaths, while they account for 54% of the world's vehicles. Europe has the lowest per capita rates, and Africa has the highest Despite the high number of accidents, the study states that the number of traffic deaths is stabilizing, even with the rapid increase in vehicles in the world. In Brazil alone, according to 2013 data, there are more than 81 million registered vehicles. The report shows that 79 countries have seen a reduction in traffic fatalities, while 68 have increased. According to the WHO, the countries most successful in reducing road fatalities have developed their legislation, enforcement, and improved road and car safety (UNITED NATIONS BRAZIL, 2018).

In most traffic accidents, it brings another consequence, which is the breakdown of the vehicles involved. These deformations can be a field to be researched, specifically relating, in some

situations, the knowledge of the deformations caused in the impacts between two vehicles and through these deformations find a relationship with the value of the speed that each of the vehicles was traveling before the collision.

According to records from the Ministry of Transport (2023), there were 5,246,238 traffic accidents across the country, with 7,345,775 motor vehicles involved.

Therefore, it is extremely important to carry out such a study, the analysis of deformations in motor vehicles involved in traffic accidents and a possible way to determine or estimate the traffic speed of each of the vehicles moments before the collision.

TENSION

We say that it is the intensity of the internal force acting on a specific point (area) selected from a body. There are two types of stress: normal stress and shear stress . They are basically classified into two types:

- Normal Voltage;
- Shear Stress;

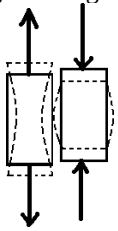
NORMAL VOLTAGE

The force intensity or force per unit area, which acts perpendicular to Δ A, is defined as **normal tension** , σ (sigma). Therefore, it can be written that:

$$\sigma = \lim_{\Delta A \to 0} \frac{\Delta F}{\Delta A}$$

If the normal force or tension pulls the area element Δ A, as shown in figure 1, it is called the *normal tensile stress* , and if it compresses the element Δ A, it is called the *normal compressive stress* as shown in figure 2.

Figure 1 Figure 2

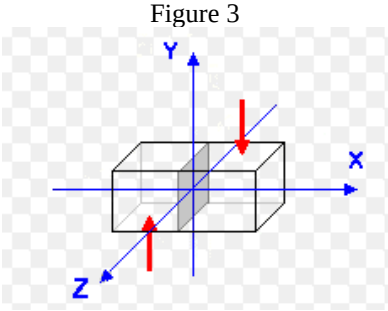


SHEAR STRESS

The force intensity, or force per unit area, acting tangent to Δ A, is called ***the normal shear stress*** , τ (tau), as shown in figure 3. You can write that:

$$\tau = \lim_{\Delta A \to 0} \frac{\Delta F}{\Delta A}$$

Figure 3



DEFORMATION

When a force is applied to a body, it tends to change its shape and size. These changes are called **deformation** and can be perfectly visible or practically imperceptible.

TYPES

There are two types:

- normal deformation
- Shear Deformation

normal deformation

It is the stretching or contraction of a line segment per unit length. Calculated by the equation:

$$\varepsilon = \frac{\Delta s' - \Delta s}{\Delta s}$$

where Δs is the start length of the object and $\Delta s'$ the end length.

Shear Deformation

It is the change in angle that occurs between two line segments that are originally perpendicular to each other. Calculated by:

$$\gamma = \frac{\pi}{2} - lim\ \theta`$$

where $\theta`$ the end angle is.

CRASH TESTS

The crash test consists of the impact of motor vehicles against non-deformable (concrete or iron blocks) or deformable (metal deformable block) barriers. Its purpose is to assess automotive safety to verify that they comply with certain safety standards for collision protection in traffic accident situations.

BRANDS

- Honda
- Fiat
- Volkswagen
- Ford

Honda Fit + 2 Airbag (2015)

This model received five stars for adults and four for children. "The structure of the vehicle showed stable performance, as well as advanced elements that allowed it to offer good levels of safety," says Latin NCAP.

Fiat Mobi + 2 Airbags (2017)

Mobi did poorly in the safety test and earned only one star. "The structure of the car proved to be unsuitable to withstand a side impact," according to Latin NCAP; Child protection has reached two stars.

Volkswagen Golf VII + 7 Airbags (2017)

It joined the list of cars manufactured in Brazil that offer maximum safety to all passengers and is the first car sold here to win the Advanced Awards seal, which recognizes models with accident prevention technologies. The model earned five stars for adult protection and another five for child safety, according to Latin NPAC.

Ford Ka + 2 Airbag (2015)

The model received 4 stars for adults and only 3 for children. "The structure has been rated as

stable, being able to withstand heavy loads," says Latin NPAC.

EXPERIMENTAL STUDY

FORENSICS IN ORDER TO DETERMINE SPEED IN TRAFFIC ACCIDENTS

Speed determination is essential in the analysis of traffic accidents. The possibility of doing so is directly conditioned to the existence of material elements, such as: brake marks, skidding marks, material damage and residual space.

In the study to evaluate the speed, the experts will make use of all the elements produced in the event. The disappearance of any of them will definitely make it impossible to accurately reflect reality.

This observation refers to unpreserved locations, and even in cases where vehicles are removed from their original positions resulting from the collision.

MAIN TRACES

The remains found at the site must be described in detail (with their relevant characteristics) and photographed by the Expert. The main characteristics of these traces will be presented, as well as the most used form for their registration.

Pneumatic Marks

They are among the most important traces at the site, serving to determine the speed and point of the collision. The descriptive record of pneumatic marks must include: **extension in meters, location and reference of start and end points,** and particular characteristics such as **distortions, interruptions, etc.** They can be classified into:

- Braking

These are marks produced by friction of the tire against the surface. When braked on asphalt or concrete pavement, the vehicle produces marks that are generally continuous and dark in color, in varying shades of gray. The ABS system is a device used today in the brakes of some automobiles that also produce marks, but more tenuous and usually sectioned and sometimes in the form of friction marks on the pavement.

- Skid

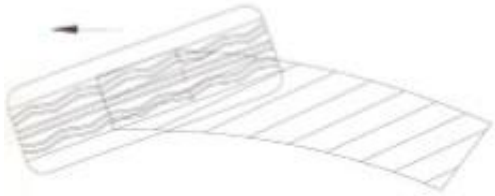
They are produced by tires without total locking, ie, they continue in rotational motion in curves or in curvilinear motion, with displacement divergent from the orientation indicated by the longitudinal axis of the vehicle. Slip marks can also be collected using the bend radius.

Figure 1: Braking or acceleration



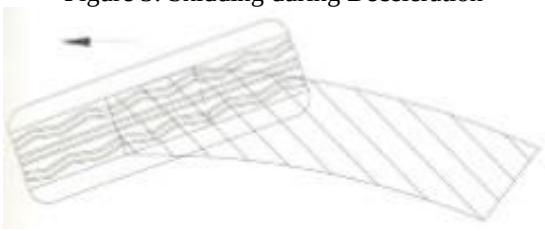
SOURCE: SANTOS & SANTOS. 2008

Figure 2: Skidding under acceleration



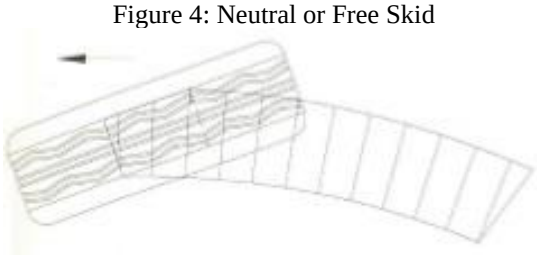
SOURCE: SANTOS & SANTOS. 2008

Figure 3: Skidding during Deceleration



SOURCE: SANTOS & SANTOS. 2008

Figure 4: Neutral or Free Skid



SOURCE: SANTOS & SANTOS. 2008

- Acceleration Marks

They are very similar marks to braking marks, however, with different characteristics in their initial regions. By applying a large amount of torque to the drive wheels, distortions are usually observed at the beginning and progressive lightening, ie, they are darker at the beginning.

Friction marks

They appear when parts of a vehicle's structure slide against the surface, without removing material from the surface. In general, they are accompanied by adhesion of surface coating material (paint or rubber) or groove marks.

Final Resting Position

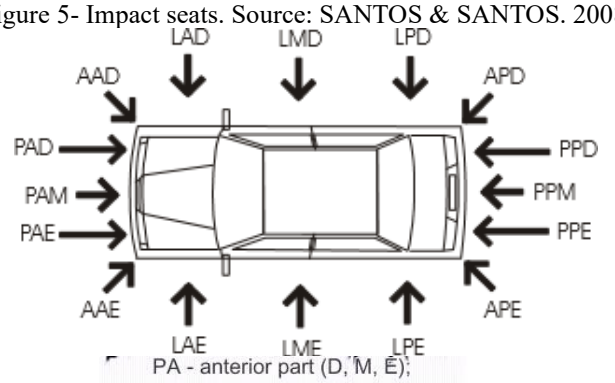
The final positions that vehicles assume after an accident are called resting positions, which

are also important for establishing the dynamics of the accident and determining the speeds at which the vehicles were traveling.

Malfunctions

The breakdowns observed in vehicles involved in accidents are the result of deformations produced by the contact of their structures. Fault description primarily involves determining the **impact seat.**

Figure 5- Impact seats. Source: SANTOS & SANTOS. 2008.



PA - anterior part (D, M, E);

PP - back part (D, M, E);

LD - lateral (A, M. P) right;

LE - left side (A, M, P).

A - angle (A, P) (D,E)

D - right; E - left; M - average;

A - previous; P - posterior.

The impact seat represents the starting point (or region) of the impact on the vehicle's structure.

Main types of breakdowns : denting, breaking, breakage, warping, deformation, etc. We treat as **dents** the damage that occurs in ductile metal parts, subject to permanent deformation without a breakage process, such as bodywork parts. Breakage occurs in parts subject to brittle fracture, ie without plastic deformation such as cast iron metal parts or rigid plastic parts. The terms **rupture** and **deformation** are most commonly used in the case of non-metallic parts, such as tires and bumper covers.

METHODS FOR CALCULATING SPEED

Energy Conservation

In physics, the law or principle of conservation of energy states that the total amount of energy in an isolated system remains constant, ie, the total energy before is equal to the total energy after a given process.

For the analysis of the speed developed by a vehicle, the beginning of the braking marks will be considered as a reference point, which corresponds to the materialization of the beginning of the deceleration process. Thus, the energy available before the speed reduction process begins is transformed into distinct portions. As a general rule , part of this energy is dissipated in the form of drag (production of braking marks), another in the form of damage (experienced and/or produced breakdowns) and a third in residual movements. Thus, one can represent

Before = And after **(1)**

The portion ***before*** basically consists of the energy due to the initial velocity, while the portion ***after*** can be represented by the equivalent portions of the transformed energy, ie:

Eantes = Eentrang + E damage + E residual **(2)**

Considering each of the above terms as kinetic energy equivalents of a body of mass m and velocity v, one can represent:

$$ec = \frac{1}{2}mv2 \qquad (3)$$

One can then write, for a given object (vehicle):

$$\frac{1}{2}mV0 = \frac{1}{2}Mv_a^2 + \frac{1}{2}Mv_d^2 + \frac{1}{2}mV_r^2 \qquad (4)$$

Canceling out the common terms, it is shown that the velocity before the impact can be represented by the plots corresponding to the "velocities" transformed after the impact, resulting in:

$$Vo2 = V_a2 + V_d2 + Vr2 \quad (5)$$

Where:

VO = initial velocity

Va = drag speed V d = damage speed ic

Vr = residual velocity

For the interpretation of an accident, it is often important to evaluate the speed at the time of the collision (Vic), which is defined by:

$$Vic2 = Vd2 + Vr^2 \quad (6)$$

When there are two vehicles, all the parcels must be considered separately for each of them. Thus, one can write:

$$\frac{1}{2}mV2 + mV2 = mV \quad \frac{1}{2} \quad + \frac{m}{2} V + m \frac{V}{2} +$$

$$\frac{1}{2}m2Va22 \frac{1}{2} m2Vd22 \frac{1}{2} m V_{r2}^2 \quad (7)$$

For the solution of the practical problem of determining the speeds of two vehicles that were involved in a collision, it is observed that in the equation above two values are unknown, which are the initial speeds, that is, those with which they traveled before the occurrence of the impact between them, which are Vo1 and Vo2. The other tranches may be determined on the basis of post-collision movements and the assessment of the damage experienced.

drag plot

It is the portion of the speed (energy) dissipated during the braking process of the vehicle. This component of the vehicle's speed is calculated based on the measurement of the extent of the tire markings on site. The calculation of this portion is also done with the extent of the pneumatic skid or rolling marks measured on site.

In addition to the extent of the pneumatic marks, the calculation of this portion of the speed uses the coefficient of friction between the tires and the track. It is essential to know the characteristics and conditions of the road: whether flat or sloping, dry or wet, types of surface , presence or absence of other substances on the surface, the type of vehicle (size: tour, utility, medium, cargo , etc.) and the type of its braking system (ABS, conventional, etc.), as well as its operating condition.

From the concepts of Kinematics and Dynamics, based on the equivalence of the Work of the Frictional Force with the Variation of the Kinetic Energy in the deceleration process, it can be demonstrated that the portion of the velocity corresponding to braking (Vf) is:

$$Vf = 15.938 \sqrt{df \cdot towards} \quad (8)$$

Where:

DF = braking space (m)

k = coefficient of friction of the pavement

The coefficients of friction can vary according to the speed developed by the vehicle, with the type of pavement and its general condition. Regarding speed, according to the tables published by the *Traffic Institute* , what is observed is a constant behavior below 48 km/h and another, also constant, for speeds above this value. In the following tables you can find coefficients of friction for light vehicles in braking processes on different types of pavement , dry and wet conditions, for both speed ranges and also for different types of material.

Table 1 – Friction coefficients for braking (light vehicles) Source: SANTOS & SANTOS. 2008.

Surface		DRY		WET	
		V<48.37km/h	V>48.37km/h	V<48.37km/h	V>48.37km/h
Cement	rough	1.00	0.85	0.65	0.58
	average	0.70	0.68	0.58	0.55
	polished	0.65	0.58	0.55	0.53
Asphalt	rough	1.00	0.83	0.65	0.60
	average	0.70	0.63	0.58	0.53
	polished	0.65	0.55	0.55	0.50
Gravel	compact	0.70	0.65	0.60	0.50
	loose	0.55	0.55	0.60	0.60
Stones		0.65	0.65	0.65	0.65
Paving stone	rough	0.88	0.80	0.78	0.79
	polished	0.60	0.55	0.40	0.38
Sand		0.60	0.60	0.70	0.70

Table 2- Friction coefficients for different types of material Source: SANTOS & SANTOS. 2008

type in material	coefficient	
	dry	wet
steel about steel	0.120	0.080
steel about bronze or iron cast Gray	0.180	0.060
steel on ice	0.014	**
steel about wood	0.500	0.100
iron cast Gray about iron cast	0.280	0.080
iron gray cast about bronze	0.200	0.080
leather about metal	0.480	0.150
leather about wood	0.400	**
rubber about metal	0.500	**
canvas in brake about steel	0.500	**
stone upon stone	0.650	**
wood about wood	0.500	**

Table 3- Coefficients of friction for different situations

Type of situation	Coefficient
Truck sliding on its side on concrete	0.30 – 0.40
Passenger vehicle sliding supported on concrete roof	0.30
Passenger vehicle sliding on its roof on rough asphalt	0.40
Passenger vehicle sliding on gravel roof	0.50 – 0.70
Passenger vehicle sliding on its roof on dry grass	0.50
Metal surfaces sliding on asphalt	0.40
Metallic surface sliding over land	0.20
Metal rubbing against metal (side friction)	0.60
Vehicle with vehicle (ride)	0.55
Engine brake engaged in heavy gear	0.10
Engine brake engaged in light gear	0.10 – 0.20
Free bearing without gear and tires with normal inflation	0.01
Gearless free bearing and partially inflated tires	0.013
Free bearing without gear and flat tires	0.017
Sliding on packed snow	0.15
Sliding on ice or sleet	0.07
Motorcycle sliding overturned	0.55 – 0.70
Human body sliding	1.10
Human body rolling	0.80

Part of damage

This portion is a value obtained through an assessment of the extent of the damage (breakdowns) experienced and caused in a collision. Although it is an estimate, it is obtained by comparing it with the results of crash tests in the automobile industry, as well as in collisions where vehicles are equipped with speed records.

There are methods of evaluating this velocity considering measurements made in the damaged region. Such methods are based on the resistance to deformation of the structure and require the knowledge of specific coefficients of strength of the vehicle structure, which depends on the structural design and the composition of the materials used in the manufacture. These values are, in general, tabulated according to the model or class (dimensions of the platform) and also to the affected region (for example, front part more resistant than sides and back. In our country, we still do not have reliable data for safe use in our vehicles, since we do not have a central body responsible for carrying out crash tests and providing this data for the use of accident analysis professionals.

Table 4- Damage speeds. Source: SANTOS & SANTOS. 2008.

Intensity in breakdowns	V d (km/h)
Light	0 at 20
average	20 The 40
serious	40 The 60
very serious	Above in 60

Table 5- Damage rates according to the type of damage Source: SANTOS & SANTOS. 2008.

TYPE IN FAULTS	V d (km/h)
01. bend bumper at tip	05
02. bend bumper at the center	10
03. bend bumper at skirt	15/20
04. crumple fender	05/10
05. crumple fender tearing	10
06. crumple fender plucking	15
07. Sink grid of radiator	30/35
08. sink grid of radiator, more hive	40/45
09. rip out suspension	40/45
10. rip out wheel guideline	40/45
11. leave spar	50/60
12. rip out O motor of the shims	60/70
13. rip out wheel driving	50/60

Table 6- Damage speeds, according to the type of damage Source: ALMEIDA. 2015.

Type in Breakdown	Vel. damage (km/h)
Warp bumper	05
To break bumper	10
To break bumper It is grid of radiator	15/20
To break bumper, headlights, sink grid, crumple hood, deform bodywork previous	20/30
To break bumper, headlights, sink grid, deform bodywork previous until lean to the engine without move it	30/40
To break bumper, headlights, sink grid, deform bodywork previous until lean to the engine without displace it, deform suspension	40/50
Surface	40/45
DROUGHT	WET
rip out guideline	40/45
V<48.37km/h	V>48.37km/h
V<48.37km/h	V>48.37km/h
Cement	rough

Residual plot

In most accidents, after the collision, the vehicles travel even further space, as a result of the residual portion of Energy. This space can be used to determine one more of the components of the total velocity.

After the collision, the vehicle can continue braking, skidding, rolling or simply rolling freely until it reaches its resting position. In order to use the appropriate coefficients, it is very important that the type of marks that were produced after the collision is identified in the site survey, measuring their extent.

The residual velocity (Vr) is then calculated in km/h by the equation:

$$VR = 15{,}938\sqrt{dr} \;.\; towards \qquad (9)$$

Where:

DR = residual space (m)

k = coefficient of friction of the pavement

Calculation of speeds based on bend radius

A vehicle in the process of cornering with constant speed has two forces acting on it, which are: the radial force that keeps it in the curvilinear movement and the friction conferred by the tires. From the moment the speed of the vehicle in the curve is higher, its radial acceleration increases and when the radial force exceeds the frictional force, sliding occurs. This speed is called the limit speed or critical speed.

The radial force is given by

$$Fr = \text{m}.\ on = m\ .\ (\ v2\ /\ R\ )(\ 10)$$

The frictional force is

$$Fatr = towards\ .\ N = towards\ .\ m\ .\ g \qquad (11)$$

Equating the two expressions and isolating the velocity, we get:

$$Vcritical = \sqrt{g}\ .\ Rcritical\ .\ towards \ \text{m/s} \qquad (12)$$

Where:

g = acceleration of gravity (9.81m/s2)

k = coefficient of friction of the pavement for skid conditions

Critical = critical radius in meters

It is important to note that, in order to determine the speed that a vehicle developed when escaping on a curve, it is not enough to indicate the radius of the curvature of the road, as this will provide the value of the limit speed for that curve. What should be measured is the radius of curvature of the skid marks produced, as these will give a good approximation of the speed that the vehicle had when it "went astray". The values obtained for the marks can differ greatly from those obtained for the curvature of the track, as one of the factors that can define the skid conditions is the "attitude".

METHOD OF CONSERVATION OF QUANTITY OF MOTION

Principle of Thrust and Amount of Linear Motion

The method based on the principle of impulse and quantity of motion can be used to solve problems involving force, mass, velocity and time, and is of particular interest in solving problems involving impulsive movements or shocks.

Considering a body of mass m subjected to the action of a force F, Newton's second law can be expressed as

$$\mathbf{F} = \frac{d}{dt}(mv) \quad (13)$$

where ***mv*** is the vector amount of motion. Multiplying both sides of the equation by ***dt*** and integrating from the instant ***t1*** to ***t2*** , one can write

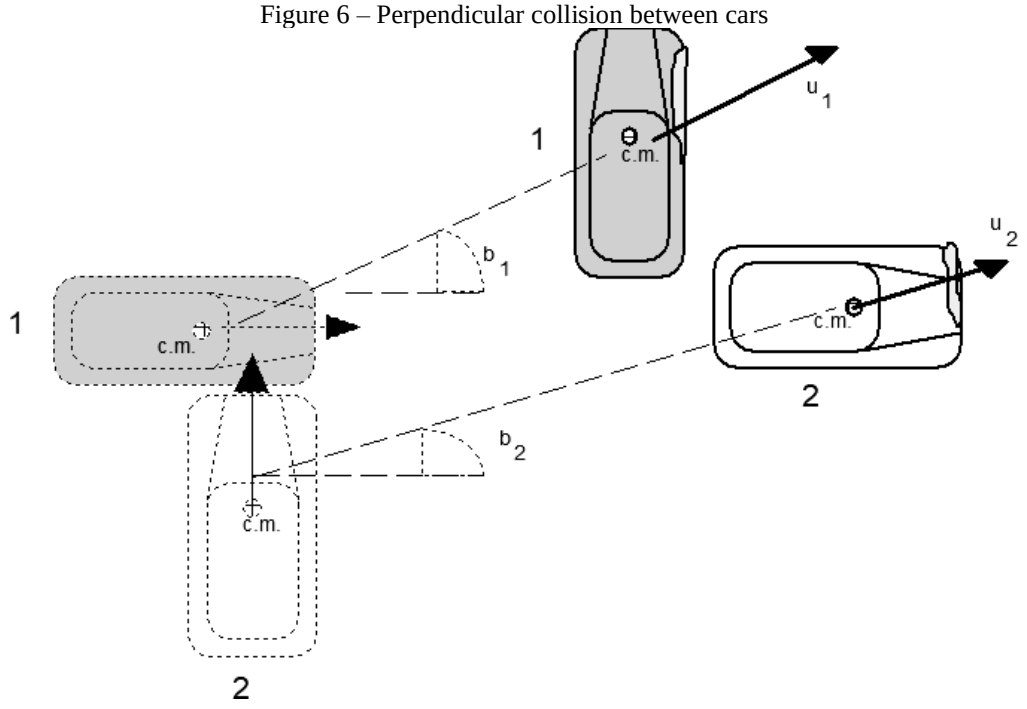
$$\mathbf{F}.\, dt = d\,.\,(mv) \quad (14)$$

$$\int_{t1}^{t2} F.\, dt = \mathbf{MV2 - MV\ 1} \quad (15)$$

The integral of the preceding equation is a vector defined as the linear impulse, or simply as the impulse of the force F, during a given time interval. It is represented as P the impulse.

Accident dynamics

Figure 6 – Perpendicular collision between cars



$$v1 = u1 \,.\, its\,(\,a2 - b1\,) + m2 \,/\, m1 \,.\, [\,u2 \,.\, its\,(\,a2 - b2\,)] \,/\, its\,(\,a2 - a1\,) \quad (16)$$

$$v2 = m1 \,/\, m2.\, [\,u1.sen(\,b1 - a\,1\,)] + u2.sen(b2 - a\,1\,) \,/\, sin\,(a2 - a\,1\,) \quad (17)$$

Where:

A1 and A 2 = Vehicle entry angles B1 and B 2 = Departure angles

U1 and U2 = Speeds after collision

Table 7: Calculation of collision speeds

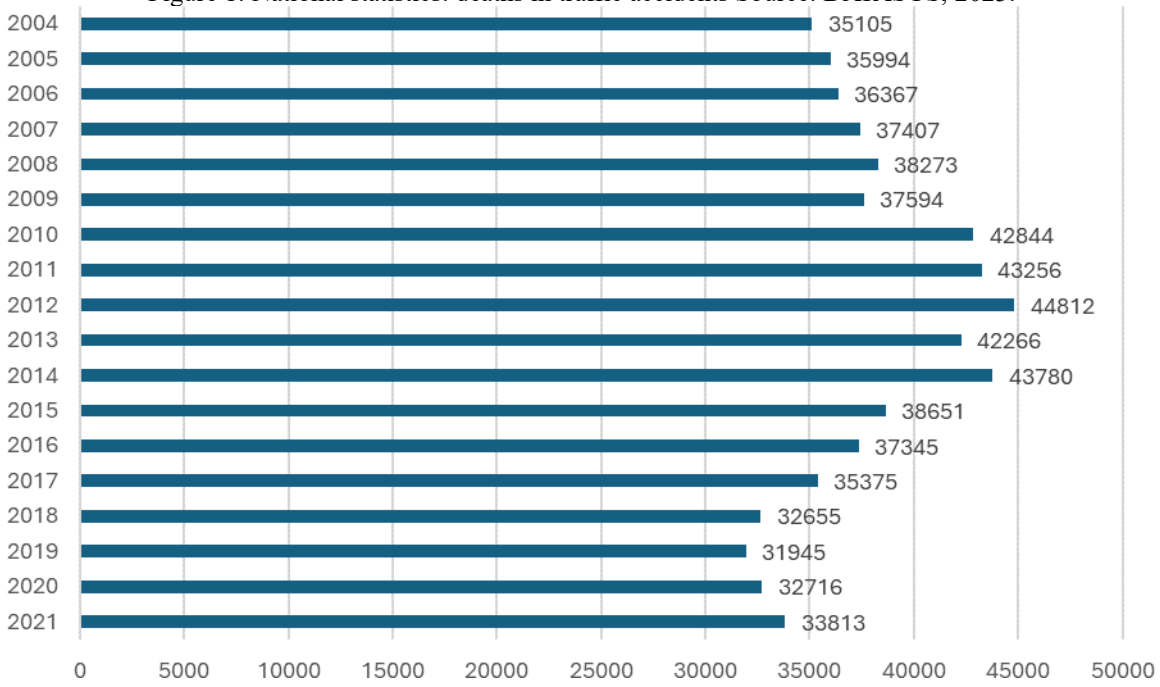
m1(kg)	m2(kg)	a1	a2	b1	b2	x1	x2	u1	u2	v1(m/s)	v2(m/s)
2025	980	0	2	0,07	0,21	28,9	28,3	20,11	19,9	28,02	3,54
2025	1080	0	6	0,07	0,23	28,9	28,3	20,11	18,9	29,57	1,16
2025	1110	0	10	0,07	0,25	28,9	28,3	20,11	17,9	29,53	0,71
2025	1175	0	14	0,07	0,27	28,9	28,3	20,11	16,9	29,63	0,5
2025	1240	0	18	0,07	0,29	28,9	28,3	20,11	15,9	29,61	0,39
2025	1260	0	22	0,07	0,31	28,9	28,3	20,11	14,9	29,19	0,32
2025	1280	0	26	0,07	0,33	28,9	28,3	20,11	13,9	28,74	0,27
2025	1650	0	30	0,07	0,35	28,9	28,3	20,11	12,9	30,47	0,22

CONCLUSIONS

Study of the causes of traffic accidents Based on data collected at traffic accident sites between two or more motor vehicles on the occasion of the forensic examination of traffic accidents in order to establish the cause, or causes, of the accident. All the steps already taken, since the survey of the site, are aimed at this issue.

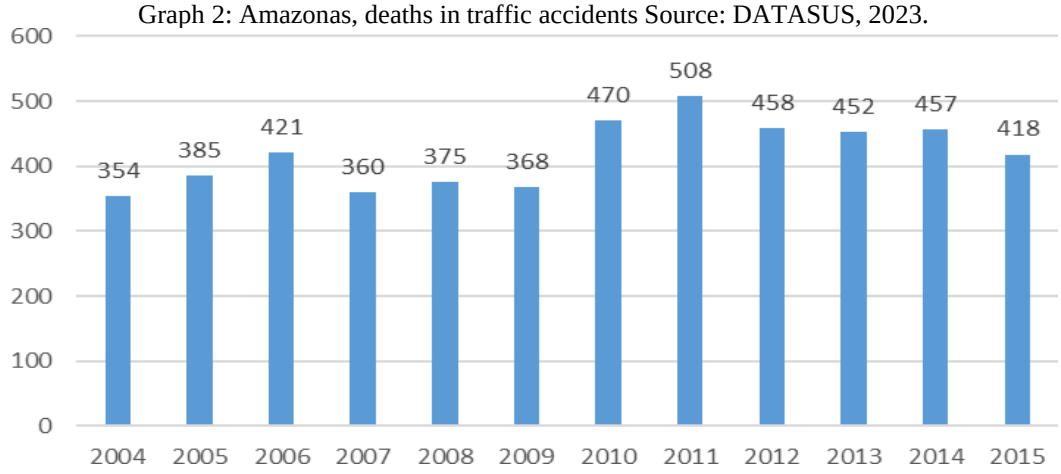
In Brazil, approximately 45,000 people lose their lives annually in traffic accidents, but it is believed that these numbers are higher because the statistics are flawed. In 2001 alone, there were 61,000 accidents on São Paulo highways with 2,300 deaths and deaths 23,000 people seriously injured. All over the world, traffic claims lives, but the Brazilian numbers are alarming and skyrocket ahead of any country in the world.

Figure 1: National statistics: deaths in traffic accidents Source: DATASUS, 2023.



The number of annual deaths in Brazilian traffic has increased for two consecutive years. In 2021, Brazil showed an increase of **3.35%** in the total number of deaths registered in traffic, totaling **33,813** deaths due to traffic accidents, an **increase of 1,097 deaths** compared to 2020 data. The percentage change of **3.35%** in 2021 was similar to the increases in 2014 and 2012.

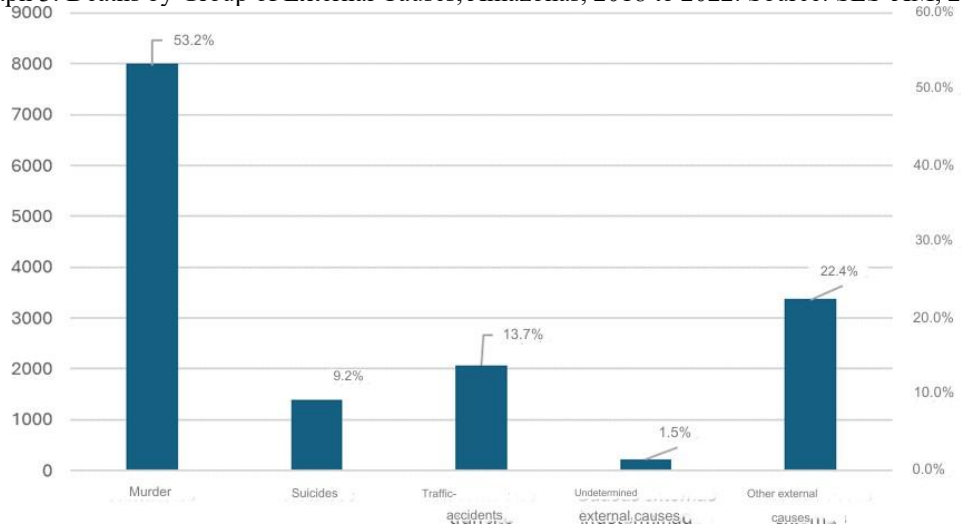
Graph 2: Amazonas, deaths in traffic accidents Source: DATASUS, 2023.



In the period from 2018 to 2022, the state of Amazonas totaled 114,511 deaths reported in the Mortality Information System (SIM). Of this total, 15,061 (13.2%) were deaths due to external causes, 8,006 (53.2%) due to homicide, 2,070 (13.7%) due to accidents involving injuries.

Land Transport (RTA), 1,386 (9.2%) due to suicides, 3,371 (22.4%) due to other external causes, and 228 (1.5%) due to undetermined external causes (SES-AM, 2023).

Graph 3: Deaths by Group of External Causes, Amazonas, 2018 to 2022. Source: SES-AM, 2023.



The human element can participate directly or indirectly, actively or passively, and it is necessary to understand the role or function of each of the protagonists in the context of the accident. They are:

- **Active direct protagonist (PDA):** is the one who performs the action from which the accident directly occurred;
- **Passive direct protagonist (PDP):** is the one who directly suffers the action practiced, directly by another;
- **Active indirect protagonist (IAP):** one who, for some reason, performs an action or configures a situation that induces another to practice an action that results in an accident with another driver;
- **Passive indirect actor (PIP):** does not contribute in any way to the accident, but suffers direct consequences.

DETERMINING CAUSES

Determining Cause is considered to be the one that, when removed, the accident does not occur. In general, it is associated with a traffic violation. In other words, it is lawful to assume that without an infringement of a traffic rule there is no cause of an accident.

Theoretically, Determining Causes are divided into mediate or circumstantial and immediate or direct.

Mediate or circumstantial causes are subjective, so it is almost always impossible to materialize them. The elements of distraction, the physical and mental situation of the drivers (fatigue, sleepiness) and acts on the part of passengers are good examples to explain that it is unlikely that the expert will be able to verify them. They can also originate from other adverse situations existing in traffic, caused by other vehicles, pedestrians, animals or even by natural phenomena.

Despite the impossibility of determining the circumstantial cause by the expert, traces pertinent to it can be found at the sites. These should be mentioned in the reports and may be used to clarify the truth.

On the other hand, the immediate or direct causes are perfectly verifiable, since, when they exist, they are materialized by the traces produced.

The Determining Causes are related to man, machine and the environment, subdivided as follows:

- Man
- machine
- Middle

man (driver)

a) **Behavior** - should be understood as a state of knowledge, on the part of the driver, of a situation of Danger created by him/herself, and his/her persistence in it until the culmination of the event. It thus reflects an action that will be illegal, dangerous or unusual.

Illegal behavior is characterized when it is found that the driver was traveling in complete disobedience to an overt or obvious sign. Eg: going on a direct line, driving in the wrong direction, etc.

Dangerous behavior is related to abnormal maneuvers and the traffic conditions of the vehicle. Eg overtaking on the shoulder, zigzagging on the road, with the vehicle without brakes, or with the tire linings exposed, etc.

Finally, **unusual behavior** is attributed to the driver who maneuvers his vehicle in an unexpected and unconventional way, as the title itself indicates, unusually. Eg: driving over the flowerbed, sidewalk, balloons, lawns, etc.

b) **Speed –** Speed is at the level of behavior , in relation to the danger it represents, to the point that it can be said, without the need for statistical data, that, if the regulatory signs were obeyed, the rate of serious and fatal accidents would be markedly reduced.

c) **Lack of reaction** and/or **delayed reaction** – occurs in those cases where the driver does not react to the obstacle in front of him or reacts at a point on the terrain, from which it is no longer possible to stop the vehicle in time to avoid the collision.

Factors influencing reaction time:

- Definitive: age, physical disability (vision, hearing, paralysis, etc.);
- Temporary: Transient illnesses (common cold, headache, etc.), alcohol, drugs, medications, emotional state, sleep

ALCOHOL AND DRUGS - can slow down the reaction time considerably. American traffic accident statistics indicate that alcohol is involved in almost 50% of fatal accidents. Some experts indicate that depending on the person, just two glasses of beer can make your reaction time increase to 2 seconds.

EMOTIONAL STATE - can also slow down a driver's reflexes and reaction time. The individual who brings to the wheel his worries of: job, salary, marital, and frustrations arising from his daily life, can greatly alter his reaction time, mainly due to the low level of concentration in the activity of driving.

SLEEP – it is one of the most important elements in the cause of traffic accidents, it is very little studied, mainly due to the difficulty of investigating this variable after the occurrence of an accident. Two rates are used to estimate the number of accidents per motor vehicle caused by drowsiness.

The first is based on the total percentage of accidents and the total number of fatal accidents that occur during the hours of greatest sleepiness, from 2 am to 7 am and from 2 pm to 5 pm (42% of the total and 36% of fatal accidents). The second is the percentage of all accidents that occur at night (54%), when reaction and performance times are considerably reduced. The tendency to fall asleep is also increased by sleep deprivation and interruption, and the effect of this loss is cumulative.

Table 8 – Minimum distance required to stop a vehicle based on reaction time and vehicle speed.

SPEED (km/h)	**NORMAL (0.75 segs.)**	**DELAYED (2 segs.)**
	DISTANCE (m)	DISTANCE (m)
50	10	28
80	16	44
90	18	37
100	20	41
110	22	45
120	25	66

SOURCE: SANTOS & SANTOS. 2008.

d) Inadequate solution – this cause is applied when it is found that the driver has seen a danger and acted incorrectly to avoid it and thus caused the accident.

Machine (vehicle)

The need for a detailed site examination, including complementary examinations (verification of mechanical and pneumatic systems, among other components), should be observed with greater attention.

From a chronological point of view, the irregularity that could have caused the accident will occur before, during or after the collision.

Whether it occurred during or after the event, it will obviously be dismissed immediately as a Determining Cause. It is perfectly possible to establish whether the failure occurred as a result of the event or whether it was produced intentionally.

If it occurred before the accident, the objective aspects that may or may not attest to its foreseeability, as well as its pre-existence. Pre-existence is equivalent, in terms of liability, to foreseeability, and the driver, in this case, must assume it, characterizing the modality of dangerous behavior . Eg the driver is aware of the defect in the vehicle and assumes the risk of putting it in traffic.

By exclusion, we finally arrive at the unforeseeable failure , which surprises the driver and gives immediate cause to the event, and only in this hypothesis is it given as the Determining Cause. Eg tire rupture in new condition, as well as rupture of the steering arm of the well-maintained vehicle, etc.

Middle

Finally, there are the causes related to the environment, here understood as the road, garrisoned or not by signaling. When the Determining Cause is attributed to the medium (road), the responsibility will fall on the representatives of the bodies responsible for the design, construction and maintenance, exempting the driver directly or indirectly. In this case, the causes are divided into predictable and unpredictable.

Although rare, the foreseeable causes register some accidents whose reason is attributed to the environment. Eg: deposition of a layer of tar on the roadway without proper signage to prevent the transit of vehicles. The technician should be alerted that the limit of predictability is exactly the fortuitous and/or force majeure event, and the characterization, whenever possible, should be recorded.

The unforeseeable causes linked to the environment are those resulting from force majeure, caused as a result of floods, windstorms, etc. Eg collapse of viaducts, bridges, etc.

Various materials are used in the manufacture of a car, not least because the functions they have to perform are also diverse. So, depending on the part and also the brand of the vehicle, we will find different materials and different ways of producing them.

Form, function, cost and safety are unknowns to consider in the selection of these materials and varying what is intended, so does the choice of these.

CHASSIS

The chassis is the least remembered part when it comes to maintenance, however, it is one of the most important parts. While it is responsible for withstanding the twists and loads that a vehicle

undergoes throughout its life, it must also be flexible enough for when excessive twisting occurs.

In cases of collisions, it must absorb the shock, preventing the occupants of the vehicle from being hit. To do this, current models are designed in such a way as to create a survival cell around the vehicle.

Modern vehicles have a computer-designed chassis, which gives them greater precision and efficiency.

Nowadays most automobiles no longer have the old chassis, what they have is a monocoque body. In this structure, the floor is stamped together with the rest of the bodywork, so all parts of the car's body come off the assembly line as a single piece, due to this characteristic it was called monocoque.

There is also the structured monocoque, a variation of the monocoque, known as a truss chassis because it is assembled in such a way that only the structure of the vehicle is part of the chassis, all the bodywork and other parts will be fixed later. Reducing the weight of the structure while offering superior rigidity and greater resistance to collisions is the goal of this type of chassis, which is why it is chosen by most manufacturers of racing vehicles.

This technology was first used in series production by Audi in the A8, which was launched in 1994. More recently, **Fiat** has adopted this concept and has already applied it to the Fiat Multiple, equipped with a structured chassis made of high-strength steel.

In the bodywork, two metal materials are used predominantly, steel and aluminum . But they can also be made of carbon fiber, Kevlar, and currently chassis are manufactured with magnesium and composite materials, a mixture of aluminum with carbon fiber or Kevlar and carbon fiber, among others.

Steel is a metal alloy made up essentially of iron and carbon.

In the past, mild steel was the most used metal in the manufacture of the different components of the automobile, however, in order to make automobiles lighter, safer and stronger, mild steel gave way to high-strength steels.

Since then, the use of this type of steel has been favored by the following Reasons:

- They reduce the mass of the vehicle by reducing the thickness of the different structural elements and body panels, without compromising strength;
- These metals are less expensive than plastics or aluminum ;
- Numerous body parts can be made of high-strength steel without altering the molds and tools traditionally used

Aluminum is abundant in the earth's crust and is relatively easy to exploit. It is also increasingly being used in automobiles, particularly in car bodies, due to the following advantages:

- Its density is approximately one-third that of steel;

- Aluminum oxide forms a thin layer, which is periodically renewed- degradation of the material is avoided;
- Alloys of this metal are easily recyclable;
- Be easy to machine;
- It has a great capacity to absorb energy, a characteristic that makes it very suitable for programmed deformation areas of the body.

However, aluminum also has disadvantages:

- Because it is soft, ductile and malleable, deformations easily arise due to stress;
- The electrical resistance is five times lower than that of steel, making it impossible to weld by resistance points;
- The coefficient of expansion of the material is twice as high as that of steel, which can cause parts to deform during welding.

Analyzing the data, we realized that there is no perfect material, but rather one that is more suitable for different situations and parts of the vehicle. Thus, when the purpose of a given component is to be of reduced mass, it will be produced in aluminum and not in steel.

When the goal is to reduce mass and also increase the rigidity of a part of the car, such as pillars for example, low-weight and ultra-high tensile strength steels are used. They are steels with high Magnesium and Boron contents, cold stamped and then coated with Aluminum and Silicon to increase their resistance to corrosion. In this way, a lightweight structural element with rigidity and corrosion resistance is achieved.

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ICMS education in Santa Catarina: Contours and implications

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ABSTRACT

The relationship between educational policies, distribution of resources and gains in educational quality is characterized as a challenge for managers in different regions of Brazil. In the State of Santa Catarina, the challenges are no different or less, and it is in this direction that as of 2023 the ICMS Education transfer methodology comes into force. Thus, our objective is to analyze the contours and implications of the new ICMS Education in the State of Santa Catarina. To this end, we describe the historical experience of other states, their initiatives and consequences. Then, we discuss the Santa Catarina model, the methodological contours and its possible implications, establishing, at the same time, a parallel with the experience of the State of Ceará. The experiences were narrated, the contours and implications of ICMS Education in Santa Catarina were thought out, methodologically modeled. From 2023 onwards, we will move on to the next stages of this movement and its transposition to the field of management.

Keywords: ICMS Education, Educational Management, Quality Indicator of Schools in Santa Catarina.

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INTRODUCTION

Education and its contours. The lines, social dynamics that directly or indirectly influence what is aimed at in education. Its forms, functioning structures, depend on a dynamic of forces that push or remove certain practices that are effective in education. We know, in this context, the difficulties of defining quality in education, the aspects and assumptions are the most diverse. However, without going into the merits of defining the contradictions, parallelisms, between the concepts of quality, we can think about the implementation of policies, their results and development.

As our approach applies to the discussion of the results and not to conceptual conflicts, we need, initially, to describe the principles that synthesize the movements related to the National Education Plan articulated with the new ICMS Education. At this point, it is enough to know, and this point we will deepen throughout the text, that we are facing a topology composed of a series of criteria, goals, objectives, which State Law number 18,489 intends to achieve via ICMS. What we intend is to shed light on this topology, to give visibility, so that we can later think about the distribution of resources linked to the development of a series of statistically mathematized variables.

In this way, we return to the historical explanation and the reports of experience. Rather, it is worth noting that building income distribution policies that generate, in some way, tangible results, measurable to some extent, have always been a challenge for managers throughout Brazil. In Santa Catarina, based on criteria articulated with the national education plan, the ICMS Education, in 2023, will link resources to the evolution of a panel of variables updated and mathematically modeled each year. We have examples in other states, such as Ceará, where this type of distribution policy linked to merit and performance has been in place since 2007. Thus, our objective is to analyze the contours and implications of the new ICMS Education in the State of Santa Catarina. To this end, we describe the historical experience of other states, their initiatives and consequences. Next, we will discuss the Santa Catarina model, the methodological contours and its possible implications, establishing, at the same time, a parallel with the experience of the State of Ceará.

THE HISTORICAL EXPERIENCE OF ICMS EDUCATION IN THE STATES: INITIATIVES AND CONSEQUENCES

Initiatives, construction of public policies that increase the quality of education, have been one of the great challenges of managers in Brazil for many decades. In addition to promoting initiatives, with regard to the construction of these policies, what is posed as a concomitant challenge is the selection of a series of variables that allow us to measure the evolution, evaluate the relationships between cause and consequence. We know that observing the relationships between cause and effect requires caution, because the simultaneity of events does not necessarily mean approximation and dependence.

Before touching on these points describing the case of the State of Ceará, the implications between the evolution of the indices that presuppose quality and the criteria for the distribution of ICMS Education according to these movements, we will turn our gaze to the State of Santa Catarina. Before talking about the IQESC, an indicator of the quality of education in Santa Catarina, and the methodology of the ICMS transfer, it is worth noting that the strategies presented later are based on the wording of Constitutional Amendment number 108/2020, which deals with:

> Art. 158. Sole paragraph. I – at least 65% (sixty-five percent), in proportion to the value added in operations related to the circulation of goods and in the provision of services carried out in their territories; II – up to 35% (thirty-five percent), in accordance with the provisions of state law, subject to the mandatory distribution of at least ten (10) percentage points based on indicators of improvement in learning outcomes and increased equity, considering the socioeconomic level of educators (BRASIL, 1988).

Thus, on August 22, 2022, State Law No. 18,489 was enacted, which regulates the form of transfer of ICMS Education in Santa Catarina, which defines the municipal share of ICMS articulated with educational criteria. It is also established that the portion referring to ICMS in Education will have a progressive increase every two years. Starting at 10% of the municipal share of the municipal ICMS, and advancing 2 percentage points in 2024 and 1.5 points respectively in 2026 and 2028, until reaching the limit of 15%.

In 2023 we will already have the IQESC model running, and related to it, the new methodological distribution logic that we will see below. However, having defined the proportions and the progression of the percentages that justify the methodology and criteria, we will make a small historical cut at the national level, bringing up the most iconic and well-known cases of this type of initiative. Linking the transfer of resources that induce the improvement of learning of students in the municipal public network is what the State of Ceará has been doing since 2007.

In 2007, several actions aimed at instituting quality management in the state, Ceará took the initiative to change its legislation regarding the transfer of the ICMS quota to the municipalities. It is a management policy,

> focused on the citizen as a customer and seeking optimal standards of efficiency, effectiveness and effectiveness, with ethics and transparency. It is a management that seeks to reduce costs for society and commits the State to the satisfaction of citizens. It is a model in which government is a means rather than an end in itself. In this model, the government needs to continuously dialogue with society and make intense use of monitoring and evaluation procedures, including from the point of view of the citizen as the main customer (GARCIA, 2006, p.83)

If we look at the case of Ceará, we can see some lines that sustain and give stability to the execution of the policy linked to the ICMS distribution law. The first of these concerns the distribution of resources.

> Article 1 - The portion of 25% (twenty-five percent) from the revenue from the proceeds of the collection of the Tax on Operations Related to the Circulation of Goods and on Provision of Interstate and Intermunicipal Transport and Communication Services - ICMS - will be distributed with the municipalities of Ceará, according to the following criteria:
> I – 18% (eighteen percent) based on the Municipal Educational Quality Index of each municipality, formed by the approval rate of students from the 1st to the 5th year of elementary school and by the average obtained by the 2nd and 5th years of the municipal network in learning assessments; (...) (NR).

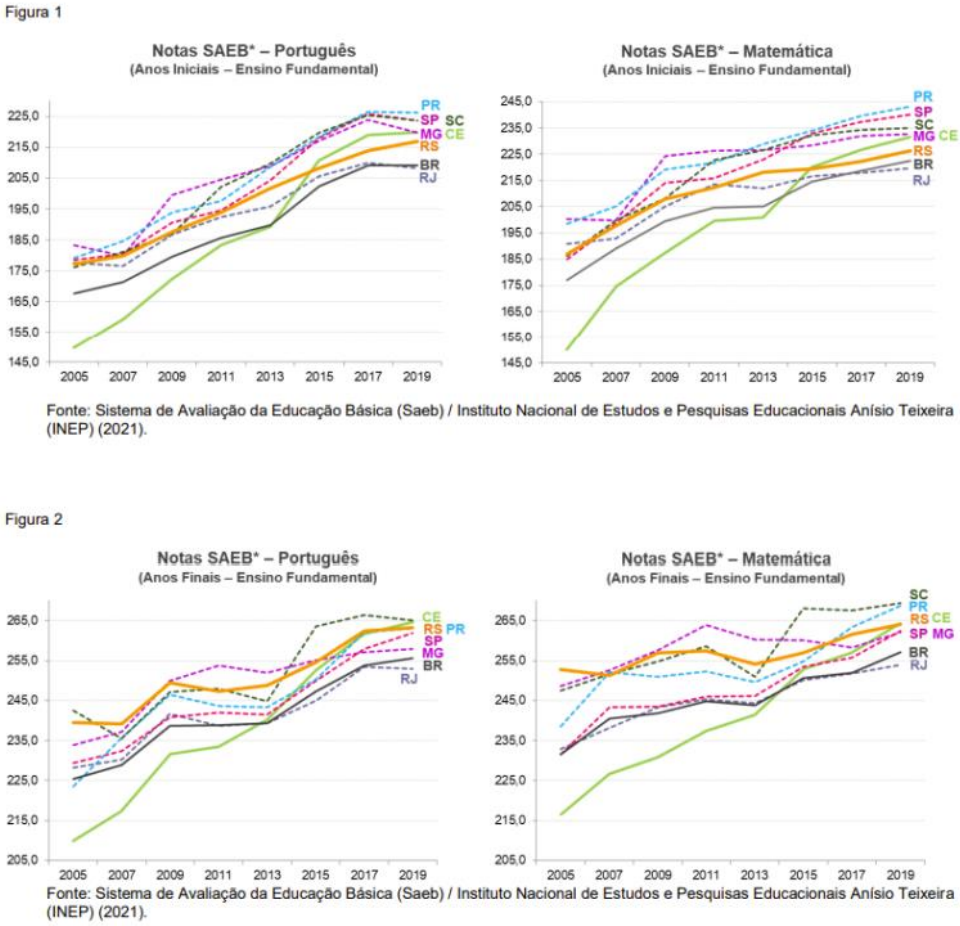
It is worth noting that since the approval of the aforementioned law, which also includes health and environmental indicators with lower percentages, 5% and 2%, respectively, education began to exert a greater weight in the distribution of resources. As a result, the higher the quality indicators, the greater the transfers made by the State. It is not a question of channeling new resources, but rather another form of distribution based on educational indicators.

The second line is articulated with continuing education programs, technical support, so that the entire school community is aware of the implementation and changes in educational policy. The third line directly impacts the political leadership that "has placed learning as the main objective of educational policy. (...) In order for such changes to be carried out, education had to be defined as a necessary condition for the socioeconomic development of the State" (LOUREIRO ET al., 2020, p.31). The fourth line promotes a transfer of school management from elementary education to the municipalities, and finally, the construction of a system for monitoring and evaluating the educational results of each municipality.

These lines form the backdrop, with regard to the actions, the current initiatives for the execution and strengthening of all the execution fronts articulated to ICMS Education. We are facing a series of implementations that go through the structure of the law and the respective financial transfers, and the educational indices that define the amount and share of resources linked to its evolution. It is the educational quality indices that allow us to think about rational criteria for the distribution of resources, and at the same time, to deepen specific strategies that allow us to improve the educational quality of the State of Ceará.

The consequences of the implementation of ICMS Education in the State of Ceará can be analyzed in different ways. The one with the greatest objectivity is related to the grades presented by the students in the SAEB, the basic education evaluation system. This evaluation system aims to identify if students are managing to achieve some proficiencies such as reading, writing, performing basic calculations and interpreting texts. The lines in the following graphs give us a sense of these variations.

Figure 1: Evolution of SAEB scores



Source: INEP, 2021.

It is worth noting that the initiatives related to ICMS Education in the State of Ceará began in 2007, as we have seen previously. Both in the initial and final years, in the areas of mathematics and Portuguese language, we had an evolution in the indexes. The representative line in the graphs of the aforementioned State accelerates its results continuously in the historical cut that is presented, that is, until the year 2019. If we look at the data itself, this cut linked to the SAEB scores, which as we know, is not about encompassing the totality and relativity of the concept of quality in education, we perceive a rapid evolution of the scores in a time constant from 2007 to 2019. Another aspect that needs to be verticalized is the relationships between cause and effect. Looking at the data itself, as we have highlighted, it is not possible to infer cause and effect in such an immediate way, in other words, the causal relationship between ICMS Education and improvements in the SAEB indicators. Even if there are strong indications of a causal relationship, other aspects need to be observed in a complementary way.

Social spaces, their internal organizations, cultural and geographical aspects are decisive for analyzing the consequences of possible political actions. It is in this line that the study by Shirasu, Irffi and Petterini (2013) walks. It is a comparative methodology that takes regional similarities as a background. In this sense, the states of the Northeast present striking approximations, both in the

symbolic cultural perceptions and in the structures of operation of the educational networks that make up the States of the Northeast. It is at this point that we open up an analytical possibility. Among the states that make up the Northeast region, only Ceará has implemented the ICMS Education. As we are assuming parameters of similarity, both social and educational, comparisons can be established. At the end of the research, Shirasu, Irffi and Petterini (2013) found, on average, an increase of two percentage points in the SAEB scale at all levels in the municipalities of Ceará, only in the interval between 2007 and 2009. Bringing as a complementary conclusion that the managers responded better to the incentives in Ceará.

It is worth noting that the scores continued to evolve and the State of Ceará began to gain notoriety for its indexes in the national scenario. Just to bring you data, in 2015, of the 100 largest schools according to IDEB Brazil - 2015, 77 are in the State of Ceará. The notoriety of ICMS Education in the State of Ceará began to inspire other states that were improving their tools for measuring and building quality indexes. São Paulo, Rio de Janeiro, are, just to cite two cases, examples of federations that are following the same path. Santa Catarina is preparing to follow these examples, perfecting them, making the modeling more complex and powerful. Let's get to its outlines.

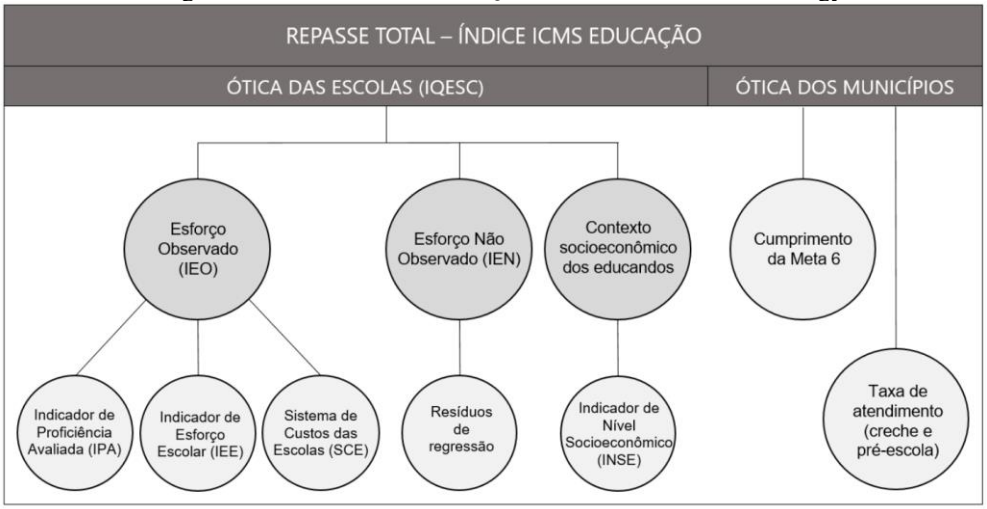
ICMS EDUCATION IN SANTA CATARINA: METHODOLOGICAL CONTOURS

Portraying the historical experience of ICMS Education in Brazil, and in more detail, in the State of Ceará, allows us to observe the positivities, and to some extent, its limitations. Looking at history, to a certain extent, creates expectations of finding similarities and, at the same time, distances from what is not achieved. It is worth noting that if it is aimed at another cultural context, the social and educational structural conditions are different, for example, from those of the State of Ceará. The State of Santa Catarina starts from another cultural, social and educational place.

Before approaching and thinking about the broader symbolic aspects and the possible implications, let's discuss the methodology for transferring ICMS Educação and IQESC – a quality indicator for schools in Santa Catarina. Before discussing the methodology itself, it is worth noting that the ICMS transfers in Santa Catarina will be linked to the evolution of these indexes, the results modeled and statistically treated, as we will see below. It is also worth noting that in Santa Catarina, of the 100% collected in the ICMS, 75% remains for the State and 25% returns to the municipalities. Of this 25%, when directed to the municipalities, 100% is again considered, 15% is divided equally among the 295 municipalities that make up the State of Santa Catarina. 85% is distributed proportionally, depending on the economic movement, that is, related to the additional value of each municipality. Starting in 2023, 10% of the additional amount will be distributed according to the indices modeled by ICMS Educação, reaching 15% in 2029.

These will be the percentages, the concrete amounts in currency, will depend on the collection of each year in the State. To begin with, let's present the image that represents the methodological flowchart:

Image 2: ICMS Education and IQESC 2022 transfer methodology



Cast iron: TCE/SC

As we have seen above, the methodology for the transfer of ICMS Educação and IQESC, a guide for future transfers, is divided into two fronts. Optics of Schools and Optics of Municipalities. The database that feeds the methodology is based on data from the Census, SAEB, and socioeconomic context indicators published by Inep. Let's start with the Perspective of Municipalities. This line considers some variables modeled and mathematically measured that are related to the fulfillment of Goal 6 of the National Education Plan and the increase in the attendance rate of daycare centers and preschools, Goal 1. "Goal 6 of the National Education Plan (PNE): 25% of public school students should be enrolled in full-time workdays" (ICMS PANEL - IQESC, 2022). In mathematical modeling, which we will not delve into at this point, this variable is considered in a binary form. That is, the municipality that has 25% of the students enrolled who make up the municipal public network full-time, will be entitled to receive 2.5% of the total transfer of ICMS Education. Those who do not comply do not enter this division.

Still from the Perspective of the Municipalities, now with regard to "Goal 1 of the National Education Plan (PNE) aims to increase access to daycare and preschool and is calculated by the net rate of attendance at daycare and preschool in the municipality" (ICMS PANEL - IQESC, 2022). The mathematical tools used in this variable apply to the increase in the percentage of attendance. In this sense, the greater the number of enrollments in relation to the estimated population of children up to 5 years of age for the municipality, the greater will be the transfer of ICMS Education values, which, in the attendance rate, corresponds to 2.5% of the total.

The Perspective of the Municipalities corresponds to 5% of the total ICMS Education. This is articulated with broad actions that somehow reach the entire population of the municipalities to varying degrees. Sharing responsibilities with the different agents that make up education, dividing the modeling into two fronts has this characteristic, as we will see below. The schools' perspective includes a series of variables that resulted in the IQESC. It is divided into three fronts: Observed Effort (IEO), Unobserved Effort (IEN) and Socioeconomic Context of Learners.

In Observed Effort (IEO), in turn, it is divided into three variables. The first is the Assessed Proficiency Indicator (IPA) which weights the result in proficiency assessments that take into account factors such as the participation rate, dropout rate and the pass rate of schools. The basic calculation of this variable is related to the SAEB score, i.e., the Portuguese and mathematics scores extracted from the basic education evaluation system made at the national level. The Observed Effort (IEO) represents 0.55 of the weight of the IQESC, subdivided among the three variables we are analyzing. It is also worth noting that the Optics of Schools (IQESC) represents 95% of the total apportionment of ICMS Education. Among these variables, the weights of each one of them are relativized according to the development of the indices presented here. In the year 2023, the Observable Effort (IEO), as we mentioned, has a weight of 0.55, which can change over time.

The second variable that makes up the Observable Effort (IEO) is the School Effort Indicator (IEE). This indicator is composed of variables considered "controllable by school managers (principals and secretaries of education) and encompasses variables related to school management, education professionals, and infrastructure" (ICMS PANEL - IQESC, 2022). In the school management line, the forms of access to the position of School Director, Schooling of the Manager, Continuing Education, Presence of Collegiate Bodies and Existence of a Pedagogical Project are contemplated. Education Professionals, in terms of % of teachers with Adequate Training, Teaching Effort, Regularity of Teaching Staff, Continuing Education, % of Staff, Support Professionals. And finally, still within the (IEE), we have the indicators of Infrastructure, Accessibility, Space for Sports Practices, Technological and Pedagogical Items and Food.

The third variable of the Observable Effort (IEO) is the School Costing System (SCE). This indicator aims to evaluate the relationship between costing and quality of education. Variables such as Teacher Remuneration Cost, Food Cost, Building Maintenance, Technological and Pedagogical Items will be included in the construction of a future platform with all this information. As these numbers are still incomplete, in 2023, the Costing System (SCE) will have zero weight and will not influence the IQESC.

Unobservable effort (IEN) is the great differential of the methodological model of ICMS Educação de Santa Catarina. Without sticking to mathematical modeling and statistical sophistication, the indicators of Unobservable Effort are calculated by means of regression residuals

from each school. The regression model takes into account a series of variables that are not directly measured by assessment systems, but that influence student performance.

> The residues of the regression model represent an effort that the education indicators do not demonstrate, but which have a relevant impact on the learning of children and adolescents at school, such as, for example: new and comfortable school transport fleet, healthy school environment, good relationship between teachers and students, teacher projects applied at school or in the classroom, good pedagogical proposal, safety in the surroundings of the school, location of the school, comfort of the accommodations, quality of the textbooks, quality of the lunches, good functioning of the Parent-Teacher Association, technical quality of the Municipal Secretary of Education, effective functioning of the Municipal Council of Education, etc. (ICMS PANEL - IQESC, 2022).

With a minimum statistical significance of 90% confidence, the regression model estimates a SAEB score, according to contextual aspects of each school. Thus, we have two observed (real) SAEB scores and the scores estimated by the regression model. From this analysis, a series of residuals are generated, consisting of the subtraction (observed Saeb) and the last (estimated Saeb). Once standardized, we have the Unobservable Effort (IEN) indicators, which in 2023 has a weight of 0.2 in the IQESC.

In the Socioeconomic Context of Students, it contains the Socioeconomic Level Indicators (INSE), which is basically an income distribution tool for Santa Catarina schools. In 2022, Inep provides an indicator of the socioeconomic level of schools. Unlike the IPA, the IEE and the levels of Unobservable Effort, which the higher their values, the higher the transfers to the schools, the relationships are reversed, schools with lower socioeconomic indicators are compensated with higher transfers. The socioeconomic context is the last line of the sets of variables that make up the schools' perspectives, and which, in turn, completes the construction of the Quality Indicator of Schools in Santa Catarina (IQESC).

The methodological contours articulated with the transfer of ICMS Education in Santa Catarina, as we have seen, permeate a set of variables divided between the Optics of the Schools and the Optics of the Municipalities. To think about the implications, at first, is to draw some parallels between the experience of other states in Brazil and the contours and transfer strategies that began to be implemented in 2023.

THE EXPERIENCE OF CEARÁ AND THE SANTA CATARINA METHODOLOGY

After observing the historical experiences, in a more in-depth way that of the State of Ceará, and then the methodological contours of the ICMS Education of Santa Catarina, we can highlight some implications due to a possible movement of approximation. In Santa Catarina we are starting this movement, the methodological construction already shows a certain degree of maturity. However, the consequences and modifications will be made and measurable over the next few years.

What we have at this moment are the comparisons of what is already presented, that is, the Santa Catarina methodological and the more in-depth historical objectification in the State of Ceará.

The history of education in the State of Ceará, the increase in its indexes, as we have already shown in the previous graphs, indicate a significant gain from the implementation of income transfer mechanisms linked to ICMS Education. Santos (2017) highlights the impact on the IQE of the municipalities of Ceará on the proficiency of students from 5th to 9th grade of municipal public schools in the Prova Brasil. The results of proficiency in Portuguese Language and Mathematics of students in the 5th grade were directly impacted by the resource transfer policies, with lower levels for the 9th grades, which were recently inserted in the same logic of resource locomotion based on merit and performance criteria.

The internal comparison of the different years that make up elementary school, and the external comparison, in relation to the social contexts of other states that make up the region, show the evolution, the transformations that occurred in Ceará after the implementation of the resource distribution system articulated with the ICMS Education. It is not a question of measuring quality, what we have is an evolution of the indices taking into account statistical mathematization.

Assuming the reduction of the complexity of the phenomenon, let's think about the approximations, we will start with the Ruler. The ICMS Education of the State of Ceará builds its indexes (IQE) based on the performance of students at the SAEB level. This, as we have seen, causes positive changes, but reduces the consequences in the act of measuring students' grades. This does not denigrate the experience of the State, it only shows the need to relativize and highlight the limitations of the legitimate transformations that numbers express. Ultimately, we are faced with a problem that involves the measurement of educational transformations and their depth.

The experience of Ceará shows us the educational path in that state, the measurement tools open up possibilities of comparison with what has already been built in Santa Catarina. In Ceará, the ICMS Education policy, in an objective way, increased the indexes, the SAEB scores. In Santa Catarina, we do not know the consequences, what we have and can observe is the power to measure depths, of the future transformations that the methodology of ICMS Education of Santa Catarina can cause in public education in the State.

At first, we can infer that the Santa Catarina methodology has the potential to measure other levels of educational development. As we have seen, the Optics of Schools and the Optics of Municipalities institute a logic of co-responsibility. Management, in this sense, is diluted between the directors of educational spaces, the secretary of education and the chief executive. The proficiency indicators, SAEB, are characterized as only one of the variables to measure the quality indicator of the schools. This is different from the Ceará model, which has as its main parameter the exams carried out on a large scale.

In the case of Ceará, the objectivity of the indicators is extracted from the exams taken every year, the measurements are carried out through the analysis of the students' performance in relation to their grades. In the Santa Catarina model, the objectivity of the data includes the proficiency indicators and two more observable lines, which are the aspects related to school management and costing systems. Thus, in addition to a sophistication in the measurement system, with a greater number of variables contemplated, there is the possibility of expanding management strategies. In a more or less direct way, the IQESC provides and gives visibility to the problems faced by public schools and that are permeated by the mathematical modeling presented in the ICMS Education of Santa Catarina panel.

We do not want to do any exercise in futurology here, because the contexts, the history that Ceará has built so far, is very different from what Santa Catarina is projecting. It is not a question of defining, or giving any value judgment, with regard to the experience of the two states. What we highlight, and have already done, are the positives of the experiences. Methodologically, and we still don't have the practical results, the Santa Catarina methodology has a measurement potential that reaches the subsoil of state public education. In addition to taking into account socioeconomic data from each school, the mathematical modeling presented in the Unobservable Effort is of an observational sophistication that helps us to support what has already been built so far. Analyzing a set of variables that describe the reality of each school, estimating, from this context, the students' scores in the SAEB, allows us to reward the effort of those schools that, even in the face of challenging realities, present good performances of their students. It is, in this sense, a provocative methodological innovation, with equally provocative consequences.

Goal 1 and Goal 6 complete the model from the perspective of the municipalities. Bringing the experience of Ceará closer to the Santa Catarina model allows us to give indications of the implications of ICMS Education in the public schools of the State. The first is, reinforcing what we have already emphasized, the degree of depth and capture of the Santa Catarina model. The consequences of inducing and directing actions in management are promising. The second is the possibility of mirroring. To see the history of ICMS Education in Ceará and take advantage of the path of this distribution policy to build our trajectory. And the third implication is the possibility of strengthening the successful experiences of cities that already have good IQESC performance.

We are in the field of possibilities, the State of Santa Catarina has already presented its plan, its distribution methodology that induces the construction of management plans that take into account the variables contemplated by ICMS Education. In 2023, we will start and start writing another story, with planning, mathematization, and management action in the macro and micro context, in the near future, the impacts will be felt, good fruits is what we want to reap.

CONSIDERATIONS

The relationship between historical experiences and the Santa Catarina model of ICMS Education leads us, almost immediately, to map the methodological differences and their contours and implications. Throughout the text, we analyze the historical experiences permeating, mainly, the section linked to the State of Ceará, its distribution criteria and results. The indices had a leap after the definition of criteria and management of improvement actions. Next, we describe the Santa Catarina mathematical model, its potential for transformation and possible implications. To this end, we bring together the prerogatives of Ceará and the Santa Catarina model, highlighting the levels, depths, and potential for transformation in the construction of future municipal management plans.

There is a potential for transformation, variables that are contemplated in the mathematical model and that have practical consequences in education, such as, just to cite an example, the socioeconomic context in which schools are inserted. The IQESC is susceptible to criticism, we can emphasize, from a certain angle of observation, the induction of attack to only some aspects that make up the educational complexity. In this sense, it induces the objectification of a series of preferences and prioritizations that can weaken everything that is not part of the lines considered by the model. At this point, it is worth the attention of managers, the constant vigilance that the ICMS causes, the opportunities for growth and the possible points of vulnerability.

The experiences were narrated, the contours and implications of ICMS Education in Santa Catarina were thought out, methodologically modeled. Starting in 2023, we will move on to the next stages of this movement. At this moment, we are deepening our methodological knowledge, because, "following Spinoza, the greater the power of receptivity, the greater the powers of action" (BUTLER, 2020, p.93).

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Teachers, education, community and professional learning tasks: A texture for the construction of professional knowledge

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ABSTRACT

This paper presents part of a research on the professional knowledge learned by teachers to teach algebra in the early years of Brazilian Elementary School, in a community of practice (CoP) context, mediated by professional learning tasks. Continuing education took place from March to May 2021, with 21 pedagogical teachers, in teaching activity, belonging to the staff of public servants of a municipal education network, in the interior of the state of Mato Grosso, Brazil. In this excerpt, we intend to discuss to what extent the development of professional learning tasks collaborated for the construction of professional knowledge of teachers participating in a CoP on the teaching of algebra to children. To this end, in addition to the theoretical framework, we present the proposal of teacher training carried out and, in sequence, in a qualitative interpretative approach, in the light of the social theory of learning and the theoretical model of mathematical knowledge for teaching, we discuss how the tasks of professional learning collaborated to the construction of professional knowledge for the teaching of algebra of this group of teachers. It can be inferred from the analysis that, in the context of the community of practice, the tasks of professional learning, more than mediation instruments, were decisive to provide the construction of professional knowledge to teachers. We hope that the discussions and shared results can contribute to the international debate on powerful proposals for the continuing education of teachers.

Keywords: Teacher education, Professional development, Community of practice, Professional learning tasks, Algebra teaching.

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INTRODUCTION

Several Brazilian researchers (Ferreira, 2017; Ferreira et al., 2016, 2017; Lima & Bianchini, 2017; Luna & Souza, 2013; Santos et al., 2014; Trivilin & Ribeiro, 2015) refer to the necessary teacher training for the teaching of algebra in the early years of Elementary School (AIEF), which serves children from 6 to 10 years of age. In such a way that it is recurrent to consider that one of the main challenges to be faced in Brazilian school education is the issue of teacher training, both initial and continuing. In addition, specifically for in-service teachers, who teach mathematics in the AIEF, there is a demand for continuing education on the teaching of algebra, as it is a branch of mathematics that was not treated in higher education courses in Pedagogy.

In this text, we understand the continuing education of teachers as a *continuum* of improving, broadening, deepening and improving professional development, whose focus is on professional learning (Garcia, 2009). Learning is understood as a process of intrapersonal and interpersonal nature of construction of knowledge, knowledge and practices related to teaching practice. We assume the concept of continuing education as practice-based professional development, on the assumption that professional learning is situated (Lave & Wenger, 1991; Wenger, 1998), continuously (re)signified in the interaction and shared practice with other teachers, in a community of practice (CoP).

Considering that our objective is to discuss to what extent the development of professional learning tasks collaborated for the construction of professional knowledge of teachers participating in a CoP on the teaching of algebra to children, we look at the learning experiences of these teachers, evidencing the specific professional knowledge necessary to teach algebra to children. that they revealed. To this end, we organized the text as follows: a) theoretical framework; b) methodology adopted and succinct presentation of the teacher training carried out; c) interpretative analysis and discussion; and d) conclusion.

THEORETICAL FRAMEWORK

The research carried out, as well as the construction of this article, They involved a theoretical framework composed of three axes, in order to guide, analyze and discuss the construction of the professional knowledge of the participating teachers, namely: learning and professional training, The teacher's professional knowledge for teaching mathematics and teaching algebra. Below, we briefly present each axis; however, with a restricted focus on the theoretical perspective assumed, namely: Social Theory of Learning (axis of learning and professional training); mathematical knowledge for teaching (axis of the teacher's professional knowledge for the teaching of mathematics; and *early algebra* (axis of algebra teaching).

SOCIAL THEORY OF LEARNING

In the light of Lave and Wenger's (1991) social theory of learning (TSA), learning is conceived as the history of participation and, therefore, of people's transformation and change. Learning is no longer based on individual processes, but is recognized in social practices, through participation. Learning, as well as participation, is always situated, resulting from the context, the specific relationships and interactions that are established between teachers, the negotiations of meanings they carry out and how each one means to themselves, revealing in actions and discourses (oral and written) in the CoP – their reifications. Thus, learning is understood as a change in actions and/or knowledge.

Social participation, as a process of learning and knowing, takes place in four independent but interconnected dimensions, which are: community, practice, meaning and identity (Wenger, 2013). These are constitutive dimensions of the TSA that manifest learning. In this way, in the community, learning is revealed as affiliation, a sense of belonging, and commitment to the community. Learning is spelled out in the form of becoming a member. In practice, learning is understood as doing and occurs through the use of historical and social resources of the joint objective of the community of practice, when it is in action, that is, learning how to do. In meaning, learning is denoted as experience. Identity, within the community, is present in the becoming of the participants, in what changes in each member.

Lave and Wenger (1991) present the idea of CoP linked to the conceptions of participation and learning. They argue that participation and learning are part of the evolutionary process of becoming a member of a CoP and present it as "a set of relationships between people, activities, and the world, over time, in relation to other tangential and partially overlapping communities of practice" (p. 98). A CoP is made up of a group of unique people, that is, with different knowledge, skills and experiences (common practices), who are willing to share knowledge, interests, perspectives and, in a special way, to share practices for the construction of knowledge, both in the personal and collective dimensions. The authors even condition the existence of knowledge to participation in CoP (in several), in such a way that it can be considered that there is no construction of knowledge without participation in a social practice.

From this perspective, in a CoP, the learning of the members takes place through their participation in practice. Therefore, seeking teacher professional development within a CoP presupposes understanding that this space provides the development of a discourse and a shared activity that permeates learning, through participation, the social negotiation of meanings and collective learning (Amado, 2017), that is, a social practice that enables the construction of professional knowledge.

MATHEMATICAL KNOWLEDGE FOR TEACHING

The shared practice of the CoP of the teachers participating in continuing education was anchored in the theoretical model of mathematical knowledge for teaching (MSC), proposed by Ball et al. (2008). The authors define the MSC as the mathematical knowledge necessary to carry out the work of teaching mathematics, focusing on teaching, on the tasks involved and on the mathematical demands of these tasks, encompassing the multidimensional knowledge of a certain mathematical content or concept that the teacher needs to know and understand well in order to create the best learning conditions for their students.

Ball et al. (2008) propose two domains of MSC: content-specific knowledge (CC) and pedagogical content knowledge (CPC). In each one, there are three subdomains, namely: a) CC subdomains: general knowledge of the content; expert knowledge of the content; and knowledge of the content on the horizon; b) subdomains of the CPC: knowledge of the content and of the students; knowledge of content and teaching; and knowledge of the content and curriculum.

Common content knowledge is knowledge that is not exclusive to teaching, which can be used in other contexts and by other professions. Content specialist knowledge is mathematical knowledge that is unique to teaching and goes beyond that taught to students. It implies knowing mathematics with depth and rigor. The knowledge of the content on the horizon demands mastering if and how what is taught in one school year is related to the following years, so that the teacher can teach the basis, the mathematical foundation to his students. Content and student knowledge is knowledge that combines knowing mathematics and knowing what students know or don't know and need to learn at any given time. The knowledge of the teaching content is also a combination, implying an interaction between the understanding of the specific mathematical content to be taught and the didactic-pedagogical understanding of how to make this content comprehensible, in order to provide the student's learning. Curricular content knowledge involves knowledge of the materials and programs available in each school year and at the intersection with different subjects of the same school year.

It is consistent with the theoretical model of the MSC to think about teacher education with reference to the three pillars proposed by Ball and Cohen (1999), namely: a) research on teaching in teaching; b) research into the practice itself; and c) learning in and with practice. A formative perspective that presents "new ways of understanding and using practice as a place of professional learning" (Ball & Cohen, 1999, p. 6) and is grounded in professional learning tasks (TAP). Thus, TAP are tasks designed to provide learning to teachers in a specific situation (Ball & Cohen, 1999) and are characterized, among other aspects, by the use of practice records (Ball et al., 2014). Therefore, in a context of practice-based professional learning, it becomes coherent, pertinent and feasible for the practice of a community to be mediated by working with TAP.

TEACHING ALGEBRA TO CHILDREN

The main objective of teaching algebra in AIEF, as prescribed in the Brazilian curriculum organization (Brasil, 2018), is to develop the algebraic thinking of young students, through generalizations and expression of these generalizations, but without the structuring of an algebraic (symbolic) language. There is affinity in the conception defended by international researchers of the *Early Algebra*, because it proposes its teaching integrated with other mathematical contents, that is, through an algebraization of the curriculum (Kaput, 1999) and algebraic thinking is understood as "a process in which students generalize mathematical ideas from a particular set of examples, establish generalizations through the discourse of argumentation, and express them, increasingly, in formal and age-appropriate ways (Blanton & Kaput, 2005, p. 413).

Blanton (2008) clarifies that algebraic thinking is a mental habit to be acquired by students in school, from the early years, through teaching action that should regularly provide students with the opportunity to "think about, describe, and justify general relations in arithmetic, geometry, and so on" (p. 94). Among the three strands proposed by Kaput (2008) to work on generalization and symbolism in the school mathematics curriculum in Brazil, the emphasis is on stimulating the development of functional thinking and generalized arithmetic. Developing functional thinking involves making generalizations about data that relate to each other through didactic work with repetitive and recursive sequences. Developing generalized arithmetic implies exploring the potentially algebraic character of arithmetic, through generalization about operations and their properties and reasoning about relations between numbers, relations of equality and the notion of equivalence of the sign of equality - aspects that constitute the heart of algebra as generalized arithmetic (Kaput, 2008).

Considering that, in the AIEF, the objective is to provide the development of students' algebraic thinking, focusing on their ideas, reasoning, representations, conjectures, arguments and generalizations, the importance of teaching work emerges. After all, the implementation of a mathematics curriculum from the perspective of *Early Algebra* It requires professional learning from the teacher, in order to master the knowledge necessary for this teaching, including the curricular knowledge related to algebraic thinking and its teaching.

METHODOLOGICAL PATH AND TEACHER TRAINING

We carried out a qualitative research of an interpretative nature (Bogdan & Biklen, 1994) and the research field was composed of a group of 21 pedagogical teachers in service in the AIEF, belonging to the staff of public servants of a municipal school system, in the interior of the state of Mato Grosso, Brazil. Teachers who deliberately decided to participate in continuing education and

who, in this text, are referred to with fictitious names (which they chose). Also, when there is reference to interventions by the researcher-trainer (first author), she will be identified as FP.

The pedagogical organization of the training was focused on professional teacher learning. We conceived and elaborated three TAPs, in a three-dimensional design, integrating *Teaching Assignments, Experiences* and *pedagogical tasks.* To this end, in addition to resorting to research carried out in the area, we used artifacts from teaching practice, such as: textbook activities, large-scale test questions, mathematical tasks and classroom records of other AIEF teachers. The *Teaching Assignments* contain mathematical tasks with potential for the teaching and learning of algebraic thinking in AIEF and, therefore, intertwined with the professional knowledge necessary for the teaching of mathematics. The *Experiences*, with records of practice (Ball et al., 2014) on real episodes of teaching and learning (Smith, 2001) or on research carried out from real episodes, analogous to teaching tasks. The *Pedagogical tasks*, with questions or theoretical-practical tasks, provide the articulation between mathematical knowledge, properly speaking, and pedagogical knowledge, both to analyze the teaching tasks explored and to projections in their teaching practices. There are three constitutive elements of the TAP, designed to mediate the social learning of professional knowledge, in a CoP context, through interactions, relationships, negotiations of meanings and reifications in shared practice, raised by the resolutions, discussions and reflections carried out in the meetings. In addition, we used complementary texts to theoretically reference what was explored and experienced in the TAP.

Continuing education in CoP, mediated by TAP, took place from March to May 2021. There were nine meetings, held on Tuesday afternoons. With a hybrid configuration, three meetings were face-to-face and the others were online. From the second to the seventh meeting, we worked with TAP. The didactic-pedagogical approach with the TAP, in the practice of the CoP, was admittedly exploratory and reflective in nature. To this end, we adopted the following methodological procedures: a) start with a teaching task, through resolution (individually, in pairs or together), socialization and discussion; b) study of one or more experiences related to the teaching task; and c) carrying out pedagogical task(s), also with plenary, collective, socialization and discussion activities. A procedural definition in the light of situated professional learning, socially constructed and grounded in concrete situations (Lave & Wenger, 1991; Wenger, 1998) and based on collective discussions of and practice (Ball & Cohen, 1999). A methodological path that took place in a *continuum* in the practice of the CoP, collectively constructed and shared by all its members.

In general terms, TAP1 was centered on functional thinking, has tasks involving repetitive and recursive sequences and is composed of three teaching tasks, three experiences and two pedagogical tasks. TAP2, directed to the arithmetic generalization of natural numbers and their fundamental operations, was organized with two teaching tasks, two experiences and a pedagogical

task. On the other hand, TAP3, focusing on the notion of equivalence of the sign of equality, was composed of a teaching task, two experiences and a pedagogical task.

The instruments used to obtain the data were: the written productions of the teachers; direct observation and notes in a field diary of the researcher-trainer; and the transcripts of the recordings of the meetings and the chat of the online meetings. From the corpus of the research, for this article, excerpts of discourses (oral or written) were selected that show meanings reified by the teachers in the practice shared in the CoP, specifically about the specialized knowledge of the algebraic content of the AIEF, which occurred during the realization and discussion of the TAP. Then, they were submitted to interpretative and discursive analysis (Moraes & Galiazzi, 2016).

ANALYSIS AND DISCUSSION

In the pulse of the CoP, in the community's practice, the collective and gradual process of construction and mobilization of professional knowledge was forged in the TAP. In the analysis of the learning experiences about the MSC, we cannot say that the teachers learned this or that professional knowledge, configuring it as static and conclusive. However, in moments of shared practice, the teachers revealed meanings constructed on some professional knowledge negotiated in the community, evidencing their learning experiences. Thus, we identified and interpreted the professional knowledge expressed by the teachers in the CoP, in the domain of knowledge of the mathematical content (algebra in the AIEF) and in the domain of the pedagogical knowledge of this content (about the teaching of algebra in the AIEF), revealed in their discourses (oral and written). Meanings that denote changes in the professional knowledge of teachers and potentially, can generate transformations in their teaching practices.

In teaching practice, there is a constant interrelationship between the domains and subdomains of the MSC, which are mobilized by teachers in an integrated way and even simultaneously. However, for the purpose of analysis, we considered the subdomains of the MSC as categories. Among the six subdomains, we emphasize here the prevalence of content specialized knowledge (CEC). The teachers started at the first meeting without understanding what algebraic thinking would be, ratifying the statement of Blanton and Kaput (2005) that most teachers who teach children have little experience with the types of algebraic thinking, and they are often mere products of the traditional training they have received. However, in community, soon after, they were constructing generalizations and expressing them in natural language, that is, constructing laws of formation of repetitive and recursive sequences, each in its own way. We analyzed that the exploratory work of the teaching tasks of TAP1 (with repetitive sequences of butterflies and increasing recursive sequence with dominoes), in the shared practice of the CoP, collaborated for the teachers to negotiate meanings, building concepts and skills that enabled them to experience

algebraic thinking regarding the exploration of patterns and description of generalizations. motivating them to learn in order to teach their students. Among the discourses that revealed the construction and subsequent mobilization of the SCC regarding the exploration of patterns and description of generalizations, we highlight reifications expressed by the teachers that are, in themselves, evidence that they were constructing this knowledge (Table 1).

Table 1 - Evidence of the construction of the CEC mediated by the exploration of TAP1

What was built/reified		**Excerpts that highlighted the reifications**
Generalization of repetitive sequences and their expression	Next (from the elements of the repeating unit)	I multiplied by 3 because there are 3 butterflies. In the 3 times table there is 15 [...] The fifteenth position is exactly the last butterfly, 15, which is the last butterfly, will be white. (Emerald, E2) Count by 3 until you reach the position you want. Then, see if there was a complete trio or not, see which butterfly it stopped at (its color). (Pearl, E2) Counting by twos. Completed, color of the second butterfly. Not completed, color of the first butterfly. (Leninha, E3)
	Distant (establishing a relationship of a general nature)	Finding multiples of 3. [...] every time the remainder is 2, my butterfly will be yellow. Whenever the remainder of the division is 1, it is blue butterfly. If the math is accurate, I'm finding a multiple of 3, so it's a white butterfly. (Emerald, E2) Because I only have two colors of butterflies, yellow and blue, alternating on the pendant, the blue butterfly will always be in a position that is a multiple of two. (White Orchid, E3) The second term, the second butterfly (yellow) represents a multiple of 2, every exact division will be a yellow butterfly, every division with a remainder will be a green butterfly" (Apolo, T2) In my sequence, the white butterfly is on the even numbers (0, 2, 4, 6 and 8) and the black butterfly is on the odd numbers (1, 3, 5, 7 and 9). (Pearl, T2)
Generalization of increasing recursive sequences and their expression	Law of formation by recurrence (from the previous term; next)	From one stone to the next, increase two points, one on each face. (Jasmine, E4) So, the top face and the bottom face, I noticed that the quantity that was at the bottom, in the next piece, the quantity would be at the top. (White Orchid, E4) Dominoes: an increasing and finite sequence (only 9 terms), which increases the number of points on each face by one or by two the total value of points with each new stone. (Pearl, notebook)
	Formation law by general (distant) term	The top face is one less than the value of the bottom face. The underside is the position value of the stone. (Emerald, E4) It becomes (n - 1) + n. (Monion, E4) [...] like this: 2 X NF + 2. (Lua, E4) The cool thing is that the table allowed this. Just like how to write the formation law algebraically! (Pearl, E4)
Algebraic symbolization	(Re)signification of the conception of algebraic representation	With this expression, if you tell me the order, the position of the stone you want, I can tell you the number of each face and the total value. (Apollo, E4)

		I'm loving making sense of it all! (Emerald, E4) I look at the expression we constructed and it makes sense. (Jasmine, E4) I've always been more into pure, exact calculation. Slowly I'm learning to think, to reflect on mathematics. I need to do it more often. (Moon, E4)
	Algebraic representation	An Bottom side = n A1 ... bottom side = 1 A46 ... bottom side = 46 (White Orchid, notebook) The top side is n – 1. The bottom side is the value of n. The total value of the stone is the sum... It is: (n - 1) + n. (Monion, E4) Or [...] n = (n - 1) (Emerald, E4) If I take A9, which is the eight-nine stone, it gives (9 – 1) +9 = 17 (Pearl, E4) Observing the table, we write that the number of stars is double the number of figures + 2, like this: 2 X NF + 2. (Moon, E4)

Source: From the first author, 2023. Caption: E (date); T (written assignment).

In the exploration of TAP2 (with the 2021 calendar and use of the hand calculator), we address the relationships between natural numbers, their properties, representation and organization in the decimal numbering system and operations. By exploring regularities in the internal organization of the months, organized in 7-day weeks, the teachers identified the algebraic character of arithmetic. There was nothing new in describing the regularity that months are organized into 7-day weeks. The unexpected and unusual thing referenced by Professor Orquídea Branca was to realize that, if we look at the month by the regularity of the days of the week, it is composed of seven increasing recursive sequences with different terms, but which follow the same growth pattern (it always adds 7). Also, it was noted that this occurred every month. Some excerpts reveal these discoveries of relationships, such as: "How could we have never seen this? That's 7 different sequences in the numbers, in the terms. But with the same standard." (Ares); "Look how cool, the sequence of the 3rd (3rd, 10th, 17th, 24th and 31st) in the month of August is the same as in the other months." (Azalea); "We know that the month has 7-day weeks. But I had never observed that if the 4th fell on Monday, the next Mondays will always be with the same days as the sequence of the 4th, that is, the 11th, 18th and 25th." (Jasmine); "I think the law of formation can be by addition, but it can be by multiples of seven, right? If it's 7 by 7, it has to do with the multiplication table and its multiples." (Monion).

In the registration of the laws of formation, even using natural language, there were significant differences. Not only because of the peculiarity of each one's way of writing, but, and fundamentally, because they were determined by the relationships and regularities that they perceived and considered regarding the month or the days of the month, as can be seen in the following excerpts: "They always begin on the first day. These are sequences that go until the 28th

(29th), 30th and 31st. The default is always +1, like the decimal numbering system itself." (Apollo); "In the sequence that the 1st term is the 7th, the other terms are the multiples of 7 themselves." (Ares); "To find the sequence of days from day 4, just add 7. That's 4, 11, 18 and 25." (Azalea); "The week has 7 days. Then the streak increases by 7. If it's day 3, a week from now, it's going to be day 10 because 3 + 7 = 10." (Moon); "Each month is a recursive number sequence, the next day depends on the previous one, always adding 1." (Sun); "Each month is organized into 7-day weeks, forming 7 different number sequences, starting with 1, 2, 3, 4, 5, 6, or 7, with the same pattern. The following terms can be found by the multiples of 7 added to the first term." (Monion).

As a result, another important concept of the CEC constructed by the teachers was the understanding that it is possible to have different ways of identifying and describing regularities, representing them, establishing relationships and generalizing, as explained by some teachers: "It is very cool to have so many options to relate to addiction. The table helps you see the regularities." (Moon); "It's impressive to think about mathematics like this... with various possibilities to see regularities and patterns." (Maya); "I thought the math was always so accurate. Being able to think about different possibilities, from what you observe, from the pattern you find, has been a great discovery." (Pearl); “[...] The tables allow you to search for regularities in the numerical expressions of the different operations, exploiting the multiples of 7." (Emerald); "I can identify different regularities by the representation in the tables. And from them, arrive at different laws of formation." (Monion).

Then, in TAP3, in the search for unknown values so that numerical expressions of addition and/or subtraction were true equalities, transversally, properties and relations between inverse operations were explored. Rather than finding the same value as a result in both expressions, we explore why a given number would be the unknown value. From this perspective, some professors revealed evidence of the SCC, as follows:

> It's not just about solving, finding the same result. The important thing is what to do so that the sentences are equivalent. I didn't even think about 14. I looked at the first installment on each side, the 9 and the 8. From 9 to 8, it decreased by 1. It's a sum, so in the other installment, the unknown number has to be -1 (of the 6), the 5. [...] The activity makes us relate the sentences to be equivalent. (Apollo)
> The equation 19 + X = 17 + 2 I solved by relating to the neutral element of addition. (Ares)
> In the case of 8 – 3 = 12 – X, I also thought about relating the numbers. From 8 to 12, it increased by 4. It's subtraction. To be equivalent, X also has to increase 4 (of 3), which gives 7. (Emerald)
> In that cut-and-paste activity, of unknown values... The 15 + 8 + 12 = X + 12, the equivalence was using the associative property, wasn't it? Then it was 23. [...] There, the equality relationship does not change if you add the same value on both sides, such as 2 + 5 + 1 + X = 4 + 4 + X. (Moon)
> In this one, 19 – X = 16 + 3 – 4, I first saw that 19 was equivalent to 16 + 3. Then, in order to get the same results, I couldn't change the value 19. Then I repeated the -4. After that I realized that it was the same operation and value on both sides. This is what the BNCC has as a property of equality. I think I get the point! (Maya)
> What a cool activity, with cutting, pasting, and a lot of algebraic thinking, eh. We explored different addition and subtraction sentences, determining unknown values so that if they

were equal, they would have the same result. I think my students would be able to solve and learn that way. (Pearl)
This equation requires thinking that what you do on one side you have to do on the other. The equation 12 + 5 – 5 = 12 – 8 + X. On the left-hand side, +5 – 5, gives zero. In the second, in order for 12 to continue to result, it has to be +8 which with -8, gives zero. So 12=12. Equivalent members remain. (Stump)

In short, the teachers' discourses evidenced negotiated meanings regarding: a) understanding that there is more than one way to perceive regularities, identify patterns/relationships/properties and construct training laws; b) identification of regularities and properties of the natural numbers, fundamental operations and their inverses; c) identification of relations and properties of equality, for the construction of the notion of equivalence; d) generalization of repetitive and numerical recursive patterns; e) expression of generalization, through argumentation and recording in natural language; f) exploration of different forms of representation, not only to construct generalizations but also to express them; and g) conception of algebraic representation, by demystifying the common sense that it is a ready-made area of mathematics, whose rules and formulas must be memorized and applied.

CONCLUSION

In this research on teacher training in CoP, the TAP have always been involved in the central process of negotiating meaning, whose learning is denoted as experience, that is, as an experience of negotiating and attributing meaning. According to Lave and Wenger (1991), I believe that the dynamic and active process built among the members of the community is what enabled them to experience thinking algebraically. After all, how can one feel at ease in the mathematics he teaches without knowing it, without having appropriated it, without having constructed meanings? They also reflected on how to promote the development of this algebraic thinking in their AIEF students and analyzed different strategies for solving mathematical activities, as well as their teaching.

During the CoP, with strong engagement and commitment of the teachers, with intense interactions, several actively participating, I consider that there was an expansion of the TAP, that is, they had their formative function resignified. More than mediation instruments as proposed by Ball and Cohen (1999), they have become central to the practice of the community, implicated in most of the negotiations of meaning that occurred in the meetings and always implicated in the negotiations of specific meanings (about algebraic thinking and its teaching).

The TAP became fundamental in the interactions and relationships between teachers, who shared their professional knowledge and built a shared practice, generating collective professional knowledge about the teaching of algebraic thinking, through processes of negotiation of meanings. Therefore, we conclude that the TAP coined the practice of the community and, ratifying the TSA (Wenger, 1998), that the professional knowledge produced collectively in this CoP was the result of

the participation of teachers who sought to learn together how to improve their practice in the teaching of mathematics.

In the light of the TSA (Wenger, 1998), we can affirm that there was construction and mobilization of professional knowledge for the teaching of algebra in the AIEF in the shared practice of the CoP, as we analyzed in the evidence of the movements, learning experiences, changes in the professional knowledge of teachers, with emphasis on the CEC. Thus, we conclude that teacher training in CoP, with the shared practice coined by TAP designed to meet the training needs of each community, is a powerful proposal, if participatory, collaborative, shared, constructed, creative training is desired. We hope to contribute to the international debate on the continuing education of teachers.

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Playful strategy applied to teaching and learning analytical chemistry

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ABSTRACT

Mediated learning is a teaching model in which a mediator stands between the learner and the world of stimuli, facilitating interpretation and understanding. This model has numerous modes of application, one of which is playful activity, or didactic games. This work presents the proposal to develop a didactic game, entitled "Analytical Chemistry Target Shooting", as an auxiliary tool in the teaching and learning process of analytical chemistry in higher education courses, especially for introductory subjects. For its construction, low-cost and easily accessible materials were used, aiming for a better applicability of the method, with the game consisting of a pair of darts, a target, a set of question cards of three levels of difficulty, a board and markers of the players. Therefore, a board game was obtained that leads to the fixation of the content taught in the classroom, in a relaxed and cheerful way, contributing to making chemistry teaching less complicated, tedious and aversive to the student, who becomes a more active in their learning.

Keywords: Active methodologies, Higher education, Teaching instruments.

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INTRODUCTION

Mediated learning is seen as a form of interaction that develops basic attitudes and skills for effective learning, enabling a dynamic of deconstruction and reconstruction of knowledge and information, with a mediator interposing between the learner and the world of stimuli, facilitating interpretation, and understanding (Feurstein, 1997; Demo, 2004).

One of the possible mediators of the teaching-learning process would be playful activity, appearing as an alternative method that helps this process. In this sense, it appears that playfulness contemplates the criteria for effective learning, in the sense that it draws attention to a certain subject, in which its meaning can be discussed among all participants and the knowledge generated from the playfulness activity can be transported to the field of reality (Coscrato, 2010).

From a playful perspective, it is not enough to manufacture what is already regulated; imaginative and rational strength becomes essential for articulating content that opens up to understanding, allowing critical thinking (Gadamer, 1985).

Playfulness should be considered as a methodological form that facilitates the construction of concepts, the reinforcement of content, sociability between students, creativity and the spirit of competition and cooperation, to the point of making this process transparent, ensuring mastery over the objectives proposed (Fialho, 2011).

Playful practices are capable of awakening students' attention, as well as their motivation and engagement in the activities carried out in the classroom, and, in this way, the anchoring of new knowledge ends up being more significant (Hoppe; Kroeff, 2014).

The discipline of Analytical Chemistry, which comprises the branch of chemistry that deals with the identification and determination of the composition of the constituents of a given sample, being an experimental science by nature (Vasconcelos, 2019), despite being evidently important, can be considered little attractive to students in related areas, especially when the content is taught only with emphasis on theory and presentation of decontextualized experiments (Pereira, 2011).

With the intention of combining play with education in the training of health professionals, it was proposed to develop a didactic game for teaching Analytical Chemistry, more specifically on the topics: gravimetry; chemical balance; volumes of neutralization, precipitation, complexation, oxidation-reduction and potentiometry, this game being constructed with low-cost materials and easy to perform in the classroom, in an introductory course in this area of chemistry.

THEORETICAL FRAMEWORK

PLAY IN TEACHING

Ludic has its origin in the Latin word 'ludus' which means 'game'. If thought only according to its origin, the term playful would only be referring to playing, playing, spontaneous movement.

However, play began to be recognized as an essential trait of the psychophysiology of human behavior, so that its definition was no longer a simple synonym for play, as the implications of the need for play went beyond the demarcations of spontaneous play (Almeida, 2009) . In this sense, playfulness encompasses games and games, but it is above all a human need, that is, it is part of human development (Marques, 2012).

Play is an activity with intrinsic educational value, but in addition, this method has been used as a pedagogical resource. Thus, there are several reasons that lead educators to use playful activities in the teaching process. As a teaching tool, it makes it possible to create a pleasant environment for students to develop in a meaningful way. Thus, the search for creativity to improve the student's cognitive skills becomes pleasurable. Furthermore, it has the ability to sharpen the senses (Macedo, 1995).

The concept of game, within the educational context, refers to situations given between two or more individuals and that occur within a specific set of rules, being systems in which players (students, and sometimes the teacher as well) develop a conflict guided by deliberate rules that will lead to a quantifiable result (Salen; Zimmerman, 2012).

Regarding the issue of game rules, Huizinga (1993, p. 33) states that:

> "A voluntary activity carried out within certain and determined limits of time and space, according to freely agreed but absolutely obligatory rules, with an end in itself, accompanied by a feeling of tension and joy and an awareness of being different from life everyday."

The use of playfulness in education is greater than the use of simple games to pass the time, being a form of action inherent to human beings, which does not depend on their age.

There are two definitions that deserve to be highlighted, which are presented by Cunha (2012, p.95):

> " [...] about games in teaching it is important to differentiate and define two terms: educational game and didactic game. The first involves active and dynamic actions, allowing broad actions guided by the teacher, which can occur in different locations. The second is one that is directly related to the teaching of concepts and/or programmed activities and that maintains a balance between the playful function and the educational function of the game, and is generally carried out in the classroom or laboratory. [...] a didactic game in terms of general aspects is educational, as it involves playful, cognitive, social actions, etc., but a game that is educational cannot always be considered didactic. This, however, does not minimize or reduce the importance of both."

It is worth noting that four important precautions must be taken into account when using playful activities in the classroom, the first of which is prior testing of the teaching resource with the intention of avoiding unpleasant surprises when implementing it in class. . The second precaution to take is to carry out a brief summary of the content to be worked on through the playful activity, as this content must have already been worked on and must be reviewed before applying the activity, to

make better use of the resource used. Thirdly, the need to check the rules with students stands out, so that they can clearly understand the activity. And finally, the fourth precaution would be the development of subsequent pedagogical activities related to the activity to investigate the value of the playful activity as a teaching tool, that is, evaluation of the activity developed (Lozza; Rinaldi, 2017).

Playfulness and Chemistry Teaching

Teaching practice in chemistry teaching continues to be predominantly traditional, which makes the discipline abstract, monotonous and with an extremely fragmented view of knowledge, in addition to being considered “difficult”, as it is a science with several formulas, calculations, names and symbols.

In agreement with this idea, Fialho (2007) highlights that students' lack of interest is often due to the teacher's imposing way of passing on content in a cold and distant way, making it necessary to arouse interest in what is taught through more attractive language, trying everything possible to bring the content closer to the maximum experience of each person's reality. Totally decontextualized chemistry propagates itself as an abstract science incapable of being present on a daily basis, thus it can only become a difficult, exhausting discipline that is impossible to relate to everyday life. In this way, the importance of teaching how chemistry is present in each person’s daily life can be seen. Silva, Mettrau and Barreto (2007) also add that there is a need for students to understand scientific statements and the construction of science itself.

Cunha (2012) highlights that the function of the game in chemistry classes should not be memorization, but, if it is related to names and symbols, the intention should be to familiarize students with scientific language, contributing to “work” (reduce) students’ difficulty with scientific language.

Fortunately, the application of recreational resources has already been the subject of several studies, mainly in basic education, and Table 1 presents some of these studies found in the literature.

Table 1. Examples of works with playful proposals in teaching chemistry

Author(s)	Proposal
Soares, Okumura and Cavalheiro (2003)	Teaching chemical equilibrium.
Farias (2004)	Concepts of density, thermal expansion and energy transformation through the use of a "Lava-Luz" type luminaire.
Oliveira and Soares (2005)	Jury to discuss concepts related to the environment.
Soares and Cavalheiro (2006)	Board game to cover thermochemistry concepts.
Franco-Mariscal and Cano-Iglesias (2008)	Learning the chemical elements of the Periodic Table, relating the map of Brazil and the names of the states of Brazil.*
Santos and Michel (2009)	Game with the theme of acidity of organic and inorganic compounds.
Filho et al. (2009)	Playful activity (crosswords) about concepts, definitions and episodes of Atomic Theory.
Godoi, Oliveira and Cognoto (2010)	Card game about Periodic Table
Dos Santos et al. (2024)	Roulette for teaching chemical elements in undergraduate pharmacy classes (higher level).

* Interdisciplinary proposal, as it relates Chemistry and Geography.

Soares (2004) admits that the use of playful activities in chemistry teaching is recent both nationally and internationally and presents several examples of this type of playful activities, such as the use of stamps and prints; a kind of real estate bank where chemical substances are bought and sold; mystery stories involving chemical concepts in adventures by the duo Sherlock Holmes and Watson; comic books, among many others.

PLAY IN HIGHER EDUCATION

Teaching aimed at the adult population, especially in higher education, has a variety of challenges, which, in order to be overcome, require the use of diverse strategies, one of which is the use of recreational activities, which are generally extremely positive. , after overcoming initial barriers (Hoppe; Kroeff, 2014). However, learning based on playful activities is still widely thought of as something exclusive to early childhood education, but they can be present from early childhood education to postgraduate studies, since any teaching and learning process can be permeated by moments of joy, well-being and pleasure (Grossi, 2017).

In Brazil, higher education or university education, after reforms that took place in the 1990s, has been seeking new methodological ways of teaching, but always based on the fact that this level of education aims to "train professionals who develop, stimulate and expand the areas of science, technology and culture" (Silva , 2014, p. 415), in addition to which it must also be considered that "in Higher Education, the student – as well as in other levels of formal education – is a subject training. The individual development of these subjects therefore passes through collective social activity" (Quadros ; Mortimer, 2014, p. 260).

A didactic game presents a concrete collaborative potential in terms of developing students' skills, abilities, knowledge, attitudes and abilities (Hoppe; Kroeff, 2014), and, in this sense, Batllori

(2009) provides a list of items, presented in Table 2, which are likely to be achieved through a playful activity developed even in Higher Education.

Table 2. Possible benefits of recreational activities

Possible benefits:
Promote mobility
Stimulate communication
Help develop imagination
Facilitate the acquisition of new knowledge
Encourage individual and group fun
Facilitate the observation of new procedures
Develop logic and common sense
Provide experiences
Help explore potential and limitations
Encourage acceptance of hierarchies and teamwork
Encourage trust and communication
Develop manual skills
Establish and review values
Streamline Cunning and Talent
Help in addressing transversal themes and content
Speed up verbal, numerical, visual and abstract reasoning
Encourage respect for other people and cultures
Learn to solve problems or difficulties and look for alternatives
Encourage acceptance of standards

Source: Batllori (2009, p.15), adapted.

When developing a playful methodology, the game itself is not its purpose, but it is the integrative axis between didactic content and the acquisition of information, which is effective through pedagogical actions of a playful nature (Grossi, 2017), and , so “cognitive skills are easily sharpened, which allows learning to be conducted fluidly, in addition to helping the teacher-student relationship.” (Marriel et al., 2021, p.3).

MATERIALS AND METHODS

The game presented in this work concerns a teaching tool that assists in the teaching and learning process of analytical chemistry, having been proposed to be applied in an introductory course present in the training of bachelors in pharmacy, but can also be applied in other higher education courses. It was entirely designed by a group of students from the Pharmaceutical Chemical Analysis discipline, which is the introductory discipline to the study of analytical chemistry at the Federal University of Pará, located in the North of Brazil, in the middle of the Amazon.

The elaborate game was called **Analytical Chemistry Target Shooting** , as it is a game containing questions and answers about analytical chemistry, using a conventional board and a target shot that defines the number of squares (parts of the path on the board) to advance and the degree of difficulty of the questions that the participant will answer regarding analytical chemistry.

The game basically features four constructive elements: target shooting; a pair of darts; a board; game pins (three and different colors) and a set of cards consisting of 30 cards, composing 3 groups of 10 cards.

The target shot and the pair of darts, shown in Figure 1, were purchased ready-to-use at a stationery store. The target shot is made up of a circle of yellow, red, green and purple colors (with written numbers: 10; 20; 30 and 40) and a pair of darts that stick to the circle (target) using magnets. This material is low cost and easy to access.

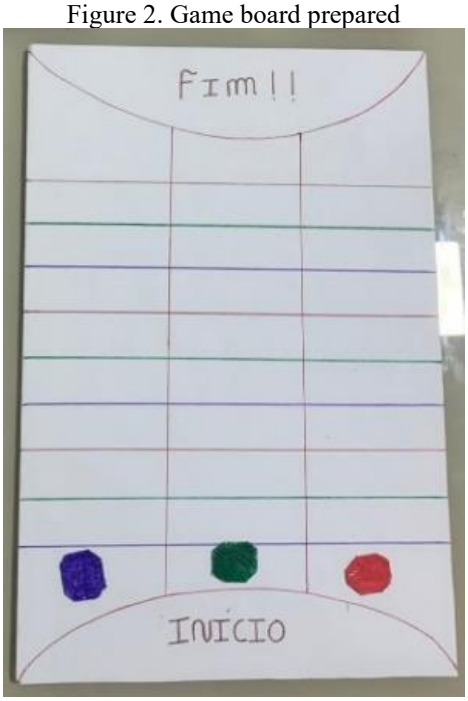
Figure 1. Target shooting and game darts



Alternatively, the target shooting could be made with a sheet of cardboard paper on which circles would be drawn and painted according to the color code shown in Figure 1 (yellow, red, green and purple), and this circle would then be glued onto the sheet. of Styrofoam, with subsequent cutting of this sheet. The donor pair could be made with a soft drink straw, with a small nail or pin inserted into one of the ends. The ready-made material was chosen as it is safer and more durable.

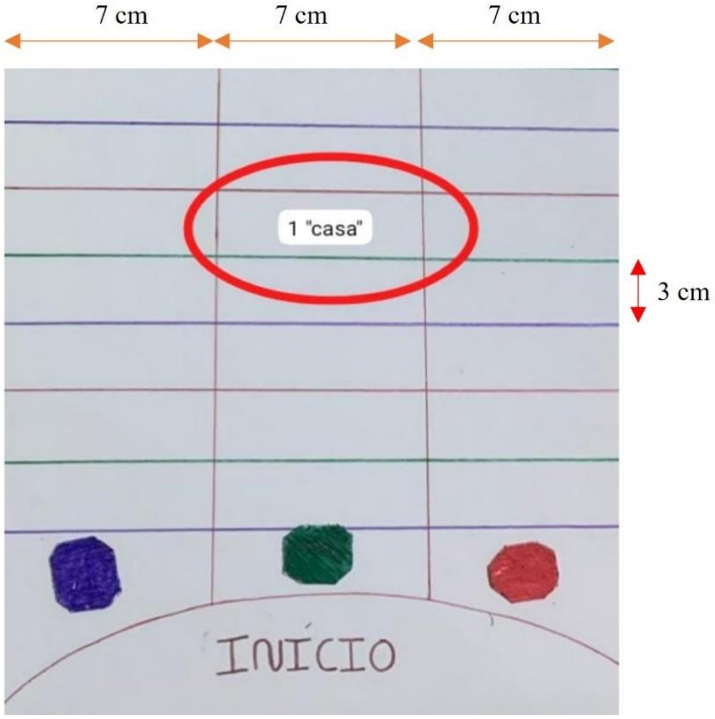
The game board, shown in Figure 2, was made by the team of students, using the following materials: white cardboard; paper scissors; silicone glue; colored pens (red, green, purple and brown); ruler; pencil; rubber; stylus and MDF (*Medium Density Fiberboard)* surface , with dimensions of 21 cm by 40 cm, for the base of the board, but which can be replaced by a common sheet of Styrofoam, of any thickness.

Figure 2. Game board prepared



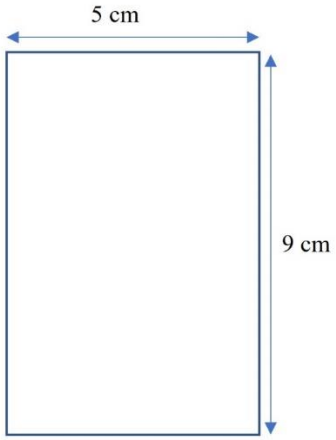
Using colored pens, straight lines were traced on the sheet of white cardboard, starting from a semicircle, where the word “beginning” was written, and arriving at another semicircle, where “End” was written. Then straight lines were drawn perpendicular to the first ones, thus forming rectangles (board houses), with dimensions of approximately 7 cm by 3 cm, with the entire arrangement measuring 21 cm by 40 cm (Figure 3). Then the outline was cut and glued onto the MDF surface with silicone glue, to give it greater stability.

Figure 3. Highlight of a “house” on the board



To construct the set of cards containing the game's questions, the following materials were used: white cardboard in the colors white, red, purple and green; scissors; paper glue; printer and common graphite paper, A4, as well as a computer with the World program for typing the questions. The dimensions of each game card were 5 cm by 9 cm (Figure 4).

Figure 4. Sizing of game cards



The construction of the game cards followed the following steps:

1- Thirty rectangles, with the dimensions of Figure 3, were cut from sheets of white cardboard, using scissors, and ten green rectangles, ten red rectangles and ten purple rectangles, were also cut, in the same dimensions, from using cardboards of the respective colors. Alternatively, in the absence of colored cardboard, white cardboard painted with colored pens could be used.

2- Each white rectangle obtained was glued, with paper glue, to one of its sides with a colored rectangle (either purple, red or green). Forming, then, three groups of cards, each with ten components and a discriminating color. These colors indicate the degree of difficulty attributed to the question on the card, with: purple associated with the easy level; green to medium and red to difficult.

4- The thirty questions prepared (Tables 3, 4 and 5) were typed into world, printed, remembered and pasted on the cards according to the level of difficulty of the questions (green, purple and red). The degree of difficulty of the questions was freely established by the teachers who developed the didactic game. The answers were printed in three lists for the game leader to monitor.

Table 3. Easy level questions (purple cards) prepared for the game

Question	Response
1- Chemical analysis is classified into 2 types, what are they?	Qualitative and quantitative analysis.
2- What do the qualitative and quantitative methods of chemical analysis consist of?	Qualitative: Identify the types of elements, ions and molecules that make up the sample. Quantitative: Determine the amount of each of these components.
3- How to calculate the pH of an acidic solution? Formula)	$pH = - \log [H^+]$
4- Which indicator is used in argentometry?	Silver nitrate.
5- What relationship should exist between the volume of the end point visually indicated by the indicator and the volume of the theoretical equivalence point?	The closer the better, as it reduces titration error.
6- Define buffer solution.	Mixture of a weak acid and its conjugate base or a weak base and its conjugate acid, which resists changes in pH.
7- Neutralization volume is classified into two classes, what are they?	Alkalimetry and acidimetry.
8- If the titrant agent is NaOH and the titrant is HCl, how is this neutralization volumetrics classified?	Alkalimetry.
9-What is the indicator used in iodometry?	Starch.
10-When determining the hydrogen peroxide content using previously standardized potassium permanganate, which indicator should be used?	Potassium permanganate.

Table 4. Medium level questions (green cards) prepared for the game

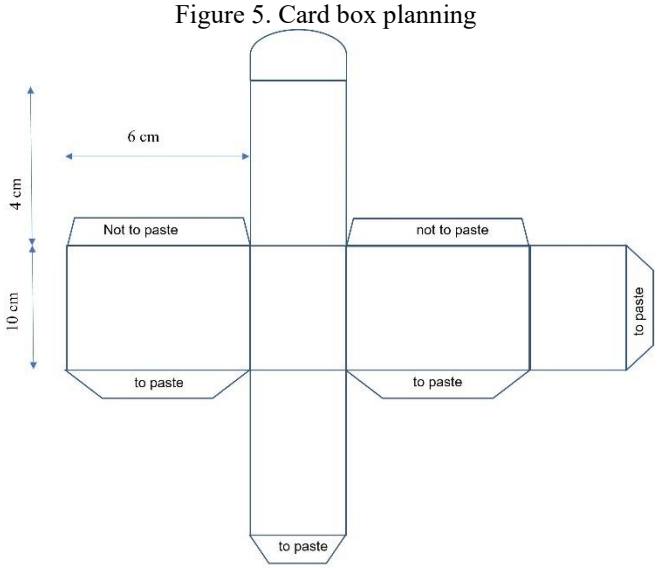
Question	Response
1- In a complexation reaction, how is the end point determined?	Instrumental and visual methods using metal indicators.
2- What causes changes in a chemical balance?	Changes in: temperature, concentration and pressure.
3- What are the two main desirable characteristics in a primary standard?	High purity, stability.
4- At what moments in a titration are calculations necessary to generate a titration curve?	Before the start of the degree, before the equivalence point, at the equivalence point and after the equivalence point.
5- What is the role of EDTA in complexation volumetrics?	It is used as a titrant to determine the concentration of metal ions in the sample.
6- In redox volumetry, what oxidizing agents are used in the iodimetric, iodometric and iodatometric methods, respectively?	Iodine, iodine and iodate, iodate.
7- How can gravimetric analysis be classified?	Precipitation Gravimetry; volatilization and electrogravimetry gravimetry.
8- What is the name of the CN^- and S^{2-} ligands ?	Ciano and uncle.
9- Define complex compound.	It is the compound resulting from the combination of a metallic ion or any substance with a group donating a pair of electrons.
10- What is the dp or potential of the solution before adding the titrant?	It cannot be calculated, as the concentration of the titrate is unknown.

Table 5. Difficult level questions (red cards) prepared for the game

Question	Response
1- What does Chatelier's Law consist of?	If a system at equilibrium is disturbed, the equilibrium position will shift in such a way as to attenuate the disturbance.
2- In relation to quantitative analytical methods, mention the classical and instrumental methods.	Classics: gravimetric and volumetric methods. Instrumental: electroanalytical, spectroscopic and separation methods
3- Differentiate between accuracy and precision	Accuracy: is the degree of agreement between the found value and the true value. Precision: is the degree of agreement between repeated measurements of a quantity. It expresses the "reproducibility" of a series of measurements.
4- When and for the Q test is it used?	It is only used when the number of results is less than 10, it is used to reject coarse values in a series of measurements.
5- In redox volumetry, Daniel's cell has cathode and anode electrodes. What reactions do they suffer?	Reduction and oxidation.
6- In the redox reaction: $Zn(s) + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu(s)$, which is the reducing agent and which is the oxidizing agent?	In this reaction, the Cu^{2+} ion is acting as an oxidizing agent, as it accepts electrons during reduction, and zinc (Zn) is acting as a reducing agent, as it loses electrons during oxidation.
7- What is the potentiometric method and when is it used?	Methods that are based on measuring the potential difference of an electrochemical cell in the absence of current. It is used when the analytes are dark.
$_3$ solutions ?	NaCl
9- What are the two most used argentometric methods?	Mohr's method and Volhard's method.
10- Why can't sodium hydroxide be considered a primary standard?	Due to its hygroscopicity, that is, its ability to absorb moisture from the environment.

To store the game cards produced, a box measuring 6 cm by 10 cm by 4 cm was made with white cardboard, ruler and pencil, as well as paper glue, according to the sizing given in Figure 5.

Figure 5. Card box planning



To identify each player in the game, small pieces were cut out with the same material as the cards and different colors to differentiate each player. These pieces were colored with purple, red and green pens.

Figure 6 shows a photograph of all the game pieces already produced.

Figure 6. Game pieces ready



GAME RULES

The elaborate game can be played by a minimum of two players (or two teams of players) and a maximum of three players (or teams of players), requiring a match organizer/judge, who can be the subject teacher, a monitor, or even one of the students in the class, previously elected for this role within the game, in addition to a game kit (a board, a shooting target, sets of question cards, player identification pieces and sheets with the answers to the questions).

The order of the players is defined by a simple draw, using a common die, or another random draw method, or by simple agreement between the participants, and the target (Figure 3) can also be used to define the order of the participants' moves. , with the first to play being the one who reaches the highest target score and the last one the lowest.

The game's target shooting (Figures 1 and 6) is made up of a circle divided into sections containing numbers and colors, each color indicating the degree of difficulty of the questions and their respective scores. To play, the player (or team) must try to hit the target correctly, that is, in the center of the section that contains the numerical value. The dart cannot reach the center of the target which has no numerical value (situation exemplified in Figure 1), it must also not fall and cannot stay on top of the line, if this happens the player (or team) loses the move and the next one continues.

In Figure 7, for example, the region of the target where if the player (or team) shoots is marked with a circle, he will compete for 40 points.

Figure 7. On-target indication of a 40-point region



The player (or team) that hits the target correctly must answer a question to advance. The question will be drawn from one of three sets of cards, according to the color of the region where the dart hit the target, for example, in the case of Figure 7, the player (or team) must answer a difficult question (red color).

The player (or team) who gets an easy question (purple) correct wins 10 points and advances 1 space; The player (or team) who gets a medium question (green) correct wins 20 points and advances 2 spaces; The player (or team) that answers a difficult question correctly (red) wins 40 points and advances 4 spaces (as illustrated in Figure 7). On the target there is also a yellow section that indicates the loss of 30 points and the regression of 3 spaces, if the player (or team) targets in that section.

Each player (or team) has one chance to correctly answer the drawn question. In case of an error in the answer, the participant does not advance and their card/question is returned to the game, and can be answered later by the player himself or by another.

The game judge is in charge of checking whether the participants' answers are correct, according to the answer sheets. However, it is up to this component of the game to judge possible answers that differ from those contained in the lists, since the intention is not to take a single textual construction as certain, in the case of which there may be changes in the way of responding (not in content, of course).

If any color of questions runs out, the player (or team) will continue with the remaining questions, and if they reach the target session in which the color ran out, they will have a new chance to play.

The player (or team) who first completes the 10-square route to the finish line on the game board wins. If all question cards are exhausted, the player (or team) closest to the finish wins.

GAME TESTING

After having its parts and rules developed by the team of students, the game was tested with all students in the class of the subject to which the team's students belonged to evaluate it, realizing the applicability of its rules and collecting possible modifications favorable to the game. good progress of the game and acquisition of knowledge.

DISCUSSION

The main result of this work is the creation of an educational tool aimed at learning analytical chemistry, to possibly be used in introductory discipline classes in this branch of Chemistry, as is the case of the discipline in which this resource was developed.

In its construction, simple, easily acquired and cheap materials were used, and it is also possible to build with other even cheaper and simpler materials, as previously presented.

This feat consists of a board game made up of several pieces that help to fix the content taught in the classroom. Therefore, the game named Analytical Chemistry Target Shooting helps in the teaching and learning process in a more relaxed and inviting way, serving as a fun way to exercise previously worked concepts and definitions.

Studies show that most students have difficulty learning chemistry and consider it to be an extremely boring subject with lots of formulas, calculations, nomenclatures, etc. However, when the subject is not taught using traditional methods, the chances of the student being interested in the content are much greater, an example of this is the use of playful activities (Lima et al., 2011). In this context, the use of educational technologies such as the one described in this work makes chemistry learning more effective and interesting since activities that are normally associated with leisure can also be associated with the classroom and studies.

Didactic games can give students a slight competition to determine the winner, this fact boosts interest in the game and consequently learning, since to win they will have to make an effort to remember and learn the knowledge taught in the classroom. These tools are useful for both students and teachers who can also relax while playing (Dos Santos, 2018).

Another applicability for the highlighted tool is the assessment of students' learning of the subject. Since, studies show that traditional assessment through tests does not correspond to the student's real learning. Therefore, new methods of assessing learning have been sought and one of them is through didactic activities in which the teacher closely monitors the performance of their

students. To do this, the class is divided into smaller groups to improve both their concentration and performance, as well as the teacher's evaluation (Felício, 2018).

The game was created by students and for students, which makes the proposal appropriate to what several authors in the literature in the area address, that is, that the student is the subject of their own learning. Another advantage of building the game by the students themselves is the fact that they learn a lot when researching to prepare the questions and other elements of the game, and not just when playing, this fact being in line with Grossi (2017) which states that, when developing a playful methodology, the game itself is not its purpose, but it is the integrative axis between didactic content and the acquisition of information, which is effective through pedagogical actions of a playful nature.

Testing a recreational resource is important so that it can be improved and so that there are no unpleasant surprises when it is actually executed (Lozza; Rinaldi, 2017). Therefore, a test was carried out by the game's team, first only among its components and then with the other students of the subject, with suggestions to improve the game being noted.

FINAL CONSIDERATIONS

The game in question was designed and created to function as an auxiliary and facilitating tool in the teaching and learning process of analytical chemistry, within the scope of an introductory course in a higher education course in the health sector (pharmacy). However, its base structure adapts to other topics in chemistry and other subjects, requiring only the exchange of questions. It can also be perfectly applied and/or adapted to subjects from other courses in the health area (nutrition, nursing, etc.) or even from other areas such as engineering and exact and natural sciences.

The thirty questions created can be changed according to the syllabus covered and even this number can be increased to 45, 60 or any other amount you wish. As for the classifications of the difficulty levels of the questions, these can also be adapted to each class, by the teacher and/or students.

The game pieces were made quickly, practically and at low cost, a fact that further boosts their use. But they can also be made with other materials, as discussed before. Therefore, the result of this work is a tool with multidisciplinary applicability and easy access.

Therefore, the target shot of analytical chemistry can be applied to competing groups or students competing to reach a single winner, encouraging the search for knowledge through the competitive spirit in didactic games, which provide students, and why not the teacher as well. ? Fun moments in class and great learning.

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Exploring elements: Playfulness as an ally in teaching the Periodic Table

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ABSTRACT

Chemistry teaching is often seen as difficult and unattractive to students, mainly because it deals with many abstract concepts that are worked through traditional teaching methodologies that do not place students as subjects of their learning. This work explores the potential transformation of the learning environment and increasing the quality of education by incorporating playfulness, through educational games and interactive simulations in the teaching of Chemistry, especially the Periodic Table. The approach promotes practical and contextualized understanding, connecting abstract concepts to everyday situations and makes learning enjoyable. This pedagogical change contributes to training students with a scientific and curious mindset. This work presents the game entitled "Elementar: War of the Atomic Clans", which is a card game inspired by RPG, designed to familiarize students with chemical elements using the Periodic Table. The careful elaboration of the letters, using low-cost materials and computational resources, highlights the importance of creativity and interdisciplinary collaboration in education, contributing to a more solid and meaningful education.

Keywords: Teaching Methods, Didactic Games, Teaching-Learning.

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INTRODUCTION

The teaching of chemistry in schools plays a crucial role in the academic training and construction of students' scientific knowledge. However, it faces significant challenges that can impact the quality of learning. Difficulties are often related to the complexity of the discipline, the lack of adequate resources, insufficient teacher training and the traditional approach used in many institutions. The difficulty is also perceived in the lack of connection between the abstract concepts of chemistry and the students' everyday reality. [1]

One of the main difficulties is the negative perception that students have of chemistry, often associated with a difficult subject. Excessive theoretical approach and lack of practical experimentation can contribute to a lack of interest and understanding on the part of students. [2] Furthermore, the lack of well-equipped laboratories and the scarcity of innovative teaching materials limit more dynamic and participatory learning opportunities. [3]

The traditional approach, often marked by expository classes and dense content, can distance students from understanding chemical principles. [4] By introducing playful elements, such as educational games, interactive simulations and practical activities, it is possible to transform the learning environment, making it more engaging and accessible. [5]

Play provides opportunities to illustrate these relationships in a tangible and stimulating way, allowing students to visualize and experience chemical principles in a more tangible way. Games that explore compound formation and hands-on classroom experiments can spark student interest and promote a deeper understanding of concepts. [6]

Educators can transform the classroom into a dynamic environment where students become active participants in the learning process. This develops skills such as teamwork, critical thinking and problem solving. Playfulness breaks the monotony of conventional classes, and creates a space conducive to exploration, discovery and curiosity, fundamental to the development of a scientific mindset. [5]

In short, by recognizing the potential of play as a facilitating tool in chemistry teaching, we can transform not only the way students absorb knowledge, but also the way they perceive and relate to the discipline. Incorporating playfulness is more than a pedagogical strategy; is an invitation for students to discover the fascinating journey of chemistry in an engaging, interactive and, above all, fun way. [7]

Considering the above, it was proposed to create a didactic game aimed at teaching Chemistry, focusing on concepts related to chemical elements and the periodic table. The conception of this game took place through the use of accessible, low-cost materials and computational resources to design the game pieces.

FUN AND TEACHING THE PERIODIC TABLE

The word “ludic” has its origins in the Latin term *ludus* which means game, [8] but, in educational terms, it is necessary to be careful with the pure and simple meaning of the word, as, in its original conception, it refers only to the act of playing, when playing, when moving spontaneously, however, one must seek to go far beyond this original concept of playfulness, and thinking that the game, in educational terms, is a voluntary practice or occupation, carried out within certain and determined limits, following rules that were freely agreed upon, but of a mandatory nature, with a purpose that is accompanied by tension and joy, in addition to being different from what happens on a daily basis. [8,9] However, it is necessary to highlight that “drawing a definition for a game is difficult, and we can say that there is no closed definition on the subject.” [10]

The use of play as a didactic strategy in teaching the periodic table represents an innovative and effective approach to engaging students in a more active and participatory way in the learning process. The game, which involves games, practical activities and interactive dynamics, provides an environment conducive to the absorption of complex concepts, such as chemical elements and their properties, in a more relaxed and accessible way. [4]

By incorporating educational games such as puzzles, [11] chemistry bingo, [12] roulette [13] or even themed board or card games, [14] educators can turn assimilating the periodic table into a fun and challenging experience. Likewise, assigning fictional personalities to the elements and creating stories that explore their interactions can humanize the Periodic Table. [15] These approaches not only make learning more enjoyable and memorable, but also encourage understanding of the properties and relationships between elements, and collaboration among students, promoting teamwork and the exchange of knowledge. [12]

The games allow for a more practical and contextualized understanding of chemical elements, as students can associate the abstract concepts of the periodic table with everyday situations. This connection between theory and practice facilitates knowledge retention, as students are able to visualize the real application of the elements in their lives. [16]

Another benefit of the playful approach is the intrinsic motivation it provides. By transforming learning into a pleasurable activity, students become more engaged and interested in the content, developing a proactive attitude towards chemistry studies. This pedagogical approach contributes to the formation of more critical and autonomous students, preparing them to face scientific challenges with a curious mindset. [17]

This didactic strategy for teaching the periodic table represents a valuable alternative to overcoming traditional learning barriers. By making education more dynamic, interactive and contextualized, educators can not only facilitate the understanding of chemical concepts, but also awaken students' lasting interest in science, contributing to a more solid and meaningful education. [15]

There are four criteria to be followed when choosing a game to be applied in class, so that such playful activity can guarantee the essence of the game and the educational process. [8, 18] Such criteria are:

I) Experimental value, which leads the student to explore and manipulate, and in this way, teaches chemical concepts through the manipulation of some type of toy, space or action;

II) Structuring value, which corresponds to freedom of action following specific rules, which supports the structuring of personality that appears in strategies developed by the student and in the way of playing;

III) Relationship value, which corresponds to the ways of relating to the environment and other human beings (social interaction);

IV) Playful value, which assesses whether the objectives have the qualities that encourage the appearance of playful action.

Another point to be considered when considering using educational games in class is that four very important precautions must be observed, the first of which is the prior testing of the teaching resource to avoid unpleasant surprises when implementing it in class. The second precaution to take is to carry out a brief summary of the content to be worked on through the playful activity, as this content must have already been worked on and must be reviewed before applying the activity, to make better use of the resource used. Thirdly, the need to check the rules with students stands out, so that they can clearly understand the activity. And finally, the fourth precaution would be the development of subsequent pedagogical activities related to the activity to investigate the value of the playful activity as a teaching tool, that is, evaluation of the activity developed. [19]

METHODOLOGY

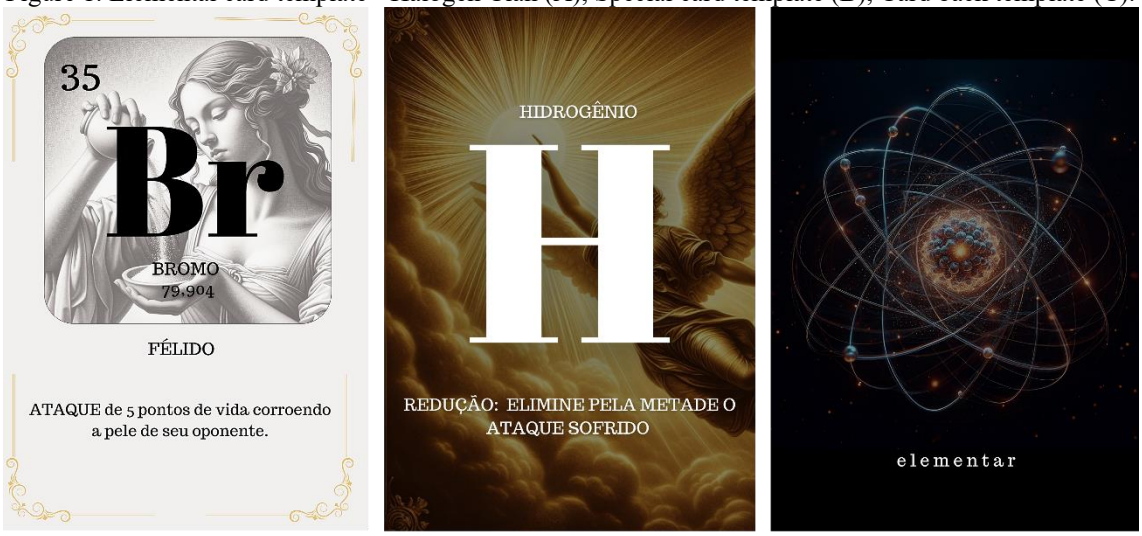
The game "Elementary: War of the Atomic Clans" was designed as a card game inspired by the RPG style, using the Periodic Table to familiarize players with the chemical elements, their names, symbols and families to which they belong. The preparation of the letters involved several steps and specific materials (photographic paper sheets; paper glue; scissors; printer; transparent adhesive paper).

The aforementioned didactic game was created by a team of students from an introductory chemistry discipline, belonging to the curricular matrix of the bachelor's degree course in pharmacy, at the Federal University of Pará (UFPA), located in the North of Brazil, in the Amazon, as a mechanism for review of content related to high school, more specifically, the periodic table, chemical elements, symbols and properties, with all work supervised by the subject teachers.

PREPARATION OF LETTERS

The cards were designed using the Canva program to create the model for the Clan cards (Figure 1), which were sized with a length of 9.5 cm and a width of 7.0 cm, using use simple scissors for your cutting.

Figure 1. Elemental card template - Halogen Clan (A), Special card template (B), Card back template (C).



(A) (B) (C)

Each of the clan cards created represents a different chemical element (Figure 1A), so 118 cards were created. Some information was included in these cards: name of the element, chemical symbol, atomic mass, atomic number, game name related to etymology, characteristic or history. Furthermore, each card was assigned a role in the game, among the following four: attack; defense; rare; restoration (Table 1). These functions will be described in the game rules.

Table 1 . Cards and their functions within the game

Type of Letter	Function or Game Action
Attack	Causes damage to the opponent.
Defense	Eliminate half or total of the attack suffered.
Restorations	They restore a specific amount of lost points.
Rare	You can assign the card any function you want, as long as this function is one of the functions of the specific card's clan.

A color code was also created for each clan to which the card belongs, according to the family of the chemical element (Table 2).

Table 2 . Game card color coding

Clan	Color	Elements belonging to the clan
Boro family	Dark green	Boron (B); Aluminum (Al); Gallium (Ga); Indian (In); Thallium (Tl) and Nohônio (Nh)
Carbon Family	Purple	Carbon (C); Silicon (Si); Germanium (Ge); Tin (Sb); Bismuth (Bi); Lead (Pb) and Flerovium (Fl)
Alkali Metals	Red	Lithium (Li); Sodium (Na); Potassium (K); Rubidium (Rb); Cesium (Cs); Francium (Fr) and Hydrogen (H).
Alkaline Earth Metals	Gray	Barium (Ba); Calcium (Ca); Magnesium (Mg); Strontium (Sr); Beryllium (Be) and Radium (Ra)
Noble Gas	Orange	Helium (He); Neon (Ne); Xenon (Xe); Argon (Ar); Radon (Rn); Tenesso (Ts) and Krypton (Kr)
Transition Metals	Blue	Chromium (Cr); Zinc (Zn); Iron (Fe); Manganese (Mn); Copper (Cu); Nickel (Ni); Silver (Ag); Platinum (Pt); Gold (Au); Mercury (Hg); Cobalt (Co); Molybdenum (Mo); Titanium (Ti) etc.
Halogens	White	Fluorine (F); Bromine (Br); Chlorine (Cl); Astatine (At) and Iodine (I)
Chalcogens	Black	Oxygen (O); Sulfur (S); Selenium (Se); Polonium (Po); Livermorium (Lv) and Tellurium (Te)

A background image for each of the cards was generated by AI Bing, with this image referring to the characteristics of the Periodic Table family for each clan. As for the special cards, a different model was created for them, including the name of the element, chemical symbol, function and a representative background image (Figure 1B). The back of the card also received an illustrative figure (Figure 1C).

In Figures 2, 3, 4 and 5 other examples of created cards are presented.

Figure 2 . Examples of letters of elements belonging to the Chalcogen family (16)

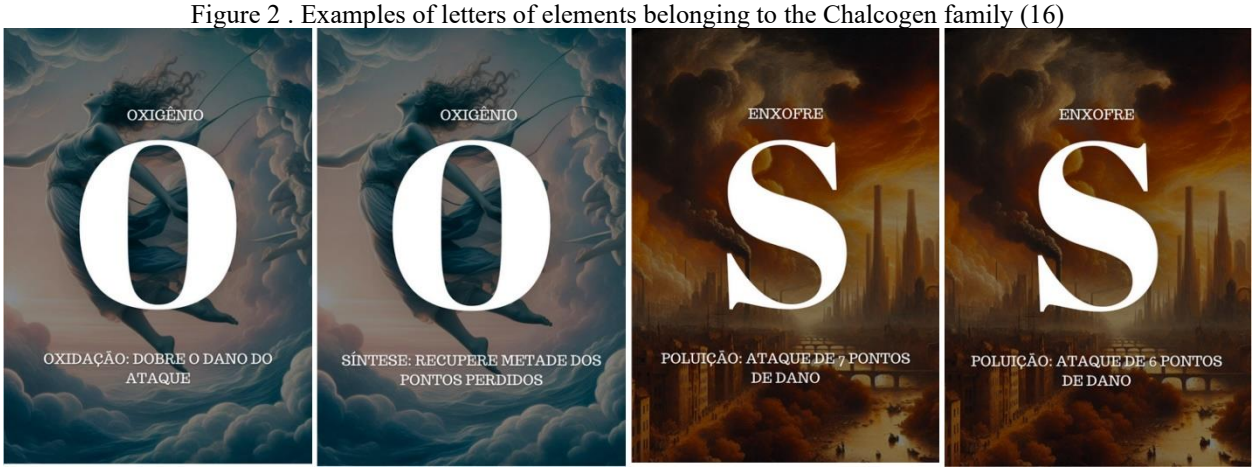


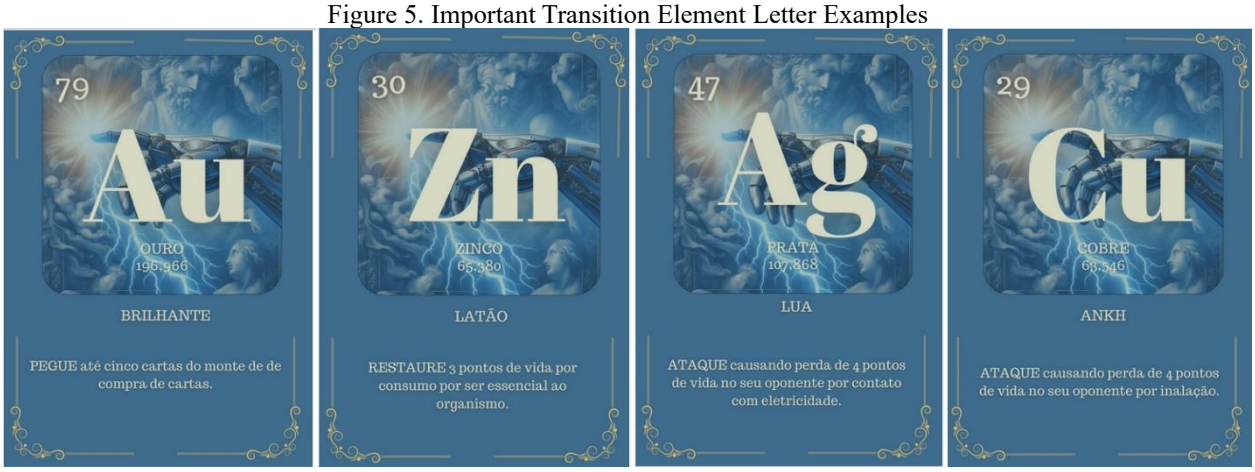
Figure 3. Examples of letters of elements belonging to the Halogen family (17)



Figure 4. Examples of charts of elements belonging to the Noble Gas family (18)



Figure 5. Important Transition Element Letter Examples



After making all the letters, they were printed on A4 size sheets of photographic paper, cut and then glued onto cardboard to make the pieces harder, and then covered with transparent adhesive paper, to ensure greater durability of the pieces.

A personalized box to store the letters was built with cardboard, with the following dimensions: height of 9.5 cm, width of 7.5 cm and length of 15.0 cm (Figure 6). Where it says “glue” means that this area is used to glue the sides of the box and where it says “do not glue” it means that they are flaps on the sides of the box and should not be glued. The box, after being properly

assembled, was decorated with images created using the Canva program and covered with transparent adhesive paper (Figure 7).

Figure 6 . Game box planning

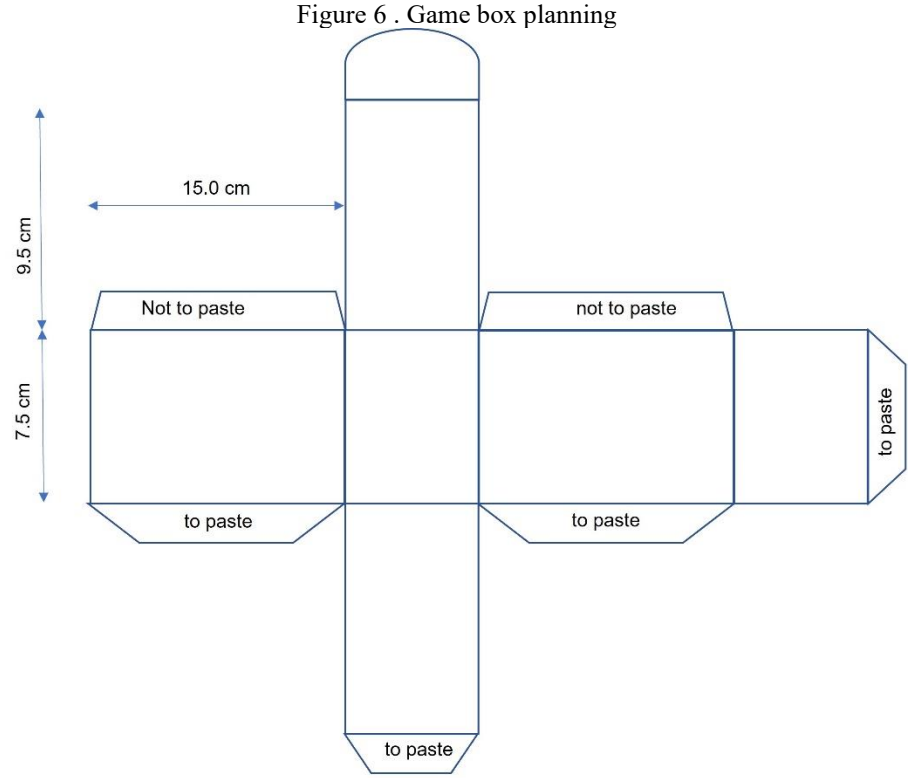
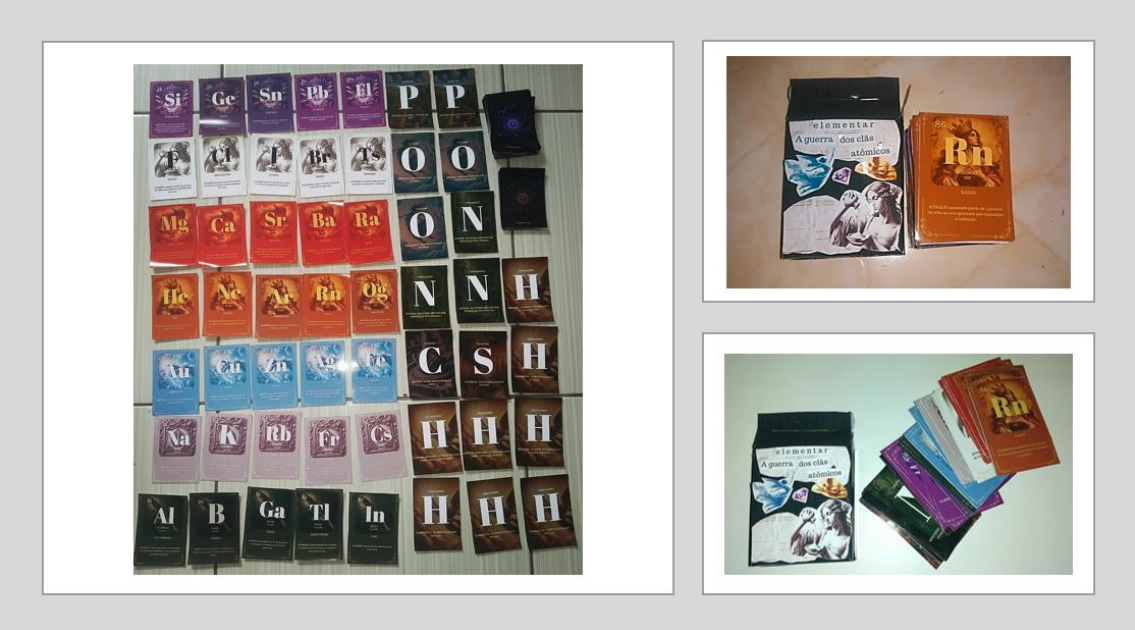


Figure 7. Completed cards and box for the game "Elementary: War of the Atomic Clans"



The entire process of preparing the game (pieces and rules) was led by students from an undergraduate Pharmacy class at the Federal University of Pará (UFPA), as the careful elaboration of the cards and other elements of the game not only integrates the fun of the game with learning

chemical elements, but also highlights the importance of creativity and interdisciplinarity in the educational process.

GAME RULES

The didactic game Elementary: The War of the Atomic Clans was designed to be played by two to four players, accompanied by a mediator, who could be the teacher, a class monitor, or a student, and in the case of four players, the The game must be played in pairs. There is the possibility of being played by teams, but always with the election of one representative per team.

The mediator is responsible for conducting the game, shuffling cards, drawing special cards for both players and keeping track of the players' points.

Initially, each player receives a set of five cards from their clan and two special cards, as well as twenty points (or twenty lives). Each player can freely choose the clan they will “defend” (Table 1) and their special cards (two) are drawn by the mediator.

The cards not drawn by the Moderator are stacked with the element's information face down, forming the card draw “pile”.

The game begins when both players agree on who will start, at which point the chosen player plays their first card. This can be done by direct agreement between the players or through some type of draw, such as rolling a common dice.

Each round, the participant plays a card in the discard pile and draws a new card from the draw pile, with the function of the discarded card announced by the Mediator.

The cards on the battlefield (round) can attack the opponent with the aim of removing energy, defending themselves, preventing the attack or restoring energy according to functions created from the properties of the chemical elements of each clan. Each of the game's cards has a certain number of attack points (representing the damage caused) and defense points (protection against damage). For example, the Bromine (Br) card, shown in Figure 1A, has 5 attack points, while the hydrogen (H) card, shown in Figure 1B, can halve the damage suffered in an attack.

If a player does not have an elemental attack card on their turn, they can draw a card, but give up playing that round, passing the turn to the opponent.

The Mediator records life point gains, losses, and restorations on a sheet with the players' names, adding and subtracting the corresponding points.

If a player resets his points, he has the right to play a card to recover points.

The one who removes all of his opponent's life points first wins the game. But in special situations, such as the end of available class time, the winner can be determined by the player with the most life points.

GAME TESTING

After its elaboration and creation, the game was tested by the team members, and was later tested with all students in the class of the game's team (Figure 8), fulfilling one of the essential points in a proposal for an educational game, which It's your preliminary test. [19]

Figure 8 . Game testing moment



FINAL CONSIDERATIONS

The work highlights the challenges faced in teaching chemistry in classrooms, whether in schools or often in universities, focusing on students' negative perception of the subject and the limitations of the traditional approach. The lack of connection between abstract concepts and everyday reality, combined with the scarcity of practical resources, contributes to learning difficulties. [20]

By adopting playful approaches, such as educational games and practical activities, [21] the work suggests that it is possible to transform the learning environment, making it more engaging and accessible. The use of the proposed game aims not only to illustrate the concepts of the periodic table, but also to promote the active participation of students and other participants (teachers and monitors).

The methodology for creating the game highlights interdisciplinarity and the importance of creativity in the educational process. The "Elementar" game not only seeks to make learning about chemical elements more enjoyable and memorable, but also aims to stimulate understanding of the properties and relationships between the elements, providing a practical and contextualized connection.

After the testing carried out with the class, it was noticed that the rules of the game and its didactic purposes were very clear to the participants of the game, in addition to that there was good acceptance of the dynamics created by the team and developed in the class, with spontaneous reports such as: “ I learned without realizing I was studying” (student 1), or “I learned while having a lot of fun. I never thought Chemistry could be something really fun.” Such reports are in line with several existing works in the literature, which present spontaneous reports of content similar to those recorded in the present work. [22]

Another point to be considered was the motivation of the team when developing the game, which agrees with what Soares (2015) says when reporting that some recreational manufacturing and construction activities in teams of students, in which it can be observed that the interest caused through the possibilities of creation, changes and adaptations, it provides student involvement. Board games, in particular, promote interaction with the game through the manipulation of pieces. Another interaction that is important to mention is teacher-student and student-student, strengthening bonds of friendship, trust, cooperativeness and/or competitiveness. [23]

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Military ideology and culture of violence in school communities in the Amazon context

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ABSTRACT

This article presents a vision of the current project in the educational field called the Civic-Military Schools Program (PECIM) in the Legal Amazon (AL), taking as a reference the State's actions investing in shared management with the armed and auxiliary forces to serve schools classified as areas of social vulnerability. PECIM was implemented in 2020 and reached a significant number of school institutions on the national scene that decided to adopt the model. By the end of 2022, 49 schools were recorded in AL. The pedagogical conception that favors militarized indoctrination in areas considered to be socially vulnerable is an educational proposal from the national State that exposes political-ideological interests in the region. Document analysis was the proposal used to extract information from the legal documents that guide PECIM within a qualitative methodological approach to reference the historical milestones that contextualize the role of the National State in a critical-reflexive perspective on combating violence in school communities and the rise of the military narrative as a political educational project from a hegemonic perspective. The region, which lives with environmental crimes and the rise of organized crime, sees military participation expand its functions, establishing a power project with education as its pillar.

Keywords: Public Policy in Education, Amazon, School Community, Civic-Military Schools, Militarization of schools.

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INTRODUCTION

This article is interested in addressing the general aspects of the allocation of military and auxiliary forces to combat violence and crime; the political use of the conception of public security as a project of power, and the implications in the Amazonian context. The discussion produces an excerpt of the federal government's policy, in the mandate (2019-2022), to adopt the civic-military schools program (PECIM), as well as encompasses reflections on the protagonism of the police discourse of punishment in the process of militarization of schools and its relations with the educational political conjuncture (SANTOS, 2020).

The theoretical-methodological contributions are based on historical-dialectical materialism, based on the concepts of the use of the militarization of education as an ideological apparatus of the state (ALTHUSSER, 1985) and the role of PECIM as a hegemonic cultural construct of neoconservatism in Brazil (GRAMSCI, 1988, 2000). The arrangement of ideological discourse to justify the militarization of schools to confront chronic social problems within the scope of public schools is an attempt to associate neoconservative ideology with the willingness to correct challenging educational issues in a reality of unequal educational quality and scrapped in the midst of neoliberalism.

The propositions of the military doctrinal model to convince society of its authoritarian project of the State aim at a consensus that militarized social control has a supposed efficiency for the existing historical conditions, expressing a constitutive process of hypermilitarization (CAMARGO; BORDIN; DE MORAES, 2018). The analysis of the conduct of the project of militarization of schools, which was organized before Bolsonarism took over the national government, indicates an instrumentalization of Brazilian neoconservatism directing a new dominant social class through education and reactionary political agendas.

The civic-military school, being a project for Basic Education in public schools, must be problematized with the references of achieving full democratic citizenship. The access of the working class to the militarized public school requires a critical and reflective look at the project. These processes, which involve a greater or lesser adherence and permeability in the collective construction of an emancipatory nature, gain new contours in the face of the institutional legitimacy of hierarchical military indoctrination and subordination of the popular classes (SANTOS, 2021). For Fraser (2018), it is necessary to deepen the neoconservative project in the midst of neoliberalism, contrasting with progressive neoliberal orientations and, if fed by the crises of capitalism.

The permissiveness of the population in the face of the educational project of political and social co-optation at the national level relies on the demobilization of the popular sectors and the lack of criticality of the working class. The inclusion of discriminated social groups in political agendas is a challenge to understand the specificities and risks of each collective (ARROYO, 2015).

According to Gonzaga and Cavalcanti (2020), the Legal Amazon (AL) region is witnessing a phase called demographic bonus that provides an age considered active in conditions to qualify professionally and academically. In scenarios in which education in the Amazonian context has as references: educational access in Basic and Higher Education, dropout and dropout rate, and Professional Education, the region's results are worse than the national average (CRUZ and PORTELLA, 2021). The political-ideological motivation of the program conceals the chronic-structural problems and the educational model in the LA region.

This study endorses the position of the National Research Network on the Militarization of Education, namely, to qualify PECIM as a military school, regardless of whether the program uses the rhetoric that distinguishes the civil-military project from other experiences of militarization of schools underway in the country. In the neoliberal context, the scrapping of education has produced a fertile field for a conformism of the worker of a deteriorated state and of few motivations of the political class to satisfy their social rights. The problematization of this study is based on the analysis of how educational challenges are adhering to the responses of the militarization of schools as a set of actions aimed at solving complex issues of daily school life in the Amazon. The research has a scholarship from the Amazonas Research Support Foundation (FAPEAM) and the support of the Coordination for the Improvement of Higher Education Personnel (CAPES).

CIVIC-MILITARY SCHOOLS IN THE AMAZONIAN CONTEXT

Decree No. 10,004, of September 5, 2019 (BRASIL, 2019) established the National Program of Civic-Military Schools (PECIM). Its creation is justified to offer quality for Elementary and Secondary Education. The management model entitled as excellence comprises the educational, didactic-pedagogical and administrative spheres. It is noteworthy that the officers and enlisted men of the military police and military fire brigades are qualified to work for the three areas of management in schools.

In the first year of PECIM's implementation, in 2020, the North region achieved the highest number of partnerships between the Ministry of Defense and the state secretariats in the national territory, totaling 35 schools. In addition to municipal schools, there are 39 civil-military schools in the North, and 49 schools under the aegis of PECIM in the Legal Amazon region.

Table - 1 Number of state and municipal departments that signed the Technical Cooperation Agreement (ACT) for the implementation of PECIM in the Legal Amazon

STATES (AL)	PECIM SCHOOLS
Acre	5
Amapá	4
Amazonas	7
Maranhão	3
Mato Grosso	7
Pará	9
Rondônia	4
Roraima	1
Tocantins	9
TOTAL	49

Source: prepared by the author (2022)

In the scenario of militarization of schools in the Amazonian context, data point to a significant incursion of PECIM in the region. The area of the Legal Amazon comprises the largest number of ACT's signed with the governments of the states of LA, and, added to the municipalities of the Amazonian municipalities, a percentage of 25% of the schools implemented in Brazil was totaled.

It is important to analyze the project of militarization of schools in the Amazon within its historical context, its execution as a national policy, its ideological links and power relations in the Amazonian context. A document entitled Nation Project: Brazil in 2035, released a neoconservative strategic plan for society with clear visions that substantiate Bolsonaro's authoritarian vision for the formulation of policies in several areas. The material shows the military intention to be present in the Amazon region.

> The Amazon has always demanded from Brazil — and now more than ever — the capacity of our Armed Forces for extra-regional military deterrence and power projection. With the maturation of society and with greater participation of Conservatives and Liberals, it is possible to affirm that, in recent years, significant social segments have begun to identify the potential and real threats to the country and, particularly, to the North Region. As a result, the Legislative and Executive Branches allocated resources to strategic National Defense projects, despite international pressures against our military and scientific-technological strengthening. (SAGRES, 2022, p.22).

The influence on public opinion of defenders of the militarization of schools deserves attention in view of their motivations as a project of power and the performance of their claimants and their functions in society articulated with the interests of conservatives and liberals in the North region. Among the responsibilities of the armed forces, the defense of national sovereignty and territory brings together the conditions for the execution of prompt employment regarding the objective mobilization of their actions, which obey a vertical and centralized command, respecting, hierarchically, the decision-making structure of their scale of power. In view of its specific training, the mirrored model of the administration of war issues for the management of a school imprints a

militarized educational conception that is inhabited in attending to issues in the social sphere in a context of escalating violence in the region.

In the Amazonian context, the complexities related to the media expression of the war on drugs and other types of violence that plague the region stem from several factors. This relationship between miners, land grabbers, illegal fishing, mining and loggers with natural resources perpetuates a predatory logic with economic interests orchestrated by criminal organizations. The fragility of border policies and the flows of drug trafficking that establish connections with the Amazon highlight a range of crimes that generate instability in national security policies.

> The presented matrix goes beyond the concept of "environmental crime" to encompass a wide range of organized human activities that are changing the landscape, societies, and climate of the Amazon Basin Some of these activities occur primarily in rural areas, while others are more common in urban or peri-urban areas The participants involved can range from isolated individual actors to highly organized legal and illegal organizations at different geographic scales (ABDENUR et al. 2020, p.130 .

Social relations in vulnerable communities coexist with distortions of police practices in the face of violence, coercion and behaviors that strain territories with present criminality. The police conduct aimed at arresting the marginal in the logic of getting caught in the act, approaching drug users, fighting petty crimes, robberies and other transgressions corresponds to a military modus operandi that moves the interests of the State towards alternatives that have been extended to the school communities. For Anunciação et al. (2022), this specific view is not consistent with practices of care for school violence that articulate integrated policies with multiprofessional contributions that reflect on humanizing actions.

Military lethality tarnishes the image of police employment in areas of social vulnerability, but it is accepted by a portion of a social stratum as a way to guarantee a feeling of security and to fight a war. The constitutional competence that refers to ostensible policing and the use of integrated intelligence and articulated with other public policies does not gain the priority it deserves from the perspective of hypermilitarization of society (BORDIN, 2020). Because these actions are frequent in favelas, peripheries and regions with a population in poverty, the daily life of the communities carries hostile impressions associated with police actions and their violent approaches, especially with the racial profile and the age classification that makes up the youth.

Among the principles of PECIM, institutions should preferably be adopted in areas considered to be of social vulnerability, have an appropriate school environment for the improvement of the teaching and learning process and a management model concerning the military colleges of the army, military police and fire department. According to the objectives of PECIM, the program's investment to combat problems in areas of social vulnerability stands out. In the cultural imaginary of society, this model fosters a discourse that excels in the hardline to solve social problems that not

only plague a school institution, but its communities. Thus, issues related to social vulnerability will be pointed out by the program, in addition to the pedagogical concern, as a military issue, translated into the general line of PECIM regarding its main objectives of service, such as:

> I. Students in situations of social vulnerability, where there are usually high rates of violence, influence of drug trafficking, prostitution, low rates of urban sanitation and precarious living conditions. II. Schools with IDEB lower than the municipal, state or national average. (BRAZIL, 2022, p.17)

The categorization of the target audience and the territorial identification that concerns the classification of socially vulnerable, from the military perspective, expose a stereotype of criminalization of poverty. The selection of the educational program of PECIM collaborates with the structural thinking of racism and with the institutionalization of the archetype of stigmatization of the transgressor in view of his social class and age classification.

It is important to understand the violent scenario in the Amazon region that can provoke a deep reflection on the subject. The data extracted by the Brazilian Public Security Yearbook-2022 indicate that there was an increase in the rate of intentional violent deaths in the North region, contrasting with the decrease in the other regions. In the North, there was an increase of 7.9%, while a decrease was recorded in the South (-7.4%); Southeast, (-7.9%); Midwest, (-13.5%); Northeast (-7.9%). When the typology contemplates the Rural-Urban issue, the cut of the Legal Amazon region reached, in the rural area, the index of 25.0 per group of 100 thousand inhabitants and the average of Brazil reached 21.8 per group of 100 thousand. In the classification of territorial planning of intermediate municipalities, the Legal Amazon obtained 33.8 per group of 100 thousand people and the Brazilian average achieved 27.1 per 100 thousand people. In the urban area, there were 30.9 per 100,000 people in the Legal Amazon, compared to 22.0 per 100,000 people in Brazil.

Issues related to environmental crimes such as land grabbing, illegal mining and deforestation present a problem on a local, regional, national and international scale. Another important situation is drug trafficking and its power relations with regard to public security. Organized criminal factions and groups arrived in the Amazonian context, as the study points out:

> It is in this context that the organized crime factions that operate in Brazil have come to see the Amazon as a strategic region for the geopolitics of drug trafficking, which is constituted by this cross-border relationship that involves multiple agents, each with its own specific function in the criminal universe. Factions from the southeastern region of Brazil, such as the Red Command, which originated in Rio de Janeiro, and the First Capital Command (PCC), which came from São Paulo, then became interested in operating in border areas, as well as in cities considered important for the flow of drugs. (FBSP, 2022, p.8)

Faced with the complexities of the Amazon issue and the military responsibilities of the armed forces to defend national sovereignty and issues of internal security and the auxiliary forces in guaranteeing the ostensible police and guaranteeing public order, these strategic demands should

belong to the hall of priorities of the responsibilities that are given. The mobilization of military personnel to devise an educational policy provides a legal, legal, and functional misunderstanding of their actions to point out solutions to the serious problems of national security in the current situation of the Amazon.

POLICE IDEOLOGY IN THE FIGHT AGAINST SCHOOL VIOLENCE

When we analyze paragraph 6 of item IV of Article 144 of the Constitution (BRASIL, 1988) where the police are militarily organized, being an auxiliary and reserve force of the Army, the orders and organizational formats similar to the armed forces will be characterized. Thus, some aspects related to the military model of severe punishments, inflexible hierarchization and centralized decision-making processes underlie the theoretical frameworks and modus operandi of the country's auxiliary forces. By transposing this format to managerial and curricular practices in the school space, the application of this functionality present in the barracks allocated to educational processes requires an inquiry into how these issues influence school work and its acceptance or not in society as a binding form of militarized discourse of quality management.

In the research entitled "Opinion of Brazilian Police Officers on Reforms and Modernization of Public Security" (FBSP, 2016). Several positions of police officers on the forms of organization of the police corporations present in the country were collected. In the questions produced that cover issues of hierarchy and discipline in the police, two stand out regarding their results, 77.2% of police officers disagree that the military police and military fire brigades should be subordinated to the Army, as auxiliary forces, and organize themselves like it, and 58.3% agree that hierarchy in the police and other security forces causes disrespect and professional injustices. From these data, the premises that the hierarchical organization and discipline in the police are questioned by the members of the corporations themselves are corroborated. Thus, what philosophical motivators accredit the hierarchical and disciplinary model to be a militarized pedagogical conception accepted as successful or promising?

This draconian model[3] of vertical hierarchization, subordination and disciplinary subservience will be defended by the State as an ideological possibility to change a school reality in the context of Brazilian public education. In other words, it would be appropriate to understand the political use of the police for the militarization of Brazilian public schools.

The legal provisions and official curricular proposals that advocate the project of civic-military schools at the national level condition a militarized organization that will influence decision-making in the aspects related to the school community and its degree of participation. The documents

[3] Dracon was a lawgiver of Athens, Greece, in the 7th century BCE, and was commonly characterized by his codes of law of high severity and severity in his penalties.

that guide the program indicate a model of democratic management on the condition that it is shared with the armed forces and auxiliaries. Democratic precepts become fluid when a project of military aspiration seeks to defend imperatives, for example, in the field of human rights.

> In fact, justifications for human rights education appear strongly in all of these scenarios, whether we adopt a fixed or malleable conception of human rights, or a conception of banking education or knowledge construction. From a top-down human rights perspective, people need to be informed and adopt the relevant values; From a bottom-up perspective, people need to be empowered to participate – both perspectives involve education (albeit in different ways). (McCOWAN, 2015, p.35).

The debate on the pedagogical conception in the Amazonian context also needs to be pointed out that the collective organizations of the teacher. The singularities of the teacher cannot be neglected in their authorship in the production of the classroom and in the systematized scope of the regional curriculum. The possibilities of non-compliance or disagreement with an ideological and curricular project within a school may be more permissive to originality and resistance within a democratic school.

The educational experiences of each school and the autonomy to be sought in teaching will be delimited as orders already established in militarized philosophy in issues, for example, of representations and acceptances of minorities. What possibilities could be made feasible in a militarized school for a black student to manifest in the growth of his hair a way of expressing his blackness? What would be the conditions for a transgender student to be able to wear the uniform of the gender they identify with? For Silva Neto and Carvalho (2022), disciplinary transgressions in everyday school life have expressions and receptions that are different from the imaginary expected by male and female students.

These questions do not polarize schools with different pedagogical conceptions, avoiding conflicts of positions in the questions presented. Therefore, it would not be reasonable to disregard the conjuncture of society and the political-social pressures to modulate the behaviors and curricular dictates of any school. However, the opportunities to change, adapt or resist ideological antagonisms within a verticalized hierarchical and disciplinary structure are unfeasible in anti-democratic processes in the organization of the school.

The intersection of an educational project with mass education aims to standardize a structure of ideas and actions that systematize school production. This organization, which permeates the administrative, legal and even curricular practices, designs arrangements that not only achieve pragmatism in providing solutions to educational demands. Publicizing a successful project in the field of education establishes ideological links that promote the State model. The policy of military schools in the light of the military civic project propagandizes its results within a neoliberal perspective of evaluation and instills the ordering of marginalized populations through police

ideology, according to data from the CGGE (2021) on the incidence of drug trafficking in the vicinity of schools and the transport of bladed weapons and firearms in the school environment.

The recruitment of police officers in the organization of the school does not only enable its task of ensuring overt policing or police presence in areas of unleashed violence; The role played in the school community will regulate behavior, culture and social relations in the organization of workers, students and families mediated by the fear of police repression characteristic in areas of social vulnerability.

The legitimization of the police ideology in the school institution promotes the belief in the militarization of the police as a projection of power extended from the interims of the barracks. The concept of demilitarization of the police force is weakened when the state's political use of the police validates militarization and its supposed organizational effectiveness. The authors Santos and Alves (2022) point out that the militarization process was established with electoral ambitions to meet the demands of conservative segments and an affirmation of the policy of repression and social control.

In order to understand the project of militarization in education, it is necessary to understand which political-social claims are able to reproduce a narrative of educational quality concerning their philosophical conceptions in the school context. In this case, the militarized conception organized in barracks, the use of uniforms, the hierarchical discipline reflected in continence and subordinations, and the other specificities belonging to the molds of the military forces will characterize the functions of the Brazilian police, leading to a pedagogical philosophy and conception.

The intentionality of the educational policy to solve conflicts resulting from social problems or the adequacy of cultural aspects in a confluence of what is planned with the real production of culture and knowledge carried out by the school institution are subject to reflection. Public policies in education articulated with social policies, in the areas of health, basic sanitation, employability, income, among other actions, are essential to create a collaborative network in search of serving people in high social vulnerability (DUARTE, 2004). The search for the model of militarization of the school to standardize its concepts of educational quality contributes to the promotion of a distorted process of effective public policies.

From the responsibility of the police management to expedite actions in the school context that produce in the cultural imaginary a set of competencies that cannot be attributed exclusively to the school, an obsession with results that boast of the defended educational model can be enhanced. When considering the processes of knowledge construction, the valorization of erudite and formal knowledge that refers to education transits in multiple experiences that are expressed in the popular field. The daily life of the school called the hidden curriculum (SACRISTÁN, 1998) is an expressive field to capture what the institutional and official discourse do not delimit and/or do not want to expose.

Within a history of police corporations and disrespect for human rights in slum and peripheral areas, this historical-cultural multiplicity and the references to the role of the police in the favelas are complex and conflicting both for the school community and for the military police. The distancing from ostensible and communal work, strengthening ties of citizenship to play the role of direct confrontation in settling violence and the fight against drug trafficking, has generated harmful arbitrariness in the relationship between society and the police institution. For Souza and Serra (2020), the defense of a repressive method in favelas and peripheries dominated by drug trafficking and paramilitary forces established a coexistence of violence as a real scenario in daily social life, producing a state of exception.

To understand the heterogeneity of the school space in the educational processes is to give visibility to the practices of the school routine and social dynamics. The idea of homogenizing the school curriculum and standardizing the meritocracy project will be determined by the political use of police ideology as a vertical and inflexible project to the opposition of ideas. In the social fabric of the school, it is the experiences of denial, concession and affirmation that condition a self-criticism of the current educational project. Democratic assumptions cannot be imagined as dialogues that are always harmonious and convenient to what is proposed. The conflict of ideas is in the daily school life concerning the student's life, the claims of the families, the concerns in the teachers' room, the authorial and directive processes in the pedagogical sphere and the other articulations of the social actors involved in the school project complexity within the plurality of the school community.

The desire to transform the harsh Brazilian educational reality imposes challenges in the formulation of policies for society. Each process devised by the public administration shares inducements in the application of the state budget and in the desire to contemplate the demands of sectors of society. It is appropriate to interpret the process of militarization of Brazilian public schools as an endogenous movement, since it began in Brazilian municipalities and states before the implementation of PECIM by the federal government. The capture of political and social demands at the local level and the guidelines of the schools organized by the police produced experiences in the country that solidified this educational project at the national level.

NEOLIBERAL REFORMS IN THE LIGHT OF A NEOCONSERVATIVE EDUCATIONAL PROJECT

Education policies will be carried out within the scales of power that are incumbent on each actor involved, theoretical foundations, projects that aim at propositions of different durations and practices guided by the demands in question. In this relationship between the State and education, neoliberal guidelines have provided an adequacy of educational policies, resulting in agendas defended by groups financed by the market and big capital. The U.S. framework points to the

emergence of a neoconservative movement in the period after World War II. For Apple (2000), neoconservatives are those who make a movement to exalt the values of the past and defend cultural traditions. The author indicates an alignment of neoconservatives with neoliberal groups, authoritarian populists, and a new professional middle class constituting a New Right in the US.

Thus, the management of educational policies will be institutionally advised, through NGOs and private educational organizations, being influenced by the beliefs of big capital for the professionalism of public policies. The perspective of managerialist ideals gained hegemonic contours based on neoliberal beliefs. According to Burgo and Bellato (2019), the critique of managerialism left a void of alternatives to management and public administration. From this perspective, militarized management has co-opted the discourse of managerialism with philosophical values that dialogue with neoconservative thought.

In the understanding of the organization of an educational system, such as the Brazilian one, the structural problems of educational governance carry challenges of various natures in the implementation of policies with ideological diversities, added to the complexity of the educational system being federative and collaborative between states and municipalities. The category of Gramscian ideology dimensioned to the subaltern classes is admitted. The dominant nature of ideological manifestation dialogues with a social organization and forges identities by establishing forms of consensus that revolve around hegemonic interests (SIMIONATTO, 2009).

In the context of globalization, the demands that prevail in education as global and contemporary demands, generating a false sense of symmetry in the challenges of regions and countries with different economic conditions, call on educational policies to organize themselves and carry out efficient actions, disregarding the singularities of the Amazon. In the hegemonic sphere, for example, it is noticeable that pedagogical projects will aim at curricular practices that reach competencies and skills that meet the demands of a global education. The author Almeida (2020) highlights a set of macro efforts for teacher training, restructuring of the evaluation system, and articulation with entities guided by the managerialist logic in the design of policies for the area.

In this conjuncture in which globalization and education have a strong confluence, the complexity of the discussion about the ideologies that lead the debates in question in Brazil is drawn in their behaviors and practices in their formulation. Thus, the project of militarization of schools competes with the attempt to present solutions to educational demands.

> It is important to emphasize that the crisis implanted by the need for capitalist accumulation and the growing popular demand for education were dismembered into conflicting, divergent and even antagonistic actions and proposals that placed the public school at the center of the disputes for a project of socialization of knowledge for all (RODRIGUES, 2007, p.150).

The combination of the neoliberal and civic-military project is similar in the form of instrumentalization of its theories and practices when it is established in public schools at the national level. The school's infrastructure and human resources will be made available for managerial experiments credited to the military orientation legitimized by the state. Thus, military ideology strives to call itself qualified to present solutions to educational issues, keeping its interests and contradictions. The environment of competition between educational projects creates an atmosphere of attacks with the aim of asserting the hegemony and legitimacy of the neoliberal philosophies themselves.

The economic factor will also influence which governments will be convenient for adhering to their agendas and interests. The adequacy of capitalism to accommodate its interests is modulable and includes the opportunities for gains and maintenance of its beliefs. The intentionality of the projects and the narratives present in education aim at a national project as a reference of power. Giving visibility to the results ensures an air of effectiveness in the context of globalization.

This issue requires a critical commitment to confront policies that ignore Amazonian experiences and realities. It is essential to demand democratic schools that consider social agendas in a region with a historical process marked by oppression and struggles against the present social inequalities. According to Carvalho and Estevão (2013), critical hermeneutics encompasses the various forms of oppression and struggle for a more just society. The demand for quality Basic Education gains strength through the banners of struggle nicknamed in defense of social justice and equal rights.

FINAL THOUGHTS

The Amazonian context demands alternative actions that can reconcile a policy of local and regional scale, with national dimension and haughtiness, and that positions itself in the international discourse of forest conservation to expand the eco-sustainable agenda of the Amazon as a priority on the public agenda. Education as a public policy needs to mediate a strategic agenda that provides a quality educational model that points to an ecological transition of its actions and serves the Amazonian peoples in the face of their singularities.

In this sense, the Civic-Military Schools Program (PECIM) forwards philosophical propositions and military curricula that do not contemplate the cultural identities and regional diversity of the Amazonian peoples as a participant in a plural pedagogical proposal with social impact. In the imagination of the target audience of students in social vulnerability, the involvement of the school community with social inclusion projects from the perspective of qualification and generation of sustainable opportunities is replaced by a public security project that intervenes in social problems through disciplinary concepts and the moralistic orbit, crediting neoconservative

civism as a project of social modulation. The coercive idea in the cultural process of the Amazon and the criminalization of poverty in the context of violence, are confronted with a vision of equitable social transformation in a democratic relationship between the State and education, reproducing the mistakes in the historical process of the Amazon.

The military ideological alignment of the federal government, under the command of President Jair Bolsonaro, protagonist of the Brazilian far right, disregards, in its discourse, a balance of ethnic groups, indigenous peoples and local populations, projecting a narrative to combat the environmentalist discourse, considered by the Bolsonarist movement as a provider of obstacles to the economic growth of the Amazon. The loosening of environmental legislation, the increase in deforestation, the encouragement of exploitative practices such as mining and land grabbing, among other inappropriate placements for eco-sustainable policies have weakened the international image of the conservation of the Amazon rainforest and weakened relations with important political actors in the region who defend the environmentalist agenda.

The disarticulation of the regional production chain with an educational project for the Amazonian context disfavors the identification of local potentialities that achieve social justice for the local population. Respect for biodiversity, investments in biotechnology and economic diversification need to be guided by a State project that articulates an educational policy from a counter-hegemonic perspective. The production of sustainable agricultural crops and respect for the environment permeate a curricular proposal that understands this relationship between the subject of nature and as an imperative of the Amazonian peoples. The diversity of the ecosystems of the Amazon is of vital importance to understand the appropriate education projects for each reality, fostering eco-training (PINHO and PASSOS, 2018).

The national project to change the management model and the pedagogical conception of schools that have adopted the PECIM do not meet the expansion of the supply of plural schools and access to enrollment in Basic Education, manifested in LA due to the fact that they are carried out in existing school institutions. The prioritization of an educational project that points to an investment in professional and technological education, optimizing a demographic bonus in the region, is imperceptible in the intention of the national State for education in the region. The initiative would be more viable for the public identified as socially vulnerable, generating opportunities for young people and adults in each sector produced in the Amazon. The investment in science and technological innovation of the local potentialities linked to universities and production centers can culminate in greater access, permanence and expansion to Higher Education of students coming from Basic Education. Thus, the hegemonic approach of giving visibility to the policy of militarized conception of schools to confront social inequalities is simplistic, reductionist and does not signal an efficient alternative to the educational challenges in the Amazonian context.

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A science didactic sequence based on inquiry-based teaching in the 9th year of Elementary School using *Scratch*

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ABSTRACT

The research in question refers to an Investigative Didactic Sequence applied in the teaching of Science to students in the 9th year of Elementary School, as part of a master's thesis defended in the Stricto Sensu Postgraduate Program in Science and Mathematics Teaching - PPGECM , from the State University of Mato Grosso, UNEMAT/Barra do Bugres. The study aimed to understand the contributions of using Scratch Software in teaching the calculation of atomic mass to students in the 9th year of Elementary School and involved 13 students from a public school in the interior of the State of Mato Grosso. The science didactic sequence was developed over six meetings (14h), which consisted of stages of theoretical exploration of Chemistry concepts, followed by the use of Scratch Software to construct the Interactive Periodic Table, covering concepts of Chemistry, Mathematics and programming in block. During this interdisciplinary approach, students were able to understand and explore the properties of chemical elements, as well as calculate the atomic mass and at the end of the Didactic Sequence, a qualitative assessment of the results achieved was carried out, through observation and journaling. fieldwork, analysis of reports and questionnaires. The results highlighted the importance of interdisciplinarity in teaching, arousing students' interest through the construction of the Interactive Periodic Table in Scratch Software. This proved to be an effective pedagogical strategy to mediate the teaching of atomic mass calculation, contributing to the development of students' skills and improving the teaching process.

Keywords: Teaching, Science, Interdisciplinarity, Programming language, Chemical elements.

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INTRODUCTION

Inquiry teaching is based on aspects of scientific research, providing students with the opportunity to engage in activities similar to those developed in Science work processes. (Carvalho, 2013). Sasseron and Carvalho (2008, p. 338), defend the idea "[...] that Science teaching should occur through open and investigative activities in which students play the role of researchers".

For Solino, Ferraz and Sasseron (2015), research-based teaching is an instrument that promotes the integration of scientific and school cultures, promoting the approximation of practices, rules, values and other characteristics of these cultural domains, creating conditions for students to develop school scientific practices.

One approach to implementing inquiry teaching in a school setting is through inquiry teaching sequences. According to Zabala (1998), a Didactic Sequence is a methodological suggestion determined by the ordered and articulated series of activities that make up the didactic units, which have a beginning and end known by teachers and students. For Pais (2002), a Didactic Sequence consists of a series of classes planned and previously analyzed to observe learning involving the concepts foreseen in the didactic research.

The Didactic Sequence developed and applied from a sociocultural perspective can present itself as an efficient option that aims, among other things, to minimize the tensions of decontextualized teaching and the dissociated action of teaching areas in the school environment (Guimarães; Giordan; Massil, 2011).

The model proposed by Delizoicov *et al.* (2002), constituting three pedagogical moments: 1) Problematization: Challenging students to expose their prior knowledge and reflections on the subject; 2) Organization of knowledge: Carry out the pedagogical activities necessary to understand the topic and initial problematization; 3) Application of knowledge: create situations in which students can test their ability to apply knowledge through scientific conceptualizations and real-world situations. In studies of didactic sequences in Science teaching, Guimarães, Giordam and Massi (2011), present a line of research on didactic sequences that investigate teaching-investigative perspectives and actions that facilitate learning. The structuring of the didactic sequences will be composed of the following elements: title, target audience, problematization, general objectives, specific objectives, contents, dynamics, evaluation, references and bibliography used. For these authors, the title must be attractive and reflect the content and creative intent. The target audience must be well defined, as teaching sequences are not universal and there is no definitive method valid in all situations. Problematization, on the other hand, is the agent that unifies and maintains the systemic relationship of the Didactic Sequence; therefore, reasoning about the problem is what anchors the Didactic Sequence through social and scientific issues that underlie the theme and problematize the concepts to be addressed. The proposed objectives must be achievable through the

methodology and reflected in the content and evaluation, one of the ways to verify whether they have been effectively achieved.

In terms of content, Guimarães, Giordam and Massi (2011) highlight that, despite the disciplinary organization, interdisciplinary and transdisciplinary references can be established to the other curricular components. The dynamics concern teaching methodologies that establish learning situations, emphasizing that the diversity of dynamics must be linked to the structural and social context provided by the target school.

The assessment must correspond to the objectives and contents set out in the Didactic Sequence. Continuing, the item bibliographic references refers to the works, books, texts, videos actually used in the development of the proposed classes and in the bibliography the works that were used in the preparation of the sequence or as support and study material must be presented. for teachers who will apply this Didactic Sequence (Guimarães, Giordam and Massi, 2011).

To compose the didactic sequence, Science textbooks from the final years and high school Chemistry textbooks were consulted, as well as articles and publications in the area of Science and Mathematics teaching, in addition to the references of this research, such as Giordam and Massi (2011), Carvalho, (2013), which served as a base reference for this sequence for investigative classes: presentation of a problem; raising hypotheses in monitored groups; carrying out an investigative, experimental or bibliographical search activity; data analysis and discussion of results during which we intended to contextualize current affairs and the students' daily lives; moments of conversations and practical activities and as a way of recording data, the researcher's own website was used, which incorporates an online school platform https://rosestrieder.mat.br/ , from the Investigative Didactic Sequence to record the actions.

SCIENCE TEACHING SEQUENCE

Teaching methodology refers to the act of teaching involving a series of efforts and choices, reflected in suggested paths called methodological options. The teacher is the one who organizes and proposes situations in the classroom to present specific content. In this sense, we can say that the teaching methodology is implemented in its theoretical assumptions through the application of teaching methods and that the methodology used by the teacher is related to their worldview and knowledge. This methodology is subject to change when the teacher can systematically reflect on their professional practice (Anastasiou, 1997).

As this research presents a qualitative approach to analysis, according to Carvalho and Gonçalves (1999) some characteristics are essential to guarantee teaching through investigation: teachers are responsible for planning activities and creating an environment conducive to investigation; activities related to problem solving and collaborative work.

In this way, the Science Didactic Sequence: teaching by investigation in the 9th year of elementary school presented in this research is composed of an investigation plan/script (Table 1). Regarding this, Ponte (2002, p. 18) states that "investigations into practice use the most common work plans and techniques of social and human sciences and, in particular, studies in education". The script serves for students to familiarize themselves with all the moments of the classes and what will be analyzed in the next meeting and is divided into 6th Meetings, each being subdivided into content, objective, intended learning results, teaching activity and teaching activity. learning in order to achieve the objectives for data production and analysis.

Table 1: Didactic Sequence Script

<table>
<tr><td colspan="3">INTERACTIVE PERIODIC TABLE IN SCRATCH: A MATHEMATICAL APPROACH TO PERIODIC PROPERTIES IN CHEMISTRY TEACHING</td></tr>
<tr><td colspan="3">TEACHING SEQUENCE SCRIPT
This itinerary helps students to familiarize themselves with all the moments of the classes and what will be analyzed at the next meeting. The Didactic Sequence is divided into 6th Meetings, each subdivided into content, objective, intended learning results, teaching activity and learning activity.</td></tr>
<tr><td>1st Meeting - Survey of students' prior knowledge and contextualization of the topic.</td><td>Duration: 100 min.
(02 classes of 50 minutes)</td><td>Location: Computer Laboratory</td></tr>
<tr><td>Contents</td><td colspan="2">Periodic table</td></tr>
<tr><td>Objective of the lesson</td><td colspan="2">➢ Socialization about the research, the methodologies used, the subjects covered, the teaching resources that will be applied;
➢ Delivery of image and voice authorization terms, the informed consent form and the itinerary of activities that will be carried out during the six meetings and a printed periodic table.
➢ The aim is to promote strategies that contribute to the contextualized knowledge of the Periodic Table and the development of students' skills.</td></tr>
<tr><td>Results
learning objectives</td><td colspan="2">▪ Know the origin of the Table Periodic;
▪ Understand the organization of the Classification Periodic;</td></tr>
<tr><td>Teaching Activity</td><td colspan="2">➢ Identify what students already know about the content and what their difficulties.
➢ Identify in the Periodic Table – structure and organization of the elements.
➢ Distribution of Periodic Tables: the tables will be distributed to all students to be used as reference during class;</td></tr>
</table>

Learning Activity	▪ To gather prior knowledge, a roundtable will be held. conversation. ▪ Applicability of the elements in everyday life and curiosities.		
2nd Meeting - Contextualization of the theme (Continuation of the 1st Meeting)		**Duration: 100 min. (02 classes of 50 minutes)**	**Location: Computer Laboratory**
Contents	Periodic table		
Objective of the lesson	The aim is to promote strategies that contribute to the contextualized knowledge of the Periodic Table and thedevelopment of skills of students.		
Intended learning outcomes	▪ Know the symbols of chemical elements and their origin; ▪ Learn to write/position and locate the symbols;		
Teaching Activity	➢ Using the current Periodic Table printed; ➢ Present the elements and symbols chemicals;		
Learning Activity	▪ Learn the writing/position and location of symbols in the Periodic Table; ▪ Activities for understanding.		
3rd Meeting – Introduction to *Scratch*		**Duration: 200 min. (4 classes of 50 min.)**	**Location: Computer Laboratory**
Contents	*Scratch* interface , event block, movement, appearance and control.		
Objective of the lesson	*Scratch* block programming environment .		
Intended learning outcomes	▪ Recognize and classify the different types of blocks in the *Scratch* ; ▪ Develop the beginning of the construction of the Interactive Periodic Table using programming blocks presented.		
Teaching Activity	➢ Delivery of a practical guide to *Scratch;* ➢ Present the *Scratch interface* and exemplify the use of event blocks, movements, appearance and control; ➢ Read and explain the construction script “Periodic Table Interactive”; ➢ Present the Questionnaire classroom.		
Learning Activity	▪ Start building the “Periodic Table” in *Scratch* Interactive”; ▪ Answer the questionnaire classroom.		
4th and 5th Meeting – Construction of the interactive periodic table in *Scratch* .		**Duration: 300 min. (6 classes of 50 min.)**	**Location: Computer Laboratory**
Contents	Steps in the process of building the Interactive Periodic Table in *Scratch* .		
Objective of the lesson	Present the steps in the process of building the Interactive Periodic Table in *Scratch.*		

Intended learning outcomes	You students after The construction from the Table Periodic interactive, can interact with it in order to understand a historical context, understanding that each chemical element inserted there has its properties, its characteristics, its applications and its history.		
Teaching Activity	➢ Present the elements that make up the Periodic Table and exemplify the process of construction; ➢ Read and explain the script for constructing the Interactive Periodic Table; ➢ Show The Table Periodic Interactive already built for the teacher in *Scratch* based on the research script developed.		
Learning Activity	▪ Construction of the Interactive Periodic Table in *the Software Scratch* ; ▪ Questionnaire of meetings.		
6th Meeting - Atomic Mass		**Duration: 100 min. (02 classes of 50 minutes)**	**Location: Computer Laboratory**
Contents	Calculation of average atomic mass		
Objective of the lesson	Address interrelated concepts in Chemistry and Mathematics, how to calculate atomic mass and check whether the constructed Periodic Table will help students in this stage.		
Intended learning outcomes	▪ Define and determine mass atomic; ▪ Calculate The pasta atomic in one element through from the equation of the arithmetic mean weighted; ▪ Use of the Interactive Periodic Table built by student himself as support in solving activities.		
Teaching Activity	➢ Conceptualize what the atomic mass of an element is chemical; ➢ Show where to find the atomic mass in the Periodic Table ; ➢ Conceptualize and determine the equation for calculating atomic mass using the weighted arithmetic mean; ➢ Explain and comment on some examples of calculations.		
Learning Activity	▪ You students should calculate The pasta atomic in some elements, through activities and resolution, have as assistance the Interactive Periodic Table built by him same; ▪ Questionnaire regarding Sequence Didactics; ▪ Forums.		
Totaling a workload of 800 minutes (16 classes of 50 minutes)			

Source: Prepared by the authors (2024)

At the first meeting, a survey of the students' prior knowledge and contextualization of the topic was carried out. At this meeting there was a presentation by the teacher/researcher to the participating students and vice versa, in addition to a brief speech about the contextualization of the

research and initial access to the website created by the researcher, which includes an online school platform https:// rosestrieder.mat.br/, from the Investigative Didactic Sequence to record the actions of all meetings. The image and voice authorization terms were then handed over: informed consent form – TALE and informed consent term/record – TCLE, as well as the script of activities carried out during the six meetings and a printed Periodic Table. The study carefully followed the guidelines of the consolidated opinion of the UNEMAT Research Ethics Committee, numbered 5,823,782. The identity assigned to the students was made with the letter "A", followed by a number: "A1", "A2", "A3" ... "A13", successively, to identify the thirteen participants, with the aim of preserving their identity.

The Science Didactic Sequence: Teaching by Investigation in the 9th year of Elementary School was applied with thirteen students from the 9th year "A" of Elementary School in the morning in person with six meetings, one in each week totaling six weeks, 16 classes of 50 minutes each (800 total minutes). All meetings were held between March and April 2023 in the computer laboratory of the Escola Estadual Professor João Batista de Tangará da Serra -MT.

Data were collected through questionnaires, conversation circles and observations , following the guidelines proposed by Flick (2009), which values the quality of information in qualitative research, highlighting the importance of these resources in the process of collecting, investigating and analyzing information. .

Given the outlined context, this research used the inductive method for the treatment and analysis of the collected data, due to its flexibility and adaptability to the research context, enabling the identification of patterns and trends emerging from the data (Oliveira, 2016). Data analysis involved organizing information based on the criteria of research sources, moments and instruments used, identifying units of analysis and building categories to group similar information (Sampieri, Collado, Lucio, 2013; Lüdke, André, 1986).

RESULTS OF THE DIDACTIC SEQUENCE AND DISCUSSION

The research results were produced (through questionnaires, conversation circles and observations), through discussions within the scope of the application of a Science Didactic Sequence: Teaching by Investigation in the 9th year of Elementary School. The discussions presented reflect the conceptions of the research participants on the proposed theme, which addresses the construction of an Interactive Periodic Table in *Scratch* , with a mathematical approach to periodic properties in the teaching of Chemistry.

The Periodic Table is a fundamental and relevant resource for obtaining information about chemical elements and their properties, being considered an indispensable instrument for the study of Chemistry (Oliveira *et al,* 2015). The central idea of the Periodic Table comes from its name itself, it

is its periodicity, that is, the regular repetition of some physical-chemical properties throughout a period (Berbaum; Maldaner, 2016). To better understand the importance of this resource, it is necessary to know its history and understand its structure. In this sense, it is important to analyze students' knowledge about the Periodic Table, in order to identify their ideas and perceptions on the topic, questions were asked and a conversation circle was promoted.

When asking students what is the Periodic Table about? It was observed that the majority of students defined it as a resource for organizing chemical elements already discovered, by their physical-chemical properties and in increasing order of atomic number. *"The Periodic Table is a tool for organizing the chemical elements already discovered, grouping them by similarity of physical-chemical properties and in increasing order of atomic number." TO 1.*

Some students mentioned the importance of grouping these elements into families or groups, for example, *"The periodic table is a table that indicates chemical elements, which are discovered over time, organizing the elements and grouping them into families/groups" A3* . One student highlighted the history of the Periodic Table by mentioning Russian chemist Dmitri Mendeleev. As presented by Leite (2019), the milestone in the history of the Periodic Table occurred in 1869, when Dmitri Ivanovic Mendeleev, a Russian, exposed his first diagram of the organization of the elements to the Russian Chemical Society. This historical milestone was elucidated by student A6.

> "The Periodic Table is a tool that aims to organize and group all the chemical elements ever discovered by human beings. It was developed in 1869 by the Russian chemist Dmitri Mendeleev, who organized elements with similar properties into groups and placed them in ascending order of mass" (A6).

It is important to highlight that the Periodic Table is an indispensable resource for the study of Chemistry, but why is it called Periodic? According to the students' responses, the name is due to the organization of chemical elements into periods, resulting in the repetition of properties at intervals of time, where elements with similar characteristics are grouped together, highlighting the close connection between the domains of Mathematics and Chemistry.

As emphasized by student A1, *"it is due to periodicity, that is, the repetition of properties, from interval to interval"*. In this context, interdisciplinarity becomes evident, since the organization by periods allows the grouping of chemical elements according to their characteristics, simplifying their classification and identification. This approach involves concepts from both Mathematics and Chemistry.

This arrangement, which is the result of the interdisciplinarity between these two disciplines, allows the properties of the elements to be analyzed in a systematic and organized way, as highlighted by student A6.

> “elements are classified in a tabular arrangement in which a row is a period and a column is a group. Elements are arranged from left to right and top to bottom in the order of their increasing atomic numbers” (A6).

The Periodic Table is also a resource that serves teaching purposes, as student *A2 points out: "It helps the elements to be identified in an easier way."* Furthermore, it is used in advanced scientific research to predict the properties of unknown elements.

In short, the Periodic Table is called Periodic due to the organization of chemical elements into periods, which allows the repetition of properties at intervals of time. Understanding these periodic properties of chemical elements allows us to understand how they are organized in the table, indicating the possibility of a certain chemical bond occurring and, also, the projection of new compounds and materials (Atkins; Jones, 2012)

Through a conversation circle, students participated in a broad discussion about the history of the Periodic Table, which included topics about its creation, development and evolution, as well as its importance for understanding Chemistry and Science in general. Additionally, students explored the practical applications of the elements of the Periodic Table in their everyday lives. From the students' reports, it was possible to identify the following relevant perceptions.

Student A2 highlighted the importance of the meeting, highlighting the rich learning about the history of the table and its evolution over time, mentioning the transition from spiral-shaped tables to a more visible and easy-to-identify form . This broad understanding provided a solid foundation for further study.

> Today was our first meeting, and there was a lot of learning, with the history of the periodic table, which has existed since the 19th century (19), evolving over time, with new elements and tables, which were previously spiral-shaped and now It has a more visible and easier to identify shape. (A2 – RC 03/15/2023).

Student A6 shared his understanding of the history of the Periodic Table and the discovery of its elements. Furthermore, he noted the presence of these elements in our daily lives, recognizing the practical importance and relevance of the table for understanding the world around us.” *I learned about the history of the periodic table, about its elements, that some elements from the periodic table are in our daily lives. (A6).*

The A10 experience was marked by an interesting class, dedicated to the study of the Periodic Table. He valued the comprehensive approach that included not only the history of the table, but also the scientists who contributed to its discoveries and the table model we know today. The personal affinity with the topic made the experience even more rewarding and stimulating.

> Today was an interesting class, we studied the periodic table, its history, the scientists who contributed to the discoveries of the elements and also the table model we know today. It's a

topic that I'm very interested in, and I really enjoyed having the opportunity to study the subject! (A10 – RC 03/15/2023).

Student A13 expressed his appreciation for learning about chemical elements and their importance for our survival. He highlighted: *"I thought it was cool, I learned that we have several chemical elements that are important for our survival, such as iron, hydrogen, nitrogen, among others"* . This discovery emphasizes the practical relevance of the Periodic Table in our daily lives.

These different perspectives and discoveries shared by students during the conversation demonstrate the enrichment of knowledge and the connection established between the history of the Periodic Table, its practical application and the importance of chemical elements in our world. The theme of the Periodic Table is of great relevance not only for learning Chemistry, but also for life. Understanding the concepts and properties of chemical elements is fundamental for understanding various natural phenomena and for the technological and scientific development of various areas, such as health, energy and the environment. In Figure 1, we can see some images from the 1st meeting.

Figure 1: Photos from the 1st meeting



Source: Prepared by the Authors (2024)

In the second meeting, the contextualization and general notions of the Periodic Table continued, addressing the names of groups/families and classifications. Students carried out research on chemical elements on *Chromebooks* , seeking information about the history and physical and chemical properties of each element, which expanded their knowledge about them.

This deepening allowed them to better understand the concept of a chemical element, defined by the students as a set of atoms with the same atomic number, that is, the same number of protons in the nucleus. This definition not only highlights the importance in Chemistry, but also reveals the direct relationship with Mathematics, as atomic numbers are integer values that underlie the organization of the Periodic Table, thus highlighting the interdisciplinarity between these areas of knowledge.

In A6's view , *"chemical elements are a set of atoms that have the same atomic number (Z), that is, the same number of protons in the nucleus, and that, therefore, have the same physical-chemical properties."* That is, chemical elements have similar properties due to the number of protons in their nuclei.

A9 *states* that *"It is a set of atoms that have the same atomic number (z)".* Student *A3* highlights the *"discovery of elements by scientists over the years, and how these elements are often provided by nature".*

In fact, the concept of a chemical element is like a set of atoms with similar characteristics. This definition was presented by Russell (1994), who stated: an element is a pure, fundamental *and elementary substance. An element cannot be broken down into other, simpler substances* . Furthermore, according to Brown et al. (1999) an element is a substance that cannot be decomposed into simpler ones, as each element is composed of only one species of atom.

When asked about the importance of chemical elements for our lives, students highlight the immense relevance of these elements for our survival and for maintaining the conditions necessary for life on the planet. As they pointed out, chemical elements play an essential role in the proper functioning of our organism and in preserving environmental balance. These students' perceptions exemplify the interdisciplinarity inherent to the topic, supported by Miranda's (2013) vision of interdisciplinarity, which is based on reading the individual's reality, considering their singularities, nuances and present diversity.

For *A2* , chemical elements are *"extremely important, as we need them to live".* This is due to its presence in the constitution of our body, as well as in the composition of the water we drink, the air we breathe, the food we consume and the medicines we use. A3 highlights this importance *by* mentioning that *"hydrogen and oxygen provide us with water and air, which are essential for our survival."* These student observations demonstrate the interconnection between Chemistry, biology and health, reinforcing the need for an interdisciplinary approach.

Chemical elements also play a very important role in the manufacture of products that are part of our daily lives, as *A6 explains: "Chemical elements form everything we know, from our body to the fuel that drives our car. They are part of the our food and diet."* This highlights the interdisciplinarity in the integration of Chemistry with areas such as engineering, technology and nutrition. The way we

use these chemical elements is, therefore, fundamental for preserving the environment and promoting a sustainable future, which reflects the interdisciplinary complexity of the topic.

In general, participants A8, A10 and A11 highlighted the indispensability of chemical elements for our lives and the proper functioning of our bodies. These students' perspectives corroborate Miranda's (2013) vision of interdisciplinarity, which highlights the importance of an integrated approach to fully understand the impact of chemical elements on our existence, involving not only Chemistry, but also biology, ecology and other related disciplines.

Regarding the question about students' familiarity with the nomenclature of chemical elements, it is clear that not everyone has prior knowledge on the subject. The nomenclature of elements is fundamental to understanding Chemistry, Science and the world around us.

While some students claim that they do not know the nomenclature of chemical elements, such as A1 and A7 stating *"no",* others demonstrate some knowledge, such as *A4* who stated that they know " *some, such as iron (FE) which is located in our body, for example , and oxygen, which is identified by the letter (O) which represents air"* . And *A3* mentions that he knows *"a little"* of the nomenclature, but not much.

Some students also highlight the importance of nomenclature for understanding chemical elements and their histories, as mentioned by *A6: "it serves to help memorize chemical elements",* and by student *A8: "because it helps memorize the elements and write down their history ".* Furthermore, *A9* highlights that *"the names and symbols of the elements have to do with their original names, which are usually in Latin or Greek".*

It is important to remember that, just like the nomenclature of elements, the nomenclature of other inorganic functions, such as acids, salts and oxides, follows some rules, as stated by *A10* . Understanding these rules is essential for understanding Chemistry and for the proper use of elements and substances. In Figure 2, we can see some images from the 2nd meeting.

Figure 2: Photos from the 2nd meeting



Source: Prepared by the Authors (2024)

Considering that Digital Technologies are present in school environments through various resources, such as applications, *software* and the internet, generally contributing to the development of research, the streamlining of classes and the restructuring of the teaching process, *Scratch Software* is stands out as a methodological resource and its importance goes beyond simple programming, as it acts in an interdisciplinary way, establishing connections between concepts of Chemistry, Mathematics and Digital Technologies.

In addition to being an interdisciplinary resource, *Scratch* allows students without specific programming knowledge to develop their skills through programming blocks, where each block represents a function or control. This approach contributes to the development of Computational Thinking (Resnick *et al.* , 2009).

In the third meeting, the introduction to the Scratch software was carried out. Students were then invited to access the *Scratch platform* via the *link* https://Scratch.mit.edu and register, creating a login and password using their *Chromebooks* . The purpose of this meeting was to prepare students to develop programming skills and competencies in order to understand how it works and its contributions to the construction of the Interactive Periodic Table.

After having access to the platform, students had the opportunity to carry out exploratory activities in the *Scratch Software* , in order to familiarize themselves with its resources, they were able to try out different functionalities, such as movement, interaction between characters, creating a

background and inserting score, among others. Furthermore, they were encouraged to create their own activities, freely exploring *Scratch* and discovering more features on their own, as highlighted by Silva *et al.* (2016). These activities allowed students to use *Scratch* autonomously, stimulating their creativity and learning in an integrated way, improving their understanding and skills in different disciplines.

Scratch *empowers* students by granting them the power to create and control elements in the virtual world. Through this *Software* , they stop being just consumers of media and become producers, developing their own projects. They then have the opportunity to share their creations on the Internet, while learning and improving their computational skills (Passos, 2014).

Handling the *Scratch Software* in the computer laboratory, the students were asked about the experience if they already knew the *Scratch Software* . In general, responses indicated that using the program presented both challenges and positive aspects.

These responses reflect different student perceptions regarding the use of *Scratch Software* . Some students mentioned initial difficulties, such as understanding and creating elements, but highlighted that, with practice, they were able to overcome them and find programming easier. Student A1 mentioned " *more or less, he may have some difficulties in understanding* . Student A6 shared that " *It wasn't very difficult. The biggest difficulties I had were when assembling it, but once I got the hang of it, I was able to do it easily"* . Finally, student A10 highlighted that " *I found it difficult at first, but over time it became easier and practical as well as fun"* .

Other students expressed that they found *Scratch* fun and interesting, valuing its ability to teach programming in an engaging way. Student A4 already had some prior knowledge and found the experience fun, while A9 had his first experience with the program and found it interesting and enjoyable. Student A4, who already had some prior knowledge, described the experience as fun, stating: "yes, it's fun to program and your games are fun." Likewise, student A9, who had his first experience with the program, considered it interesting and enjoyable, commenting: "no, I thought it was really cool and fun, I liked it because it teaches us how to program in a cooler way".

The different perspectives highlight the challenging yet rewarding nature of prior *Scratch knowledge* and programming experience. In Figure 3, we can see some images from the 3rd meeting.

Figure 3: Photos from the 3rd meeting



Source: Prepared by the Authors (2024)

In the fourth and fifth meeting, the Interactive Periodic Table was constructed in Scratch. Using the *Scratch platform* (Figure 4), students had the opportunity to build one of the Interactive Periodic Table, demonstrating the application of interdisciplinarity, integrating Chemistry concepts with Digital Technologies and programming. Interdisciplinarity occurs when students apply knowledge of Chemistry to represent chemical elements in the Periodic Table and, at the same time, use programming to create interactions so that, when clicking on an element, information about it is displayed, such as the symbol, atomic number , atomic mass and other relevant properties. As shown in figure 4.

Figure 4: Construction of the interactive periodic table



Source: Prepared by the authors (2024)

During the construction of the Interactive Periodic Table in *Scratch,* the students encountered some difficulties in the process. One of the main difficulties was in relation to understanding and applying the programming concepts necessary to create interactions and display element information. A1's report highlighted that the *Software interface* can be confusing, requiring care not to get lost. " *You have to be careful because you might get lost."* A2 highlighted the importance of planning to avoid surprises *"I thought it was doing groups".* A6 mentioned that the complexity of the controls was a challenge " *All the complexity of being able to assemble the exact controls".* A7, on the other hand, only had difficulty fitting in some things " *only when fitting in some things, but it wasn't difficult".*

It is important to consider the students' lack of ability to deal with the *Software* and the programming required, since this was their first experience, which naturally makes the task more complex. On the other hand, this need for students to change commands and redo procedures can instigate reflection on the obstacles encountered, leading them to rethink mistakes and redo programming until they reach the final objective of the project (Pinto, 2010; Malan and Leitner , 2007). From this perspective, what could have initially been seen as a negative aspect can be interpreted as a characteristic with benefits. In addition to the difficulties encountered during the construction process, the students also identified some advantages. Student A1 cited the ability to change commands in real time as an ease " *you can fix the wrong commands whenever you want"* .

A6 mentioned that, once he learned the repetitive commands, creating the Interactive Periodic Table became easier " *At first, it was quite complex, but once I learned it it became easy, mainly because of the repetitive commands"* . This demonstrates the importance of repetition and commitment to the learning stages.

A7 highlighted the organization of commands according to their use " *the commands organized according to use, it is easier to find that way"* . This made the search for solutions easier, as the location of specific resources was grouped by function.

Student A10 mentioned the ease of use of the *software* and the clarity of the teacher's explanations as positive points: " *the way to program, as the commands are easy to use, and the teacher explains very well"* . The *Scratch* commands were considered easy to learn and use, and the teacher's ability to explain how the *software works* helped students understand the concepts necessary to construct the Interactive Periodic Table.

Finally, student A13 expressed that he found the process dynamic and did not face significant difficulties " *look, I found it very dynamic, the teacher explained it well so I didn't find it difficult at all"* . He highlighted that the teacher's good explanation contributed to his understanding and the fluidity of the work in the *Scratch Software* .

By building the Interactive Periodic Table in *Scratch,* students improved their programming skills. They planned and structured the logic behind the interactions and information displayed, in addition to learning basic programming concepts, such as variables, conditionals, also allowing them to interact with their own creations in order to perceive a historical context, understanding that each chemical element there inserted has its properties, its characteristics, its applications, its history and the calculation of atomic mass, as it is an interrelated concept in Chemistry and Mathematics and of course they shared their creations with colleagues, promoting collaboration and the exchange of knowledge.

Overall, this construction provided an enriching educational experience, integrating concepts from Chemistry, Mathematics and programming in an interactive way, that is, students improved their programming skills, planned interactions and information, demonstrating how interdisciplinarity can expand knowledge and deepen their knowledge in Chemistry. In Figure 5 A, B we can see some images from the 4th and 5th meetings.

Figure 5: A) Photos from the 4th Meeting , B) Photos from the 5th Meeting



Source: Prepared by the Authors (2024)

In the sixth meeting, the interrelationship between Chemistry and Mathematics was addressed, focusing on the calculation of atomic mass and the use of the Periodic Table constructed by students as an aid in this process. Chemistry has vast contents and many peculiar languages, full of nomenclatures and notations as a way of understanding the meaning of phenomena, suggesting memorization and deciphering that often makes no sense to students. This often makes it difficult to know how to connect chemical theories to the behavior of materials. However, the importance of this language and different approaches to teaching interrelated Chemistry and Mathematics content cannot be underestimated. About the factors that can create challenges in teaching Chemistry. Santos, Silva and Lima (2013) point out that the lack of a solid theoretical foundation in Mathematics, as

well as the lack of connection between the content taught in the classroom and the daily lives of students students is a fact.

By interrelating these disciplines, students have the opportunity to explore the relationship between chemical elements and the mathematical calculations necessary to determine properties such as atomic mass. According to Russel (1994, p. 242) “the atomic mass of an element is calculated by the average of the masses of the isotopes of that element. The average needs to be weighted to take into account the relative abundance of the isotopes.” To calculate the atomic mass of an atom in Chemistry, it is essential that the student has a good understanding of the mathematical concepts related to equations, as well as the operations involved in them. Therefore, to calculate the atomic mass of an atom, the student must add the atomic mass value of each isotope multiplied by its percentage of occurrence in nature. Then, this value must be divided by 100 to obtain the result in percentage form. This relationship can be expressed through the following equation:

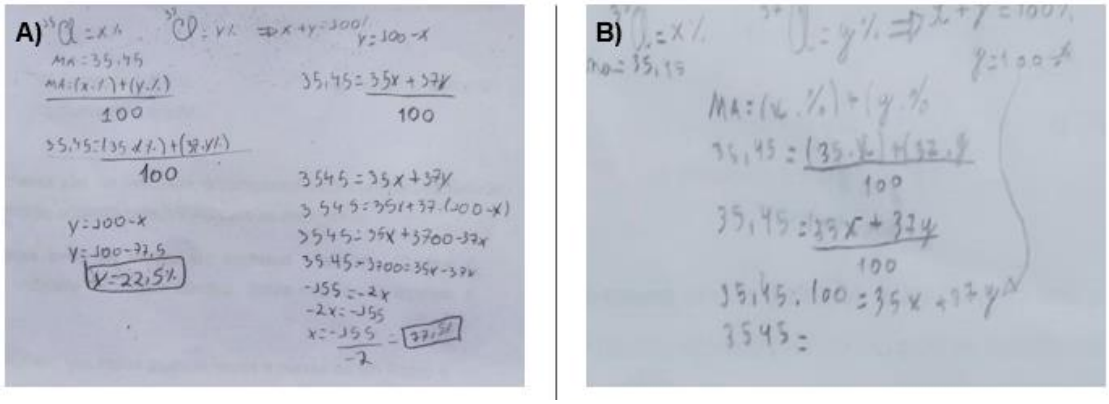
$$MA = \frac{[(\%_1 \text{ x } MA_1) + (\%_2 \text{ x } MA_2) + \ldots]}{100}$$

Where:

- MA: Atomic Mass,
- $\%_1$, $\%_2$: Percentage of isotope abundance,
- MA_1, MA_2: Atomic mass of isotopes.

After developing the interdisciplinary class with the help of the Interactive Periodic Table, problem situations were presented to the students so that they could put their knowledge into practice. One of the situations addressed was the following: (FGV) Chlorine is found in nature in two isotopic forms of 35 and 37 atomic mass units. Given that the average atomic mass of chlorine is 35.45 µm, what is the percentage of the two isotopes in nature? The resolution of this situation made by students A3 and A11 is shown in Figure 6A and B.

Figure 6: A) Resolution of the complete MA calculation, B) Resolution of the partial MA calculation.



Source: Researchers’ archive (2024).

The students were able to correctly formulate the equation and perform the operations appropriately. In total, 9 of the students solved the problem completely, while 4 were able to correctly operationalize the elements within the equation. In this way, we believe that the approach to mathematical concepts to assist in the teaching of Chemistry had significant results in students' understanding.

In order to evaluate the influence of the Interactive Periodic Table on the process, we asked students to answer the following question: What was it like to solve the questions about calculating atomic mass when interacting with the Interactive Periodic Table that you built in *Scratch Software* ? (Figure 7).

Figure 7: Interaction with the Interactive Periodic Table to calculate atomic mass.



Source: Prepared by the Authors (2024).

Based on student responses, using the Interactive Periodic Table to solve atomic mass calculation activities proved to be a beneficial and positive experience. As mentioned by student A2, *"it helped a little with the calculations of classroom tasks and other things".* On the other hand, student A4 recognized that *"it's a little complex because we can get lost in the middle of the process, but I believe that, as we do more activities, it can become simpler and even fun"* . Student A11 expressed that *"it was a little difficult at first, as the mathematics is very complex"* , highlighting the complexity of the Mathematics involved in the calculations, which makes using the table initially challenging. Despite this noted complexity, student A7 highlighted that the table was useful in the complex calculations necessary to determine the atomic mass, stating that *"it was not that easy, but it helped a lot, which made the calculations easier, as the calculations are a little complex"* .

Finally, student A8 evaluated the use of the Interactive Periodic Table as a positive experience, stating that *"it was really cool, I learned a lot of different things, but I found the calculations a little difficult"* , highlighting the challenges faced in the calculations. On the other

hand, student A12 highlighted that the table facilitated the learning process, expressing that *"I thought it was really cool and it's easier to learn".*

The Periodic Table is an important instrument in the field of Chemistry, as it allows us to understand different aspects of chemical elements including atomic mass, which is essential for chemical analyses. Scerri (2007) reaffirms that the Periodic Table plays an indispensable role in the study of Chemistry, since it is through it that all chemical elements are found, organized in a way that allows the observation of their properties and similarities.

At this stage of the Didactic Sequence, students used *Scratch Software* to build an Interactive Periodic Table to work with activities related to the Periodic Table and atomic mass calculations. In this sense, the students were asked: What improved your understanding of the concepts of the Periodic Table and its atomic mass calculations when using *Scratch Software* for construction and interaction during activities?

According to the students' responses, using *Scratch Software* to construct and interact with the Interactive Periodic Table was beneficial in relation to understanding the concepts of the Periodic Table and atomic mass calculations. As evidenced by student A4, *"I was able to understand better thanks to the interactive table, as it is easy to use and learning becomes more enjoyable".*

Student A7 highlighted that *"through the construction of the periodic table, I learned more about the elements and I am also learning about how to calculate atomic mass".* Student A6 mentioned that *"Scratch helps a lot with certain activities"* , while student A11 stated that *"well, I still didn't know the periodic table, but the little I learned was enough for me to learn more about it, in my understanding was the calculations of atomic mass".*

Finally, A12 highlighted that *"Before classes I didn't know anything, now I know".* Using *Scratch Software* allowed him to gain knowledge and understanding regarding the Periodic Table and its calculations.

Based on the answers provided by students, using the Interactive Periodic Table to perform atomic mass calculations proved to be a useful and beneficial resource, even though some students mentioned that this approach was a bit complex and challenging.

However, they noticed an improvement in solving activities and understanding concepts. These results corroborate the idea of Marcondes and Peixoto (2012), who advocate contextualized Chemistry teaching, which involves both procedural and attitudinal knowledge, allowing students to construct knowledge instead of just absorbing it.

In this context, the use of *Scratch* as a teaching resource provided students with the opportunity to explore *software* that encourages the creation, protagonism and sharing of ideas and information. Specifically, when teaching the Periodic Table and calculating atomic mass, *Scratch* favored the development of essential skills, such as basic notions of programming.

In the conversation circle, students were able to share their experiences and opinions about the meeting and the knowledge provided. Initially, some students had difficulty understanding the topic, but with the researcher's explanations, they were able to understand it better. According to A1's report, *"it was difficult to understand but after the explanation everything became easier to understand!!"* , demonstrating that the interdisciplinary approach was fundamental to knowledge.

Although it was a little challenging for some students, as mentioned by A4, " *I thought it was really cool, but it was a little complicated and had some difficulties",* overall, the meeting was seen as an interesting and useful opportunity for improvement. As A8 stated, *"it was a very good meeting and a lot of learning, we saw that mathematics is related to various subjects and in everyday life".*

The reports of A9 and A10 point to a positive experience in relation to interdisciplinary teaching about atomic mass. From this same point of view, the National Curricular Parameters (2002, p. 89) consider that "interdisciplinarity must start from the need felt by schools, teachers and students to explain, understand, intervene, change, predict, something that challenges a discipline isolated and attracts the attention of more than one look, perhaps several". A9 highlighted the importance of acquiring knowledge in the areas of Science and Mathematics, expressing his satisfaction by saying *"I found it rewarding to learn new content related to science and mathematics, I believe I managed to assimilate the material in a certain way".* In a similar way, A10 demonstrated his interest in learning new calculations associated with atomic mass by stating *"It was very intriguing to acquire knowledge about these new calculations related to atomic mass."* These reports show that students not only understood the relevance of the topic addressed, but also engaged positively in the context of interdisciplinary teaching.

Despite having encountered some challenges during the mathematical calculations, A11 evaluated the meeting positively, considering it very cool. He expressed his appreciation for the experience, mentioning *"I really enjoyed it!!! Today was really cool, removing some difficulties regarding the MATHEMATICAL accounts."*

By analyzing the results and students' perceptions, we can see the effectiveness of the interdisciplinary approach between Chemistry and Mathematics, using the Interactive Periodic Table in *Scratch Software* . This integration allowed students to visualize and interact with chemical elements, understand the structure of the Periodic Table and perform atomic mass calculations in a practical and contextualized way. From this perspective, the adoption of interdisciplinary practice emerges as one of the viable solutions to overcome the fragmentation and lack of contextualization of knowledge, in addition to contributing to the search for solutions to complex problems (Morin, 2000; BRASIL, 2017; Fernandes, 2007) .

Furthermore, during the conversation circles, students were able to express their opinions and share their experiences. These discussions provided a greater understanding of the challenges faced

by students, as well as their achievements and development throughout the knowledge process. In Figure 8, we can see some images from the 6th meeting.

Figure 8: Photos from the 6th meeting



Source: Prepared by the Authors (2024)

Regarding the Didactic Sequence developed with the teacher using Digital Technologies, it can be said that it was very well accepted by the students, and contributed to more efficient and interesting learning. A4 highlighted that the project helped a lot in understanding the content studied in the classroom, as mentioned *"I really liked it because I was able to understand the content much better with the project, before I had more difficulties"* .

Furthermore, the students also highlighted that the Didactic Sequence was a fun way of learning. *"I really liked it, because it's been a fun way and I'm learning a lot from our meetings. And they are useful topics in our daily lives"* as A7 said. A8 mentioned that Digital Technologies can be very useful for learning, facilitating the understanding of the content studied, according to his statement *"my assessment is 10, digital technologies make learning a lot easier"* .

Thus, the students' responses indicate that the Didactic Sequence was successful in achieving its objective of supporting and integrating Digital Technologies in the knowledge process, making it more interesting and stimulating for students. Some students also highlighted that the Didactic Sequence was essential to help in Science classes, as mentioned in this answer by A13 *"It's a lot of fun and helps a lot in science classes".* Finally, it is clear that the teacher played an essential role in the success of the project, according to A2 *"she helped a lot with studying in the classroom".*

Regarding *Scratch Software* , students gave it a positive evaluation and shared their experiences enthusiastically. A1 described the experience as "incredible", giving the maximum score of 10/10 and praising the teacher's good explanation. According to the excerpt of his speech *"it was incredible 10\10, and the teacher also explained it well".* Student A4 mentioned that *"it was a little tiring to do, but it wasn't difficult. In the end, using Scratch was an interesting experience."* He acknowledged that it was a little tiring, but using *Scratch* was not difficult and that the experience was interesting and allowed him to explore new study approaches.

A8 expressed his satisfaction with the project, emphasizing that using *Scratch* helped a lot in learning chemical elements. For her, using this technological resource was an engaging and effective way to understand the concepts, providing a positive and beneficial experience. *"I thought it was cool that Scratch helped a lot in learning about chemical elements".*

Finally, the A10 *"was cool, I really liked it and my experience with it was great"* describing his experience with *Scratch* as cool and highlighting how much he liked the project. For him, using the *Software* was an enriching teaching opportunity and his overall evaluation was very positive.

These responses reflect the positive impact of the Didactic Sequence using *Scratch Software* on students' understanding. Involvement with this technological resource sparked enthusiasm, improved understanding of concepts and made the teaching process more interesting and engaging. Positive feedback from students highlights the potential of *Scratch as an* educational resource and demonstrates the success of the Didactic Sequence in providing an enriching experience of studying and exploring content.

CONCLUSION

This didactic sequence contributed to the acquisition of conceptual content and attitudes, values, facts and procedures. And it allowed us to verify that the *Scratch Software* at the teaching in Chemical showed up one important resource, allowing an interdisciplinary and technological approach that can favor both the school context and the understanding of important concepts in the area of Chemistry and Mathematics. It is also important to highlight that the practical classes held in the computer laboratory, within this interdisciplinary approach, became enjoyable and motivating for the students. They demonstrated an interest in solving problems, formulating hypotheses, testing them, and adjusting their ideas based on experimental results. This approach aroused curiosity and interest in teaching Science, enabling the construction of new knowledge and providing students with a new way of thinking about Chemistry through the connection between reality and practice.

As a suggestion for future studies, it is recommended that teachers apply the investigative didactic sequence and carry out similar research to verify the results obtained and compare them with those of this research. Furthermore, it is important that investigations are carried out in different

classes in order to develop a more comprehensive approach in terms of analyzing and understanding the results. Another relevant aspect is starting the teaching process based on the students' prior knowledge, seeking to rebuild their understanding of the topics to be covered. This approach can contribute to a more enriching and effective educational process, taking into account the particularities and experiences of students. In this way, it will be possible to expand knowledge about the effectiveness of teaching sequences and improve the teaching strategies used.

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Teaching Practices in Biology, History, and Geography, from Plants ritualistic and medicinal rituals used in Umbanda terreiro in southeastern Brazil

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ABSTRACT

The starting point of the present research is to know the medicinal and ritualistic plants of the Umbanda terreiro in São Mateus-ES. As this is an anthropological research, there is this starting point but the arrival point cannot be predicted. Umbanda is an Afro-American, and Afro-Brazilian, marginalized religion that underwent a process of Christianization when its practicing people arrived on Brazilian soil. Based on this, it is an "outside" cultural practice of Western Christian scientific knowledge, and it is also a marginalized reality. The specific objectives are: (1) To carry out a survey of plant species in the Umbanda terreiro; (2) Carry out a survey of plant species of a ritualistic nature; (3) Build a witness collection of useful plants from the Umbanda terreiro through exicatas, dried herbs and a live collection in pots; (4) Investigate the biological name from the common name collected, and the origin of the plant; (5) Develop interdisciplinary teaching practices in History, Geography and Biology from the knowledge collected; (6) Interview religious leaders of the Umbanda terreiro to learn about the plants used, common name, part of the plant used and how it is used. As methodological paths we will use the ethnography of school practice or anthropology of non-anthropologists for educational purposes; Malinowski's participant observation; Geertz's unstructured interviews; ethnographic reports and content analysis. For ethnobotanical work, the Hanazaki methodology will be used. For the preparation of teaching practices, the work will be based on Freire, Romão and Duarte-Silva.

Keywords: Afro-Brazilian culture, Afro-descendant populations, Africanities, Afro-Brazilian ethnic-racial relations, Ethnobotany.

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INTRODUCTION

The starting point of this research is to know the medicinal and ritualistic plants used in the Umbanda terreiro of São Mateus ES. As this is an anthropological research, one has this starting point but one cannot predict the point of arrival.

According to Roué (1997), the "ethnosciences" are the field of study linked to the natural sciences with the addition of the prefix *ethno*: ethnoecology, ethnobiology, ethnobotany, ethnozoology, ethnopharmacology, etc. Ethnosciences encompass the areas of research that propose to study the semantic categories of "outside" Western scientific knowledge (ROUÉ, 1997 apud ROZÁRIO, 2018). The present work proposes to document the knowledge, which we admit here as scientific, of an Umbanda Terreiro. Therefore, a knowledge "outside" Western scientific knowledge guided by the Judeo-Christian religious tradition, scientific academia and Western culture as a whole. Positivist scientific knowledge meets the Cartesian scientific method of research, unlike the research presented here, which is referenced in the methods of Human Sciences and Ethnography of school practice or ethnography carried out by non-anthropologist teachers. The method of Ethnography of school practice consists of literature review, document analysis, and fieldwork (ANDRÉ, 2020).

That is why we ask ourselves if ethnographic work is a scientific practice? Foucault. (2008) argues that the contemporary anthropologist is not a scientist but a journalist of marginalized realities. Bawman (2001), a contemporary sociologist, goes further; According to him, with the information society, each and every citizen becomes a journalist from the camera in hand and the publication on the world wide web of the observed social phenomena, as well as their opinion about them.

Umbanda is an Afro-American and Afro-Brazilian religion, marginalized, which underwent a process of Christianization when its practicing peoples arrived on Brazilian soil. Based on this, it is a cultural practice "outside" Western scientific knowledge and it is also a marginalized reality. Some of the importance of documenting a marginalized reality is to give voice to that culture, another is to bring the culture closer to its non-practicing descendants, and finally, to combat racism and prejudice. Including other issues such as xenophobia, religious intolerance, in a syncretic country, but very Christian and conservative.

Secondly, the documentation of the reality of the Umbanda terreiros also provides very relevant scientific data on the knowledge about ritualistic and medicinal plants that are important to ethnopharmacology.

OBJECTIVES

(1) To know the medicinal and ritualistic plants of the Umbanda terreiro of Pedra D'agua for pedagogical purposes. (2) To carry out a survey of the plant species used in the Umbanda terreiro. (3)

Carry out a survey of plant species of a ritualistic nature. (4) To build a collection of useful plants from the Umbanda terreiro by means of exicatas, dried herbs and a living collection in pots. (5) Investigate the biological name from the collected common name and origin of the plant. (6) Develop interdisciplinary teaching practices in History, Geography and Biology based on the knowledge collected. (7) Interview religious leaders of the Umbanda terreiro to learn about the plants used, common name, part of the plant used and how to use them.

BACKGROUND

Combating racism, knowledge of the use of herbal medicines, bringing the science of the traditional Afro-Brazilian communities of São Mateus closer to the Scientific Academy of UFES, promoting an intercultural dialogue.

MATERIAL AND METHODS

METHODOLOGICAL PATHS OF ETHNOGRAPHIC WORK

From the 1980s onwards, the method of participant observation became more practicable and less criticized, i.e., the non-distancing of the researcher and the researched in ethnological practice (TADDEI and GAMBOGGI, 2011). In the same way, at the same time, *the recovery of the oral life history of* the researchers gained strength in Historiography, in addition to the traditional documents (SILVA, 2004). Based on this, it became possible to call ethnological research a work that consists of the researcher's experience and deep *ethnological immersion* in the researched group and *autoethnographic* works (ROZÁRIO et al. 2018; DUARTE-SILVA, CONCEIÇÃO and SALES 2019; CONCEIÇÃO, ALMEIDA and DUARTE-SILVA, 2020) when these ethnographies document veiled or marginalized realities.

Based on ethnological immersion and participant observation (TADDEI and GAMBOGGI, 2011), unstructured interviews will be conducted according to Geertz's structures, or dialogues with scripts (DUARTE-SILVA, CONCEIÇÃO and SALES 2019). These non-recorded interviews, so as not to inhibit the interviewee, will generate ethnographic reports that are dense descriptions of the realities and dialogues experienced that will be described in the results of the present work (ANDRÉ, 2020; DUARTE-SILVA, CONCEIÇÃO and SALES 2019).

THEORETICAL AND METHODOLOGICAL FRAMEWORK

This work consists of a case study whose methodology used was the ethnographic work, according to André's theoretical-methodological assumptions (2020). These are short-term works, carried out by non-anthropologists, or professionals from other countries. areas of science. They do

not have an ethnographic purpose in themselves, but are carried out in order to seek answers for the specific areas of the researchers in question

The ethnography of school practice was used in the present work for the purpose of solving problems in teaching practice, and subsidies for Environmental Education, Ethnobiology and Botany Teaching. However, the historical and ethnographic value of the data researched here transcended its utilitarian character, and will be compiled in this work, with a purpose different from the initial objective.

The methods used in the research were: review of scientific literature, fieldwork and document analysis (André, 2020). “A work can be characterized as ethnographic in education, when it makes use of the techniques that are traditionally associated with to the ethnography, i.e. participant observation, intensive interviewing and document analysis. The researcher approaches people, situations, places, events, maintaining direct and prolonged contact with them. How does this contact take place? First, there is no pretense of changing the environment by introducing modifications that will be experimentally controlled as in experimental research. Events, people, and situations are observed in their natural manifestation, which is why such research is also known as naturalistic or naturalistic” (André, 2020 p.25).

Participant observations in ethnography

In the present study, participant observation was chosen as a working method instead of structured and semi-structured interviews. The work presented here deals with participant observation, intense interviews and, in isolation, some unstructured interviews. According to Taddei and Gamboggi (2011) on Malinowski's line of research, participant observation acts on data that are difficult to collect through formal interviews:

> "Malinowski realized that there is a research methodological problem related to the way certain issues are salient in the everyday thinking of members of a society, while others are not. There are things in our social existence that we don't talk about, and that's for a number of reasons. One of them is the fact that we internalize some forms of behavior in childhood and continue to repeat them in social life, in a habitual way, without paying attention to such behaviors. Another is that we learn to avoid talking about—or even thinking about—certain topics, such as taboo issues, even if events in some way related to such taboos are frequent. Malinowski realized that, by staying long enough with a certain social group, the researcher has the opportunity to observe behaviors and social events (such as certain rituals) that would hardly be mentioned in interviews" (TADDEI & GAMBOGGI, 2011).

Taddei and Gamboggi (2011) state that ethnography can be understood as more than a mere methodology, but taken in its sense of intercultural dialogue. The ethnographic experience, as a special instance of the more generic experience of communication, presupposes, from the outset, beings in contextual coexistence, making use of their conceptual and material resources to position

themselves in front of each other, in the dialectic between being existentially open (curiosity) and closed (fear).

Retrieval of oral life history

"Meihy (1996) mentions as an assumption that "Oral history implies a perception of the past as something that has continuity today and whose historical process is not finished" (Silva, 2004, p.11). Subjects construct knowledge based on a determined intention to make articulations between what they know and the new information they intend to absorb. In view of this assumption, it is necessary to write about the oral history of life is It is gratifying, it involves a whole historical and socio-cultural context from the past to the contemporary. "Oral history is indicated as a prospect. It is important for the research of subjects, for whom there is no other access, to answer new questions about old themes, to provoke new subjects and to open new perspectives of analysis (Silva, 2004, p.19-20).

Netnography

Netnography is understood as the netnographic method adapts techniques, procedures, and methodological standards traditionally employed in ethnography for the study of emerging cultures and communities on the Internet (CORRÊA and ROZADOS, 2017). Is It is in this context that netnography emerges, a research method, based on participant observation and online fieldwork, which uses the different forms of computer-mediated communication as a source of data for the understanding and ethnographic representation of cultural and communal phenomena (CORREA and ROZADOS, 2017). The term netnography is a combination of the words *Ethnography on the Net* and was coined by the American researchers Bishop, Star, Neumann, Ignacio, Sadunsky and Schatz in 1995 with the aim of describing the methodological challenge of preserving the details of observation in the ethnographic field using the electronic medium to monitor individuals (CORREA and ROZADOS, 2017).

MATERIALS

(1) Financial resources for the purchase of materials related to the terreiro (purchase of dispatches). (2) Material for herbalization: Press, ropes, newspaper, cardboard and aluminum foil, white cardstock, glue and paper labels. (3) Boxes and mothballs and paper labels for packing the herbs. (4) Pots, sand, clay, seedlings, humus and gardening supplies.

ETHNOBOTANICAL METHODS

(1) Survey of plant species in the Umbanda terreiro (ALVES, 2019). (2) Survey of ritualistic plant species (ALVES, 2019). (3) Construction of a collection of useful plants from the Umbanda terreiro (through exsiccatae, dried herbs, living collection in pots) (SANTOS, 2019). (4) Interview with religious leaders of the Umbanda terreiro to learn about the plants used, common name, part of the plant used and method of use (TADDEI and GAMBOGGI, 2011). (5) Investigation of the biological name based on the common name collected and the origin of the plant (DUARTE-SILVA et al., 2019). (6) Develop interdisciplinary teaching practices of history, geography and biology based on the knowledge collected (DUARTE-SILVA, MACIEL and SALES, 2014; MACIEL et al. 2014; DUARTE-SILVA et al. 2019; DUARTE-SILVA et al. 2020).

RESULTS AND DISCUSSION

AFRICAN-AMERICAN RELIGIONS

A bibliographic review of scientific works was carried out, and netnographic document analysis was carried out on the Youtube platform on the following items below.

Haitian and American Voudou (Mississippi, Louisiana)

Voudou or Voudouism is an African-American religion present in Haiti, and in the French-colonized states of the United States of America (USA), such as Louisiana and Mississippi. It is an Afro-descendant religion originating in the Gulf of Benin in the Africa, culturally based Gege or Jeje (we find both spellings). Yoruba-based religion. Religion that brings together knowledge of the Haitian indigenous culture, knowledge of the Catholic religion, and knowledge of the African Yoruba culture and language. The nuns wear white garments as in the Cuban Santéria, in the Brazilian Umbanda, and in the Afro-Brazilian Candomblé. The Altar is filled with images of Catholic saints, African rites, candles of all colors, alcoholic beverages, tobacco, dances and percussions. There is the cult of orishas and entities. There is Afro percussion and Afro dances. A peculiarity of Voudou is the use of human bones, exhumed, in religious rites. As well as, the painting of the face with white sand at the time of the incorporation of spirits. Some entities of Voudou are: the Loas, from the French ‘Les lois” ,that is, the laws. These are the most important deities of the Voudou. Examples include: Baron Samedi (Saturday in French, Creole), Maman Brigitte, Papa Legba. Different analyses of Haitian voodoo point to the fact that the term is used*Vodou*be used to define rituals that involve singing, dancing, drumming, commensality, and movements and promote interaction between humans and spirits (BULAMAH and DALMASO 2019).

Santeria Cubana: the umbanda of the Caribbean

Santeria is a term used for religions of indigenous and African ancestry existing in both Mexico and Cuba. Since Mexico does not have compulsory colonization of enslaved Africans, we are not going to analyze Mexican Santeria because it is not an African-American religion, but Cuban Santeria. The Santeria is an African-American religion present in Cuba. This religion brings together knowledge from the Cuban indigenous culture called "Taíno culture", knowledge from the Catholic religion, and knowledge from African culture. The nuns wear white garments as in Vodou, Brazilian Umbanda, and Afro-Brazilian Candomblé.

> For the believer of Santeria there is no doubt about this relationship, but even today it is believed only in the African orishas, and the image of the cult of the Catholic saint is superimposed on them. A series of practices are still carried out today in which Yoruba cultural elements remain, perfectly coordinated, although in some cases one element has been lost, forgotten or replaced by another. Religious elements of related groups have also been mixed, which have disappeared assimilated by our population. Today, there are no songs, no words, no touches, no deities, no minas, gangás, ibos, mandingas, etc., who at some point coexisted with the Lucumís or Yorubas." (LINARES, 1993, p.3).

Quimbanda of the Iberian and Brazilian left: exús and pombas-gira

In this item, we would like to point out that certain entities of the left-wing Quimbanda such as exús and pombas-gira, often seen as an integral part of Brazilian Umbanda, are actually of Iberian origin, and not African. There are several entities in the set of exús such as the Exú Caveira, Exú Caveirinha, Exú-Tata Caveira, Exú Tranca-rua, among others. The entities of the left-wing Quimbanda as well as the entities of Umbanda are disembodied people who help the incarnated ones by energetic means and incorporation of the medium, according to the religious rite. On the other hand, in Candomblé, the entities are orishas or deities who never descended to Earth in incarnated beings. Based on this, religious mythology proclaims, for example, that the Exú Tata Caveira was a Roman Centurion. Therefore, he will work on protection demands, such as São Jorge da Umbanda and Ogum do Candomblé. Exús are dispatchers or diplomats between human beings and deities. Hence the etymology of the word. According to religious precepts, the human being offers something to the Exú (offerings), Exú takes this demand to the deities, performing the dispatch, and the deities grant the wishes of the human being. There are several cute doves that are embodied by female, trans or cis (biological women or trans women) mediums. There are several Cute Doves: Maria Mulambo, Maria Farrapo, Maria Padilha, Gypsy, Queen, Rose, Maria Quitéria, Seven Keys, Rose of the Night and Girl. The mythology of the Quimbanda, through oral history, describes the Pomba-Gira Maria Padilha as a very beautiful lady, of Iberian origin, southern Spain, who had her body burned to the ground. So, this entity helps cis or trans women in matters of sentimentality and sexuality. The gifts that the Cute Doves ask for to perform the spells are usually of the color red, and involve lipsticks, nail polish and roses of the color red, and perfumes. Drinks and tobacco are also

part of the rite. Exús are sought after for matters of war. And doves-cute, for matters of love. The Quimbanda is called left-wing because the entities are to the left of the sacred orishas (NUAO, 2022).

African and Afro-Brazilian Candomblé

Candomblé is an African religion present in Brazil with a Yoruba cultural base, with Nagô language. Native to the Gulf of Benin, Guinea and Guinea-Bissau region. The nuns, called mothers of saints, wear white robes as in the Cuban Santeria, in the Brazilian Umbanda, and in the Voudou. The Candomblé terreiros are full of arboreal and herbaceous, ritualistic and medicinal plants, as well as African handicrafts, especially in clay. It is a polytheistic religion and there is the worship of deities called orixás: Iansã, Iemanjá, Oxum, Oxumaré, Xangô, Ogum, Oxosse, Oxalá, Omulu, Nanã. There is African percussion, African language, the Nagô and African dances. In the Candomblé terreiros, there is the reception of its practitioners called filhos de Santo, for spiritual, psychological and physical matters. Healing takes place through consultations with the mothers of the saint and the father of the saint, with recipes for rites, rest practices (stress reduction) and plants. Candomblé is strongly present in Brazilian and Bahian culture, in particular. Being an emblematic part of our culture, tourist attraction to national and international tourism in Bahia and Brazil. A Candomblé practice is practiced annually by millions of Brazilians: offerings to the deity Iemanjá in the sea on the passage from the old year to the new year. And the practice of spending New Year's Eve on the beach and in the sea. Candomblé, in Brazil, is a strongly syncretic religion. Due to centuries of slavery and colonialism, and prohibition of the practice of Candomblé until the twentieth century, the deities of Candomblé were practiced in a hidden way by Africans, and Afro-Brazilians, through the image of Catholic saints. There are associations between the orishas and the saints known to the Brazilian population to this day

Brazilian Umbanda: brings together indigenous, African and European religions

O Umbanda is a religion that originated in Brazil at the beginning of the twentieth century. is a religion originating in the Gulf of Benin in the Africa, Nago-speaking and Yoruba culture. It is a religion that brings together knowledge from the Brazilian indigenous culture, repeated, for example, in the entities Cabocla Jurema and Caboclo Sete Flechas. Knowledge of the Catholic religion, such as the entity of St. George, St. Cosmas and Damian. And knowledge of the African Yoruba culture and language, of Candomblé such as: oxalá, ogum, oxosse, omulú, erês, iemanjá, oxum. Exús and Pombas-gira are also worshipped in Umbanda. And there are Afro-Brazilian entities specific to Umbanda, such as Preto-Velho, and Vovó, Preta-Velha. The nuns wear white garments, as in Cuban Santeria and Afro-Brazilian Candomblé. The Altar is filled with images of Catholic saints, African

rites, candles of all colors, alcoholic beverages (marafo), tobacco, cigars, dances and percussions. There is the cult of orishas and entities. There is Afro percussion and Afro dances.

Notes on European Black Magic

There are rites and practitioners of European Black Magic in Brazil who are often confused with practitioners of Umbanda. When in fact, Black Magic comes from Europe, and from the multiple Portuguese and Iberian history that encompasses ancestry such as pre-Christian pagan religions, and persecuted in the Inquisition, religious rites of peoples persecuted in the Inquisition, and European ancestral pagan religions in general, some very old, dating back to the period of the Roman Empire and their relations with the cultures of the Middle East and Egypt. European Black Magic Rites involving the murder of children as offerings were investigated by the Brazilian police. Those involved have been arrested. It's something geographically interesting is that these crimes took place in the states of São Paulo and the south of the country, more specifically in the state of Santa Catarina, where there is no strong Afro-descendant presence. In Umbanda, animals are slaughtered as offerings (such as chickens and goats), but there are no records of homicides.

Teaching practices in Biology, History, and Geography, based on the ritualistic and medicinal plants of the Umbanda terreiro in São Mateus, Espírito Santo.

Anthropological immersion was not obtained with the researched group, in this case, the leaders of an Umbanda Terreiro in the municipality of São Mateus-ES, for two main reasons: the closure of the terreiro during the COVID-19 pandemic, and another private reason. Due to the pandemic scenario, there was no time in person to establish relationships of trust, whether they were established through dialogues or those established through contracts, such as the submission by the committee of Ethics in research with human beings.

Based on this, the work sought to maintain its specific educational research objectives through a bibliographic review on medicinal and ritualistic plants from Umbanda terreiros present in the Atlantic Forest Biome, preferably as close as possible to the region of São Mateus-ES, both from a phytogeographic and cultural point of view.

A search was carried out on Google Scholar about medicinal plants and rituals of Umbanda terreiros, and a course completion work developed in the Atlantic Forest Biome and in the state of Minas Gerais was located. And it was used to study its species survey, in order to compare and identify the existing species both in Ituiutaba-MG and in São Mateus-ES. And from the species occurring in São Mateus-ES, elaborate teaching practices in Botany, History and Geography, based on these species.

With regard to teaching practices, the medicinal and ritualistic species of the Umbanda terreiro of Uberlândia, common in São Mateus, were purchased in a flower shop, and a mobile Didactic Garden of medicinal and ritualistic species of Umbanda was created.

From this mobile Sensory Garden of plants A photographic catalogue and explanatory captions on how these plants can be approached in the classroom.

When flowering and fruiting, exsiccates of the botanical material will be made and a herborized collection will be as future perspectives of this work.

A table was also prepared with the ethnobotanical aspects of the species, and their phytogeographic origin, making it possible to interdisciplinarize with ethnology, sociology, history and geography in the High School of Basic Education.

Finally, in view of item 6 of the present work: adequacy of the research for the pandemic scenario and Voudou research as a subsidy for the Haiti project, registered at PRPPG-UFES, and coordinated by this advisor;

The present work compared the author's experience in the terreiros of Umbanda in the North of Espírito Santo, as a visitor, to scientific documentaries of Haitian Voudou available on the Youtube Platform. This netnography sought to understand Voudouism as a subsidy for the anthropology of school practice in Haiti, and to seek similarities between Voudouism and Umbanda that can reinforce and clarify our unique roots of African origin, our Afro-American affirmation, and our capacity to fight together for the rescue of our history, for the affirmation of our culture, and for the solution of the problems caused by colonialism and slavery.

Documentary analysis of ritualistic and medicinal plants of Terreiro de Umbanda in the Atlantic Forest Biome

In the municipality of Ituiutaba-MG, the following medicinal and ritualistic species were found in the Terreiro de Umbanda (Alves, 2019), described in the following items of the results.

Field survey of species with ritualistic and medicinal character in the city of São Mateus - ES, botanical, ethnological, pharmacological and historical-geographical characteristics

Of the species contained in the research carried out in Terreiro de Umbanda in Ituiutaba-MG, the following species below also occur in the municipality of São Mateus-ES.

The ethnological, ethnobotanical and pharmacological characteristics of the following plant species were collected by Alves (2019), (http://clyde.dr.ufu.br/bitstream/123456789/24955/5/Etnobot%C3%A2nicaPlantasRitual%C3%ADsticas.pdf).

Below is a table with the survey of species with ritualistic and medicinal character in the city of São Mateus - ES based on comparisons between the local culture of Mato Grosso, and the work of Alves (2019) in Ituiutaba-MG, Atlantic Forest Biome.

The table below was composed according to the assumptions of the work of Duarte-Silva et al. (2019) on Teaching Botany from the diet of Haiti, Brazil, and other sites in Latin America and the Caribbean, with the presence of enslaved Africans, compulsorily immigrated.

To support the knowledge of Botany that can be taught with plants, in table 1, Botância books of Plant Morphology, Plant Taxonomy, Plant Anatomy, Plant Physiology and Physiology of Seed Germination (APEZZATO DA GLÓRIA and CARMELLO-GUERREIRO, 2014; RAVEN, EVET and EICHHORN, 2007; VIDAL and VIDAL, 2000; FERREIRA and BORGUETTI, 2004; APG, 2009), and Basic ecology, applying this knowledge in plant ecology (RICKLEFS, 2003).

In order to research the geographical origin of the plants, we searched articles in the Google Scholar database (https://scholar.google.com.br/?hl=pt).

Table 1- Survey of species with ritualistic and medicinal character in the city of São Mateus - ES: botanical, ethnological, historical-geographical characteristics and educational potential.

Family **Name Scientific**	**Popular name**	**Botany knowledge that can be taught with the plant**	**Phytogeographic origin**
ANACARDIACEAE *Spondias dulcis* G.Forst.	Cajá-manga	Secretory structures in leaves. Fruit morphology. Chemical components of the cell, Human nutrition.	America
ANACARDIACEAE *Mangifera indica* (L.)	Mangueira	Secretory structures in leaves. Fruit morphology. Chemical components of the cell. Human nutrition	India. Asia
ARACEAE *Colocasia esculenta* (L.) Schott	Inhame	Toxins in the leaves. Leaf Morphology. Underground stem. Tubers. Amyloplasts. Chemical components of the cell. Nutrition. Iron. Anemia. Diseases resulting from anemia. African cuisine. Morphology of Monocotyledons.	Africa
ARACEAE *Dieffenbachia amoena* (Bull)	Comigo ninguém-pode	Toxin in leaves. Poisoning of domestic animals. Photosynthetic pigments. Leaf pigments. Morphology of Monocotyledons.	America.
ASPARAGACEAE *Sansevieria cylindrica* (Bojer)	Lança de São Jorge	Toxin in leaves. Poisoning of domestic animals. Photosynthetic pigments. Leaf pigments. Morphology of Monocotyledons. Paralenine leaves typical of Monocotyledons. African culture.	Colombia and Costa Rica.

ASPARAGACEAE *Sansevieria trifasciata* (Prain)	Espada de São Jorge verde	Toxin in leaves. Poisoning of domestic animals. Morphology of Monocotyledons. Paralenine leaves typical of Monocotyledons. African culture.	Africa
ASTERACEAE *Solidago chilensis* (Meyen)	Arnica	Morphology of a herbaceous plant. Morphology of a eudicot. Amplexicaule sheath. Morphology of the flower with capitulum inflorescence. Pivotal roots. Rapid seed germination for experiments. Easy cultivation.	Europe
CRASSULACEAE *Kalanchoe laetivirens* Desc. (23)	Fortuna Kalanchoe Língua de Exú	Meristem. Leaf meristem. Vegetative propagation. Water storage tissues in leaves (aquiferous parenchyma). Succulent plant African culture.	Africa
CURCUBIACEAE *Luffa aegyptiaca* (L.)	Bucha vegetal	Stem anatomy. The stem has the main tissues of primary origin: epidermis. Parenchyma. Sclerenchyma. Collenchyma. Xylem and Phloem. Leaf morphology. Leaf Evolution, Flower Morphology.	India
EUPHORBIACEAE *Ricinus communis* L.	Mamona	Toxic plant. Presence of latex. Eudicot. Floral morphology. Inflorescence in dichasium. Fruit in globose capsules with thorns. Lots of collenchymatic tissue in the stem. Good model for teaching the function of collenchyma. Spontaneous plant. Teaching environmental degradation and ecological succession.	South Asia
RUTACEAE *Ruta graveolens* L.	Arruda	Morphology of secondary growth in plants. Periderm. Stem in rhythm. Leaves with translucent glands. Secretory structures in leaf anatomy. Essencial oils. Mediterranean culture. Ancient history.	Europe and North Africa
LAMIACEAE *Plectranthus ornatus* (cood)	Boldo. Falso boldo	Eudicot leaf morphology. Secretory trichomes and vectors on leaves. Volatile oils. Leaf anatomy. Floral morphology of asterid eudicot. Flowers with gamopetalous petals.	African Origin

LAMIACEAE *Ocimum thyrsiflorum* L.	Manjericão	Aromatic plant. Peninsular leaves. Secretory structures in the leaf. Leaf anatomy. Essencial oils. Herbaceous habit. Cross-opposite phyllotaxis. Pleasant flavor. Edible and medicinal for teas. Mediterranean culture. Ancient history.	Asia. India. Cultivated for more than 5 thousand years.
Myrtales LYTHRACEAE *Punica granatum* (L.)	Romã	Arboreal habit. Medicinal plant. Folk medicine. Throat ailments.	Middle East. Domesticated 2000 years before Christ BC.
LAURACEAE *Cinamoum verum* J. Prels.	Cinamomum Canela	Plant used by Umbanda. Cinnamon is used by Ogum, it opens paths and is used in job interviews.	India. Asia One of the spices sought after by the Portuguese on large voyages.
MORACEAE *Artocarpus heterophyllus* (Lan.)	Jaqueira, apaoka	Aromatic plant. The part used is the bark of the stem (which contains the periderm tissue). It is used to study secondary growth in plants. It is a basal angiosperm, in taxonomic sciences. It is not easy to find examples of basal Angiosperms for teaching. This is one of them.	Índia.
MORACEAE *Morus nigra* L.	Amora. Amoreira-negra, amora e amora-negra	Fleshy fruit in berries. Photosynthetic pigments associated with protection against UV rays. Fruit rich in vitamin C. Human nutrition. Importance of vitamins.	Asia. Middle East. Persia (Iran)
MUSACEAE *Musa paradisiaca*	Bananeira	Monocotyledon. Underground stem. Immense leaves with petiole (erroneously called aerial stem) and leaves. Parthenocarpic fruit. Vegetative propagation by underground stem. Pollination by bats. Highly nutritious fruit. Rich in vegetable lipids. Human nutrition. Chemical components of the cell. Anabolism and Catabolism. Malnutrition and obesity.	Asia. It was brought by the Portuguese in the great navigations. Banana is the most consumed fruit in the world. And cheaper too.
MYRTACEAE *Psidium guajava* L.	Goiabeira Goiaba, araçá-goiaba, guaiaba e araçá-das-almas.	Eudicot. peninevian leaves Morphology of secondary growth in plants. Periderm. Stem in rhythm. Leaves with translucent glands. Secretory structures in leaf anatomy. Essencial oils. Chemical components of the cell. Guava is rich in vitamin C. Human nutrition.	America Neotropical

PASSIFLORIACEAE *Passiflora edulis* (Sims)	Maracujá	Rosid eudicot. Climbing habit. Leaves modified into tendrils. Presence of extra-floral nectaries. Edible fruit. Leaves and fruits used as tranquilizers in mild and moderate depressions. Use in the herbal industry. Rich in Vitamin C. Flower Morphology. Seed morphology. Seed with expanded aril in yellow edible part. Fruit rich in pectin used in the food industry.	Pantropical. It occurs in America and Africa. Called by indigenous Americans as Murucuia which means gourd for drinking water.
POACEAE Cymbopogon citratus (DC.) Stapf	Capim-cidreira	A relative of sugar cane, corn, rice, wheat and barley. It's a grass. Monocotyledon. Parallel leaves. Underground stem. Leaves with sheath and without stem. Aromatic plant. Leaves used for soothing tea. Used in cosmetology.	India.
POACEAE *Zea mays* L.	Milho	A relative of sugar cane, lemongrass, rice, wheat and barley. Monocotyledon. Parallel leaves. Leaves with sheath and without petiole. Edible grain-producing plant. Highly versatile in cooking. Leaves used for soothing tea. Used in cosmetology.	American. Improved by pre-Columbian civilizations (Mayans, Aztecs and Incas).
RUTACEAE *Murraya paniculata* (L.)	Murta. Dama-da-noite	Eudicot. Morphology of secondary growth in plants. Periderm. Stem in rhythm. Leaves with translucent glands. Secretory structures in leaf anatomy. Essential oils Aromatic plant. White flowers. Nocturnal pollination by moths. Used in bridal attire in Early Modern Europe.	Asia and North Africa.
ZINGIBERACEAE *Zingiber officinale* Roscoe.	Gengibre Gengibre, mangarataia, gingibre e gengivre.	From used is the underground stem. Edible and medicinal aromatic plant. Used for sore throats. Monocotyledon. Evolutionary relative of garden bananas, and to a lesser extent, related to yam and taioba.	Asia

Making of the mobile Didactic Garden of medicinal plants and rituals of Umbanda

The plants The useful (medicinal and ritualistic aspects of the Umbanda culture) occurring in São Mateus, listed in the table above, were purchased in vases, in flower shops in the municipality, on the Island of Guriri, and kept at the Nucleus for Pedagogical Research in Biology Teaching (NPPBio), where they will be stored and cultivated. They will be available for exhibitions, classes and didactic sequences, as well as educational research, in schools and at the University.

As perspectives, when the specimens obtained are in the reproductive phenophase (with flowers and fruits), branches containing leaves, flowers and/or fruits will be collected and exsiccates will be elaborated, composing a didactic herbarium of medicinal, aromatic and ritualistic plants of Umbanda, and of the general culture of Mateense.

In addition to the living collection of live specimens, other plant species (Table 1) parts of the plant such as roots, grains and leaves were purchased in supermarkets and in the public market to complement the "photographic catalogue of the mobile Didactic Garden with guidelines for teaching practices", inspired by the work of Santos (2019).

Considering the realization during the field that a good part of the ritualistic plants of Umbanda are aromatic plants, the process of obtaining plants and creating a mobile didactic garden was taken advantage of and some typical aromatic species of São Mateus-ES and the Brazilian southeast were also purchased, which will constitute a complementary collection in exhibitions and didactic sequences. They can be found at the end of the catalogue in the item below. In prints separate from the plants useful to the Umbanda terreiro.

Most of these aromatic plants, also used in Umbanda but very common in São Mateus-ES, and in the Brazilian southeast, are of European, Mediterranean origin due to the strong influence of Italian cuisine, and Italian immigration in the region. Syrian-Lebanese influences are also visible in southeastern Brazil. Its vulgar names are: white basil, purple basil, oregano and mint. The first ones used in Italian cuisine, and the the latter, used in Syrian-Lebanese cuisine.

Also included in the catalogue was pink pepper, an aromatic plant typical of the sandbank of Guriri Island. Dating back to the times of the indigenous occupation of the region.

It is guaco, a medicinal species widely used in Brazil through the herbal medicine industry (commonly known as "melagrião", registered trademark).

Plants of different cultural and historical-geographical origins were kept in different prints of the catalog, so as not to incur in learning mistakes.

Development of a mobile Didactic Garden Photographic Catalogue with teaching practice guidelines

The plant species listed in the work with medicinal and ritualistic plants of the Terreiro de Umbanda of Ituiutaba-MG were searched in the flower shops of São Mateus in order to identify if they were occurring in the processes of purchase and sale in the present municipality.

The specimens found were purchased to compose the Mobile Didactic Garden of Medicinal and Ritualistic Plants of Terreiro de Umbanda, and then photographed to compose the Photographic Catalog of the Didactic Garden, which is a digital didactic resource of the Garden.

Tree species were photographed in fieldwork by the anthropic environment of Guriri Island.

Figure 1- Passion fruit. Medicinal and ritualistic plant used in Terreiro de Umbanda in southeastern Brazil, Atlantic Forest Biome. Figure 1a: Young creeper. Figure 1b: Vine holding tendrils on other plants during their growth. Modified sheet. Figure 1c: Curled tendrils and young leaves. Figure 2d: Mature leaf with peninervian vein, showing to be a eudicot, in this case, a eudicot rosid. Genus: *Passiflora*. Botanical family: Passifloraceae.



Figure 2: Gorse and lemongrass: medicinal and ritualistic plants used in Terreiro de Umbanda in southeastern Brazil, Atlantic Forest Biome. Figure 2a. Gorse. Genus *Baccaris.* Botanical family: Asteraceae. Eudicot asterid. Figure 2c: Lemongrass. Botanical family Poaceae. Figure 2d: Parallel-ribbed leaves of lemongrass showing to be a Monocot.



Figure 3: Fortuna, sweet potato, mango and rosemary: Medicinal and ritualistic plants used in the terreiro From Umbanda in southeastern Brazil, Atlantic Forest Biome.






Figure 3a: Luck. Figure 3b: Batata-doce.
Figure 3c: Hose. Figure 3d: Rosemary.
Figure 4: Pink pepper, an aromatic plant typical of the sandbank of Guriri Island. Dating back to the times of the indigenous occupation of the region. Botanical family Anacardiaceae. Eudicot.



Figure 5: Aromatic plants also used in Umbanda and well occurring in São Mateus-ES, and in southeastern Brazil. They are of European origin, Mediterranean due to the strong influence of Italian cuisine, and Italian immigration in the region. Syrian-Lebanese influences are also visible in southeastern Brazil. Their vulgar names are: white basil, purple basil, oregano, and mint. The former used in Italian cuisine, and the latter used in Syrian-Lebanese cuisine. Figure 5a: Oregano. Figure 5b: Rosemary. Figure 5c: White basil. Figure 5d: Mint. Used by the Oxalás, Iemanjá, Xangô, Oxosse and the Erês line.









NETNOGRAPHIC WORK ON SIMILARITIES AND DIFFERENCES BETWEEN BRAZILIAN UMBANDA AND HAITIAN VOUDOU AS A SUBSIDY FOR THE HAITI-UFES PROJECT.

A netnographic analysis of a documentary about Haitian Voudou (VICE, 2022) was carried out, assisted by the present author, a practitioner of the Umbanda religion. Similarities and differences of the two religions were listed in order to seek common cultural patterns that can reinforce and clarify our unique roots of African origin, our Afro-American affirmation, and our capacity to fight together for the rescue of our history, for the affirmation of our culture, and for the solution of the problems caused by colonialism and slavery.

The first similarity found between Voudou and Umbanda was the clothing, dances and drawings on the floor. In Umbanda and Quimbanda, the ground is scratched, at the so-called point, where is incorporated into the entity. The left-wing Voudou, Umbanda and Quimbanda reinforce that they do not work with Black Magic. These peoples of Afro-descendant religions are routinely labeled, and demonized by Western Christian culture, as practitioners of Black Magic.The video about Haitian Voudou demonstrates a welcome in the Terreiro through dinners typical of the culture, as observed in Candomblé. We cannot say anything about Umbanda. Practitioners of Voudouism suffer prejudice from practitioners of Christianity in Haiti, as well as practitioners of Afro-descendant religions in Brazil.

> "Voudou comes from slaves brought from Africa. They captured them, beat them, abused them, and killed them. Voudou set them free. They (the entities) walked around the world and came here between us. And so the Voudou spirit entered us. And is called Voudou from Haiti. When you know our society (Voudouism), the spirits that protect us will also protect you." (VICE, 2022).

The religions of Umbanda and Candomblé they are also affirmative religions of the Afro culture, and transmitters of History. They are liberating religions. In the documentary about Voudou, skulls and femurs exhumed from human beings, and images of tombstones are shown. These practices do not occur in Umbanda and Candomblé. Although images of tombs and skulls associated with exús of the left-wing Quimbanda have been seen.

In both Umbanda and Voudou, there are altars with Catholic saints, candles of various colors, rosaries, drinks of various kinds, tobacco, cigars, and symbols and images of Afro-American entities and deities. In Voudouism there is the reception of afflicted and needy people. In Umbanda as well. In the Christian religions as well. The homosexual population feels welcomed in Voudou and Umbanda, including leaders, mediums of homoaffective or transgender identity. Gays and transgenders do not feel disrespected in these religious spaces, even though both Haitian and Brazilian societies are prejudiced The documentary about voudou demonstrated the purchase of goats, goats and the slaughter of chickens. Certain aspects of Umbanda and Quimbanda can act with the slaughter of animals as offerings, although we do not collect this information in the present

fieldwork and netnographic. In Voudou rites are observed in cemeteries and exhumation of bodies, which is not observed in Afro-Brazilian religions, even for legal reasons. Is It is important to point out that in the left-wing Quimbanda rites take place in cemeteries, with the offering of animals such as goats, but without exhumations and the use of human bones. In Voudou there is the incorporation of deceased ancestors by mediums, as in Kardecism. In Umbanda, entities are incorporated. Both in Voudou and in Umbanda there are people who advise the medium during the incorporation. The Popcorn is used as an offering in Voudouism and Umbanda. Children participate in certain ceremonies in both Voudou and Umbanda. According to Umbanda mythology, they take the children both to participate in the culture of their parents and the children are released in the Terreiro to “play" with the And if you want to be sure, you have Mediums in Voudou feel the energetic presence of their dead ancestors. Once again, Voudou approaches Kardecist Spiritism and distances itself from Umbandism. As a hypothesis, this fact may result from the French origin of both the Haitian State and the Spiritism of Allan Kardec, with a Christian basis. Both Voudou and Umbanda mediums claim to lose consciousness during the trance of incorporation. African percussion, dancing, alcohol and tobacco are part of the process that leads to trance in both religions.

Finally, in the past there were no morgues in Haiti. And Voudouism was in charge of the funeral services. That's why there is so much symbolism related to human death.

FINAL THOUGHTS

The present work proposes to document the knowledge, which we admit here as scientific, of an Umbanda Terreiro. Therefore, a knowledge "outside" Western scientific knowledge guided by the Judeo-Christian religious tradition. The netnographic review carried out, and the comparisons of the Umbanda culture with the Voudou culture through netnography, found that all non-Christian religions in America: Voudou, Santeria Cubana, Umbanda, left-wing Quimbanda, Candomblé, European Black Magic are demonized to a greater or lesser degree because they are religious rites external to the Christian tradition. They date back to the persecution of pagan peoples and New Christians, to the persecution of African religions in the American continent, from Colonialism. This work sought, through teaching practices in Biology, with aspects of History and Geography, to deconstruct prejudices about African ancestral knowledge immersed in Brazilian culture. As well as subsidizing extension actions in Haiti from the perspective of ethnographic work and ethnological immersion.

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Pedagogical methodologies in Science to facilitate the teaching and learning of children with autism

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ABSTRACT

The present work aims to seek methodologies and interventions through the autoethnographic work of the present researcher, university student and mother of a 5-year-old non-verbal autistic child, to help students, with this condition, in overcoming obstacles, developing socialization, of speech, with Science teaching as its generating theme. The method used was ethnography of school practice, an ethnological method for non-anthropologists with educational objectives. It is based on a review of scientific and educational literature, interviews and fieldwork. The following teaching practices were developed below. Use of applications: (1) Tiny puzzle (memory game; alphabet soup with complete alphabet; association of animal sounds with their shape); (2) Syllabando (forming syllables; learning the shape of letters; forming simple words with syllables). The following educational games were also developed: (1) Dynamics with alphabetic magnet; (2) 'The beach' dynamic; (3) Fruit and vegetable dynamics; (4) Book "Textures of Nature"; (5) Discovering the cycle of life; (6) Using ready-made toys. Finally, the researcher carried out participant observation at the municipal event: 'Autism in our lives'. Aimed at fathers, mothers and guardians of children with autism spectrum disorder (ASD). As a result, it was noticed that after stimulating his skills with the dynamics described, the research participant with ASD then began to have a new skill, hyperfocus starting to ask him to identify the words for him and speak the letters that form these words. This behavior occurs in various places such as food packaging, street signs, at school or at home. Finally, the work established a form of non-verbal communication between the child and the researcher-mother, enabling communication for the autistic child, learning about the world around him and literacy. As for the mother-researcher, this research enabled access to scientific and social events aimed at families with members with ASD, carrying out a voluntary scientific initiation, preparing a course completion work, and completing the undergraduate course, promoting with mastery, new horizons for this very capable family, which needs so little access, from means of communication (verbal, non-verbal) to fundamental rights to education for children and women.

Keywords: Biology, Ethnography, Autoethnography, Early childhood education, Stay at University.

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INTRODUCTION

MEMORIAL

My name is Jéssyca Ananias Cipriano, I am a resident of Guriri Island, north of Espírito Santo, I am in the eighth period of the Bachelor's Degree in Biological Sciences at UFES, São Mateus Campus and I am the mother of Pietro, a 3-year-old boy with autism.

In 2019, I moved to the Biological Sciences course at UFES, São Mateus Campus. At that moment I was still unaware of the pregnancy, but I was already expecting it. Shortly after I found out that I was giving birth to him, I soon had many concerns about how to reconcile raising a baby with the academic journey.

At first I even thought about dropping out of college to be a mother, due to the difficulties I would encounter, but with the encouragement of my mother and my husband, I decided to continue because I realized that I could be a mother and a student. I knew it wouldn't be easy, but it also wouldn't be impossible.

The pregnancy from the beginning was very difficult, because I already had gallstones that caused me pain that could cause contractions that would lead to an abortion. Because of this, constant monitoring has always been necessary. It intensified in the middle of pregnancy with the increase in blood pressure, leading me to have preeclampsia.

The reconciliation of prenatal care and college was very difficult, especially the judgments of some classmates and teachers, but I always did the best I could. At the beginning of the second semester I had to request an anticipation of the leave due to the risks of pregnancy.

In 2020, I was referred to Colatina-ES to have a cesarean section since it could not be a natural birth and Pietro was born. He was born in good health, had only a jaundice that was soon resolved, and was discharged to return to São Mateus.

Pietro has always been a very energetic, cheerful boy and a little different from other children. One of the first major challenges was food. Twenty-seven days after giving birth, I had an inflammatory gallbladder crisis due to numerous stones, which led to emergency surgery. Due to the urgency of the situation, I was forced to remain in the hospital. During this period, I was unable to breastfeed my son due to the prohibition of minors entering the surgical recovery center. It is worth mentioning that the year was 2020, during the COVID-19 pandemic.

We were forced to introduce industrialized food to the baby. Even after a few hours without eating, he simply did not accept food, nor formulas of various brands that were offered, nor porridge, absolutely nothing, which led me to great despair. Out of prudence, I expressed some breast milk and sent it through a relative. That's the only way he fed. Right after this event I didn't find it strange that he rejected food, at least I noticed his food selectivity, and I continued to feed only with breast milk, which is indicated. After 6 months, in the phase of food introduction, I noticed a rejection of some

foods, especially pasty and milky, which made it very difficult to introduce food. With this, pasty fruits were introduced, and then solid food.

We started to suspect he had autism when he was just one year old, but we couldn't get the diagnosis because he was so young. He had food selectivity, liked to line up toys, he didn't play functionally with toys, and he performed repetitive movements. Many of the doctors we went to said that it would develop later.

Throughout this process I continued with my studies, with the main support of my mother and my husband who were always by my side. Sometimes I needed to take my son with me to class, but sometimes I was not so well received by the teachers, because Pietro was a very agitated boy.

As time went by, Pietro did not develop ordinary activities that other children of the same age could. We realized that he had a compromise in his learning and speech, at the age of two we finally got his report.

We thought we would finally be able to give him medical treatment, but even in private care, it is difficult to find professionals specialized in the area. In addition to the high financial cost, which ends up causing little access to them.

At the age of three, I enrolled him in a school for his age, since school is a great space for learning and socialization, which are his greatest difficulties. Even with the report, the place in the school was denied. It is worth remembering that this is illegal. However, we were aware of the rights of people with Autism Spectrum Disorder (ASD) and we claimed their right to regular school, which is guaranteed by law, according to chapter V of the Law of Guidelines and Bases of National Education (LDB), which addresses special education.

Even getting their place thanks to the law, we are faced with a great difficulty of the teachers in knowing how to act to contribute to their learning, due to the lack of interaction with autistic people, not only being a difficulty of this single school more than many.

Many cases of prejudice have happened to him, caused by people who are uninformed about the symptoms present in people with ASD. I have heard many times that my son was rude, that autism was contagious, and many times I have seen him excluded from parties, by adults who were afraid of their child's coexistence with an autistic person.

Today, as a mother of an autistic person, a student and a future teacher, I see the need for an approach in schools and colleges about special needs, such as autism, so that situations like these are less and less frequent in our society.

THEORETICAL FRAMEWORK

Autism spectrum disorder is a condition that affects the neurological part, causing some characteristics that are noticed in early childhood, which may be more persistent in some individuals

than in others. They may have speech delay, repetitive movements, impairment in communication and social interaction, hypersensitivity, learning difficulties, among others.

This condition has individual peculiarities and requires the active participation of parents together with teachers to develop an action plan that provides the best learning, adaptation and social inclusion in the school environment. There is no ready-made recipe to make children with autism spectrum disorder (ASD) learn more easily, however, building trust between teachers and parents, identifying the importance of each of these parts, is already the beginning of this long process (BRUNI & MACEDO, 2013).

During childhood, while the child's development occurs, he tends to associate names with objects, thus identifying them in a functional way, occurring through his experiences caused in the external environment, where the information will be becoming functional knowledge. However, children with ASD have their social interaction poorly developed, making it difficult to use knowledge in a functional way, and objects are used only for sensory function, impairing cognitive learning. The impacts that this condition causes on the child end up impairing their language due to the difficulties in symbolizing and naming objects (CUNHA, 2017).

In childhood, it is where the first signs of ASD are usually noticed, for the medical diagnosis, at the stage when these children will be starting the school phase, in their first years of life, the teacher can have a huge contribution in this process, as he will spend a long period of time with this child. Sometimes parents may even be aware of the signs that the child presents and have doubts about whether or not they should look for a trained professional in the area, so the teacher, when well instructed can help parents in this difficult and often lonely process.

One of the great challenges to be overcome is the development of speech, which strongly contributes to literacy. For Paulo Freire (1987), "literacy is not a play on words, it is the reflexive awareness of culture, the critical reconstruction of the human world, the opening of new paths, the historical project of a common world, the bravery of saying one's word.Therefore, literacy contributes both to social development, which is one of the great factors to be overcome by autistic people, and to their cognitive development.

Regarding the importance of the teacher in this process, it can be stated that:

> The interested teacher can do a lot for children with autism, even if they are not experts in this area. With love, dedication, and patience, you can earn a child's eternal trust. Specific information about autistic functioning is essential tools to guide the teacher in dealing with this student and, above all, to assist him in his development. Some subtleties, such as speaking softly, drawing attention in a delicate way, or helping him understand the content through pictures or images, are always very welcome. To do this, it is important to assess your student's weaknesses and put strategies into practice. Your hard work can make a huge difference in his life. It can take you out of a world with restricted repertoires and redirect you to a universe full of novelty and attractiveness. (SILVA; GAIATO and REVELES 2012, p.55).

Currently, many teachers still do not understand the role played in the face of this social demand, which is why there is a need for continued and specialized training to better serve these students in the classroom, mainly due to the fact that these cases of children with this prevalence have been increasing considerably. (MOURA.; PEREIRA & RIBEIRO, 2023)

When we talk about the role of the teacher during the student's learning process, there are no words to describe its importance, the teacher is not only necessary in educational matters but in life, because he will be present in most of the course of the student's life.

According to Lindomar Batista, "To be a teacher is to invent, it is to reinvent, it is to be creative, it is to be a clown, it is to be an artist, because each class taught is a theatrical play presented, which will be remembered by the students, as it will be the base, the foundation to build the path to success".

People with ASD require formal and non-formal experiences for their learning, and it is necessary to provide diversified experiences in social places, both family and educational, enabling mediation, adaptation and flexibility strategies, always taking into account their particular condition and brain functioning. Since they have difficulty in communication and social interaction. (SILVEIRA; SANTOS & STASCXAK, 2021).

Inclusion is necessary for quality learning, where all individual characteristics are taken into account. A different but efficient approach is essential for education, which is one of the rights present in the 1988 Magna Carta, to be exercised (CONSTITUTION, 1988).

Since inclusion is much more than a way of teaching or learning, it allows socialization and acceptance of individual differences, which are not only present in autistic people, as all people have their own specificities.

A little more about inclusion:

> The inclusion of people with special needs is part of the paradigm of a democratic society, committed to respect for citizens and citizenship, defends the idea that teaching is built on plurality and on the certainty that students are not, under any circumstances, capable of building their knowledge of the world alone. The learning process merges in interaction, from which it develops a human and meaningful way of perceiving the environment. Valuing the peculiarities of each student, serving everyone in the school, incorporating diversity, without any kind of distinction. The inclusion of students with special needs in regular classes represents a historic advance in relation to the integration movement. Inclusion postulates a restructuring of the education system, with the aim of making schools open to differences and competent to work with all learners, without distinction of race, class, gender or personal characteristics. For this reason, all children who are in special schools have the constitutional right to enter the regular system, in classes appropriate to their age. As we have seen, it is essential to promote actions aimed at school inclusion, and can use the use of technologies as strategies that promote autonomy and independence in the participation of people with disabilities or reduced mobility as a facilitating agent. (MOREIRA ET AL., 2022).

Currently, inclusive education has been used by many schools across the country, but many schools do not use this form of education or have it in a precarious way, even though it plays a great

role in the lives of these students. Often this absence is caused by the lack of continuous and specialized training of these professionals, making the approach to this subject indispensable.

Based on the above assumptions, the present work aims to research didactic methods to facilitate the teaching-learning of people with autism in Science. Having the discipline Sciences of Early Childhood Education and Elementary Education, as a generating theme for a holistic education of the human being that encompasses their most urgent needs, as in the case of Pietro, the development of speech, and socialization in the family and at school.

Being the development of speech, the guiding point for the other challenges to be overcome. Practical classes in Early Childhood Education and Elementary School can take Language to a concrete level, facilitating the learning of the first key words for the beginning, or trigger, of speech development. Taking into account, obviously, neurological, psychopedagogical and speech therapy conditions.

It documents in an amateur ethnological way some of the contemporary realities of the Federal University of Espírito Santo, Campus São Mateus, as well as the north of the state. Among them, we can mention the permanence of students in the Public University, the limits and possibilities of university mothers, the prejudices of the traditional school and the teaching trained in the traditional school in the face of diversities, the daily experience of mothers and fathers of autistic children, and the deficient conditions of the public and private health system in the north of the state.

Based on this, an autoethnography of the present researcher, university student and mother of an autistic child will be elaborated using the ethnography of school practice as a method. My son Pietro is 3 years old and has autism. Through autoethnographic work, I intend to rescue our life story, in order to seek methodologies, solutions, interventions that can help you overcome obstacles, such as the development of socialization and speech, having as a generating theme, or medium, the teaching of Science.

The work goes through the following themes that justify it: the permanence of students in the Public University, the limits and possibilities of university mothers, the prejudices of the traditional school and the teaching trained in the traditional school in the face of diversities, the daily experience of mothers and fathers of autistic children, and the deficient conditions found in the health system, public and private, in the north of the state of Espírito Santo.

OBJECTIVES

Based on the above assumptions, the present work aims to elaborate an autoethnography of the present researcher, a university student of Biological Sciences at CEUNES-UFES, Campus São Mateus, and mother of an autistic child.

And it has the following specific objectives: (1) to use autoethnography as a diagnosis of needs for the development of the autistic child, participating in the research, (2) to research didactic methods to facilitate the teaching-learning of people with autism in Science, (3) to have the discipline Science in Early Childhood Education and Elementary Education, as a generating theme for a holistic education of the human being that encompasses their most urgent needs, (4) develop speech, (5) develop socialization within the family and in the school environment.

MATERIALS AND METHODS

MATERIALS

The present study used the following materials: textbooks of Early Childhood Education Sciences, school context, family context, social context as learning elements. And the Laboratory of Instrumentation for the Teaching of Biology (IEB II) of the Degree Course in Biological Sciences of CEUNES-UFES for the acquisition and manufacture of didactic materials henceforth necessary.

The following teaching practices have been elaborated below. For each of them, the following materials were used:

Practice " alphabetic magnet":

Magnetic tape;

Colorful cut-out alphabet;

Polaceal;

Coke court;

Ferromagnetic surface.

Practice "the beach":

Plastic pool or basin;

Toys in the shape of sea animals;

Water;

Sand.

Practice "fruits and vegetables"

Adhesive Velcro ;

Sheet with images of fruits and vegetables printed;

Polaceal;

Coke court;

Pompoms in the colors of the images.

Practice " textures of nature"

E.v.a.;

Satin ribbon;

Instant queue;

Shells;

Stones;

Different types dry leaves;

Sticks;

Dried chestnuts;

Dried flowers.

"Discovering the Life Cycle" Practice

Plastic cup;

Muda plant ;

Water;

Earth.

"Using ready-made toys" practice

Toy Mister Potato Head;

Modeling clay.

METHODOLOGICAL PATHS:

The didactic sequences elaborated will be investigative according to the theoretical-methodological framework.

In order to know what knowledge is taught in Elementary School Sciences, the Elementary School Science textbooks used in the public network of São Mateus-ES, in the school where the research participant studies, will be analyzed.

After the analysis of the Elementary School Science textbook, the didactic materials and innovative teaching practices that we can use to stimulate the speech and socialization of the student in question will be inventoried. The life story of the present author and her son will be considered.

To this end, an oral rescue of their life history will be elaborated, as explained in the theoretical-methodological framework. In addition, animations will be researched in the following media: Youtube Platform, Google, Google Scholar, open TV, pay TV, bookstores, libraries, newsstands.

Depending on the results found, an article will be produced whose annex will contain the materials found and developed.

THEORETICAL-METHODOLOGICAL FRAMEWORK

This work consists of a case study whose methodology used was *ethnographic work*, according to the theoretical-methodological assumptions of André (2020). These are short-term works carried out by *non-anthropologists*, or professionals from other areas of science. They do not have an ethnographic purpose in themselves, but are carried out in order to seek answers to the specific areas of the researchers in question. The ethnography of school practice was used in the present work for the purpose of solving problems in teaching practice, and subsidies for Environmental Education and Ethnobiology. However, the historical and ethnographic value of the data presented here transcended their utilitarian character, and were compiled in this work, with a purpose different from the initial objective.

The methods used in the research were: scientific literature review, fieldwork, and document analysis (André, 2020).

> "A work can be characterized as ethnographic in education, when it makes use of the techniques that are traditionally associated with ethnography, that is, participant observation, intensive interviewing and document analysis. The researcher approaches people, situations, places, events, maintaining direct and prolonged contact with them. How does this contact take place? First, there is no pretense of changing the environment by introducing modifications that will be experimentally controlled as in experimental research. Events, people, situations are observed in their natural manifestation, which makes such research also known as naturalistic or naturalistic" (André, 2015, p.25).

Participant observations in ethnography

In the present study, participant observation was chosen as a working method instead of structured and semi-structured interviews. The works presented here deal with participant observation, intense interviews and, in isolation, some unstructured interviews. Below is Malinowski's insight into data that is difficult to collect through formal interviews. "Malinowski realized that there is a research methodological problem related to the way certain issues are salient in the everyday thinking of members of a society, while others are not. There are things in our social existence that we don't talk about, and that's for a number of reasons. One of them is the fact that we internalize some forms of behavior in childhood and continue to repeat them in social life, in a habitual way, without paying attention to such behaviors. Another is that we learn to avoid talking about—or even thinking about—certain topics, such as taboo issues, even if events in some way related to such taboos are frequent. Malinowski realized that, by staying long enough with a certain social group, the researcher has the opportunity to observe behaviors and social events (such as certain rituals) that would hardly be mentioned in interviews" (TADDEI & GAMBOGGI, 2011).

Taddei and Gamboggi (2011) state that ethnography can be understood as more than a mere methodology, but taken in its sense of intercultural dialogue. The ethnographic experience, as a special instance of the more generic experience of communication, presupposes, from the outset, beings in contextual coexistence, making use of their conceptual and material resources to position themselves in front of each other, in the dialectic between being existentially open (curiosity) and closed (fear).

Meihy (1996) mentions as a presupposition that oral history implies a perception of the past as something that has continuity today and whose historical process is not finished" (Silva, 2004). Subjects construct knowledge based on a determined intention to make articulations between what they know and the new information they intend to absorb. In view of this, writing about the oral history of life is gratifying, it involves a whole historical and sociocultural context from the past to the contemporary. Oral history is indicated as a perspective. It is important for the research of subjects, for whom there is no other access, to answer new questions on old themes, to provoke new subjects and to open new perspectives of analysis (Silva, 2004).

In ethnographic works, André (2020) recommends the arrangement of the results separately from the discussion, so that it is clear which were the results obtained through ethnology from those taken from the literature, since ethnology is primarily based on experiences, and the arrangement of the results is given by narrative and essay texts.

ETHICAL ASPECTS OF RESEARCH

The present study was developed with 1 research participant, a 5-year-old autistic child, and two researchers: the advisor and the student-mother-researcher. There was no participation of the advisor in the application of teaching practices and data collection with the child, who participated in the research and was a minor. The practices were developed by the student-mother-researcher in her family. Pedagogical games similar to those developed at school in the age group of the research participant were developed, and the risks of the research were minimal, such as shyness or fatigue when developing the activities, which were solved with short or long breaks, depending on the process. The research participant performed only the teaching practices to which he or she was attracted. The relatives, the researcher-mother's side, the father, and the grandmother who live in the same household, and in a neighboring household, agreed to the execution of the research and were present in the process as witnesses who estimate that the research participant is a minor. Written agreement (registration of informed consent) of the mother, father, and grandmother.

RESULTS

APPLICATIONS USED

Tiny puzzle (memory game; alphabet soup with complete alphabet; association of animal sounds with their shape).

Syllabando (form syllables; learn the shape of letters; form simple words with syllables).

THE USE OF PHYSICAL GAMES FOR EDUCATION

Different types of physical games were selected to be presented to the research participant, in order to arouse their interest and also their motor coordination, since the differentiated activities help in the children's interest to learn while having fun.

Activities can and should be developed with all students, encouraging reading and knowledge of biology areas can and should be applied to all children, thus making it possible for inclusion within the school, at the same time, everyone benefits from the activity.

Dynamics with alphabetic magnet

For this dynamic we used an alphabet, printed in a colorful way, since it more easily attracted your interest, which was plasticized for greater durability/reuse and we glued magnet on the back, to be placed on some metal surface.

In the presence of an adult, the participant began to pick up the letters and change locations, with each letter he took in his hand, the adult vocalized the sound of the corresponding letter, until Pietro then started to try to imitate the sound, being a great advance, since a great characteristic of the autistic child is not being able to imitate and after the stimulus he started to try to do the same.

This alphabetic magnet was also used to form words, which were vocalized through the adult present, e.g. their own name; the name of objects; the names of animals, and their great interest in hearing and also trying to reproduce these sounds is remarkable.

"The Beach" dynamic

In the present dynamic, we are looking for ways to reproduce the aquatic environment (basin with water) and the terrestrial environment (sand), separating them in a pool. We separated forms with different forms of life in these environments, in addition to reproducing the names of these animals, the main characteristics were also highlighted, and placing them in their habitat showing those that have semi-aquatic, terrestrial and aquatic life.

With each shape he took in his hand we repeated his name, to know if he was really associating the name with the shape of the animal, we said the name of the wrong fish, calling it a turtle, soon it was possible to see in the expression of his face that he understood that it was wrong

and gave me the toy again so that I could say his right name, He insisted on the same toy until we spoke the correct name to him, when I finally pronounced it was the fish, he stopped insisting, demonstrating that he really understood the name of the same.

Dynamics of fruits and vegetables

In this dynamic, fruits known and unknown to the participant were strategically chosen, below each of the figures is written their name, thus stimulating the recognition of the name of the fruit both in its written and oral form, in addition to its visual recognition and the colors that are predominant in each of the drawings.

In order for the proposed activity to be carried out, there was the printing and lamination of a page with the selected figures and a velcro was glued to them and pompoms of colors corresponding to the predominant color of each one were separated, so that Pietro could place each color in its corresponding place, while the adult next to him, First pronouncing letters that form the name and then the verbalization of that word, so that he can hear and associate the visual, oral and written form.

After a while doing this activity daily, we noticed that he started to recognize fruits and vegetables when eating and being interested in fruits that he did not like to eat before, such as melon, which he did not eat before, but when he was in the supermarket and saw the melon, he asked to take it for him, taking our hand to the fruit and feeding it when we offered it to him, Showing an advance even in his food selectivity due to his curiosity, after that, we started to introduce him to several known and unknown fruits.

Book "textures of nature "

Following the idea of the sensory garden, which exercises the five senses, touch, sight, hearing, taste and smell, we prepared a book produced from e.v.a. in which each page contains a different texture work mainly on the tactile and visual sensory part of the student in question, together with the participant, we carried out a tour in the neighborhood where we live so that materials such as stones were separated and collected, leaves, sticks, sand, shells, among others, that were found along the way, including on the beach.

This book was built together with him and was at his disposal so that he could handle it whenever he wanted, without any kind of pressure, this makes him more confident to handle these unknown textures that can bring him some discomfort and sharpens his interest and curiosity, making it possible for him to learn about his difficulties.

The fact that Pietro participates in all stages also allows him to know more about ecology, because he will know where each part present in this book was taken from, which promotes his

knowledge more, because each time he passes by that place again, he will recognize the parts taken from there.

Discovering the Life Cycle

The life cycle can be observed through plants, so we can use a seed to start a life cycle, observe all stages: germination (birth); growth; reproduction and death, being an illustrative way to teach the participant about this cycle present in all living beings.

For this to occur, seeds and a seedling of different species were established, with the help of the adult Pietro actively participated in the whole process, we prepared the seed and the place where the seed would be planted for germination and we established a time within his routine to dedicate exclusively to the care of the seed, at each stage observations were made with him of what was happening.

Always allowing him to handle, water every day, in addition to helping in his organization, it also helps in motor aspects, in his knowledge, to know where the food, fruits, vegetables come from, in addition to participating in the care of a vegetable garden at home, bringing more interest in consuming food, because he sees it every day.

Using ready-made toys

The toy market has a great diversity of toys, so why not use them in the learning process?!

We use the " mister potato" which is a toy that uses playdough to form the parts of its body, to make the participant associate the names of the parts of its body.

Soon, when Pietro made the clay eye, the adult present showed him his eye on his body and so on, after a while of playing, he started to make each part of the doll's body and point out these same parts on his body, especially the hair, which was the part that attracted his attention the most.

PARTICIPATION IN THE EVENT: "AUTISM IN OUR LIVES"

During the writing process of this work, I participated as a listener in the event, autism in our lives, with the speaker Clarisse Schmidt - Neuropsychopedagogy and Human Development, which took place on October 17, 18 and 19, 2023, at Rua Coronel Cunha Júnior, São Mateus-ES.

At the invitation of the university professor who is the father of an autistic child. In order to seek to understand a little more about autism, to promote a better understanding as an atypical mother and especially as a teacher of future students with their singularities that are present within ASD.

Since as teachers, we have to adapt to the student and not the other way around, especially with autistic students who have a unique and different look at seeing the world.

We know a little more about autism and its various ways of learning, among them it was mentioned that the autistic student needs at least two different activities to choose, since they need to have options and power of choice, such as two biology activities, but that have different application methods, because they need to have the feeling of being in control of the situation.

The feeling of not being in control of what is going to happen can generate crises, as well as recurrent noises, can also lead to the same, one way that teachers can deal with the situation is to take the student's attention away from what is causing him discomfort and take him to another situation, notice the signs that precede a crisis, They are essential for effective intervention, preventing this crisis from occurring. Another important factor in times of stress is not to allow the child to associate his leaving the room with that crisis, causing him to repeat the crisis to get out of that situation immediately.

It is extremely important to train people around this autistic person, at home and also at school, so that it is easier to perceive the initial signs, so that they can act, thus preventing the child from hurting himself and not also going through the discomfort of this situation.

Students also need a break between activities, especially if the teacher intends to completely change the type of activity, since the change brings discomfort, as it will be causing the feeling of losing control of that environment that was comfortable.

Autistic people need a social reward, as this leads to a greater chance of this behavior that was rewarded occurring again, for example, When we want to socially reward the participant, we clap our hands and smile so that he understands that his action should be repeated more often, since he was little we realized that this was the form of social reward that he understood the most, However, it could be a compliment to your action among others, depending on the student

In the participation of this event, situations present in our society were mentioned, which shows how much we are not yet prepared to receive and welcome, people with some type of disability or disorder, leading to critical thinking, the subject addressed must be increasingly constant in society so that situations of exclusion and embarrassment are not present in the lives of these people who already go through many challenges throughout their lives.

DISCUSSION

An important step for children to understand biology is the literacy of biological terms, literacy and scientific literacy (GONÇALVES et al. 2015). However, Biology goes far beyond learning terms, especially at the participant's age, so when we can make him understand what his hands, his feet, or where the air he breathes goes, he will be learning about the anatomy of his body, which refers to Biology, for example.

Due to this fact in the present work, we seek to learn Science and Biology while the literacy process occurs, since it would be impossible to separate them since all knowledge is connected, for this will be used: activities, games, applications, among others, to assist in this arduous process.

THE USE OF TECHNOLOGY IN EDUCATION:

Technology can be a great ally to education, when used properly. A major point present in the behavior of the research participant at the moment is restlessness and lack of concentration. In the present work, new ways to circumvent this situation in an efficient way were explored.

Technology as a didactic resource:

> The increasing use of digital media in the academic and corporate environment as a strategy, with an audience increasingly involved with technology, brings to institutions several options of didactic resources to give them the opportunity to respond to individual differences and multiple facets of learning. (BITTENCOURT, P. A. S. & ALBINO, J. P., 2017, p.209)

Taking into account the assumptions, some applications that stimulate the participant's cognitive function were separated. After two months using these applications in a monitored way, Pietro started to vocalize the letters A, E, I, O, when he saw the alphabet, although so far he could not identify the corresponding shape of each letter, it was possible to perceive the association of the sound with the alphabet, leading to the idea that he recognizes that the sound is a member of that group and does not correspond to an object, for instance.

In addition to the literacy aid, his memory was also stimulated, as he was able to relate equal cards, forming the pairs, around twelve cards, totaling 6 pairs, in addition to being able to assemble puzzles with few pieces, which before the help of these games he did not assemble correctly.

THE DEVELOPMENT OF SPEECH, SOCIALIZATION AND LITERACY OF THE AUTISTIC CHILD, PARTICIPANT OF THE RESEARCH

The research participant is a non-verbal autistic child. About non-verbal autistic people it is known that:

> From 20 to 30% of individuals with autism never speak. This percentage is considerably lower than it was about 10 to 15 years ago, thanks in large part to early and intensive intervention. Delays in language acquisition are the most frequent complaints of parents. Usual patterns of language acquisition, such as playing with sounds and babbling, may be absent or rare. (KLIN, 2006).

After stimulating his skills with the dynamics described, Pietro then started to have a new skill, the hyperfocus starting to ask to identify the words for him and speak the letters that form these words, this behavior occurs in various places such as food packages, signs on the street, at his school or at home.

Regarding hyperfocus, we can point out that:

> Children with autism may exhibit different behaviors, some with preserved intelligence, others with hyperfocus on a certain subject. Hyperfocus, then, can be defined as an intense concentration on a subject or task, manifesting itself with emphasis on subjects who exhibit restricted and repetitive behavior (Lovas et al., 2015).

The same occurs when he witnesses a different animal or a toy that represents something he does not yet know the name of, demonstrating a high capacity for memorization, being observed an expressive confusion when pronouncing the wrong letter or word, requiring immediate correction of the correct words, in addition to an extraordinary intuitive intelligence when playing with the fitting of pieces and tasks of his daily life.

> There is evidence of a high rate of occurrence of Intellectual Disability (ID) in Autism Spectrum Disorder (ASD). This evidence is questionable, since, in general, intelligence tests, such as the Wechsler Intelligence Scales, presuppose the ability to understand and/or produce language, a skill often deficient in autism. It is possible, therefore, that by using these tests we are underestimating the intelligence of these individuals. In fact, different groups of researchers have shown that estimates of intelligence in the population with ASD vary greatly depending on the instrument used for assessment. In particular, these authors have argued that individuals with ASD perform better on tests that assess fluid intelligence than on tests that assess crystallized intelligence (SOARES, 2018).

This behavior began to occur through his own interest in knowing the names of objects and letters of the alphabet, leading his hand or finger to the object he wants to know, through his difficulty in pointing out objects, which is one of his present characteristics, since neuroatypical children tend to use the hand of the nearby adult as a tool so that he can get what he wants. Try to get a quote on that.

> Infants and young children with autism can guide their parent's hand to obtain a desired object, without making eye contact (i.e. as if she were obtaining the object by the hand and not by the person). Unlike the child with developmental language disorder, there is no apparent motivation to establish communication or attempt to communicate by nonverbal means. (KLIN, 2006).

The results may seem small compared to what still needs to be worked on, but it is worth remembering that Pietro is still only 3 years old, and is overcoming some of these challenges in a fun way, in his time, at no time did we impose our will on him, he always had the interest to participate. I don't think they're small, but we'll leave it to the panel to analyze. I think we can explore here what are the next steps we have to take at home, at school, in special care, in the speech therapist, and neuropsychopedagogue.

So far we have noticed many advances in relation to his limitations, even if there are still many that need to be worked on, but it is worth remembering that Pietro is still only 3 years old and

is overcoming some of these challenges in a fun way, in his time, at no time did we impose our will on him, he always had the interest to participate.

CONCLUSIONS

Although Pietro is non-verbal autistic, we look for other forms of language, because language is not just talking but the way the person uses it to communicate, which already happens in his way, when he develops his speech he will already know the letters, the animals, the way he writes it and maybe even in the near future, Be writing, soon to match the development close to or even equal to that of other neurotypical children of your age.

More important than speech, he established a means of communication with his mother, and then with his family, making it possible to say what he wanted, learning and teaching, and thus developing.

When the autistic child is stimulated both by the family and at school from childhood, the chances of the delay being overcome become more likely, so we should not treat a child with ASD as inferior to others, as if there was no ability to learn, because their potential is great and we can help to reduce the impacts, always trying to get closer to the level of his age.

We chose to use the term conclusions, and not final considerations, because a teaching method was applied, the didactic literacy games mentioned above, and concrete results were obtained. The autistic child developed a method of communication with the researcher-mother by means of concrete objects, which the child placed and took out of her hand, as the mother spoke the correct word that designated that object. With the presence also of communication mechanisms that the child signaled to his mother, whether the word associated with the object was right, or wrong. In this way, a method of communication between the non-verbal child and his/her educator was generated with the potential to expand to the child's communication with the world, until other means of communication, such as speech and writing, are developed.

This was a work built in the Degree Course in Biological Sciences at CEUNES-UFES, Campus São Mateus, and is a starting point in the perspective of the teaching of Biological Sciences, with a Freirean theoretical framework, focused on the resolution of real social problems, in a fraternal, solidary, and emancipatory perspective. But the work lacks continuity in the hands of professionals specialized in autism, pedagogy, early childhood education, and education and inclusion. It will continue to be developed in the research center, both with regard to the development of teaching practices in Science, Biology and Environmental Education to increase the communication processes between mother and child, but also, the work will be forwarded to specialists in the area, to be reviewed and expanded, in terms, new applications and discussions.

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The limits and possibilities of music in the early years of elementary school

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ABSTRACT

In the context of curricular organization at the national level, there are several institutions that still find it difficult to integrate music teaching into the educational context, given its specificity. This article is an excerpt from a master's research in which a study was carried out on the pedagogical practice of teachers regarding music in Elementary School. The research field was a municipal school, located in the municipality of Goiânia, State of Goiás, the participating subjects were: 01manager, 14 (fourteen) teachers and 132 (one hundred and thirty-two) regularly enrolled students. This qualitative study had the data collected through a structured interview, after approval by the Ethics Committee of the Military Police College - FPM (CAAE: 61333922.4.0000.0145, Opinion No. 5.586.122) and the dissemination of the results was authorized by the research participants, who signed the Free and Informed Consent Form and the Informed Consent Form. It was found that most of the teachers did not have any discipline on Music in the initial training. The students signaled the reproduction of classes focused only on activities that involve the Visual Arts, data identified through the interviews carried out, a fact that contributes to the fragility in the initiatives of the Municipal Department of Education regarding the process of implementing the teaching of music in schools, given the inclusion of music as a proposed content for the teaching of this discipline.

Keywords: Music at School, Pedagogical Practice, Teacher Training, Elementary Education.

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INTRODUCTION

The cultural traditions of each era have always been related to music. From this perspective, what can be observed is a diversification of musical tastes that are established throughout the changes that have occurred in society. Thus, teaching proposals, especially in school institutions, need to consider this musical diversity so that the student can experience the joys of music in the classroom. This implies that access to diversified musical works contributes to the formation of critical and sensitive individuals.

Since the nineteenth century, music has always been present in Brazilian schools. Contrary to what is proposed today, the learning of music was based on technical musical elements, in a more systematic way. Over time, by the end of the 1930s, the way music was conducted in school spaces began to change.

With the insertion of Law No. 11,769 published in the Official Gazette of the Union in 2008, which amends the Law of Guidelines and Bases of Education (LDB) – No. 9,394, of December 20, 1996 and makes the teaching of music mandatory in elementary and high school. According to the aforementioned Law, all public and private schools in the country must include music in their curricular structure.

This research aims to investigate the way in which the pedagogical practices of teachers who work in the teaching of the early years in Elementary School are configured, within the scope of the legal and curricular bases that guide the teaching of music as mandatory content in schools.

Music in school encompasses historical, cognitive, conceptual, physical, and sociological issues, serving as a gateway to deep and fundamental discussions about how to provide adequate music education. There are many challenges until the inclusion of music in schools as a tool for the full development of children and young people is achieved.

In view of the above , it is possible to understand the need for the involvement of all education professionals, to increasingly strengthen pedagogical practices that can present music as a privileged laboratory for the development of the most diverse skills.

METHODOLOGY

This article is an excerpt from a master's research in which a study was carried out on the pedagogical practice of teachers regarding music in Elementary School. The research field was a municipal school, located in the municipality of Goiânia, State of Goiás, the participating subjects were: 01manager, 14 (fourteen) teachers and 132 (one hundred and thirty-two) regularly enrolled students. This qualitative study had the data collected through a structured interview, after approval by the Ethics Committee of the Military Police College - FPM (CAAE: 61333922.4.0000.0145,

Opinion No. 5.586.122) and the dissemination of the results was authorized by the research participants, who signed the Free and Informed Consent Form and the Informed Consent Form.

MUSIC AND ITS CONCEPTIONS

Music in Early Childhood Education is used at various times. So that the child recognizes organized sounds and uses the voice as an instrument. Some important products of music are: compositions, improvisations, and interpretations. Music is a powerful educational resource, an important source of stimuli. In this way, musical facts should lead to actions such as: motor behaviors, gestures, body expressions. According to the National Curriculum Framework,

> Music is one of the important forms of human expression, which in itself justifies its presence in the context of education. Thus, the work of music in Early Childhood Education contributed to improve learning performance, favoring the cognitive, linguistic, psychomotor and socio-affective development of the child. And thus to discover which methods are most effective and used by educators in schools (Brasil, 1998, p.45).

It can also work on musicalization in a teaching and learning process, making the school environment more receptive, joyful and that all children can study in harmony. Music is increasingly used to teach literacy, aiding in the construction of knowledge and exploring cultural diversity. In this sense, it is important to insert music in games in Early Childhood Education, so it will become more interesting. When the teacher starts content in the middle of music, the children will be learning in a fun way.

In the educational field, music is a great resource for distraction and fun, resulting in knowledge building. According to the NCP (1997, p.76), any teaching proposal that considers this diversity needs to make room for the student to bring music into the classroom. In this way, it allows the student to build hypotheses and feel free to express themselves in the best possible way.

Jeandot (1993) says that children like to accompany music with body movements , such as clapping, tapping, dancing, head volleys, but initially it is this bilateral movement that will be performed. Through this relationship of gestures, sound, listening, singing, imitating, dancing that the child builds his knowledge about music. When he begins to have contact with objects, he soon begins to communicate with the sound world.

Snyders (1997, p.29) says that "modern music pedagogy has been able to develop very simple instruments and procedures for students to carry out personal constructions". There are several ways for there to be a good development of students through the insertion of music. Therefore, when they are involved in this musical environment, they will learn without even realizing it.

When children build their musical instruments, they awaken the desire to explore them musically. There are numerous varieties of musical instruments that children can make on their own, with the guidance of the teacher in the classroom.

In this sense, it can be said that music is a very positive factor, which contributes to the development of the child, to the formation of the personality, to the balance so that they live their musical experiences through language and thus helping in intelligence and motor skills.

Teaching and learning being made possible by the introduction of musical repertoire does not in fact mean music teaching, but a strategy that reaches the sensory aspect in school practice, also allowing the appreciation of culture, depending on the songs that will be used in these learning moments. In this sense, all subjects in the curriculum benefit from music. In view of this, it is known that discussions about the absence of teachers with specific training in meetings held with professionals in the field of music education are common. This fact may result from structural and conjunctural conditions.

Penna (2002) contributes to this discussion when he proposes questioning the way in which music education has been committed to music in basic education schools, understanding a commitment in the sense of a collective effort to occupy this school space, to seek pedagogical and methodological proposals appropriate to this context and its own needs.

A BRIEF HISTORY OF MUSIC IN BRAZIL

Music as it is known today has its roots in ancient civilizations and has played, throughout history, an important role in the development of the human being, in view of religious, moral and social aspects; It contributes to good human formation and the exercise of citizenship.

The etymological study of the word "music" points to the term from the Greek language – "Mousikê" – and designated, along with poetry and dance, the "Art of the Muses". Rhythm, the common denominator of the three arts, was summed up in music. The ancient Greeks and other civilizations of their time attributed to the gods all the inspiration for the creation and exercise of music; It was defined as a creation and integral expression of the Spirit, a means of achieving perfection.

From this vision, the Greeks made music an art that influenced the way of thinking and being in society. From childhood they learned singing as something capable of educating and civilizing. The musician, in Greek society, was seen as the guardian of a science and a technique, and his knowledge and talent had to be developed by the study and exercise of music.

In this context, the recognition of the formative value of music gave rise to the first concerns with the pedagogy of music in that country. Thus, music went beyond its initial limits, of a religious and aesthetic nature, purely. It has become a school subject, an object of mastery, providing the measure of ethical values; as well as the good formation of the human being.

Gradually, "mousike" came to encompass everything related to the development of intelligence. Faced with this reality, for the citizen to receive a musical education did not only mean

learning to play musical instruments such as piano, violin, or bassoon, but studying in depth all the liberal arts, writing, mathematics, drawing, declamation, physics and geometry, this was related to "competence and development of intelligence - knowing how to sing in a choir and play at least one instrument perfectly" (Loureiro, 2001, p. 36).

With the development of societies, many concepts have been modified and the very objectives of the application of music in human activities have also undergone profound transformations. Nowadays, music is intertwined with the very history of the development of human intelligence and culture. According to Jeandot (1993), music is the language of the heart. A universal language that involves different ways of playing, singing, and organizing sounds and traditions.

In this sense, Brazilian music is a mixture of origins, it was formed from the mixture of cultural and religious elements of European, African and indigenous peoples, brought together by the colonization of Brazil in the sixteenth century; this process took place, initially, by the Portuguese colonizers and the natives who inhabited the so-called New World, and later, by the African peoples, enslaved by the Colony.

From the seventeenth century onwards, brotherhoods of musicians began to form, some made up only of blacks and mulattoes, brotherhoods that began to monopolize the writing and performance of music in much of Brazil. However, already at the time of the arrival of the Portuguese in Brazil, these Europeans saw with astonishment the customs of the natives and the way they made music: singing, dancing, playing instruments (rattles, flutes, drums).

It is important to highlight that there was a social segregation, and consequently, a musical one, because, until the beginning of the eighteenth century, most of the classical music was practiced only in the states of Bahia and Pernambuco, but at the end of that same century a fusion of various melodic elements and African rhythms began to delineate the identity of popular music in Brazil. with its own sound; This spread throughout the country and formed the first names in Brazilian music: classical, romantic, national; modinha, choro, samba, among others.

Considering the cultural and ethnic miscegenation of the Brazilian nation, with regard to the origins of popular music, its roots are rooted in African culture, but nowadays, its various rhythms and sonorities have expanded and reached an extraordinary diversity, which presents an infinity of musical genres, enriching Brazilian culture more and more.

MUSIC AND PEDAGOGICAL PRACTICES

Many studies show that music awakens intense brain stimuli in the human body. They generate assimilation of new information and new learning. Even if the teacher does not have musical training, he can take courses and programs such as continuing education, so he will learn methodologies that will help him in the practice in the classroom, when the subject is music.

> Among the teachers' needs for the realization of their pedagogical-musical practices, most highlight that the musical training received was not enough. They wish to have more in-depth musical knowledge, which could bring, according to their statements, more security to carry out their work, improving their practice (Diniz, 2005, p. 95).

Thus, it is clear that it is important to include music in the midst of education. The gains it brings with this work are positive, in which the benefits are diverse, more diversified classes, getting out of the routine and providing meaningful learning.

Therefore, teachers can make a study on methodologies related to music in continuing education. So that they learn to take this into the classroom and provide students with more fun, relaxed learning with good results. It is important for the teacher to keep in mind that the student's knowledge construction process is continuous. It should involve perceiving, feeling, experiencing, limiting, creating, and reflecting. Placing the teaching of music in the midst of activities in an interdisciplinary way, thus providing a comprehensive education.

Music is the result of countless experiences and reflections on music from different civilizations with the insertion of several individuals who fell in love with making, singing, composing music within different cultures. Thus involving the children's universe, where music is present in everyday life and refers us to the particular experiences and experiences of each person. From the first years of life, the individual participates in this musical universe, which influences life and marks a culture.

Silva (2010, p.16) says that music can contribute to making the school environment more joyful and favorable to learning, providing a joy that is experienced in the present moment and this is the essential dimension of pedagogy, and it is rewarded by this environment. It is understood, then, that when music is inserted in the school environment, it results in a pleasurable learning. And the reward that the teacher has is to see that this insertion of music in the school is working.

Thus, the child always has this musical universe around him. When the teachers insert it in the middle of the classes, it is not strange because they are already used to this environment full of music. In view of the above, it is possible to perceive what music awakens in students, in their perception of getting to know the culture better and creating a taste for knowledge. It enables a better development and the proposed objectives are achieved obtaining better results.

> Music has been serving several purposes in the day-to-day of Brazilian Education, according to pedagogical conceptions that are currently in force in the country. Activities that awaken, stimulate and develop the taste for musical activity such as: listening to music, learning a song, playing in circles, making rhythm toys, hand games, also meet the needs of expression that pass through the affective, aesthetic and cognitive spheres, learning music means integrating experiences that involve living, reflection and perception, directing them to increasingly elaborate levels (Soler, 2008, p.18).

In this way, music has been bringing several purposes that only bring gains to students. It is important to arouse interest in the student, working in a way that seeks their curiosity, such as inserting objects that catch their attention in the middle of the classes, they can even be made by the students themselves so that meaningful learning occurs. The issue of the insertion of music is always linked to culture, and in the midst of education it is important that the teacher seeks to diversify in the best possible way. Because music, being well crafted, allows for better learning.

It is up to the teacher to seek several strategies so that the work with music is meaningful, always seeking to innovate in their classes. For this, it is important that in the act of planning you think about what you will put into practice.

MUSIC AND ART TEACHING IN BRAZIL: EXISTING RELATIONS

Throughout history, music has played an indispensable role in the process of human development in all aspects. According to Loureiro (2001), the word music comes from the Greek —Mousikê and designated, along with poetry and dance, the — Art of the Muses. Rhythm, the common denominator of the three arts, fused them into one. As in other ancient civilizations, the Greeks attributed their music to the gods, defined as a creation and integral expression of the spirit, a means of achieving perfection.

It is worth considering that Brazil has undergone, in recent decades, several reformulations in terms of school legislation. From this perspective, the Law of Guidelines and Bases of Education - No. 5.692/71 stands out, which at that time already advocated the obligation of artistic education in the then 1st and 2nd grade education.

This law, which has been enacted for more than 50 years, guided the work of Art Education teachers, often without any experience or specific preparation. In this context, the teacher acted as an advisor for all artistic languages, which consequently compromised the quality of teaching, especially in this discipline.

Subtil (2012) reflects on this historical moment, asking how and why in an authoritarian context, which excluded philosophical and political reflection, which prevented free expression and expression, which imprisoned, tortured and extradited its artists, at the same time made artistic education in schools mandatory. The author uses the following hypothesis:

> One of the hypotheses would be that art, an area historically linked to the exercise of freedom and creative expression, should remain under control, become an instrument in favor of conservation and the developmentalist objectives proclaimed by the military dictatorship. Evidently, the obligation of artistic education came clothed in a discourse centered on the individual development of the students, based on a technical-scientific character and with a rigorous planning that concealed criticism and contradiction. One might ask at this point, forty years later: what is the importance of bringing these issues to the fore? (Subtil, 2012, p. 13).

In fact, these questions may not be so productive since after this law, other legal bases were instituted in order to value the discipline of Art in the School Curriculum. However, considering the teaching of Art Education mandatory in the middle of the military regime meant meeting the demands of the area, which, through theoretical debates, put on the agenda the free expression and creativity that are indispensable and inseparable elements of the artistic context. In general, the weekly workload was minimal: only one hour per week, or forty hours per year, a fact that is still observable even in schools considered reference.

Law 5.692/71 contributed significantly to the elaboration of the new LDB, No. 9.394/96 and that, in a certain way, reflected in the DCNs as well as in the PCNs that brought Music, Theater, Dance and Visual Arts as specific content. As can be seen, there were several factors that contributed to the teaching of music in Brazil, including the methods disseminated in Europe and that reached Brazil. Such methods used percussion, games, and singing circles.

The PCNs highlight the idea of the importance of teaching and learning Art, stating that:

> Since the beginning of human history, art has always been present in practically all cultural formations. The man who drew a bison in a prehistoric cave had to somehow learn his craft. And in the same way, he taught someone what he learned. Thus, the teaching and learning of art are part, according to norms and values established in each cultural environment, of the knowledge that involves artistic production at all times. However, the area that deals with school education in the arts has a relatively recent trajectory and coincides with the educational transformations that characterized the twentieth century in various parts of the world (Brasil, 1997, p. 20).

The 1980s and 1990s were marked by discussions about the situation of the arts in general and Music Education in Brazil. Professors organize themselves in national meetings for the promotion of research, in associations, to discuss a new direction for the teaching of the arts. It is from the 1980s that a national movement in favor of the teaching of the arts emerges, which multiplies throughout the country through meetings, seminars and events promoted with universities, with the aim of raising awareness and organizing professionals in the area: the Art Education movement. New proposals are then configured for the progress of educational action in art.

During this period, several documents were sent to the Ministry of Education with the objective of strengthening the teaching of Art, bringing back to the classroom, specialist teachers, in view of the specificity of the discipline.

Oliveira (2007) highlights the National Symposium on Research and Graduate Studies in Music (SINAPPEM), the first being held in Paraíba in 1987, and the creation of music associations at the end of the twentieth century – the National Association of Research and Graduate Studies in Music, the Brazilian Association of Music Education, and the Brazilian Association of Ethnomusicology as elements that contributed to the development of music education in the country.

Musicians of various nationalities offered proposals for music education that still raise

discussions and reflections due to the elements presented for the musical development of children, young people and adults. Such proposals, which can also be identified as methods of music education, are still applied today in various educational contexts.

In this historical course of the teaching of Art in Brazil, the different orientations inherent to the purpose of Art are visible, especially with regard to educational policies, which includes teacher training and performance. The teaching of this discipline has always been marked by a philosophical and humanist vision that definitively demarcated the New School and traditionalist approaches.

The discipline Drawing, presented in the form of Geometric Drawing, Natural Drawing, and Pedagogical Drawing, was considered more for its functional aspect than an experience in art; In other words, all orientations and knowledge were aimed at immediate application and qualification for the job.

The activities related to performing art and dance were valued and recognized only in the festivities related to the Commemorative Dates held in schools.

> In Music, the traditionalist tendency had its maximum representative in Orpheonic Singing, a project prepared by the composer Heitor Villa-Lobos, in the 30s. This project is an important reference for having intended to bring the musical language in a consistent and systematic way to the whole country. The Orpheonic Song8 disseminated ideas of collectivity and civility, principles consistent with the political moment of the time. Among other issues, the Villa-Lobos project ran into practical difficulties in guiding teachers and ended up transforming the music class into a musical theory based on the mathematical and visual aspects of the musical code with the memorization of orpheonic pieces, which, reflecting the time, were of a folkloric, civic and exalting character (Brasil, 1997, p. 27).

In this historical construction, between the 1920s and 1970s of the twentieth century, there were several experiences lived within Brazilian schools about the teaching and learning of art. Gradually, the Fine Arts and Drawing classes gave way to a more expressive practice, valuing the spontaneity and artistic progress of the students.

The PCNs for the teaching of Art (1997) situate the 1920s to the present day as a period of several attempts to work with art outside the schools as well, in addition to the growth of cultural movements, announcing modernity and avant-gardes. Also noteworthy in the late 1960s and 1970s were song festivals and large student mobilizations involving theatrical experiences. Also noteworthy is the lack of teacher training courses in the area of Art.

The inclusion of Art Education in 1971 in the school curriculum was an advance, especially with regard to the formation of subjects with renewing thinking, even though teachers were not prepared to guide this area of knowledge.

> Art Education teachers, initially trained in short courses, had as their only alternative to follow official documents (curriculum guides) and textbooks in general, which did not explain foundations, theoretical-methodological guidelines or even specific bibliographies. The very faculties of Art Education, created especially to cover the market opened by the law, were not equipped for the most solid training of teachers, offering eminently technical

courses, without conceptual bases (Brasil, 1997, p. 32).

It was only in the 1980s that the movement of art educators was formed, which initially emerged with the objective of organizing professionals in this area in order to broaden the discussions about the appreciation and improvement of art teachers. Barbosa (1989) clarifies some questions about art education, stating that:

> Art educators in Brazil are politically very active. The politicization of art educators began in 1980 at the Art and Teaching Week at the University of São Paulo, which brought together 2,700 art educators across the country. This was a meeting that emphasized political aspects through debates structured in small groups around pre-established problems such as the immobilization and isolation of art teaching; educational policy for the arts and art education; cultural action of the art educator in the Brazilian reality; education of art educators (Barbosa, 1989, p. 173).

Law No. 9,394/96 is clear when it states in its article 26, § 2 that ―The teaching of art shall constitute a mandatory curricular component, at the various levels of basic education, in order to promote the cultural development of students‖. Thus, it is worth considering the advances of the proposals for the teaching of Art and its contribution to the formation of students.

FINAL THOUGHTS

In general, Brazilians have a close relationship with music and with the different productions played in each region. Thus, the return of music in the school curriculum brought the hope of new transformations, in which creativity, joy and culture become elements present in society and especially in school.

The research carried out made it possible to understand that music in school encompasses historical, cognitive, conceptual, physical and sociological issues, serving as a gateway to deep and fundamental discussions on how to offer an adequate musical education. There are many challenges until the inclusion of music in schools as a tool for the full development of children and young people is achieved.

In the context of curricular organization at the national level, there are several institutions that still find it difficult to integrate music teaching into the educational context, given its specificity. From this perspective, this study met the researcher's understanding of the importance of studies and experiences on the best use of music, in view of the lack of a consistent education that can meet the pedagogical challenges inherent to the teaching of music in the classroom.

Music is a human activity that manifests itself in making, in musical practice. Thus, the first function that can be attributed to music education is to insert students in musical contexts based on an authentic, artistic and critically reflective musical making. In view of this, it is possible to understand the need for the involvement of all education professionals, in order to increasingly strengthen

pedagogical practices that can present music as a privileged laboratory for the development of the most diverse skills.

Thus, reflecting on the need to consider the student's sound/musical universe in the development of a meaningful musical education, this research considered the need to propose a reflection on the various questions about pedagogical practices that can provide access to new paths in relation to music teaching in the early years of Elementary School.

At the end of the research, it is expected to be able to contribute to the discussions about the presence of music as mandatory content in school. It is also hoped that this study can serve as a reference for further research, guaranteeing and expanding the field of work of the teacher with a degree in Music, or of those who aim to be a specialist in this area of knowledge, thus ensuring that the student actually has the right to this content described in the legal repository.

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"Revoada" a reinterpretation of Bel Borba: Geographing in the country school through mosaic art

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ABSTRACT

The article presents the result of the extension project "Revoada – a rereading of Bel Borba", using art as a way of geographizing, as a possible policy for the democratization of space. The objective was to develop geographical knowledge through the construction of a mosaic panel at the Prefeito João Alves dos Santos Agricultural School, based on the geographical formation of production and appropriation of space from the reinterpretation of the mosaic street work of Bel Borba known as Pássaros. To this end, we use bibliographic studies, documentary analysis on the impact of street works, participation of the social subjects that make up the school community in geographical pedagogical workshops, with themes from art in the city and in the countryside, mosaic workshops and installation of mosaics produced at the Agricultural Technical School Mayor João Alves dos Santos, Itabaiana/SE, which resulted in the launch of the work "REVOADA: A Rereading of Bel Borba". As a result, we point out the need to think about the local space, since our actions have driven in the students in training of the geography course a new thinking of the geographical space and the possibility of recreating it, modifying it, as well as contributing to the students of the school unit in the consolidation of knowledge and reconstruction of their living space.

Keywords: Rural School, Geography Teaching, Mosaic, Public Art, Extension Project.

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INTRODUCTION

The extension project "Revoada – uma releitura de Bel Borba" used the word 'Revoada' in the Figuretive sense of reading, since the reflection of the mosaic inspired by Bel Borba are birds. The literal definition "flock, group of birds in flight" represents the work of reinterpretation proposed as an intervention, in the production and appropriation of space, having art as a way of geographizing, as a possible policy for the democratization of space.

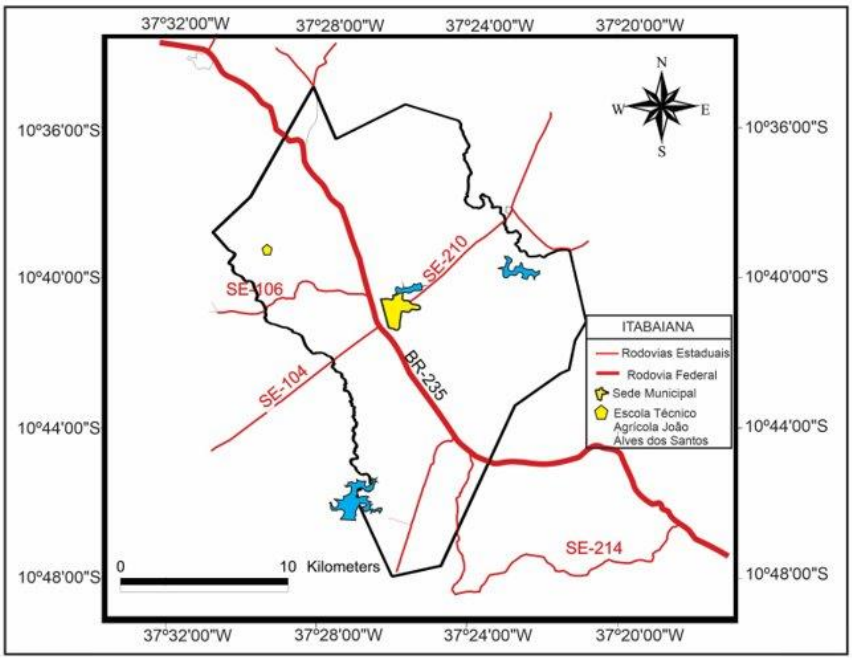
It was carried out at the Prefeito João Alves dos Santos Agricultural Technical School, in the village of Roncador in Itabaiana-SE. And the installation was done in the common playground environment, where there are school meetings and celebrations. This decision was made collectively, considering that "the place is an important instigator of perception, which makes people question themselves" (Freitas, 2006, p.127), and the "group of birds in flight" represented this process of flight of the minds of the students involved or not in the process.

The justification is presented precisely in the object of study of geography, which is the production of space. In this aspect, the much-debated duality of urban and rural is observed through the productions and interrelations of these spaces, verifying the manifestation of art in each of them. Therefore, the language of musive art, in the production of mosaics of birds, senders to nature and the countryside, made it possible to develop geographical knowledge by modifying the landscape, because

> Aesthetic evaluation leads to philosophical speculation, and why not? Are not the compositions of nature, the lines and colors of the terrain and the vegetal mantle things to consider? [...] Human structures express functions based on adaptation to the site, like a seal that identifies the preferences of each particular culture. There is an aesthetics in the set of forms, an aesthetic morphology of the landscape, often violated by industrial civilization. Isn't this question of a harmonious landscape something worthy of reflection? (SAUER, 2000, p.150)tag.

In view of this, the proposal of this text has similar objectives to the one carried out in the extension project, as an active approach: to analyze the production and appropriation of space from art, creating spaces for debate with teachers, future teachers and students of the school community where the project operates; disseminate the production of the reinterpretation of a work based on the reality of the Escola do Campo that stimulated creativity and fostered students, demonstrating in order to research the social impact caused by artistic productions; and last but not least, valuing the Prefeito João Alves dos Santos Agricultural Technical School (highlighted in Map 1), as well as education in the countryside, based on belonging and appropriation of space, building means through partnerships to disseminate art and visitation in the school.

Map 1 – Location of the João Alves dos Santos Agricultural Technical School, Itabaiana, Sergipe.



Source: SEPLANTEC Cartographic Base (2010)
Elaboration: Diana Mendonça de Carvalho (2020).

This location close to the Federal University of Sergipe, Alberto Carvalho campus in Itabaiana, provided the dialogue and actions of the project that will be specified in this article. Which is organized beyond this introduction into methodology, theoretical framework, results and discussions, conclusions and our references.

METHODOLOGY

We subsidize the theory from bibliographic studies, as it is pertinent to form a base, being the reading and debate about the chosen references the first step for development. As part of an active approach, the objective is the participation of the subjects who make up the community of the rural school, because "it is the social practices that qualify the space at each moment [...] it is the social practice developed there that gives a meaning, that values that place in a certain way at a certain historical moment" (MORAES, 2008, p.4).

For a better detailing of the execution of the extension project , the following methodologies were used: Geographical pedagogical workshops with themes of production and appropriation of space from art in the city and in the countryside; photographic and documentary analysis on the impact of the mosaic street works of Bel Borba; mosaic workshops and installation of mosaics produced at the Prefeito João Alves dos Santos Agricultural School; and, to finish, the launch of the work "REVOADA: A Rereading of Bel Borba", inviting the school community and partners. Being defined as a target audience that would participate directly in the production activity from start to finish the 9th grade students, from the class of 2022.

The promotion of the rereading of the work Pássaros de Bel Borba occurred through the analysis of the artist's work, in a qualitative perspective, when executing, together with students of Basic Education, the birds, in our rereading were initially made by the extension worker Maria Daniele, colored by the students of the 9th grade and built a clothesline of the images in the classroom, On this path, we invited the class to produce the mosaics for the central wall of the courtyard of the Mayor João Alves dos Santos Agricultural Technical School.

These procedures contributed to the geographical analysis of the artist's work, while conditioning an understanding of the sense of belonging and fostering interest in the appreciation and production of street visual arts as a form of democratization of space. The chosen school space was strongly influenced by the interactional dynamics of the countryside-city relationship visualized there, which conditioned new perspectives of appreciation for this school floor.

THEORETICAL FRAMEWORK

The main materials reviewed focus on the production of street arts, with emphasis on mosaics, as well as have repercussions in their exhibition on the daily lives of the subjects who pass through them. Among the main ones: SANTOS (2021), MONTES ROJAS (2016) and FREITAS (2006). Texts by the authors such as "*Art in the fight against violence against women*", the course material "*Arte y Espacio Público*", and the master's thesis "*The mosaics of Bel Borba in the city of Salvador*". The first is also a record of experience, where the Arte Musiva "*Ciranda de mulheres: nos queremos vivos!"* located in the Praça do Sol Nascente and J.K in Aracaju-SE, demonstrates that mosaics bring themes pertinent to the struggles against repression of minority classes, be it the female class, the peasant class, or another that wants to be represented.

Turning our gaze to the teaching of geography, CAVALCANTI (2013) provides us with "*Geography Themes in Primary School*" To reflect on the school daily life and within the contemporary challenges, to guide teaching in the reality of students for a formation of significant and critical knowledge. Of particular note is the chapter on "*The City Taught and the City Lived: Encounters and Reflections in the Teaching of Geography*", since one observes the strong countryside-city relationship of the educational body and students of the Agricultural Technical School, many of whom live in the city as regulars of rural education, thus being able to rethink, paraphrasing, the field taught and the field lived. On the other hand, in order to understand the categories of analysis, MORAES (2008) in "*The formative meaning of Geography*" the Space, as a category that houses the others, the main one of this work, being also used those of Place and Landscape.

In addition, the key reference for the development of the mosaic panel, which goes from the theoretical to the practical, is in the experience of the Mosaicist and Project Coordinator Laiany

Santos, who shared her knowledge and techniques verbally and applied, thus associating the theories of assembly and studied contents to practice.

RESULTS AND DISCUSSION

Bel Borba is a plastic artist, mosaicist, from Bahia, who has works recognized around the world, but we specifically studied his works in Salvador. Art culturally and artistically shapes the city and the artist's works are found in different areas of the city, breaking with ready-made rules and forms. It reflects the diversification of artistic modalities, seeking the right of freedom and rupture, but with responsibility to society. It is as an artist that he allows his works to be mentally recreated by timeless narratives. They are works of public and urban art of a gigantic force of expression, as well as

> We can conclude that Public Art, a term we use as a reference for the understanding of Bel Borba's work in the urban context of Salvador, represents a manifestation that interacts work of art, city, artist and society, being a result of the interrelationship between these four systems (physical, symbolic and cultural) characteristic of the human being and its insertion in the contemporary world. (FREITAS, 2006, p.32).

Thus, Bel Borba uses spatialization, studies the considerations and characteristics that are expressed in certain places in the urban areas of Salvador, organizes them and architects them in works that express the reality wherever she is or resignifies them as in a fairy tale, which brings warmth to those who pass by these works.

After these initial approximations, reflecting the theme 'art and geography', debating the texts, the notion of what Art and Mosaic are and how they are intrinsically endowed with geographical issues is broadened. At first glance, the process of making a mosaic seems long and laborious, but at the same time engaging and rewarding, it carries meanings and brings a sense of fascination[4].

Through these discussions, readings and attributed suggestions on how to observe art and its meaning embedded in everyday localities, the development of a Workshop on Public Arts was carried out in the municipality of Itabaiana, which addressed artistic manifestations in the urban and rural spaces of experience of those involved, divided between the theoretical expository part and the dynamic part.

The survey of material (photographic images of paintings, monuments, sculptures) for the construction of the dynamics was done through a search in the field, in the streets of the city, walks through squares, use of means of transportation, going through the center and neighborhoods of the city, some villages, as well as casual and occasional dialogues with colleagues, teachers and friends

4 These feelings were perceived and experienced from the extension worker Maria Daniele to the other participants who expressed them during the process, and for this reason, we emphasize here in the text.

about works that they usually see. if they see them, and I use images taken from Google Earth and Google Maps.

Within the time available and accessibility to the localities, the works found were of predominance of the urban space, which is also justified by the fact that art is more centralized, produced and appreciated in areas of great movement of people such as cities, but it should not be restricted to them, which further reflects the need for production and appreciation of artistic productions in the countryside.

In this sense, we justify why we use in the workshop works found in the urban environment of Itabaiana to work on what is production and appropriation of space, because these arts served as a resource with which to demonstrate the different types of artistic practices closer to the reality of the students of the rural school, based on the teaching of Geography, often

> In order for the objectives to be fulfilled, the teaching work will seek ways not to be reduced to the presentation of ready-made information and definitions, providing, instead, the encounter/confrontation of the immediate daily experience of the students in their reality with the pertinent scientific concepts. (CAVALCANTI, 2013, p.65).

It is worth noting that going to the countryside in urban and rural areas, in addition to being the focus of research, also serves as a Study of the Environment in Basic Education, guiding knowledge about what should be addressed. It is important to recognize the teaching that these localities propose and , with this purpose, to explore or take advantage of the youth practices of living the city and living the countryside, recognizing their interrelationship, also in the sense of "circulating, of walking through it, including the school activities of imagining, of describing the landscape, of its places to understand its movement, its appropriation, the processes of identification" (CAVALCANTI, 2013, p.75).

The workshop began with the theoretical part involving explaining and teaching to the students of the Agricultural School the different ways of making art, of expressing oneself artistically, how to turn an educational and geographical look to these works. Then, it was specifically addressed what a Mosaic would be and the process of making it and, mainly, what the project proposes: the installation of a mosaic to reinterpret the work 'Birds' in that space.

To this end, this objective of appropriation and democratization of that geographical space is only possible with the participation of the school community, because "it is the social practices that qualify the space at every moment (...) it is the social practice developed there that gives a meaning, that values that place in a certain way at a certain historical moment" (MORAES, 2008, p.4).

Therefore, the dynamics aimed at the students of the 9th grade class of the Agricultural School was developed, counting on their participation, using the previously photographed works, arranged in a game of Naval Battle, which works on the notion of location. The figures achieved the

goal of encompassing the theme of Public Art in the urban space of Itabaiana, in addition to making us think about the creation of art in rural areas. In addition, he brought artistic reflections as part of his daily life, demonstrating that "the domination of space in everyday life is thus made by its individual and group appropriation, hence the process of valuing certain regions of the city" (CAVALCANTI, 2013, p.68).

Figure 1: Battleship: Discovering Itabaiana's Public Arts.



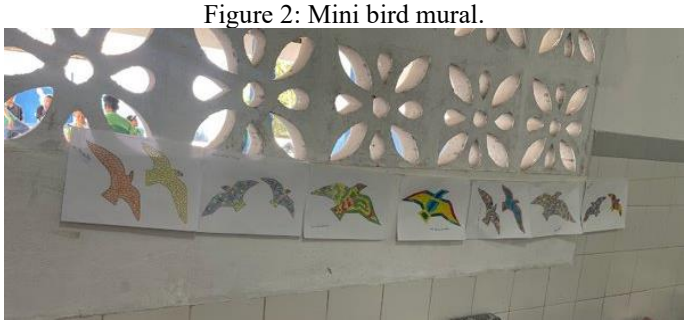
Source: SANTOS, L.R.S. Acervo pessoal, 2022.

The experience, in addition to being attractive and interactive, rescued the representativeness of the works in those spaces through their (re)knowledge by the class, since through the contextualization of the reality of the participants, there is a collective formation, interaction and exchange of knowledge about the presence of street arts. Since they are in their daily space, exploring perception because "in addition to everything that can be transmitted by instruction and can be mastered through techniques, there is the domain of individual perception and interpretation, the art of geography" (SAUER, 2000, p.149).

However, not everything can be identified in the same way, because "at the same time that monuments remember, they also forget [...] the inevitable passage of time makes what one wanted to remember nebulous, confusing, and our way of approaching these stories is difficult" (MONTES ROJAS, 2016, p.2). In this way, objects can thus be remembered, forgotten or re-signified from the power of cultural absorption, in terms of belonging.

At the end of this stage, the students of the rural school record through a practice of coloring, or drawing, how they imagine or want the 'birds' to be, followed by the assembly of the mini mural of birds, a clothesline with their works, aimed at expanding their visions and thinking about the types of artistic doings, as well as the first step towards visualizing the work 'REVOADA'.

Figure 2: Mini bird mural.



Source: SANTOS, M. D. O. Acervo pessoal, 2022.

In the next stage, we held a practical workshop on the elaboration of the mosaics, the coordinating teachers of the extension project invited the artist and also mosaicist from Goiás, Kleiber Araújo Padilha, who, together with the mosaicist Laiany Rose Souza Santos, carefully guided and closely monitored throughout the making, teaching the teachers and students of the School, and the students of the Federal University of Sergipe who were part of the activity, on how to use materials, from sandpaper to pliers safely, to cutting tiles carefully, among other details.

The chosen type, therefore, is the indirect mosaic, in which the design is prepared on paper or cardboard and the pieces used, tiles and tiles, are glued by the side that will be exposed. As in Bel Borba's works, the ceramics used to make the mosaics stand out in the midst of the concrete surfaces where they are installed and at the same time manage to resist the weather and damage resulting from the exhibition in open and public spaces (FREITAS, 2006, p.74).

Thus, step by step, the items were arranged in various shapes and sizes on the *contact paper* so that it was possible to glue the pieces together on top of previously designed bird molds (Figures 3 and 4), arranged according to the wishes of those who produced individually, in pairs or groups.

After completing the filling of tiles, and other chosen pieces, forming the desired mosaic bird, a TNT cloth bathed in water and white glue is placed on top of each and left to dry for approximately 3 days, and on another day the mosaics are grouting to fix the pieces and so that they do not fall or come off, The intention of mosaic art is to be a perennial, timeless work.

Figure 3: Initial phase of the Mosaic Production Workshop at the Agricultural Technical School.



Source: SANTOS, M. D. O. Acervo pessoal, 2022.

Figure 4: Bird created in the Mosaic Production Workshop.



Source: SANTOS, M. D. O. Acervo pessoal, 2022.

To finish the indirect type mosaic, the installation is carried out, bird by bird, on the wall with fixation through mortar. Being set up in the place that was chosen for the installation of the work, the common courtyard of the Agricultural School, an accessible space where everyone could enjoy the artistic beauty and re-signify the environment from their imaginations, a new item now changes that landscape, the place, the space, and this one that belongs to everyone. In addition, we can also reaffirm that not every artistic work needs to be associated with a painting in a closed gallery, bringing more prestige to public environments, as well as

> Bel Borba, as well as other artists who dedicated themselves to public art, sought to escape the limitations and rules of these spaces, even enabling a greater approximation of his works with the public. He believes that this space provides an expansion of the public, favoring those who do not go to galleries and museums to have direct contact with his works. (FREITAS, 2006, p.58)

Thus, the installation was also done collectively, however we had the help of the artist Kleiber Padilha to prevent the students from directly handling the mortar, as shown in Figure n°5 with the birds still covered with TNT to wait for the wall to dry.

Figure 5: Kleiber Padilha at the Mosaic Installation.



Source: SANTOS, L. R. S. Acervo pessoal, 2022.

In the step-by-step process carried out in the workshops of arts and construction of the mosaics, the students were questioned about the meaning of this work, here are some of their statements: "it means to me the freedom of people"; "I liked the new experience I got"; "This new experience was very good"; "I thought it was nice and very lively"; "I thought it was very interesting." The considerations put forward gave dimension of how they belong to that space. The execution of the birds of Bel Borba gave the students of basic education the sense of belonging to that space until the moment that art is kept there, that is, their passages through the unit were territorialized in order to be remembered as pioneers of new spatial perspectives. It is worth relating to the fact that

> If we consider that space is something that is given, but at the same time constantly reconstructs for us as we move in it, then we understand that, as the historian Gabriel Salazar puts it, space operates between the inherited historical situation (the space already built) and the space that is being built each day by the way we move in it. (CORNEJOS CAVAS, 2016, p.3).

The following figure shows the finished panel, with the plaque (Figure n°7) that highlighted everyone involved.

Figure 6: Mosaic “REVOADA: A Rereading by Bel Borba".



Source: SANTOS, L. R. S. Acervo pessoal, 2022.

Figure 7: Inauguration plaque for the work “REVOADA: A reinterpretation of Bel Borba”.



Source: SANTOS, L. R. S. Acervo pessoal, 2022.

With the launch of this work, the relationship between UFS and the Mayor João Alves dos Santos Agricultural Technical School, as well as understanding of the countryside-city relationship and the teaching-learning of geographical categories such as space and place through appropriation by art. Considering that it has no finalization, this project does not end when its execution period ends. The launch of the work "REVOADA" builds a path for all participants, whether teachers, employees, principal, undergraduate and elementary school students, to live a transformative experience of looks, recognize themselves as belonging to and transforming space and democratize the uses of spaces through art.

FINAL THOUGHTS

The contextualization of the phenomenon of a universe in constant transformation, characterized in a simple physical structure, such as a school wall, was significant with the applicability of representations and the expression of its own identity manifested in a mosaic. Thus, the learning about production and appropriation of space from art is achieved and the recognition of street art in Itabaiana, Sergipe, is now beyond, being the recognition of rural art, made in the rural school by rural students.

The experience of belonging and relationship traced with the Prefeito João Alves dos Santos Agricultural Technical School established a record for future generations, because "the places are becoming different, not only for their natural characteristics, but also for the accumulated spatial heritage, for the built spaces that each one contains. They are varied spatial legacies" (MORAES, 2008, p.4). In this regard, mosaic is a perennial art, thus occupying a space and largely fulfilling its role as a memorial.

The present work became important in view of the need to think about the local space, since it boosted in the students in training in the geography course a new thinking of the geographical space and the possibility of recreating it, modifying it, as well as contributing to the students of the school unit in the consolidation of knowledge and reconstruction of their living space.

This interactive construction contributed to arouse curiosity and provide hopes of occupying training spaces, understanding its importance and potential as a transforming agent of reality, that is, a generator of socio-environmental and cultural well-being in all involved. This is because only art imitates life and by imitating it it brings with it the overload of knowledge acquired about our space.

The release of the work meant allowing other people to know, interact, consume and give different meanings to it. Therefore, the dissemination to society is also a beginning of its path, since "appropriations feed on both impressions and perceptions and "even if it is experienced individually, it is always a collective phenomenon" (CONEJOS CAVAS, 2016, p.3 apud SANTOS, 2021, p.38).

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Teacher training and Pedagogical Political Project: Advances and challenges

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ABSTRACT

This work addresses Rural Education and its nuances related to the Political Pedagogical Project. The objective is to understand the teacher training of those who work in rural education and what are the advances and impasses in this process through research in the area. In this study, it is necessary to pay attention not only to the specificity of the school in question not only being a rural school, but also a school that is far from the urban environment and that this in itself characterizes a huge difference when it comes to building teaching-learning relationships. The methodology used for the development of this work was through a literature review, with searches in online journals and magazines, bringing authors who address the theme in question.

Keywords: Rural Education, Teacher Training, Pedagogical Political Project.

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INTRODUCTION

Rural Education requires a differential in its pedagogical proposals, seeking to meet the specificities of those who live there, so it is necessary that teacher training is able to work in this area. The school's identity is built from the experiences and needs of its subjects, as well as from the entire environment in which it is inserted. It provides the entire school community with its effective participation, this is what is expected from the process of building the Political-Pedagogical Project (PPP) of an educator, as it must dialogue with the interests and desires of the community of which it is a part.

In this context, it is also essential that the Political Pedagogical Project (PPP) be specific to Rural Education, elaborated and built with the participation of all those who are part of the school context.

As Veiga (2004) points out, the PPP contributes to the construction and consolidation of the school's identity, in addition to enabling everyone to experience its multiple dimensions in the institution: social, administrative and political-pedagogical.

Article 28 of the LDBEN of 1996 proposes that in the provision of basic education to the rural population, the education systems shall promote the necessary adaptations to adapt them to the peculiarities of rural life and of each region, especially: "I - curricular contents and methodology appropriate to the real needs and interests of students in rural areas; [...] III - adequacy to the nature of work in rural areas" (BRASIL, 1996).

Such principles are reinforced in Decree No. 7352, which provides in its article 2 on the principles of Rural Education, of which the following stand out:

> I - respect for the diversity of the field in its social, cultural, environmental, political, economic, gender, generational, and race and ethnicity aspects; II - incentive to the formulation of specific political-pedagogical projects for rural schools, stimulating the development of school units as public spaces for investigation and articulation of experiences and studies aimed at social, economically just and environmentally sustainable development, in articulation with the world of work (BRASIL, 2010, p. 1).

Considering such issues, it is essential to have the involvement of teachers, management and the school community in the process of building the PPP, a document that guides all the functioning and goals to be followed in the school, guiding the pedagogical work of the teacher, meeting the specificities of the Rural School.

The objective of this study is to understand the process of participation of teachers in the reconstruction of the political-pedagogical project of a rural school located in the countryside of Rio Grande do Sul. Thus, we seek to understand how the participation of teachers in the current document took place; reflect on how teachers contribute to the permanent reconstruction of this document; and

to analyze the obstacles and possibilities in the construction of the PPP of the rural school that involves its teachers.

In this study, it is necessary to pay attention not only to the specificity of the school in question not only being a rural school, but also a school that is far from the urban environment and that this in itself characterizes a huge difference when it comes to building teaching-learning relationships.

THE ROLE OF TEACHERS IN THE RECONSTRUCTION OF THE POLITICAL PEDAGOGICAL PROJECT IN A RURAL SCHOOL

In recent decades, after much struggle by the Landless Rural Workers Movement (MST) and the discrimination that originated with the members of this movement, the need to establish in the country an education focused on the reality of the subjects who live in the countryside has emerged.

According to Hage (2004, p. 1), rural education is "collectively defined by the rural subjects themselves". He also states that this education is carried out "with the subjects of the countryside" and not for them, much less without them. In which its reality, culture, social organization, among other aspects, will be portrayed.

The Brazilian educational history itself shows us the neglect of the implementation of a public policy, aimed at the rural population, always leaving it in the background and not giving due value to this reality. Using an urban curriculum model in rural schools (ARROYO, FERNANDES, 1999).

According to Gritti (2003, p. 24) "historically, the isolated school has been the school of the rural environment, that is, this school designed for the rural man and not by the rural man, or rather, for the rural man who must think and act as an urban man".

Rural Education is a crystallized example, one of the products that the political struggle of rural subjects obtained, that is, the result of the struggle of men and women who resisted the control of the ruralists and did not accept the model of education once offered. Rural Education is part of the construction of a new societal project that aims at the emancipation of rural citizens based on the appreciation of their land, their beliefs, ideals and ways of living. In 2001, with the approval of the Operational Guidelines for Basic Education in Rural Schools, it is important to highlight that:

> Rural education, referred to as Rural Education in Brazilian legislation, has a meaning that incorporates the spaces of the forest, livestock, mines and agriculture, but goes beyond them by embracing in itself the fishing, caiçaras, riverside and extractive spaces. The countryside, in this sense, more than a non-urban perimeter, is a field of possibilities that dynamize the connection of human beings with the very production of the conditions of social existence and with the achievements of human society (BRASIL, 2001, p. 1).

After years of resistance, the workers had several achievements, which brought possibilities for the elaboration of proposals in the PPP of the Rural Schools, according to the identity of each one.

To this end, Arroyo (2009, p. 27) emphasizes that: "it is not enough to have schools in the countryside; we want to help build rural schools, that is, with a Political Pedagogical Project linked to the causes, challenges, dreams, history and culture of the rural working people".

The advances in recent years in relation to rural education policies have been under pressure from social movements, mainly from the MST, unions, federations of family farming workers, among others. All of them fight for an education that is truly focused on the countryside and its reality. These movements fight for the construction of a legitimate educational process for the people of the countryside and not the updating of an urban and imported model (CALDART, 2004).

Based on this assumption, the construction of a proposal or curricular matrix for the school is discussed, having as the main articulating instrument of learning, the revitalization and appropriation of the identity of the peasant people, the culture, the way of understanding the purposes of life, the seriousness in their beliefs, which favor supports that foster the change of paradigm (SOUZA, 2006).

In 1930, there was no conception of rural education, but rather a rural education that was configured in a set of policies defined and elaborated to discipline and prepare labor for the factories. From 1940 onwards, Brazilian education incorporated the urbanized and industrialized curriculum, characterizing the economic, social, cultural and educational interests of the elites.

In 1932, the idea of creating a National Education Plan (PNE) was already present, also perceived in the ideas of the Pioneers of Education. The "Manifesto of the Pioneers of New Education" sought the modernization of the country through the modernization of education. It demonstrates the discontent on the part of rural workers with the educational system. In this manifesto, in addition to calling for the organization of education at the national level, it also proposed a program that was configured with a national education system (PINHEIRO, 2007).

The Constitution of 1947 proposes that rural education be transferred under the responsibility of private industrial, commercial and agricultural companies to provide the apprenticeship of workers in a form of cooperation and excludes from this responsibility only agricultural companies (PINHEIRO, 2007).

The Constitution of 1967 and the Constitutional Amendment of 1969 establish the obligation of companies to have primary education, but guarantee free education for employees and children under 14 years of age. This explains why until 1970 our country had a rural education, under the care of private initiatives (PINHEIRO, 2007).

In the 1988 Constitution, education was enacted as a right of all and a duty of the State. And even though it was not specifically in the charter on rural education, it made room for the State constitutions and the Law of Guidelines and Bases of National Education (LDBEN) "the treatment of rural education within the scope of the right to equality and respect for differences" (LDBEN, 2001).

In 2002, CNE/CEB Resolution No. 01 of April 3, the Operational Guidelines for Rural Education were approved; It consolidates a historical milestone for Brazilian education and especially for rural education. However, the slowness means that the policies of law do not reach significant proportions and are concretely effective in the rural school of the entire Brazilian society. According to the Ministry of Education (2012, p. 5) "a milestone in the consolidation of rural education is the institution of Decree No. 7352 of November 4, 2010, which provides for the Rural Education Policy and the National Program for Education in Agrarian Reform – PRONERA".

According to the Ministry of Education (MEC, 2012), the decree highlights the principles of rural education, such as respect for diversity, the formulation of specific PPPs, the development of policies for the training of education professionals and the effective participation of the community and social movements in the countryside, which marks an advance for Rural Education.

Another advance is also observed in Law No. 9394/96 of Operational Guidelines for Rural Education of the school's identity, the pedagogical proposals of rural schools are supported by articles 23, 26 and 28. Respect for differences and the right to equality and the immediate and full fulfillment of its establishment, with regard to the curriculum, calendar, contemplating the diversity of the field in all its aspects: social, cultural, political, economic and others.

Resolution No. 02, of April 28, 2008, called Complementary Guidelines, disciplines the systems in the fulfillment of structural issues for the feasibility of Rural Education. The legal provisions that were presented, for the most part, point to the democratization of rural education, as they were elements conquered by organized social movements, mainly around the National Articulation.

Next, we will continue by presenting the methodology carried out in the research and its results, ending with the final considerations.

METHODOLOGY

The methodological procedures of this article will be of a qualitative nature, which according to Câmara (2013, p. 181), are characteristic of a qualitative research when we can "verify how people consider an experience, an idea or an event". To accomplish this task, we propose to follow the paths of an experimental research that, according to Gil (2002, p 22):

> It focuses on "first-hand" documents, which have never received analytical treatment (these are documents found in company archives, personal letters, diaries, photographs, etc...) and "second-hand" documents, which have already been analyzed (research reports, company reports, etc...).

Based on these concepts, the data were collected through research carried out in national documents on Education, authors who address the theme and in online journals, such as SCIELO.

RESULTS

In all this context, we need to discuss the training of teachers for rural schools, as it has been one of the most challenging scientific fields today. For Rosa, Nascimento and Silva and Barros (2022, p. 14) "teacher training is a strategic theme that has been gaining notoriety in recent decades. This is because it has been highlighted as a mediating process for quality education." The authors point out that "the teacher is the effective subject in the classroom and it is through his practices that the conduction of the teaching-learning process can take place with greater or lesser success".

In this sense, Cordeiro (2018) says that teachers need to be motivated and guided with continuing education that enables new educational practices which must be based on discourses that meet the guidelines of National Education, mainly related to Rural Education, which can be aimed at meeting the needs of rural communities.

For Bezerra and Silva (2018), training is an essential instrument that makes teachers appropriate policies, legislation, discussions, concepts, knowledge and practices in the area of their work and, when it comes to Rural Education, this training gains greater relevance, as it is through it that the specific knowledge necessary to work in rural schools is guaranteed.

According to Bezerra e Silva (2018), in the absence of teacher training, whether initial or when the teacher is already working, it represents an influence on the process of appropriation of teachers over the policy that involves Rural Education, as this training is what will allow their actions. The theorists also point out that without good training, the teachers of the Rural Schools are unable to evolve in relevant discussions and knowledge, with regard to what gives meaning to the rural school and its subjects.

For Souza (2018), the training of the educator is one of the most important pillars for the adequacy of the teaching methods practiced by teachers, therefore, teacher training seeks an alignment between the preparation of education professionals in the scientific context and the pedagogical practice of knowledge in the classroom. Finally, Veiga (2013) states that the continuing education of teachers is a right, as it enables professional development articulated with schools and their projects.

In our initial training, as future educators, very little is worked on Education in/of the Countryside, they are only brushstrokes, requiring continuous training, seeking to understand the specificities and needs of developing a pedagogical practice that will contribute to the training process of those who live in the countryside.

Therefore, the PPP is considered as a plan to change reality, to improve the pedagogical work, in the curriculum, in the methodology, in the evaluation process, in the form of parental participation, in interpersonal relationships and, mainly, in the conception of education that the school defends. The

participation of the school community is one of the essential elements of democratic management that should permeate the entire process of construction and/or resignification of the PPP.

> The pedagogical political project has to do with the organization of pedagogical work at two levels: as the organization of the school as a whole and as the organization of the classroom, including its relationship with [sic] the immediate social context, seeking to preserve the vision of totality. In this journey, it will be important to emphasize that the Political-Pedagogical Project seeks to organize the pedagogical work of the school as a whole (VEIGA, 2004, p. 14).

The elaboration of the PPP should, in addition to being a bureaucratic instrument, be the guide of the pedagogical work of the school, aiming at the search for proposals that can guide the pedagogical practices considering the subject who is part of it in its totality:

> The autonomy and democratic management of the school are part of the very nature of the pedagogical act. The democratic management of the school is, therefore, a requirement of its political-pedagogical project. It requires, first and foremost, a change of mindset from all members of the school community. A change that implies leaving aside the old prejudice that the public school is only a bureaucratic apparatus of the State, and not an achievement of the community. The democratic management of the school implies that the community, the users of the school, are its directors and managers, and not only its supervisors or mere receivers of educational services. In democratic management, parents, students, teachers and staff assume their share of responsibility for the school project (GADOTTI, 1998, p. 17).

Considering the 2002 Operational Guidelines for Rural Education, elaborated based on LDB No. 9394/96, its purpose is to direct and guarantee the schools that are in rural areas, based on their realities. It also expresses guiding principles that "aim to adapt the institutional project of rural schools" (BRASIL, 2002). The legislation in force is important for the elaboration of the PPP considering all these aspects.

The school project occupies a space of constant decisions and discussions. Thus, participation, resistance, conflicts, and divergences are extremely political acts, because the exercise of these actions involves our relationships with debates, suggestions, or opinions, whether they are for or against. Demo (1998) states that:

> With a pedagogical project of its own, it becomes easier to plan the school year, or to review and improve the curricular offer, improve evaluative expedients, demonstrating the capacity for increasing positive evolution. It is possible to launch strategic challenges, such as: reducing repetition, introducing increasing rates of qualitative improvement, experimenting with alternative didactics, and achieving a position of excellence (DEMO, 1998, p. 248).

Presidential Decree No. 7352, of November 4, 2010, defines that the policies of Rural Education, among the principles established for rural education, there is the valorization of the identity of the rural school through political projects that are linked to the reality of the students, including their relationship with space and time.

The construction and/or resignification of the PPP of the rural school permeates a democratic practice that respects the specificities of the subjects who live in the countryside and understands that the knowledge, the peasant practices are the foundations of the pedagogical political construction of the transformative project of Rural Education. Everything happens vertically, that is, the recipes are ready-made.

In this sense, education in the countryside is forgotten and abandoned, and according to Gritti (2003, p. 134)

> The contemplation of an urban culture in the curriculum of the rural primary school, to the detriment of the cultural manifestations present in the rural environment, is a demonstration that the dominant culture in our society is the one linked to the urban-industrial sector.

FINAL THOUGHTS

RURAL education needs to aim at the formation of autonomous subjects, imbued with culture and values capable of fighting for an education from the perspective of workers and peasants. THE rural school can no longer be taken as an extension of the urban area in which the same knowledge of the city is taught without contextualization and/or adaptation.

It is possible to affirm that the elaboration of a school's PPP should not be seen only as a bureaucratic task that meets a legal requirement, but that aims to re-signify the performance of and in the school. The construction of a PPP is based on the need to structure proposals that guide educational practices focused on the reality in which the school and the subjects that are part of it are inserted.

From the construction of the PPP, which needs to be in a collective way, where everyone has access and knowledge, really understanding the real objectives of Education of/in the Countryside, uniting theory and practice, being fundamental for a pedagogical practice grounded and consistent with the reality of those who live there.

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Training and teaching work in public universities: Characterization and impacts

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ABSTRACT

Nowadays both society and the government demand more and more productivity from higher education teachers, generating excessive fatigue and, consequently, compromising their physical and mental health. In this sense, it is important to know the current context that professors at public universities face in their professional lives. The objective of this study was to conduct a survey on the training and work of teachers in public universities. The Support Program for Restructuring and Expansion Plans of Federal Universities democratized access to higher education in Brazil, however, there was a greater demand for training and efficient pedagogical practices that facilitated student learning and not only reproduced content, as in traditional education that still persists today. It is also observed that professors have exhausting routines and debauched salaries, along with an enormous demand for productivity, then developing teaching, research and extension activities, in addition to sometimes participating in commissions and administrative positions. Therefore, it is necessary and urgent to understand the real situation of training and the work of teachers in federal institutions, in order to support more assertive decision-making regarding higher education, so that they can count on qualified and satisfied workers, in which they promote a liberating education and contribute to the development of the country.

Keywords: Teacher, Higher education, Productivity.

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INTRODUCTION

The government and society are increasingly demanding more efficiency and productivity from higher education teachers. However, teacher training and incentive policies are still incipient. Production is required, but no feasible means are offered for its execution. The process begins at the undergraduate level and extends through graduate studies until the beginning of the program. None of these levels offers didactic-pedagogical instrumentalization compatible with the educator's attributions.

In addition, within the academic universe, professors are faced with exhausting routines and outdated salaries. In addition to teaching, research and extension activities, in addition to the demand for their participation in commissions and administrative positions. In the face of so many activities and functions, the regimental workload is extrapolated and the professional identity is superimposed on the personal one in search of the much desired "productivity". Despite this, there is "a gap between what was considered ideal and what would be possible to achieve" (PEREIRA; AARON; COSTA, 2015).

In general, it is observed in federal universities that there is an increase in the workload without equal tenure. Associated with the accumulation of activities, there are also bureaucratic obstacles in the production process, difficulty in communication and, often, in interpersonal relationships, as well as the overlapping of quantity to the detriment of quality. Thus, although the professional fulfillment of the desired occupation is present in the university professor's statements, it is necessary to be aware of the repercussions of the new scenario of higher education (BORSOI, 2012). What has been the training profile of these professionals? How has your training impacted your teaching performance? What have been your working conditions? How have the new responsibilities that have been imposed on you impacted your health and quality of life?

In order to have good professionals from the most different areas of activity, it is necessary to end the cycle of "academic productivism versus precariousness of teaching work". To this end, it is necessary to know the real situation of higher education teachers, through comprehensive investigations that characterize their professional profiles and work processes, in addition to evaluating their possible impacts, whether on pedagogical practices or on their well-being.

In Brazil, the literature on the subject is extensive, and the teaching work is the most studied between 2003 and 2007 in the dissertations and theses defended in the Graduate Programs in Education accredited by the Coordination for the Improvement of Higher Education Personnel (Capes) and by the Institutional Partners of the National Association of Graduate Studies and Research in Education (Anped). Thus, there is a need for a broader analysis on the subject, especially in higher education. Thus, the objective of this study was to make a survey on the training and work of teachers in public universities.

DEVELOPMENT

The educational reform movement with the restructuring of higher education, centered on the Support Program for Restructuring and Expansion Plans of Federal Universities, democratized teaching, making it more integrative and flexible, by increasing the number of vacancies, pressing for curricular diversification and greatly increasing the number of technicians and professors. In this aspect, Selbach (2015) draws attention to the complexity of the impact that the expansion has brought to multiple dimensions of universities, such as the deficient training and pedagogical practices of the high number of professors who joined the Federal Institutions of Higher Education.

Although higher education professors have different profiles of professional training, it is the same: to contribute to the construction of the student's knowledge, so that he becomes a professional with technical competence and critical-reflective capacity, aligned with the sociocultural and political demands to which he may be exposed, and always valuing ethics and respect for human dignity. To achieve this goal, teachers must have pedagogical skills, because having technical knowledge in a given area is not enough for transformative teaching (VALENTE; VIANA, 2011).

It is noteworthy that teacher training for higher education remains incipient. Undergraduate degrees, with the exception of bachelor's degrees, basically offer technical disciplines for the exercise of the profession. In addition, graduate courses, at *the stricto sensu level,* prioritize, in their curricula, research to the detriment of teaching, despite the fact that it is the prerogative of the Law of Guidelines and Bases of Education (BRASIL, 1996) that higher teaching positions are occupied primarily by masters and doctors (SILVA, 2008).

It is well known that teaching and research must go hand in hand and be part of the day-to-day lives of teachers and students. However, it should be made clear that: "scientific training is not necessarily synonymous with teacher training" (RIBAS, 2008). Master's and/or PhD students do not always have an approximation to the teaching-learning approaches or conceptions that enable them to teach with the same efficiency as they do in their profession of origin (VALENTE; VIANA, 2011).

On the one hand, we have teachers with inadequate pedagogical training who place themselves at the center of the teaching-learning process, using traditional methodologies, focused on passing on knowledge and not on building it, reproducing educational models resulting from their training. On the other hand, there are constant demands within the spheres of teaching, research, extension and management, characterized by a high workload of classes, institutional evaluation by productivity criteria, almost always linked to quantity and not necessarily to quality.

This situation sometimes causes the teacher to be stuck between the desire to qualify for teaching, in order to meet the new demands imposed by the political-social paradigms, and the need to be and feel productive *in* and *for* the university, meeting goals and obtaining results. The mismatch

between these aspects ends up increasing the degree of stress of teachers, impacting them in a biopsychosocial way (BOSI, 2007).

In addition, it can be seen that the restructuring of higher education, with the expansion and internalization of teaching, although it has provided greater access to universities, does not present equivalence between the proportion of students and the number of teaching vacancies created. In this sense, it is worth mentioning that one of the global goals of Reuni is to achieve the ratio of eighteen undergraduate students per professor in face-to-face courses (Decree No. 6,096, of April 24, 2007), which leads to constant intensification of the work of these professionals who lack pedagogical training and who demand greater productivity (CHAVES; GUIMARÃES, 2015).

Mancebo, Vale and Martins (2015) point out that, despite the incipient investigation on the repercussions of Brazilian university expansion, the qualitative research carried out so far demonstrates an increase in the workload and precariousness of teaching, triggering professional dissatisfaction, in addition to repercussions on the physical and mental health of educators.

CONCLUSION

It is a priority to carry out surveys of the situation of teacher training and work in the Federal Institutions of Higher Education, in order to support correct decisions about the direction of higher education in the country, which must have qualified and satisfied workers, acting as true educators committed to the training of professionals committed to the development of the country.

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The importance of epistemological discussion in contemporary times and the contribution of Freire's critical pedagogy to education

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ABSTRACT

This article explores the relevance of the epistemological discussion in contemporary times and the contribution of Freire's critical pedagogy to education, highlighting how reflection on the nature of knowledge is fundamental to understanding the challenges faced in an increasingly complex and interconnected society. We discuss the impact of epistemology in the areas of science, technology, education, and culture, highlighting its influence on the formation of paradigms and the search for answers to fundamental questions. Finally, the work brings reflections on the theoretical contributions of Paulo Freire's critical epistemology to the study of education and its relevance to social transformation.

Keywords: Epistemology, Education, Technology, Critical Pedagogy, Paulo Freire.

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INTRODUCTION

The present research has its genesis in the Graduate Program in Education: Curriculum in the New Technologies in Education Research Line of the Pontifical Catholic University of São Paulo, whose orientation was concentrated in the second semester of 2023 as a natural extension of the themes developed in the disciplines: 1) Integrated Seminar: Freirean conceptual plots: a theoretical methodological framework for teaching and research, and 2) Epistemology and Education. Our research and discussions have inspired us to explore specific issues, deepen our understanding of key concepts, and consider innovative approaches to contemporary educational challenges.

Epistemology, or the philosophy of knowledge, plays a central role in understanding contemporary society. In a world characterized by rapid change, technological advancements, and increasing complexity, the discussion about how we acquire, validate, and apply knowledge becomes more relevant than ever.

Epistemology, or philosophy of knowledge, plays a fundamental role in the understanding and investigation of various areas of human knowledge. It invites us to reflect on the nature, limits, and processes of knowledge acquisition, as well as to evaluate the foundations on which we build our beliefs and theories.

In this article, we will explore the importance of epistemological discussion in contemporary times, highlighting its implications in areas such as science, technology, education and culture and the theoretical contributions of Paulo Freire's critical pedagogy to the study of education and the curriculum.

We will begin our journey by bringing a historical rescue of the path traced by the different philosophers and their contributions to the fields of study of epistemology over the years. We will then explore epistemology in four distinct contexts, each with its own peculiarities and implications, initially discussing "Epistemology in Science", where we will investigate the ways in which scientists construct and validate scientific knowledge, examining issues related to methodology, objectivity, and scientific theory. Next, we will turn our attention to "Epistemology in Technology," exploring how technology shapes our understanding of the world and how our technological innovations affect our cognitive capabilities.

Subsequently, we will enter the field of "Epistemology in Education", where we will consider the relationship between teaching, learning and knowledge construction, investigating how educators approach epistemological issues to improve the educational process. And then we will examine "Epistemology in Culture and Society," exploring how cultural conceptions, social norms, and values influence what is considered legitimate knowledge in different cultural and social contexts.

Finally, we will bring the theoretical contributions from the epistemology of Paulo Freire's Critical Pedagogy to the educational field, considering his important legacy for studies in education

in the country and which contemplates a vast knowledge of knowledge aimed at the emancipation of individuals.

METHODOLOGY

On a daily basis, we use research to seek answers to our questions, from the simplest to the most complex. To research is to seek knowledge. However, for a research to be considered scientific, it must be supported by procedures capable of giving reliability to its results. In general, research can be considered as the "search for knowledge that, in a practical way, seeks to discover answers to problems, through the use of scientifically systematized procedures and methods" (Fazenda; Tavares; Godoy, 2015, p. 48). According to Prodanov and Freitas (2013), the method chosen for data extraction in the elaboration of a research will indicate the model that best expresses the ideas and the procedure adopted for data collection, which will involve organization, analysis and interpretation.

The methodological procedures used were based on the methodology of theoretical research, also known as bibliographic research, it is a systematic process of investigation that focused on the analysis, review and critical synthesis of the existing literature on the themes of Epistemology, Education and Technology.

As Antonio Chizzotti (2014) points out in his work "Research in Human and Social Sciences", the methodology of theoretical research as has an approach that focuses on the analysis and interpretation of theories, concepts, and ideas already existing in the academic literature. He defines theoretical research as a type of research that does not involve the collection of empirical data, but rather the critical analysis and synthesis of theoretical knowledge already available.

The collection of data based on the materials already elaborated in the works of books and scientific articles that will be important for the survey of the basic ideas related to our theme, will support the article in question, because "The main advantage of bibliographic research lies in the fact that it provides the researcher with an analytical instrument for any other type of research". (Oliveira, 2011, p.40).

EPISTEMOLOGICAL IN CONTEMPORANEITY - SYNTHESIS AND THEORETICAL FRAMEWORK

Epistemology, as a central field of philosophy that investigates knowledge, has a long history and has been influenced by several theorists throughout history. Leading theorists of epistemology include Plato (c. 427-347 B.C.) who addressed epistemological issues in his philosophical dialogues, especially in works such as "Theaetetus" and "Menon". He discussed the nature of knowledge and the idea of eternal forms or ideas as objects of knowledge.

Aristotle (384-322 BCE) also made a significant contribution to epistemology, focusing on the distinction between theoretical knowledge (episteme) and practical knowledge (phronesis) in his Nicomachean Ethics and discussing logic as a tool for knowledge.

René Descartes (1596-1650) is known for his search for an indubitable and foundational knowledge, expressed in the famous phrase "I think, therefore I am" in his work "Meditations on First Philosophy".

John Locke (1632-1704), one of the founders of empiricism, argued that all knowledge derives from sensory experience. He elaborated on his ideas in works such as "Essay on Human Understanding."

David Hume (1711-1776) highlighted the issues of empiricism and questioning the nature of causality and induction. His work "An Enquiry into Human Understanding" is influential in epistemology.

Immanuel Kant (1724-1804) proposed a synthesis between empiricism and rationalism in his "Critique of Pure Reason". He argued that our knowledge is shaped by the structure of the human mind.

Gottlob Frege (1848-1925), a central figure in the philosophy of language and logic, dealt in his works with logic and language and had a significant impact on contemporary epistemology.

Edmund Husserl (1859-1938) founder of phenomenology, which investigates consciousness and experience directly. His work "Ideas for a Pure Phenomenology and a Phenomenological Philosophy" addresses epistemological questions.

These are some of the many theorists who have contributed to the development of epistemology throughout history. Epistemology is an ever-evolving field, and contemporary theorists continue to explore and expand on its fundamental questions and concepts.

Epistemological discussion in contemporary times is essential for us to understand and navigate the complex and interconnected world in which we live. It profoundly influences various areas of society, including science, technology, education, and culture, shaping how we acquire, validate, and apply knowledge.

In contemporary times, several theoretical currents and philosophers have discussed epistemological issues that are relevant to understanding knowledge and its application in today's world. Some of the leading theorists and currents addressing these issues include, among them:

Michel Foucault (1926-1984) was a French philosopher, historian, writer, and social theorist. He is widely recognized as one of the most influential thinkers of the twentieth century and his works address issues related to power, knowledge, social control, and discourses. Foucault (1977) investigated how knowledge is constructed and maintained by power and social institutions. He argued that knowledge is always situated in historical and social contexts and that institutions exert

control over what is considered legitimate knowledge. His work is relevant to social and cultural epistemology.

Thomas Kuhn (1922 – 1996): was a renowned American philosopher of science, known for his revolutionary contributions to the understanding of the evolution of science and scientific knowledge. His most influential work is "The Structure of Scientific Revolutions", published in 1962, Kuhn introduced the concept of scientific paradigms and paradigm shifts. He argued that science does not advance continuously, but undergoes revolutions in which established paradigms are replaced by new ones. His work has significant implications for the epistemology of contemporary science (Kuhn, 2013).

Karl Popper (1902-1994) was an Austrian-British philosopher widely recognized for his contributions to the philosophy of science and his advocacy of falsificationism as a criterion for demarcating science and pseudoscience. Popper is a central figure in twentieth-century philosophy, and his ideas have had a significant impact in the fields of epistemology, political philosophy, and social philosophy. (Popper, 1944).

Ludwig Wittgenstein (1889-1951) was an Austrian-British philosopher, widely regarded as one of the most influential philosophers of the 20th century. Here is some information about Ludwig Wittgenstein and his contributions. Wittgenstein, in his two philosophical phases, explored the relationship between language, thought, and reality. His work "Philosophical Investigations" addresses fundamental questions about the nature of knowledge and language as a tool to represent the world. (Wittgenstein, 1998)

Richard Rorty (1931-2007): was an American philosopher who had a significant impact on contemporary philosophy and political theory. He was known for his pragmatic approach to philosophy and his critiques of traditional philosophy, as well as his reflections on politics, language, and morals. Rorty was a pragmatist philosopher who argued that knowledge is a social and cultural construct. He questioned the notion of objective truth and argued for the importance of cultural relativism in contemporary epistemology. (Rorty, 1998)

Bruno Latour (born 1947) is a French sociologist, philosopher, and anthropologist of science widely recognized for his contributions to social theory, the philosophy of science, and the sociology of technology. His work has an impact in the areas of science and technology studies, actor-network theory, and political ecology. He developed Actor-Network Theory (ART) to understand how science is done and how objects and agents interact to construct knowledge. (Latour, 1999).

Thomas Nagel (born 1937): Nagel is known for his work on the philosophy of mind and the nature of consciousness. It raises fundamental epistemological questions about the possibility of fully

understanding subjective experience and how this affects our understanding of the world. (Nagel, 199).

Hilary Putnam (1926-2016): was an American philosopher widely recognized for his significant contributions to various areas of philosophy, including philosophy of mind, philosophy of language, philosophy of science, and epistemology. Putnam is known for his work in philosophy of mind and philosophy of language, as well as for his role in the debate over scientific realism and antirealism. (Putnam, 1981).

EPISTEMOLOGY IN SCIENCE

Epistemology plays a vital role in science, where the pursuit of objective knowledge is paramount. It raises questions about the nature of evidence, the criteria for the validity of scientific theories, and the relationship between theory and observation. Philosophers of science, such as Karl Popper and Thomas Kuhn, have contributed to the understanding of these questions. His ideas about falsifiability, scientific paradigms, and research programs have influenced how scientists conduct their investigations and evaluate the validity of scientific knowledge.

Epistemology in science plays a crucial role in the pursuit of objective knowledge and in assessing the validity of scientific theories. It is the philosophical discipline that investigates how knowledge is acquired, justified, and validated in the context of scientific inquiry. In this context, epistemology raises fundamental questions about the nature of evidence, the methodology of science, and the relationship between theory and observation.

EPISTEMOLOGY IN TECHNOLOGY

Technology plays an increasingly important role in contemporary society, and epistemology is essential for evaluating its creation and application. Questions about how we know a technology is safe and effective, how we assess its impact on society, and how we deal with the ethics of technology are central. Epistemological reflection in technology extends to artificial intelligence, ethics of artificial intelligence, and reliability of algorithms, areas in which epistemological discussions are urgent.

Epistemological reflection on technology plays an increasingly relevant role in a world driven by technological innovation, in particular in the field of artificial intelligence (AI). As AI becomes an increasingly integrated part of our society, issues related to epistemology become pressing. Three specific areas in which epistemological discussions are particularly relevant are: the ethics of artificial intelligence, the reliability of algorithms, and the nature of AI-generated knowledge.

The ethics of artificial intelligence is an area in which epistemological reflection plays a key role. AI makes decisions based on data and statistical models, which raises questions about how AI

"learns" and how it acquires knowledge about the world. Epistemology helps to understand how AI systems process information, how they determine the relevance of data, and how they extrapolate to make ethical decisions. In addition, epistemology assists in analyzing the knowledge bases embodied in AI systems and assessing the reliability of these decisions in light of different ethical perspectives.

The reliability of algorithms is a critical concern in many fields, from medical diagnostics to autonomous driving systems. Epistemology comes into play as we examine how algorithms process data, how they form beliefs, and how they justify their conclusions. Epistemological issues include assessing the validity of the assumptions on which algorithms are based, the uncertainty associated with predictions, and the transparency of decision-making processes. Epistemology helps us understand how algorithms acquire knowledge, how they update that knowledge, and how they communicate the reliability of their decisions to users.

AI has the ability to generate new knowledge and insights, but the nature of that knowledge raises epistemological questions. How can we consider the knowledge generated by AI systems valid? How does traditional epistemology apply to knowledge that is not produced by human agents, but by algorithms? These are fundamental questions that need to be addressed. Epistemology in technology challenges us to reflect on the nature of knowledge in a world increasingly dominated by AI systems.

However, epistemological reflection on technology, especially in the context of artificial intelligence, is fundamental for understanding how technology acquires, processes and generates knowledge. It allows us to assess the ethics of AI, the reliability of algorithms, and the nature of the knowledge produced by AI systems. As technology continues to play a central role in our lives, epistemology in technology becomes an increasingly important area of research.

EPISTEMOLOGY IN EDUCATION

Education is fundamental to the construction of knowledge, and epistemology directly influences how we teach and learn. The discussion of how students acquire critical thinking skills, evaluate sources of information, and develop a solid understanding of reality is an essential issue in contemporary pedagogy. The epistemology of education examines the theories of knowledge that inform teaching and assessment methods, promoting critical reflection on the nature of learning.

Epistemology in education plays a vital role in the way we conceive and implement teaching and learning processes. It is deeply rooted in contemporary pedagogy, influencing not only teaching methods but also the way students acquire critical thinking skills, evaluate sources of information, and build a solid understanding of reality. The epistemology of education is intrinsically linked to reflection on the nature of knowledge and the investigation of how this knowledge is transmitted and acquired. Let's explore this context further. **Nature of Knowledge in Education**: The epistemology

of education investigates the nature of knowledge and how it is acquired by individuals. Questions such as what constitutes valid knowledge, how beliefs become knowledge, and how sources of knowledge are evaluated are central in this context. For example, epistemology can help determine whether knowledge is actively constructed by students through personal experience and reflection, or whether it is passively imparted through instruction.

Teaching and Learning Methodologies: Epistemology in education plays a significant role in the choice and implementation of teaching and learning methods. Understanding how students acquire knowledge influences how educators plan their lessons. For example, constructivist epistemology argues that students actively construct their own knowledge through interaction with their environment, while the behaviorist approach emphasizes passive learning through reinforcement and punishment. The choice between these approaches is influenced by epistemological considerations.

Knowledge Assessment and Validity: Epistemology also plays a key role in assessing students' knowledge. It helps us determine how to tell if a student really understands a concept or if they have just memorized it. In addition, it raises questions about the validity of information sources and how students should assess the reliability of information in a world filled with diverse sources, such as the internet. The ability to discern between accurate and inaccurate information is a critical skill in a world where access to information is plentiful but not always reliable.

Development of Critical Thinking: The epistemology of education also relates to the development of critical thinking. She encourages educators to promote questioning, healthy skepticism, and rigorous inquiry as part of the learning process. Not only does this help students gain knowledge, but it also helps them develop analytical and evaluation skills that are essential for making informed decisions in everyday life.

Epistemology in education is fundamental to understanding how knowledge is constructed, transmitted, and evaluated in the educational context. It directly influences teaching and learning methods, the assessment of students' knowledge, and the development of critical thinking. Therefore, critical reflection on epistemology in education plays an essential role in improving the quality of education and empowering students to become independent and informed thinkers.

EPISTEMOLOGY IN CULTURE AND SOCIETY

In contemporary culture and society, the epistemological discussion is also relevant. Questions about the reliability of information sources, the spread of disinformation, post-truth, and the impact of social media on knowledge construction are central. Epistemology in contemporary culture and society takes on a crucial role as we navigate an information-saturated world where issues of trustworthiness, misinformation, post-truth, and knowledge construction are of critical importance.

Reflection on epistemology in culture and society helps us understand how information is generated, disseminated, and assimilated in a complex and ever-changing social context. Let's explore how epistemology applies to these challenges.

With the proliferation of information available online, it is critical to assess the credibility of data sources and discern between reliable and misleading information. Epistemology provides us with tools to analyze how sources of information are constructed, what their validity criteria are, and how we can assess their reliability.

Epistemology also relates to misinformation and the concept of post-truth, where emotions and personal beliefs often carry more weight than objective facts in forming opinions. This leads us to reflect on how society deals with the construction of truth and how epistemology can help combat the spread of incorrect or misleading information. Social epistemology, in particular, explores how beliefs are influenced by social, cultural, and emotional factors.

Social networks play a significant role in the dissemination of information and the construction of knowledge in today's society. Epistemology in culture and society examines how social networks shape the perception of reality, how filter bubbles affect access to information, and how interaction on social networks influences the formation of beliefs and opinions. This leads us to question how social media platforms can be used to promote critical thinking and careful evaluation of information.

Social epistemology and the philosophy of language are areas that stand out as culture and society shape and are shaped by knowledge. Social epistemology explores how beliefs and knowledge are collectively constructed in a cultural and social context. Philosophy of language investigates how language influences how we interpret the world and how words can be used to convey, distort, or hide information.

Epistemology in contemporary culture and society is essential for understanding how knowledge is constructed and disseminated in a world characterized by abundant information and social complexity. It helps us assess the reliability of information sources, deal with disinformation, understand the impact of social media, and explore how culture and language influence our perception of knowledge. Epistemological reflection in culture and society is key to fostering critical thinking and a deeper understanding of the dynamics of knowledge in our digital age.

In summary, the epistemological discussion is necessary in contemporary times, as it influences the fundamental areas of science, technology, education and culture. It challenges us to reflect on how we acquire knowledge and how we apply that knowledge in a complex and ever-evolving world. Understanding the implications of epistemological discussion in all of these areas is essential for navigating the complexities of modern society.

PAULO FREIRE'S CRITICAL EPISTEMOLOGY AND THE SEARCH FOR AN EDUCATION FOR TRANSFORMATION

Understanding that education emerges with a fundamental role for the understanding and formation of individuals, it is observed that in scientific productions there is a vast collection of theories about the problems, in different aspects and subjects that are part of this space. Among these studies, Paulo Freire's epistemological contribution is pointed out by several scholars as one of the most relevant for the educational spaces of our country.

Thus, thinking about education from a Freirean epistemological perspective requires reflecting on the conditions for changes in social, cultural, economic or political structures and processes, because it is from education that the subject perceives himself as a being in the world and can seek his capacity for transformation, as well as that of the environment in which he lives. without disregarding the historical relationship in which Paulo Freire is contextualized in his works, he brings a critical argument about knowledge, discussing themes focused on educational problems of the country's reality such as: oppression, alienation, massification, inequalities, poverty, illiteracy, absence of democratic spaces and proposes an education, focused on the autonomy and freedom of the student, which can create conditions to react to 'banking' education.

Recognized by Freire as 'banking education', this proposal is one in which the teacher transfers the content and the student (the one who receives it) does not participate, since he only repeats and reproduces the content transmitted by the educator. In this sense, the students have a secondary role and are restricted to being depositories of knowledge transmitted by the teacher and, in this "the only margin of action that is offered to the students is to receive the deposits, keep them and archive them" (Freire, 2005, p.37).

In this educational model, individuals are placed in the world and do not relate to it, thus rejecting the idea of critical thinking and dialogicity. In addition, it does not provide spaces for autonomy and social transformation, which contributes to exclusion and social inequality in which some exploit and possess wealth and many cannot enjoy their rights already instituted according to the law, reflecting the existing power structures in society (Silva, 2017).

In critical epistemology, outlined by Freire, aspects in a scientific, existential and historical-cultural dimension are discussed, where knowledge is constructed through different spaces and experiences, since it considers that man, as a being of relations and is a being with others who constructs himself as a social being and, therefore, as a historical being. It is through education and through the encounter of the individual with the other and with the world that he orients himself.

If we understand that man is the subject of relationships and that knowledge is constructed by the relationship he has with himself, with the other and with the world, it is necessary to commit ourselves to an education that recognizes the transforming capacity that the school possesses. Paulo

Freire understands that education is being built within society and man, as this social being, historically constructed, can be summoned to this ontological vocation of 'being more', which will provide development as a subject, critical, reflective and focused on social change. (SMITH; Muraro, 2014)

The author defends an education with the responsibility of stimulating the freedom and autonomy of the students, taking into account their "I" and their relationship with the world, because these cannot be seen as empty deposits, without any information. If the human being interacts with the world, therefore, the act of dialoguing with the other is not only a right, but an opportunity to speak in a meaningful way and for there to be transformation in him and in the world. For Freire, one man cannot be the recipient of the other's knowledge, like docile bodies. He needs to be the subject of his own knowledge and be a subject of knowledge, committed to his problematization in his relation to the world. In this sense, awareness must be a critical understanding of human beings existing in the world and with the world, and this process is unique to human beings.

In this sense, education committed to the transformation of individuals must be based on a permanent construction, which is not static and rigid. It is from this perspective that Paulo Freire reflects the human being as an unfinished being and aware of his incompleteness. Only if it is aware of its state of incompletion can it be in continuous formation, thus suggesting that the subject is in a process of constant search for knowledge. (Freire, 2002)

As dialectical thinking, knowledge results from man's interaction with the world and with the culture that surrounds him, starting from the collectivity and social relations and never from individuality. It is based on a dialogical relationship, where criticality is made in the very act of knowing, aiming at social change. That is why it requires an active action on the reality that involves individuals, which is only possible with a desire, effort and with action on the world.

In this way, we can understand that the epistemology that surrounds Paulo Freire's works has a critical basis committed to the oppressed, based on a liberating, dialogical education that values the knowledge that comes from the students. Thus, we defend an education focused on humanization, committed to a practice aimed at the formation of critical citizens, which aims at social emancipation and actually enables the transformation of the world, because the "educator, at the service of man's liberation, has always addressed [addresses] the most oppressed masses, believed [believes] in their freedom, in their power of creation and criticism" (Freire, 1967, p. 33).

In Freire's Critical Pedagogy, resistance to the neoliberal ideology is sought, which permeates the educational environment and reproduces capitalist principles, through the bias of a 'banking education', where students are silenced and submissive to the interests of the privileged classes. The neoliberal utilitarian logic is confronted by Critical Pedagogy when it seeks an education focused on the various human dimensions – cognitive, affective, social, cultural, religious that recognizes and

respects the most different "ways of thinking, judging, being and acting and, through the dialogical and loving approach to the producers of these other narratives, shortening the abyssal distances that perpetuate the chronicle of inequality and injustices in human history" (Franco; Bike; Silva, 2021, p. 82).

In his work "Pedagogy of the Oppressed",3 Paulo Freire protests against this elitist and exclusionary proposal and defends, in practice, education for the inclusion of subjects, based on dialogue and the union of men, where everyone must be involved in the educational process, in order to understand the world, through awareness. In it, the uniqueness of the learner is defended, bearer of knowledge and even if oppressed and/or even dehumanized by the system, he cannot be considered without any information.

Therefore, Critical Pedagogy values the knowledge of the individual through education as a space of meaningful learning for students, providing pedagogical conditions that guarantee them to assume their commitment to change and to society. It creates possibilities for the insertion of the most diverse knowledge, which were sometimes left aside by a curriculum that separated the subjects from their history and their reality, because this has always been linked to the interests of the current class and at the service of the desires of those who held power and this has brought negative consequences to the teaching we have in our schools. In addition to valuing the public school space as a welcoming place for all diversity.

Thus, when we raise our gaze to the world and to today's society, where the discourses of individualism and hatred increasingly permeate, we feel the urgent need for Freire's critical pedagogy to become a practical imperative in our school spaces, which stems from an ethical, emancipatory commitment. For this, it is necessary to act, decide, because if we recognize that we are humans capable of making decisions, choosing, deciding, modifying, breaking, we can become ethical beings capable of resisting, fighting and not crossing our arms in the face of the injustices that are in front of our reality (Santos, 2021).

Critical epistemology points to a proposal of "Dialogic Education", where, in this conception, dialogue is considered the core for a liberating teaching that, consequently, makes it more democratic and, thus, contributes to participation and autonomy being increasingly present and can break with the authoritarian model existing in the school. Thus, in order for there to be a dialogic education, it is necessary to have critical reflection. It is through criticality that the awakening to a new thought takes place and this is only possible when we relate to the other, because critical thinking is generated by dialogue. It is necessary to break with the limited vision that "annuls the creative power of the learners or minimizes it, stimulating their naivety and not their criticality, satisfies the interests

[3] FREIRE, Paulo. Pedagogy of the Oppressed. 49. Reimp. Rio de Janeiro: Paz e Terra, 2005.

of the oppressors: for them, the fundamental thing is not the denudation of the world, its transformation" (Freire, 2005, p. 39).

Thus, we defend a pedagogy based on critical thinking, which is based on the assumptions of liberation and emancipation, where the individual is recognized as a subject of knowledge and, therefore, reality is the starting point for the learning process and for the construction of knowledge. Their history, their social relations reveal meanings of their life and recognize the importance of these for their own construction.

Finally, Freire's critical epistemology brings us a perspective of education for social transformation, fostering in individuals the recognition of the importance of knowledge as a social practice, transforming it into critical and clarifying knowledge of reality and its history. (Santos, 2021). For this, the school needs to rethink its curricular bases, recognize itself as a space that fosters the union between the subjects and that their relationships can be transformed into instruments of action. It is necessary to observe the school space as an environment of struggle against the hegemonic forces and the interests of the dominant classes that aim to remain as a dominated space and at their service, contrary to what was defended by Freire.

FINAL THOUGHTS

The epistemological discussion in contemporary times is crucial to face the challenges of a world in constant transformation. It influences science, technology, education, and culture, shaping how we acquire knowledge, make decisions, and interact with the world around us. Reflecting on the nature of knowledge is a powerful tool for understanding and shaping our future in a more informed and responsible way. As society advances, the importance of epistemological discussion only becomes more evident and vital.

Throughout this study, we examine how epistemology shapes our understanding of knowledge, truth, and the validity of information. We highlight how philosophers and theorists of epistemology have contributed to our ability to question, analyze, and discern between different forms of knowledge.

In science, epistemology reminds us of the need for a critical approach, the importance of falsifiability, and the inevitability of ever-changing paradigms. In technology, epistemological reflection helps us evaluate the reliability of algorithms and the ethics of artificial intelligence. In education, it guides teaching methods and the promotion of critical thinking. In culture and society, epistemology warns us about the spread of misinformation and reminds us of the importance of critical analysis of information sources.

In a world where "post-truth" seems increasingly prevalent and where social media can shape perceptions, epistemological discussion is an essential tool for preserving the integrity of knowledge.

It empowers us to evaluate and question the information we encounter, to discern between opinions and facts, and to maintain a commitment to the search for truth.

We conclude that epistemology is not just an abstract philosophical discipline, but rather a vital approach to understanding the contemporary world. It helps us navigate a sea of information, make informed decisions, and contribute to a more critical, informed, and responsible society.

Therefore, as we move into the information age, we invite everyone to continue to promote and participate in the epistemological discussion. Only through constant reflection on how we know the world can we hope to build a future based on a solid and reliable understanding of reality.

Throughout this article, we seek to shed light on the intersections and challenges that epistemology faces in each of these domains, revealing how the search for knowledge is intrinsically related to human practices, the evolution of society, and technological transformations. As we explore these topics, it will be possible to understand how epistemology plays a central role in how we perceive, acquire, and apply knowledge in our contemporary world.

The epistemology of Paulo Freire's critical pedagogy is intrinsically linked to the epistemological formation of curriculum for social change, since his pedagogical approach emphasizes the importance of critical reflection on knowledge, the construction of knowledge and the transformation of reality. Freire's critical pedagogy values dialogue as a central element in the teaching and learning process. In this context, the epistemological formation of the curriculum involves the creation of spaces for dialogue between teachers and students, where knowledge is not transmitted in a unidirectional way, but built collaboratively through discussions, questioning and reflections.

Freire's pedagogy also emphasizes awareness, which involves a critical understanding of the power structures, social conditions, and power relations that shape knowledge. This entails a critical epistemological approach in which students are encouraged to question the sources of knowledge, the dominant narratives, and the history behind what is taught.

For Freire, the curriculum should not be a mere set of content to be transmitted, but rather a tool for social transformation. This means that the epistemological formation of the curriculum should be oriented towards the promotion of social justice, equality and critical awareness. Students should be empowered not only to acquire knowledge, but also to use it to address social issues and contribute to positive change.

Freire's critical pedagogy highlights the importance of contextualizing knowledge, making it relevant to students' lives. The epistemological formation of the curriculum must consider the experiences and realities of students, connecting the content of the curriculum with their own lives and challenges.

Freire argues that students should not be passive receivers of knowledge, but rather active participants in the construction of their own knowledge. This implies an epistemological approach that values students' curiosity, research, problematization, and collaboration in the construction of the curriculum. Finally, Paulo Freire's critical pedagogy and the epistemological formation of the curriculum are interconnected through the emphasis on the construction of knowledge in a critical way, in dialogue, providing spaces for autonomy and social transformation.

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The influence of democratic school management on the work of pedagogical coordination

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ABSTRACT

Democratic school management plays a crucial role in the effectiveness of the work of pedagogical coordination The accomplishment of this research is relevant because it included investigating what democratic school management is, emphasizing its influence on the performance of pedagogical coordination in schools. Through a literature review, the impact of the participation of the various actors of the school community in decision-making, in the promotion of autonomy and in the establishment of a collaborative culture is examined. Democratic management favors the exchange of experiences, dialogue and the collective construction of educational projects, strengthening the role of pedagogical coordination as a mediator between the demands of the community and educational practices. In addition, it addresses how democratic leadership contributes to the professional development of pedagogical coordinators, encouraging reflection and continuous improvement of their practices. Finally, this article was an experience that served to expand the knowledge about the importance of democratic school management for the work of pedagogical coordination, seeking to understand how these strategies influence the management process and the quality of the education offered.

Keywords: Democratic School Management, Pedagogical Coordination, Education, School.

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INTRODUCTION

It is notorious in the field of education that the community demands an egalitarian institution, so that it is pertinent to meet the demand of the population. A democratic school, which performs its social function, always becomes a management concerned with its society, in the performance of its employees of the school unit directed by a manager, with the participation of teachers, pedagogical coordinators, parents and students in general.

For all areas of education, the institution is responsible for the transmission of knowledge, making the school have another way of visualizing the demands and globalization, different ways of working, renewing its posture to transmit a high level of knowledge, preparing its students with creativity and that they can have positive thoughts. Forming citizens with the capacity to participate in society, to obtain satisfactory and favorable results for the development of the human being in the current perspectives.

Each question that was generated had answers with the concept of equal share and observed, in view of this, the following question arose: How does democratic school management contribute to promote the participation of pedagogical coordination in decision-making?

In view of the elaborated questioning, this work aims to show some important points of the influence of school management in the work of the pedagogical coordinator so that the educational process of the school is democratic and consistent, in order to stimulate the collective and/or individual moment based on a democratic and participatory school management.

DEFINITION OF DEMOCRATIC SCHOOL

The democratic school is always open to dialogue for the entire school community, creating new ways of interacting with the school community, and establishing a democratic teaching environment with everyone, showing that the school and community must walk together in the same purpose and changes.

This interaction is directly linked to the construction of the school unit (preparation of the PPP, execution and evaluation) respecting the construction of each project and pedagogical processes regarding the issue of a bureaucratic nature.

With the responsibility and process of the community around it, showing that the school was able to cross barriers and establish a commitment to society.

Even so, we know that it is not easy to interact between school and community, because in the world of school it is where relationships of conflict and dispute for power are created, in a way where sometimes decisions are made without the participation of the community, leading through authoritarian and bureaucratic strategies." We cannot stay in the world, with the world with gloves in

our hands, looking only for accommodation in me and only for addiction, which implies courage, choice, action in reality" (Freire, 2014).

Deconcentration, therefore, seems to be more the case practiced in Brazil, in the name of fuller decentralization. As also pointed out by Parente and Luck (1999, p.13)

> What has been happening in Brazilian educational practice (...) is the displacement of the decision-making process, from the center of the system, to the executive levels closest to its users, that is, the decentralization of the federal government to the subnational levels, where the Union ceases to directly execute educational programs and establishes and strengthens its relations with the states and municipalities. reaching the level of the school unit. In the same way, the state systems have been adopting a similar policy, that is, they transfer resources and responsibilities for the provision of educational services, both to the municipality and directly to the school.

Even knowing that the decisions come from the union, it does not favor or determine the demands of the schools, because it is a process that flows directly from educational programs, so that the schools can receive the resources, to maintain their school and their resources come to administrative and financial management. Even so, talking about public policy within a school is still complicated, as managers are not always able to manage the resources sent by the government according to the school's needs.

DEMOCRATIC AND PARTICIPATORY MANAGEMENT

The manager is very important within a school, as he is the one who leads and ensures the democratic and participatory performance of the school council or body, similar to the class council and the Student Council and other school collegiate bodies, as well as assisting the pedagogical coordinator in his decision-making. Because it is the manager who encourages the participation of all segments of the school and school projects, keeping abreast of the issues of society and the school community with its social processes, making the community have a better view of the path inside and outside the school.

Democratic management is a principle defined in the Law of Guidelines and Basis of National Education (ART.3 Item VIII). And in the Federal Constitution (ART.206, item VI). It is based on the assumption that education is a collaborative social process that demands the participation of everyone from the school's external community, such as parents and society in general.

As indicated by Carvalho (1979), "... As social consciousness develops, duty is transformed into collective will", that is, it creates within the school its own culture guided by the realization of the ideals of education, which become a natural part of the way of being and doing school and, for this very reason, does not need to be imposed from the outside in.

The definition of management is a simple participation in which several people work together for a quality school. Democracy is a word that is always present in almost all speeches within education.

At the moment it doesn't mention the administrator, it talks about the manager. Therefore, the school management. According to Luck (2009):

> It should be understood as a work that is carried out together, with the presence of everyone in the school community, popularized as a school manager, in a concept of popular management sovereignty, with a direct connection of knowledge directly with the culture and coexistence where the school community is inserted.

To this end, the main idea of democratic school management is,

> Seek opportunities for knowledge and open new experiences in the area of Education, respecting the individual specificities of each student, providing a characteristic environment for them to overcome their personal and collective challenges (Brasil, Mec, 2007).

School management is a democracy of possibility involving everyone with nature and their citizenship, seeking to achieve freedom with the people involved, within the context of experience, whether formal or informal, with autonomous and creative responsibility.

In order for "management to collaborate for the progress of autonomous citizenship, these four elements are fundamental for its effectiveness to occur." (Brazil/MEC, 2007)

A) PARTICIPATION - is the moment when projects are developed where all participants have the opportunity to expand their knowledge together, seeking ways to improve education;
B) PLURALISM - when diversity plays a fundamental role in the actions of those who collaborate with the institution;
C) AUTONOMY – withdrawal from power, when the school will finally be able to adapt to the true needs in which it is inserted, being able to give life to its Political Pedagogical Project – PPP – in a joint way, aiming at independence and social reform;
D) TRANSPARENCY – is the image of the school area, showing the space and that it is open to the community society and the various opinions of those who want to collaborate with school structures.

For these are the four elements of the columns that are supported by democratic school management, highlighting the important actions in knowledge with education and vision of new democratic postures and cultures. They are necessary to obtain a quality education where individuals can be critical and responsive, creating in their environment an environment adapted to their reality.

> ... Democratization begins inside the school, creating spaces where staff, students, parents, teachers, etc.

> Be able to discuss everyday school life. In this way, the school has the function of indoctrinating critical and participatory individuals [...] (Oliveira; Martin; Golden, 2014)

MECHANISMS THAT CONTRIBUTE TO THE EXERCISE OF DEMOCRATIC SCHOOL MANAGEMENT

In democratic school management there are several mechanisms for an effective democracy and that can be used in the most different ways within the education system. These procedures will assist in the scope of democratic educational management, and one of these mechanisms will be represented by school councils.

SCHOOL BOARD

The council is represented by both the local community and the school community. 'It is through these councils that all those involved in the school community will decide the direction that school should take in its daily life'. (Brasil/MEC, 2007).

As for the collegiate management structure. The Ministry of Education (MEC) itself guided the organization of these structures, with the objective of systematizing and ordering the formation of these management mechanisms, generically calling them the Executing Unit, whose responsibility would be to receive, execute and manage financial resources of the school unit:

> The executing unit is a generic name, adopted to refer to the various nomenclatures, found throughout the national territory to designate a private, non-profit entity, linked to the school, with the objective of managing financial resources, transferred to the maintenance and development of education. It does not matter what denomination the school unit and the community choose for the Executing Unit, be it Association, School Fund. Parents' Circle and others. The basic principle is the search for the promotion of school autonomy and community participation, in all its dimensions: pedagogical, administrative and financial (Brasil, 1997).

It is known that talking about public resources is complicated, because these organizations aim to move to a financial resources manager, so that they can manage their money, unfortunately not all managers have this ability to organize according to the needs of the school.

It is impossible to compare the family with a community as a participatory group within schools, because there are few who still go to school to learn about their children, in front of a school, because each human being has a way of seeing and thinking. It is necessary to improve and bring parents into the school and the relationship of society with what we are experiencing is important, perhaps in this way we can form a concept of knowledge to form a group that can encourage and show the reality of life of each community.

PARENT-TEACHER ASSOCIATION

It is an invocation of participation, which "signifies a great way of participating in a meeting between family and school, creating significant bonds for the smooth running of a democratic school management". (Brazil/MEC, 2007)

In order to contribute to the development of leadership, the parent-teacher association promotes an educational culture and an important association to analyze the issues between parents and teachers, making them have more participation of the family in the school, with a perspective of quality teaching guided by the practice of leadership within the school.

CLASS COUNCIL

Within a synthetic approach of the Ministry of Education document that deals with the organization and performance of the Class Councils, it establishes that:

> It is represented by the school community, and is composed of all the components and all the segments existing in the institution, establishing itself as a matter of urgency. It is a body that links all the other institutions, it is where the democratic function takes place.

Despite these assignments and participations we have not yet seen or established with a group of people who approve and fail students at the end of each school year. However, it must be a body that acts on the needs of the institution and in continuous evaluations, always showing the results achieved, proposing necessary interventions that avoid problems in student learning, in which it is important to review and reevaluate the attribution of the Class Council to interact in the students' difficulties.

STUDENT COUNCIL

The student council awakens in the student the interest in the school, Beyond the classroom it induces the member of the Guild to organize himself, "offering the students a responsibility to create some decision-making, having the opportunity to create an internal and participatory action to the Guild itself related to the school conditions of the students.

According to the Ministry of Education and Culture (2014), the following are classified as an obligation of a Student Council:

> a) to organize the approximation and relationship of the students with the staff and the teaching staff of the school;
> b) strengthen the understanding of companionship and collaboration between the collegiate and the school;
> c) allow students to create and develop social actions both within the school environment and outside it together with the community;
> d) support the construction of the school community.

This range of activities should serve as stimuli to insert broader actions, so that students will be able to have a reflection of their own activity in citizenship and social life.

THE ROLE OF THE MANAGER IN DEMOCRATIC SCHOOL MANAGEMENT

Luckesi (2007) shows that, "the school is the mirror of its administrators, its educators, parents, students and the community; in the school it arises from the joint action of all these elements".

"The figure of the manager was seen as authoritarian, who dictated rules, aiming at the proper functioning of the school" SEED (2008). This hierarchical pyramid of a manager who did not accept opinions ended up leaving a negative appearance about education, which has been seeking the interests of the powerful. With the purpose of a new democratic school management, this image of the manager is being detached from this aforementioned authority.

The manager employs a democracy that concentrates attention to stimulate the democratic process of the school unit, offering an environment where everyone participates, thus being able to share the decision-making power.

"In democratic management, the principal is presented as a school and local leader, with the ability to exercise with mastery the exercise of public manager" (Brasil, 2007).

A democratic school management grants the participation of all, not only the student, the manager elected by the community or by the members of the school, has the duty to act in an appropriate way to the needs of the school and interact directly with the pedagogical coordination.

The population in general demands a new attitude: "from the perspective of management as a strategic resource for the evolution of any society, a bureaucratic manager is no longer allowed, guided only by a regimental manual" (Araújo, 2009).

It is necessary that the true values of the school are developed together with the democratic manager, transmitting and sharing knowledge, respect and trust, the values of the school integrate the lead and generate collaboration and stimuli of collective and cooperative activities.

In this regard, the democratic manager carries out his "activities respecting adversities, knowing how to listen, maintaining dialogue among colleagues, observing, staying informed, seeking opinions and relating in a healthy way with the members of the community" (Silva, 2009).

THE INFLUENCE OF DEMOCRATIC SCHOOL MANAGEMENT ON THE WORK OF PEDAGOGICAL COORDINATION

The influence of democratic school management on the work of pedagogical coordination, focusing on the decentralization of decisions and school autonomy. Starting with the construction and implementation of the Political Pedagogical Project (PPP), democratic management seeks to

involve the entire school community in decision-making and promote a participatory culture in the school.

Democratic school management, based on the participation and collaboration of all members of the school community, is an essential element for the promotion of inclusive and quality education. According to Veiga (2013), "a school maintained by a democratic management begins with the construction of the PPP and its realization". This implies the need for the involvement of all school actors in the definition of the institution's future.

The decentralization of decisions, as highlighted by Luck (2009), is a central aspect of democratic school management. The PPP is the instrument that guides the school's actions and should reflect the interests and needs of the community. This fosters a culture of participation and engagement among education professionals. In addition, school autonomy allows the institution to develop its own pedagogical and administrative practices, aligned with its local characteristics and demands, thus including the indispensable work of pedagogical coordination.

Democratic school management within the scope of pedagogical coordination is also concerned with promoting inclusion and respect for diversity. Castiglioni (2011) points out that "the interaction of the population is an essential part of the democratization of the school". For this, it is essential that the pedagogical coordination promotes inclusive practices that are sensitive to the individual needs of students. This requires the development of appropriate pedagogical strategies and emotional support to ensure the participation of all students, regardless of their differences.

Despite the benefits of democratic school management, there are challenges to be faced. As Freire (2004) points out, "education involves the democratization of the knowledge produced". This implies the need for a continuous commitment to participation and dialogue, as well as the development of leadership and management capacities on the part of the pedagogical coordination.

THE ROLE OF THE PEDAGOGICAL COORDINATOR IN A DEMOCRATIC SCHOOL MANAGEMENT

The role of the pedagogical coordinator in a democratic school management is multifaceted and challenging. He acts as an articulator, promoter of dialogue, guarantor of the quality of teaching and facilitator of the educational process. In order to perform this role effectively, it is essential that the coordinator has a strong background, leadership skills, and an unwavering commitment to the principles of democracy and educational quality.

The pedagogical coordinator is one of the most important actors in school management, acting as a link between the principal, teachers, students and the community. In a democratic management approach, its function is even more relevant, as it has the responsibility to promote the

participation of all those involved in the educational process, ensuring that decisions are made collectively and transparently.

The pedagogical coordinator plays a fundamental role in the articulation between the various actors of the school community. It should establish effective communication channels, promote dialogue, and encourage the participation of all those involved in the educational process. According to Luck (2009), "the active participation of the coordinator is essential for the success of a democratic school management".

Another important function of the pedagogical coordinator is to ensure the quality of the education offered by the school. It must monitor the work of teachers, offer pedagogical support, identify and propose solutions to problems that arise in the school day-to-day. For Libâneo (2004), "the pedagogical coordinator is a fundamental agent in the search for continuous improvement in the quality of teaching".

In addition to articulation, the pedagogical coordinator is responsible for promoting reflection among teachers and other members of the school community. It should create spaces for teachers to share experiences, discuss pedagogical practices through dialogue, and reflect on the challenges and possibilities of education. As Veiga (2013) points out, "dialogue is a powerful tool for building a democratic culture at school".

CONCLUSION

The implementation of a democratic, efficient and quality school is a social request. With this new social model for the school environment, new theories also appear to assist in the pedagogical coordination that plans, works with subjects of the most different levels, which means facing an immense diversity within the school environment.

In conclusion, the influence of democratic school management on the work of pedagogical coordination is indisputable. Through the active participation of all members of the school community in the definition and implementation of educational policies, democratic management provides an environment of collaboration and engagement. The decentralization of decisions and the valorization of school autonomy allow pedagogical coordination to play a more significant role in promoting quality education, adapted to the local and individual needs of the collegiate.

In short, democratic school management is an essential element for the success of pedagogical coordination and for the promotion of a more equitable and effective education. By creating an environment of collaboration, autonomy and inclusion, democratic management allows pedagogical coordination to play its role more effectively and collaboratively.

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Application of an instructional model based on perceptual discrimination to teach concepts of materials and manufacturing processes in design courses

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ABSTRACT

The objective of this work is to experiment with an instructional model based on perceptual discrimination for the teaching of concepts in design. The process of developing this model was based on the understanding of how the pedagogical relationship between teachers and design students is established in the search for expertise in the area and, with that, to propose a didactic-pedagogical model capable of assisting in the processing of information, in order to enhance the training of new professionals based on an integrated educational system. This work is part of the teaching of design and, consequently, of education. Its focus is dedicated to the use of educational technology resources in pedagogical situations within bachelor's degree courses in design. The selected starting criteria contextualize its development and implementation, in parameters recently tested and presented by the science of learning and cognitive science, with main interest in the use of perceptual discrimination. It is understood that the model can enhance the teaching of design by allowing greater dynamics, flexibility and technological integration, especially in the first years of the course; The results of experiments on laypeople with no knowledge of the subject demonstrate how successful the technology has been in this aspect. The results corroborate the idea of optimizing the process and, therefore, would be able to reduce the time needed for pedagogical fulfillment in certain phases of teaching; The results of the application in an open course applied at a distance and also used with regular course design students corroborate this point. The protocol applied favors technological advancement in the search for continuous improvement of teaching in its entirety; The modules, once built, are easy to reapply, with simple adjustments, providing the continuous evolution of the model, whether in updating content, adjusting praise and feedback, or even expanding the didactic program.

Keywords: Instructional Model, Perceptual Discrimination, Design Teaching, Experimentation.

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INTRODUCTION

EDUCATIONAL TECHNOLOGY APPLIED TO THE TEACHING OF DESIGN

This work is part of the teaching of design and, consequently, of education. Its focus is dedicated to the use of educational technology resources in pedagogical situations within bachelor's degree courses in design. The selected starting criteria contextualize its development and implementation, in parameters recently tested and presented by the science of learning and cognitive science, with main interest in the use of perceptual discrimination[4].

Perceptual discrimination is one of the most relevant techniques and theories for the science of learning, both because of the surprising results achieved quickly with students from different areas, but also because of the good theoretical structure and research models.

This experimental study is part of a large research project that is directly associated with the areas of design, education and expertise training. Still, being a vague delimitation about what was investigated, with a reasonably broad definition, connecting to this theme, we have the theory and practices of perceptual discrimination, along with investigations about the construction of expertise.

OBJECTIVES

The overall goal with the research is the experimentation of an instructional model based on perceptual discrimination for the teaching of concepts in design. The process of developing this model was based on the understanding of how the pedagogical relationship between teachers and design students is established in the search for expertise in the area and, with that, to propose a didactic-pedagogical model capable of assisting in the processing of information, to enhance the training of new professionals based on an integrated educational system.

MAIN ARGUMENT AND ASSUMPTIONS OF THE RESEARCH

The research is based on the following assumptions:

A) The teaching of design, as well as all educational and training practices, are facing unprecedented obstacles in the history of humanity (ROBINSON, 2006, 2010a and 2010b). Thus, the need for innovative, flexible, customizable instructional models are the front line for a reform, or even a revolution, in education.

B) As presented by the theory of perceptual discrimination and indicated by empirical investigations related to the subject, the brain learns automatically, assimilating information, facts, and concepts naturally and unconsciously.

[4] *The translation used by CAREY in his 2014 bestseller of the original English term, "Perceptual Learning", was adopted;*

C) The identification and discussion of the factors that define design expertise can help in the development of guidelines for the training of professionals who are better prepared for the challenges of the uncertain future job market.

D) The use of various technologies such as methods, software, models and electronic and digital equipment have proven to be interesting resources for a better learning experience, helping active, collaborative learning and teaching for understanding.

GENERAL SCOPE

For the development of the project of an educational model or technology for the design, the research was based on concepts, methods and theories from four areas of human knowledge:

1. Perceptual Discrimination
2. Science of Expertise
3. Cognitive Science and Learning Science
4. Data Analysis

The first contribution comes from the theory of perceptual discrimination, which offers the mechanisms of rapid assimilation of concepts. From the studies related to expertise in design, it is understood how to define expertise in the area and achieve it through pedagogical means. The pedagogical factors analyzed by the bias of learning science, in turn, indicate the best practices and strategies related to the cognitive and non-cognitive aspects of the teaching-learning relationship, and finally, the theory of data analysis applied to the classroom, presents organizational techniques for decision-making based on reliable data.

PERCEPTUAL DISCRIMINATION

The most appropriate technical description of the theory of perceptual discrimination, however, is directed to the researcher who organized and presented this important resource to the academic community. Gibson (1969) stated that "perceptual discrimination is a process of differentiation of distinct features of objects, permanent features of spatial layout, and invariants of events." The Stanford Encyclopedia of Philosophy presents on its official website[5] the assertion that the process involves the incredible improvement in the individual's ability to respond to the environment. In 1978, in a similar way, Westheimer stated that throughout the life of an organism, perceptual discrimination occurs successively and naturally, leading to functional and structural changes of neurons in the sensory cortex. As will be presented below, in laboratory experiments, it is more easily observed that the use of this learning instrument improves the performance in pattern recognition in interval tasks. In all the cases presented, the individual who is repeatedly exposed to

[5] https://plato.stanford.edu/entries/perceptual-learning/

stimuli and information presents an improved performance for the trained skill. Geller (2011) points out that perceptual discrimination can be defined as the process of changes induced by experience or practice in the collection of information.

Carey (2014) presents a collection of studies to reveal the idea that the brain can be understood as a pattern-recognizing "machine" and, when properly focused, can quickly deepen a person's understanding of a principle. In even more detail, Gibson (1969) informs that the three basic elements that guarantee the effective result of the practical application of the theory structured by it are:

1. The specificity of discrimination (what is learned)
2. Attention optimization (how learning occurs)
3. The increase in the economy (speed in the identification of stimuli)

METHODOLOGY

The experimental part of educational technologies are laboratory in nature, taking place in controlled or partially controlled environments. The practices and use of technology "at a distance" and in some cases was used in order to mimic learning situations in MOOCs[6], for example. The distinction between students, professionals and laypeople in relation to the theme of the experiments establishes a "control group" effect in all the cases presented. Many of them also offered only part of the stimuli put to the test in the training protocols. This procedure allows the researcher to accurately verify the impact of the deliberate practice protocol training on the participants' performance.

The pre-tests established the initial parameters of the experimental groups and delimited their diversity, while the longitudinal character of the experiments evaluates the evolution of the information collected over time, i.e., measuring the use and impact of the training (performance) and also measuring the variations in the measurement of perception in subjective aspects such as motivation and academic mentality. The indicators of motivation and academic mentality used are derived from references presented in MOTA-SANTOS, I.; LANA, S. (2019b) and Santos and Lana (2020) respectively, with 5 statements that are placed as a self-assessment system on a scale of agreement. One of the indicators of motivation also concerns the learning objectives, which is one of the most important elements for the success of any pedagogical project. In addition to this indicator, some modules carry out a self-assessment of the specific objectives of each content, in which participants answer directly with 'yes', 'no' or 'maybe' about the ability to perform tasks or recognize certain contents. In some of the modules, only a few participants received stimuli related to the construction of an academic growth mentality in relation to the themes. In these cases, the objective was to measure the impact of this procedure on the overall improvement of performance results, as

[6] MOOCS - Massive Online Open Courses - "Cursos Online, Abertos e Massivos"

well as on the ability to positively alter this non-cognitive factor of pedagogy in design. Finally, participants were also asked to confirm whether they performed other tasks simultaneously with the study sessions, with the goal of verifying the impact of multitasking on performance outcomes.

The trainings were basically applied in two modalities: free practice and formatted and identical execution for all participants. The objective was to verify whether the number of times the individual was exposed to training directly affected the general indicators, whether cognitive or not. In some of the cases, the indicators mentioned above were also included in the training sessions, so that the capacity for longitudinal changes in the execution of the tasks could be ascertained. The final evaluation forms served as a comparative basis to measure the changes obtained in performance, academic mentality, motivation levels and other specific indicators. The details and variations in each of the experiments conducted throughout this work will be presented.

A deliberate practice protocol-building approach was adopted for recognition training and utilization of design concepts within the first two years of the regular course. In addition, a form of automatic correction of evaluations was structured and, in some cases, also in the training of placing praise written according to the guidelines found in the previous chapters, as well as feedback with the correct answers. In specific didactic situations, in addition to the correct answer, some kind of stimulus related to self-determination or academic mentality was added. The compliments, when used in the automatic answers to the forms, were always intended for the effort to gain autonomy and competence, in addition to thanks for the time dedicated to the acquisition of that knowledge.

MATERIALS IN DESIGN WORKSHOP

The protocol of deliberate practice[7] applied in a workshop to teach the concepts of materials for design was constituted in three major stages or modules. The first stage concerns an initial assessment dedicated to the measurement of content knowledge, with 65 points or questions, in addition to a subjective self-assessment of questions related to motivation, which are structured in 5 indicators. In addition to these motivation indicators, two indicators are directly linked to learning objectives. Regarding the motivation indicators, five statements were selected that, when presented to the participants, allow self-assessment on a Likert scale (1932)[8] ranging from 1 to 5, with 1 being total agreement, three being neutral, reaching 5 level of total disagreement. Regarding the learning objectives, the questions were asked with yes and no answers. They were structured in a very direct

[7] Concept, which refers to repetitive training dedicated to a theme or activity. It aims to gain expertise quickly and efficiently, and structures many mechanisms of perceptual discrimination. (ERICSSON, 1999)
[8] A type of psychometric response scale commonly used in questionnaires, and is the most commonly used scale in opinion polls. When answering a questionnaire based on this scale, respondents specify their level of agreement with a statement. (LIKERT, 1932)

way, confronting the participants if they knew how to point out certain contents or differentiate types of materials, for example, and totaled 20 points.

The second phase of experimentation concerns training. In this specific case, the trainings were carried out in four sections divided by themes: introductory aspects of materials with 23 questions, aspects of production with 19 questions, recent developments in materials with 15 questions and, finally, environmental impact in the production of materials with 8 questions. It should be noted that the training offers participants the opportunity to review the 65 questions that are the performance metrics presented in the initial evaluation and that will also be part of the final evaluation. In addition, each of the 4 training modules offers participants the opportunity to report on whether they multitask during the study sessions. In this first experiment, only closed multiple-choice questions were used. Most of them presented as options the material groups or specific types of subcategories within the major material groups. In addition, the other questions presented statements about materials that allowed the choice of true or false. During all trainings, regardless of the right or wrong, each participant had to see the correct answer to the question before being able to move on. The final evaluation, in turn, which is the last stage of the experiment, has an identical structure to the initial evaluation, with the same metrics of performance, motivation and learning objectives. These modules were structured using digital form-building tools. These tools allow the quick collection and organization of data, in addition to the possibility of using data exported in "CSV" format to spreadsheets that allow for different analysis approaches.

After carrying out the experiment related to materials concepts, which was configured as an introductory module for the initial testing of the protocol, the manufacturing process modules were developed. These, despite being broader and more in-depth, maintained the basic structure of initial forms, trainings and final forms. In addition, the modules allowed a longitudinal verification of learning and tested different variables, such as the comparison of different visual stimuli containing the same information.

MANUFACTURING PROCESS MODULES FOR DESIGNERS

The modules teaching manufacturing process concepts to designers is a much broader experiment than the previous experiment. Although the structure is similar, the amount and variety of content is much greater, with six different modules totaling 18 stages in total. Each module had an initial evaluation form, a training form that could be completed numerous times, and finally, a final general evaluation form.

The first module referred to the categories of industrial manufacturing processes as cited in Thompson (2007). The second module concerns the identification of 18 different forming processes. The third module deals with the classifications of industrial processes, and the fourth concerns the

subcategories of manufacturing processes as indicated in Lefteri (2009). As a highlight in this application, we have the execution of the fourth, fifth and sixth modules that deal with the precise recognition of industrial processes. The three modules have identical structures in their initial assessment, in their training, and in their final assessment. However, the highlight is the stimuli used, as the first of them uses texts and descriptions about industrial processes; the second presents images of products produced with the processes and finally, the third presents organizational charts and explanatory images of the operation of the processes. Thus, the creation of these three modules aims to measure the impact of different stimuli on the assimilation of concepts in design, in this case the recognition and memorization of 20 different industrial manufacturing processes.

Regardless of the contents for each module, the first form made the initial measurement of the participants' knowledge on the subject, also allows self-assessment and measurement of motivation. In addition, the form also offered the evaluation of the subjects' position on the learning objectives. In the training, in turn, in addition to measuring scores or performance, the subjects were also asked to report the performance of other activities and multitasking during the study sessions, as in the previous experiment. The final modules, on the other hand, measure, in addition to the performance gain, all the requirements contained in the initial assessment, allowing the comparison of motivation indicators and learning objectives.

GENERAL SUMMARY OF THE STRUCTURE OF THE EXPERIMENTS

For a more direct visualization of the structuring indicators of the protocols, a table was developed. In addition to the performance indicators, their types and quantity, the indicators of motivation, academic mentality, learning objectives, and indicators of multitasking were quantified for each experiment performed (TAB.1).

TAB 1. Basic structuring of the experiments.

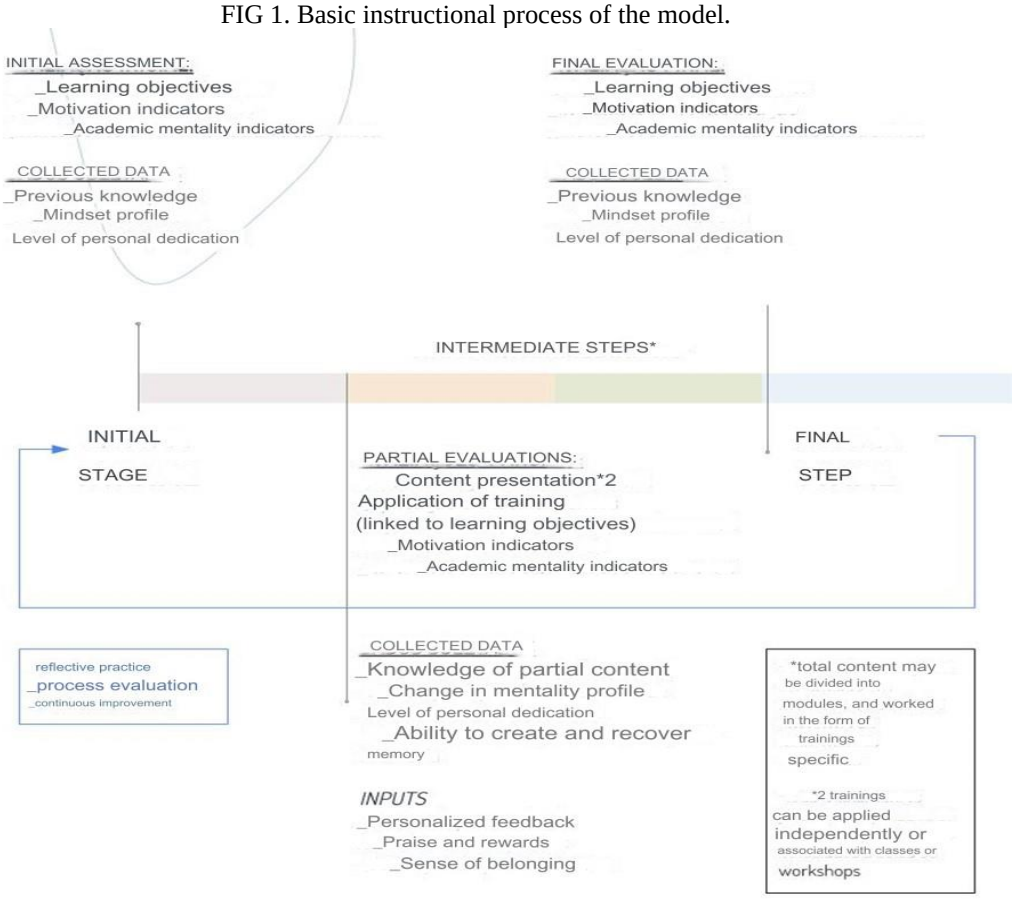
EXPERIMENTS	PERFORMANCE INDICATORS		INDICATORS MOTIVATION	INDICATORS ACADEMIC MINDSET	OBJECTIVES APPRENTICE SHIP	INDICATORS MULTITASKING
	CONCEPTS	KIND				
MATERIALS	65	VF ME	5	1	20	2
PROCESSES	119	VF ME	5	1	1	2
CLASSROOM DISCIPLINE	84	VF ME QA QR	–	–	–	–
WHAT 3D	33	ME QA QR EP	5	5	1	2

CAPTION: VF - True or False | ME - Multiple Choice | QA - Open Questions | QR - Reflective Questions | EP - Practical Exercises

Source: From the author, 2024.

The procedures of the instructional model, organized by stages in a simplified version, are illustrated in Figure 1. In it, it is possible to see the relationship of the initial stage with the training sessions and with the final evaluation, both with regard to the indicators mentioned above, as well as in relation to the data collected and possibilities of action of the instructor/teacher (*Inputs*).

FIG 1. Basic instructional process of the model.



Source: By the author, 2024.

SAMPLING

General Profile of Participants

During the initial questionnaires, questions were asked to understand basic information about the participants. Regarding design students and professionals, the reported ages range from 21 years to 47 years old, however, the largest group of participants, 18 of the 49, are between 22 and 24 years old, and 30 of the participants are between 21 and 28 years old. They represent 6 different design courses.

In the case of design teachers, on the other hand, the age ranged from 28 to 67 years and the average age of the 21 participants is around 45 years. The professors participating in the research represent seven different institutions, one of them being an international university. Of the 21 professors, more than 50% have a doctorate and almost 40% have a master's degree, and 81% of them have a background in design in their undergraduate studies and have been graduated for more than 10 years. Regarding teaching practice, 30% of the participants have been teaching for more than 20 years, 35% for more than 10 years, and 30% have up to 5 years in the classroom.

All participants who answered the questionnaire are Brazilian. In the group of design students and professionals, only 2% of the population had a master's or doctorate degree, and 14% had a postgraduate degree. Of the rest, just over 80% are design students or recent graduates.

When we evaluate the participants of the initial experiments and the protocols applied in didactic situations, we have the totality of students or professionals who have recently graduated from the undergraduate program. The participants are mostly students from Brazilian universities, whether they are students of design or other courses. We also found the participation of professionals from different areas, as well as exchange students from universities in other countries.

TAB 2. Total sampling and distribution by activities.

ACTIVITIES AND PARTICIPANTS	Types of Subjects	Quantity	Total
Applied Model	Students	106	136
	Lay	30	

Source: By the author, 2024.

RESULTS OF THE APPLICATION OF THE MODEL

The protocol model of deliberate practice developed based on the concepts and implications presented by Mota-Santos and Lana (2019a), served as the basis for reaching this point of the research. Then, extrapolations in variables such as stimuli, in addition to the expansion of the longitudinal character of tests will be presented in the modules related to industrial manufacturing

processes. Another aspect that makes the model unique is the measurement of indicators of non-cognitive pedagogical factors presented by Santos and Lana (2019b) and (2020).

METHOD APPLIED TO MATERIAL CONCEPTS

The training modules applied to the concepts of materials in the lay group, which had 7 participants, obtained an initial average of 44 points out of 65 offered. In the case of the 24 design students participating in the other group studied, in turn, the initial average was 46.04 points out of 65. This result is noteworthy, because the design students were already taking or had attended at least one materials course, which would suggest a much greater difference in this result. Thus, it can be inferred that the questions presented are supposedly very basic, linked to superficial knowledge of the groups of materials and their characteristics. The results described are summarized in Tables 16 and 17.

Most of the indicators of intrinsic motivation of the laity were associated with positions of partial and total agreement, and only the indicator linked to the level of knowledge in relation to the theme remained neutral in this initial phase. The motivation indicators of design students were also maintained on the concordance scale.

TAB 3. Synthetic results of the materials experiment: laymen.

PERFORMANCE INDICATORS	INITIAL ASSESSMENT	FINAL EVALUATION	TRAINING	
–			REPETITIONS	OVERALL AVERAGE
CONTENT	44/65	62/65	19	56,75
MOTIVATION	1,94	1,56		
LEARNING OBJECTIVES	32,7%	93,3%		

MOTIVATION SCALE: Scale: 1.Very Good, 2.Good, 3.Fair, 4.Poor, 5.Very Poor
Source: By the author, 2024.

The overall average of points obtained in relation to the introductory training was 19.6 out of 23 points, and, among those offered in the productive aspects, the average was 16.4 out of 19 possible points. On recent material developments of 13.75 out of 15 possible, and in the training module on environmental impacts, the average was 7 points out of 8 possible.

The final average obtained by the lay participants in the 65 possible points of the last global evaluation of the course was 62 points, a considerable increase in relation to the 44 average points of the initial evaluation. The final average obtained by the design student participants also increased, reaching 56.29 points out of 65 offered. Although this number showed a considerable improvement,

more than 20 points in the initial average, the result was below the final result obtained by the lay participants. As a related indicator, the motivation factor of design students can be reported. In the case of design students, once again the result was surprising. The motivation indicators remained at the level of agreement for the most part, but worsened in relation to the initial evaluation in almost all indicators. In the case of lay people, on the other hand, the motivation indicators also improved, with four of the five indicators tending to be in full agreement with the statements presented. The level of interest in acquiring knowledge can be understood as a possible explanation for the recorded phenomenon. The lay people volunteered to carry out the modules in MOOC format offered in the university's program. Design students, on the other hand, had the modules inserted as training exercises during the regular completion of course subjects. Many of them reported feeling an excess of curricular activities during the period.

TAB 4. Synthetic results of the materials experiment: students.

PERFORMANCE INDICATORS	INITIAL ASSESSMENT	FINAL EVALUATION	TRAINING	
	–		REPETITIONS	OVERALL AVERAGE
CONTENT	46,04/65	56,29/65	125	58,44
MOTIVATION	2,24	2,1		
LEARNING OBJECTIVES	28,8%	49,1%		

MOTIVATION SCALE: Scale: 1.Very Good, 2.Good, 3.Fair, 4.Poor, 5.Very Poor
Source: By the author, 2024.

METHOD APPLIED TO MANUFACTURING PROCESS CONCEPTS

The first module of this large experiment, linked to industrial manufacturing processes for designers, had 25 questions in its initial form. The initial average obtained by the laity was 8 points and 8.04 for the design students. It should be noted that once again, we have a similar initial note between the groups. Despite being a different phenomenon from what was predicted, which would place design students with a higher initial grade, these occurrences do not take away from the measurement merit of the research or the model used.

On motivational indicators, design students will tend to agree, but close to neutrality on almost all indicators. Unlike the lay people, who showed that they were much more motivated with the execution of the course and only tended to neutrality in relation to the indicator that refers to the level of knowledge on the subject. Thus, we have exactly the same result as the previous experiment for the initial phase, both in relation to performance indicators and non-cognitive factors linked to motivation. The indicator referring to the knowledge of the theme is in line with the answers of the

lay participants about the learning objectives; in which they indicated in their entirety or lack knowledge of the contents presented in the course. In the case of design students, many indicated that they may have been able to point out part of the course content correctly, which would perhaps justify the demotivation registered.

In the training form, the design students performed 84 sessions and increased their overall average performance to 17 points, while the lay people performed five sessions and increased their performance to 22 points out of a possible 25. In the execution of the final form of the polymer module, the design students achieved an average of 18.33 points and the lay people achieved an average of 24 points out of a possible 25. The motivation indicators of design students have improved, with the exception of the indicator that concerns the level of knowledge. The laity, on the other hand, had a significant improvement in all motivational indicators, with the exception of the statement regarding the level of interest in the topic. This result was further reinforced, with the learning objective gauges that were mostly negative or uncertain for design students and, unlike for laypeople, showed significant improvements.

This same pattern was repeated in the second module of the course, since the initial average of the 18 possible points in the second module was 13.85 for design students and only 7.50 for laypeople. The motivational indicators also show the same type of reaction of the participants, with the design students showing agreement with the statements but tending close to neutrality, while the lay people are also in the agreement zone but tending, in most indicators, to total agreement. After completing the training, the design students were able to improve their performance by reaching 16.46 points on average out of a possible 18. Otherwise, the lay participants, surprisingly, improved their performance to 17.40 points. Also, as we saw in the previous module, the motivational indicators for laypeople also showed improvements, while the motivational indicators for design students remained stable.

In the third module of the industrial processes course, the design students totaled an average of 11.57 points out of a possible 16 and the lay people in turn got only 7.29 points. After the training, the design students improved their performance to 15.19 points and the lay people got 16 points, that is, all the participants in this group got all the questions of the final module right. The motivational indicators reflected this improvement in performance and, although the indicators of the design students remained practically stable, the motivation indicators of the lay participants improved a lot. It also includes the indicator that relates to learning objectives.

On this issue, the two questions that directly address and gain knowledge after the training, was practically unanimous in its positivity for the lay participants. On the other hand, for design students it was predominantly dubious.

Despite the relevance of the data presented so far, the main investigative focus of the industrial process modules concerns the modules that present the 20 manufacturing processes repeated three times in the course. With stimuli of different natures, such as: the descriptive text, the image of products made in specific processes, or even the image that represents all stages of the production process. In the initial module in which the protocol was assembled with textual descriptions, the design students were able to improve the initial performance from 14.88 points of overall average to 18.04. In the case of lay people, the initial performance of 10.67 points was increased to an astonishing 19.4 points of final average. In the next module, in which textual descriptions were replaced by images of products manufactured with the processes to be learned, the design students also improved their performance from 17.88 points out of a possible 20 to 19.45. The lay participants, in turn, went from 13.20 points of initial average to 19.60 points in the final form of this module.

The last comparative stimulus module, on the other hand, had representative images of each stage of the manufacturing processes in illustrations or infographics and, for design students, represented an improvement from 18.7 points in the overall average in the initial evaluation to 19.32 points in the final average. The other participants who started with a much lower average of 10.80 points achieved a significant performance improvement reaching an average of 19.4 points.

TAB 5. Synthetic results of the manufacturing process experiment: layman.

PERFORMANCE INDICATORS	INITIAL ASSESSMENT	FINAL EVALUATION	TRAINING	
–	–	–	REPETITIONS	OVERALL AVERAGE
MODULE 1	8/25	24/25	5	22/25
MODULE 2	7,5/18	17,4/18	5	11/18
MODULE 3	7,29/16	16/16	4	10/16
MODULE 4	10,67/20	19,4/20	4	15/20
MODULE 5	13,2/20	19,6/20	4	14/20
MODULE 6	10,8/20	19,4/20	4	14/20

Source: By the author, 2024.

Although all the trainings showed positive results in performance, for both categories of participants, the results of the laypeople show the power of this tool. Quickly, in minutes, the protocol proves to be able to equate totally unmarried individuals with beginner designers. In addition, the indicators of non-cognitive factors linked to student motivation were also able to reliably represent the reaction to learning outcomes. Together, the two indicators can be an essential

tool for teachers to conduct courses with much higher levels of professional training. All reported data were organized in TAB 5 for laypeople, and in TAB 6 for design students.

TAB 6. Synthetic Results of the Manufacturing Process Experiment: Design Students

PERFORMANCE INDICATORS	INITIAL ASSESSMENT	FINAL EVALUATION	TRAINING	
–	–	–	REPETITIONS	OVERALL AVERAGE
MODULE 1	8,04/24	18,33/24	84	17/24
MODULE 2	13,85/18	16,46/18	50	17/18
MODULE 3	11,57/16	15,19/16	32	14/16
MODULE 4	14,88/20	18,04/20	98	18/20
MODULE 5	17,88/20	19,45/20	70	19,42/20
MODULE 6	18,7/20	19,32/20	77	18/20

Source: By the author, 2024.

METHOD APPLIED TO CLASSROOM ASSESSMENTS

In the application of the protocols in discipline evaluations related to materials and manufacturing processes for designers, the results were considered very good. Regarding the evaluation of polymeric materials, the initial average obtained by the students before the training was 14 out of 24 possible points. With the execution of 224 training sessions of the 25 students, the average rose in the final evaluation, to 22 points out of the same 24 possible. In the training, 15 questions were offered for review and the average of the students was 14 points in general. It is noted that, although the training does not bring all the evaluation questions for review and training, the recapitulation of the concepts apparently helps in the retrieval of other questions and/or information, improving the overall performance.

In the protocol carried out physically, on paper forms, and referring to metallic materials, the initial average of the students was 18 points to 24 possible points. The same 25 students freely performed 119 training sessions and totaled an average of 14 points for the 15 offered in the training. As a result, the students improved their performance in this evaluation as well, and managed to achieve an average of 23 points out of a possible 24 in the post-training evaluation.

In the module dedicated to ceramic materials, and natural materials, the students achieved an average of 16 points out of a possible 24 in the initial evaluation. In the trainings that contained 9 questions, the students were able to achieve the overall average of 8 points, repeating the training 102 times. As a consequence, they improve their performance to 21 points out of a possible 24 in the final evaluation on the subject.

In the modules dedicated to the understanding of composite materials, which did not contain an initial evaluation, students were exposed to the opportunity for free training, for two weeks prior to the execution of the test, with 4 days of mandatory spacing of the evaluation. The form contained open questions to train the concepts and, of the 25 students, performed 64 repetitions. Subsequently, divided into two groups, they were invited to take a test that contained 12 questions. The mean score in the first group was 8 points and in the second group was 7 points. It can be seen that in addition to the execution in a much smaller number of training sessions, apparently, the slower and cognitively more demanding training with open questions, did not result in a performance of the same level as the previous trainings.

In the execution of the global exams, which measured the assimilation of the concepts during the semester period, the class was also divided into two groups that performed an evaluation of 80 points. All these concepts and questions were identical to those posed in previous evaluations. The first group obtained an average of 59 points and the second group an average of 57 points in this evaluation.

APPLICATIONS OF THE METHOD IN COURSES AND WORKSHOPS

The first relevant aspect to be pointed out as conclusive within the results presented is the fact that in all modules and experiments, all individuals showed performance improvements in cognitive indicators. In some modes or courses, some performance indicators managed to increase by more than 60%, which proves the efficiency of the model used. Regarding the objective of positioning the method for gaining expertise in concepts in the first years of the design course, the experiment carried out with lay individuals proved to be fundamental. The results presented in laypeople's performance gains were relevant, including those referring to the indicators of non-cognitive pedagogical factors. The modules proved that with minutes dedicated to correctly structured training, it is possible to match the performance performance of a layman audio student in the first years of the regular course. This discovery paves the way for the use of these protocols so that students can quickly gain autonomy. Thus, being able to use the basic concepts of design in a more assertive way in the execution of projects and using the remaining time that was optimized using these trainings to seek experience in problem solving in design practice.

The training structured in a protocol way, such as initial and final evaluation points, also allowed the correct structuring of corrections, feedback and praise that help students both in the acquisition of new concepts, as well as in the improvement of self-determination, motivation and academic growth mindset indicators. All these performance factors are also added to the speed gain in the execution of these tasks, that is, in the recognition of concepts and stimuli, in their use for categorization for justification and even for the elaboration of faster solutions. Speed gain is an

important mechanism within cognitive studies, especially related to perceptual discrimination. As mentioned in other studies, the design students already performed the activities in a more agile way than the lay people, however, it was noted that both types of participants were able to improve their performance regarding the time needed to perform the tasks.

TAB 7. Synthetic results of the experiment in classroom assessments.

PERFORMANCE INDICATORS	INITIAL ASSESSMENT	FINAL EVALUATION	TRAINING	
_	_	_	REPETITIONS	OVERALL AVERAGE
POLYMERS	14/24	22/24	224	14/15
METALLIC MATERIALS	18/24	23/24	119	14/15
CERAMIC & NATURAL MATERIALS	16/24	21/24	102	8/9
COMPOSITE MATERIALS	_	7,5/12	64	_
GLOBAL	_	_	_	58/80

Source: By the author, 2024.

CONCLUSIONS

To demonstrate the validity of the proposed research, the expected results were extracted from two questions that Moreira and Caleffe (2008) present as crucial to evaluate and clarify the purpose of a research situated in the area of teaching, namely:

- It is understood that the model can enhance the teaching of design by allowing greater dynamics, flexibility, and technological integration, especially in the first years of the course; The results of experiments on laypeople with no knowledge of the subject demonstrate how successful the technology has been in this aspect. (Paragraphs 4.2 and 4.3)
- The results corroborate the idea of optimizing the process and, therefore, would be able to reduce the time needed for pedagogical fulfillment in certain phases of teaching; the results of the application in an open course applied at a distance and also used with regular course design students corroborate this point (Item 4.3)
- The protocol applied favors technological advancement in the search for continuous improvement of teaching in its entirety; The modules, once built, are easy to reapply, with simple adjustments, providing the continuous evolution of the model, whether in updating content, adjusting praise and feedback, or even expanding the didactic program.

- The results emphasize the need for an awakening of the educational system to the integrated use of the technological set in which society finds itself, for use in the classroom, in order to collect educational data that can support pedagogical decisions; The experiments carried out physically, on paper, proved to be slower and more inefficient, both for the students and for the researcher. The forms, in turn, were filled out quickly, on cell phones, tablets, computers, in order to adapt to the routine and type of access available to each participant.

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The health of education workers: Situations of vulnerability and illness

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ABSTRACT

The present study has as objective: to identify studies on the health of the education worker and situations of vulnerability and illness experienced in everyday school life during and after the covid 19 pandemic . In addition, it also seeks to problematize and discuss issues related to teacher health promotion in the school context, from the perspective of building public policies which focus on teacher health. For this, the reference used was of health policies, National Policy for Health Promotion and Education and the Welfare, Health and Quality of Life Policy at Work and Valorization of Education Professionals. Methodology: This is a qualitative study of the construction of the state of knowledge carried out in the databases of the Catalog of Theses and Dissertations of the Coordination for the improvement of Higher Education Personnel and the Brazilian Digital Library of Theses and Dissertations. Results: The results indicate that the overload of work hours, external demands, stress, little mastery of technological tools, psychological shocks and lack of interaction with colleagues imposed by the pandemic context impact the physical, mental and psychological well-being of the teacher, leading to the development of anxiety and burnout syndrome. The research contributes to highlight factors that lead teachers to illness, making them vulnerable when facing these results. It is necessary to plan actions to improve the quality of life and promotion of health and well-being of these professionals.

Keywords: Teacher health, Teacher illness, Covid-19 pandemic, Teacher health promotion.

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INTRODUCTION

The Covid-19 pandemic, in 2020, drastically affected the entire society, in a short space of time, changing the lives of people around the world, in all dimensions. The educational system immediately had to review its methodology, quickly implementing remote teaching in institutions, closing schools in prevention and so that there was no spread of the disease, given its severity and the lack of effective forms, necessary measures that required the distancing. A study carried out in the state of Amazonas, during the Covid-19 pandemic, showed that the educational administrative structure of states and municipalities was deficient and teachers were the main education agents affected/vulnerable throughout the pandemic (Vieira *et al* ., 2023).

In the pandemic scenario, the encounter with the unknown generated fear and anguish, which turned into anxiety, panic and, depending on the way each person deals with the situation, especially those who already had some type of symptom, the triggering of problems within the scope of the pandemic. of emotional and mental health was evidence. These aspects brought serious consequences for teachers. In this sense, it is pointed out that social vulnerability, whether of a personal, social or environmental nature, is defined by emphasizing the weaknesses of families, people and even a society in conditions of risk. Vulnerability, therefore, arises from difficulties in transforming current conditions and requires subsidies and development of processes, people and structural conditions (Vieira *et al* ., 2023).

Education, in fact, is the process that goes through the most vulnerable moments given the situation experienced during the Covid-19 Pandemic. Vulnerability can have several characteristics that encompass its different dimensions, that is, the vulnerability of citizens, families, people and societies (Vieira *et al* ., 2023). Psychological suffering affects groups with a lack of resources to a greater extent, making family and social structures vulnerable throughout life. Vulnerability affects different factors, including moral, ecological, economic, parental, psychological, among others (Lovo, 2021).

Furthermore, it is worth adding the conceptual representation of vulnerability proposed by Ayres *et al.* (2003), which is linked to the individual, social and programmatic component. The three components of the conceptual framework are interconnected, allowing multidimensional analyses, with vulnerability defined by the interweaving of material, psychological, cultural, moral, legal and political conditions (Ayres *et al.* , 2003). In this context of education and vulnerability, education, in general, already presented situations of vulnerability, however, after social isolation and the changes imposed by the pandemic, it was directly impacted on the health of teachers, due to a multiplicity of situations that generate stress. and adaptation; Exhaustion from excessive work demands and the presence of emotional and social conflict leaves the teacher weakened.

Depression, anxiety and stress were pathologies that increased during the pandemic period. Teachers had to reinvent the way they work and deliver content, through hybrid and remote virtual platforms, highlighting the precariousness of teaching activity, with an increase in involuntary online workload, as there was a need to be connected and involved with their planning over a much longer period of time, therefore affecting the financial, emotional and ethical dimensions of teachers.

In view of the above, this construction of the State of Knowledge aims to identify studies on the health of education workers and the situations of vulnerability and illness experienced in daily school life during the Covid 19 Pandemic until the return of in-person attendance. Furthermore, we seek to problematize and discuss issues related to the promotion of teacher health in the school context, from the perspective of building public policies focused on the health of education workers, especially teachers. Furthermore, it aims to contribute to educational debates about the importance of teachers' mental health, planning and implementing educational practices to promote health. And, more broadly, contribute to the development and implementation of public policies that consider teacher health as a fundamental aspect of quality education.

From this perspective, this text is organized into three chapters. Initially, it deals with health policies and the interface with education; Subsequently, the stage of methodological procedures describes the realization of the State of Knowledge based on the databases of the Catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Brazilian Digital Library of Theses and Dissertations (BDTD). The third chapter presents the results of the research in the databases, namely: teacher health – situations of vulnerability and factors related to illness.

HEALTH POLICIES AND THE INTERFACE WITH EDUCATION

Discussing public health policies and the interface with education, when analyzing teacher health, in a current scenario, after various situations of vulnerability during and after the Covid-19 pandemic, requires an understanding of the expanded concept of health.

Health can be understood as a complex phenomenon or merely as the absence of disease that is influenced by the context, the situation, cultural and economic policy. Health, as an expanded phenomenon, involves ways of being and producing and/or recreating life in its singularity and multidimensionality. Along these lines, it is necessary to question the discourses that privilege the concept of health solely due to its biological dimension, ensuring a fragmented conception of the human being, as well as the imposing and normative nature of the ways of intervening in the reality of individuals and communities (Medeiros; Bernardes ; Guareschi, 2005).

Health is considered a right of all and a duty of the State, guaranteed through social and economic policies that aim to reduce the risk of disease and other injuries and universal and equal

access to actions and services for promotion, protection and recovery (Brazil , 1988) This is the basis that guides the Unified Health System (SUS) and it is this basis that contributes to developing the dignity of people, as citizens and as human beings.

Thus, in its expanded concept, health has as determining and conditioning factors, among others, food, housing, basic sanitation, the environment, work, income, education, transportation, leisure and health. access to essential goods and services; The population's health levels express the country's social and economic organization, they also concern health and actions aimed at guaranteeing people and the community conditions of physical, mental and social well-being (Brazil, 1990). The Federal Constitution of Brazil democratized essential rights, such as those dedicated to education and health, and regulated public policies, focusing on the expanded concept of health, making it essential to implement some SUS principles and guidelines, such as decentralization, articulation, intersectorality, comprehensiveness in programs, articulating such principles in planning, sharing of resources, equipment and knowledge (Brasil, 1988, 1990).

The National Occupational Health Policy in the SUS, established in 2012, is aligned with the set of health policies within the SUS, considering the transversality of worker health actions and work as one of the determinants of the health-disease process (Brazil, 2012). Still in this vein, this policy covers all workers, prioritizing, however, people and groups in situations of greater vulnerability, such as those involved in activities or in informal and precarious work relationships, in activities with greater risk to health, subjected to forms of harmful effects of discrimination, or child labor, with a view to overcoming social and health inequalities and seeking equity in care. To this end, it highlights the importance of identifying vulnerable people and groups defined based on analysis of the local and regional health situation and discussion with the community, workers and other social actors of interest to workers' health, paying attention to their specificities and cultural and social singularities (Brazil, 2012).

In terms of the construction of public policies, the health of education workers, specifically teachers, thus far, shows fragility or incipience, which can be seen as a failure (or omission) on the part of the bodies responsible for the creation and implementation of pedagogical proposals. On the other hand, health policies are transversal and should include teachers in the group considered vulnerable, especially after the changes imposed by the Covid-19 Pandemic.

The teacher is a worker who, on several occasions, has his health conditions and quality of life compromised, due to numerous risk factors. In this way, it must be part of the construction of new references, which enable an expanded concept of health, understood as an integral phenomenon, integrating and enhancing healthier living.

Faced with the need to rethink the process of attention and care for teachers, especially taking into account the pandemic impact , in 2023 the Policy for Wellbeing , Health and Quality of Life at

Work and Valuation of Education Professionals was established with the Law No. 14,681 of September 18, 2023 “Institutes the Policy for Welfare, Health and Quality of Life at Work and Valuation of Education Professionals”. This Policy considers the need to develop actions aimed at providing comprehensive health care and preventing illness, in addition to encouraging practices that promote well-being at work in a sustainable, humanized and lasting way (Brasil, 2023).

It is important to address the concepts established in the Policy on Welfare, Health and Quality of Life at Work and Valuation of Education Professionals. Quality of Life at work is conceptualized as a set of standards, guidelines and practices that integrate conditions, organization, work processes, management practices and socio-professional relationships, with the purpose of aligning demands and well-being from employees to the institutional mission. In the meantime, Well-Being at work is defined as the perception of positive emotions and the worker's feeling of satisfaction with the organization and working conditions, management practices, emotional involvement with the development of their tasks and the possibilities of symbolic recognition. Finally, the concept of comprehensive health is associated with the integrated vision of the worker as a biopsychosocial being, with needs in different areas of life, including work (Brasil, 2023).

> Art. 1 This Law provides for the creation of the Policy for Welfare, Health and Quality of Life at Work and Valorization of Education Professionals, considering the need to develop actions aimed at comprehensive health care and the prevention of illness, as well and to encourage practices that promote well-being at work in a sustainable, humanized and lasting way. (BRAZIL, 2023)

The Promotion of Workers' Health in Education is a subject that has been discussed by scholars with the aim of understanding ways for teachers to live in better living conditions and influence their physical, mental, economic and social well-being. In this way, the concept of Health Promotion emerges as a tool for the construction of activities that express a transformative character. The National Health Promotion Policy (PNPS) highlights the relevance of social conditions and determinants of health in the health-disease process and has as its assumptions intersectorality and the creation of co-responsibility networks that seek to improve quality of life (Brasil, 2014).

> Art. 4 The guidelines of the Policy for Welfare, Health and Quality of Life at Work and Valuation of Education Professionals are: Sole paragraph. The policy guidelines referred to in this article must be developed through quality of life plans in the work that aims to improve the organizational climate, through active participation and listening to education professionals from a preventive perspective, in which productivity results from the human meaning of work, experiences of well-being, promotion of health and safety in institutional spaces. (BRASIL, 2023)

Still in this sense, the PNPS is a transversal policy, with a view to promoting dialogue between the different sectors of government, private sectors and society, forming networks of commitment and co-responsibility regarding the population's quality of life (Brasil, 2014). The PNPS

brings the expanded concept of health and the theoretical framework of health promotion as a set of strategies and ways of producing health, at the individual and collective level, characterized by intra and intersectoral articulation and cooperation, through the formation of the Care Network Health (RAS), seeking to articulate its actions with other social protection networks, with broad participation and social control. It stands out as a challenge for the PNPS to advance intersectoral action, linking actions aimed at specific audiences, such as promoting health in the teaching work environment, advancing projects aimed at improving teaching health and identifying situations of vulnerability that may be related to coping of the determinants and conditions that influence the health of this group.

The PNPS intends to promote equity and improve conditions and ways of living, expanding the potential of individual and collective health, reducing vulnerabilities and health risks arising from social, economic, political, cultural and environmental determinants. In line with the Policy of Well-being, Health and Quality of Life at Work and Valuation of Education Professionals, it is based on the development of comprehensive health, personal and professional development, management practices, quality of life actions in work and promoting experiences of well-being.

The school is an environment for teaching work, socialization, production of knowledge and an instrument of social transformation, but it is also a place that triggers discontent, malaise, psychological suffering and illness in the bodies of teachers, from the daily school life and the contradictions that permeate the social issue and its expressions, and which are experienced in the school environment and classrooms (Silva, 2021).

Health Promotion spaces are understood as all places where human care activities are carried out, whether health units or other collective spaces, such as schools, in which there is the possibility of carrying out educational activities, aiming at the best quality of life and health of people.

METHODOLOGICAL PROCEDURES

This research is a qualitative study, using the State of Knowledge methodology. The State of Knowledge is the identification, registration, categorization that lead to reflection and synthesis on the scientific production of a given area, in a given space of time, bringing together periodicals, theses, dissertations and books on a specific topic, enabling a broad and current view of research studies linked to the object of investigation that we intend to develop, providing opportunities for the search for new meanings regarding the topic of study (Morosini; Fernandes, 2014; Morosini; Nascimento; Nez, 2021).

> When constructing a survey of scientific production in an area, it is important for the researcher to know and reflect on publications related to the topic in the scientific field. It is also essential to identify and analyze possible approaches and paths, not only regarding theoretical foundations, as well as methodological aspects, which will contribute to the

> delimitation and organization of your investigation (Morosini; Nascimento; Nez, 2021, p. 70).

The databases used were the CAPES Theses and Dissertations Catalog and the Brazilian Digital Library of Theses and Dissertations (BDTD). The period adopted was between 2020 and 2023, when the Covid-19 Pandemic emerged and spread throughout the world, resulting in several impacts in the area of education and teacher health.

The following descriptors were crossed: teacher health, teacher illness, Covid-19 Pandemic and teacher health promotion. Secondly, studies whose titles had some relation to the topic covered were placed in front of them. The search in the aforementioned databases was carried out between second half of 2022 and the course of 2023.

RESULTS

The results of the searches in both databases and the crossing of the descriptors are presented below. In Tables 1 and 2, the research carried out in the CAPES Theses and Dissertations Catalog and in the Brazilian Digital Library of Theses and Dissertations (BDTD) can be seen.

Table 1 – Research carried out through the CAPES Database, 2023

Descriptors/filter	Total	Dissertations	Theses
Teacher health	3,583	2,900	683
Covid-19 Pandemic	279	251	28
Promotion of teacher health	19	17	two

Source: Prepared by the author (2023)

The research carried out in August 2023, in the CAPES Catalog of Theses and Dissertations, using the descriptors **teacher health** , found 3,583 works, 2,900 theses and 683 dissertations. Using the **Covid-19 pandemic** descriptor , 279 studies were found, including 28 theses and 251 dissertations. Using the descriptor **teacher health promotion** , 19 works were obtained, including two theses and 17 dissertations. The time frame was from 2020 to 2023.

Table 2 – Research carried out at the Brazilian Digital Library of Theses and Dissertations (BDTD)

Descriptors/Filters	Total	Dissertations	Theses
Teacher health	3,587	2,516	1,071
Teacher's illness	227	174	53
Covid-19 pandemic	12	8	4

Source: Prepared by the author (2023)

In the research carried out in the BDTD database, the descriptor **teacher health was used** , 3,587 works, 2,516 dissertations and 1,071 theses were found; using *AND* **teacher illness** , 227

works, 174 dissertations and 53 theses were obtained. With *AND* **Covid-19 pandemic** , there were 13 works, nine dissertations and four theses. The time frame used as a filter was the period in which the Covid-19 Pandemic emerged, that is, from 2020 to 2023.

Abstracts of works that, theoretically, maintained a certain similarity with the research objectives were read. Finally, only publications that were related to the mentioned topic were selected and analyzed in their entirety.

As a result of analyzing the studies in full, 14 works were selected from the last descriptor mentioned above, 14 of which were dissertations. From this research, we focused on studying and briefly presenting what each of the authors brought to their work, what paths they took methodologically, what objectives they had with the work developed, who the participants were and what new developments were announced in terms of results. .

We sought to systematize these studies, verifying similarities with our research. Table 1 presents the 15 studies identified in line with the objective and analyzed based on thematic categories, namely: teacher health – vulnerable situations and factors related to illness.

Table 1 – Studies selected from the CAPES and BDTD database

AUTHOR UNIVERSITY	YEAR	TITLE	LEVEL	GOAL	RESULTS
Carlos Eduardo Cervilieri University of Sao Paulo	2021	Teaching work and health: study with teachers from public schools in the state of São Paulo in the city of Ribeirão Preto/SP	Dissertation	Investigate the relationships between teaching activity and the health problems reported by these professionals.	With the arrival of the Covid-19 pandemic, work pressures on teachers increased, low pay and high workload, a lack of professional and social recognition and appreciation of the category. These factors were responsible for greater physical and mental illness.
Camila Penha Duré Vieira Don Bosco Catholic University	2021	Mental health of early childhood education teachers in the face of the covid 19 pandemic: study in a municipal school in Campo Grande / MS in Brazil	Dissertation	To analyze the impacts of the Covid-19 Pandemic on the mental health of teachers and early childhood education at a municipal school in Campo Grande/MS.	The results indicated that in addition to the psychological impacts directly related to Covid-19, the psychological and social shocks caused by preventive measures to contain the pandemic coexist, such as, for example, the effects of quarantine and social isolation, which limited not only the face-to-face interactions and social relationships, as well as restricting leisure activities.
Sheila Maria Gonçalves da Silva Ceara state University	2021	Illness of teachers working in the municipal public education network of Quixadá - CE	Dissertation	Understand the causes and complaints of basic education teachers in the municipal education network of Quixadá.	The results demonstrated that the teacher's illness during work was related to interpersonal relationships at work, institutional demands for results, the lack of appreciation of the teacher, causing the worsening of the mental health of those surveyed.

Priscila Barros de Freitas Ceara state University	2021	Coffee with affection: a formative experience for promoting teacher emotional health in times of pandemic	Dissertation	Analyze professional teaching training referenced in the educational principles of Historical-Cultural Psychology, describing emotional health in this process of appropriation of knowledge and practices.	In the results, it can be seen that with the pandemic and the obligation to work remotely, teachers inevitably began to take on more care and concern for their own families, allocating less time to themselves, mainly because they are women.
Sandra de Araujo Teixeira Bispo Lutheran University 1 of Brazil	2022	Stress among teachers at the Federal Institute of Brasília during the covid-19 pandemic	Dissertation	Investigate the influence of stress on the absenteeism of high school and elementary school teachers through an integrative literature review and the level of stress in the work environment of high school and technical school teachers at the Federal Institute of Brasília-IFB during the class period remote access imposed by the pandemic.	The results showed that the majority of IFB teachers perceive themselves as having a high and intermediate level of stress (59.6%). The highest level of stress was identified for females (p=0.04). Teachers who received training that did not meet the needs for remote teaching had a high level of stress (p=0.01). The Autonomy and Control, Roles and Work Environment dimensions were those that presented the highest levels of stress; and Relationship with boss, Interpersonal relationships, Growth and Valuation were those with the lowest levels.
Antonieldo Araujo de Freitas Federal University of Piauí Foundation	2023	Health vulnerability of basic education teachers to Covid-19: analysis in light of the subject-social model	Dissertation	To evaluate SV to Covid-19 between the years 2020 and 2022 of basic education teachers in light of the subject-social model.	In 2020, the authors identified that the variables that were most associated with Health Vulnerability were: training area (p=0.001), weekly working hours in the state network (p=0.001), link(s) with another(s) education network(s) (p=0.003), sharing working hours with other tasks (p=0.040), inactivity due to health reasons related to teaching work (p=0.001), seeking health services (p= 0.001), worsening of chronic diseases (CD) (p=0.001), diagnosis of CD before 2020 (p=0.001), and leisure planning (p=0.001); on the other hand, the following weakened SV: provision of *a face shield* or protective glasses by the school (p=0.001), practice of physical activities (p=0.001) and social support from friends (p=0.005). In 2021, the variables that potentiate Health Vulnerability to Covid-19 were: working outside normal hours (p=0.001), seeking the same health services (p=0.001) and practicing physical activities (p=0.001) ; meanwhile, the following weakened SV: ergonomically adequate remote work furniture (p=0.004), inactivity due to work-related health reasons (0.001), worsening of CD during

					the pandemic (p=0.001) and leisure planning (p=0.001). For 2022, working outside normal working hours (p=0.017) proved to increase Health Vulnerability to Covid-19; and, the following proved to weaken Health Vulnerability: training for remote work (p=0.013), seeking the same health services (p=0.001) and social support from the family (p=0.012).
Martha Eliana Waltermann Lutheran University of Brazil	2021	Home office work, daily life and the perception of happiness and health of university professors	Dissertation	Knowing how working from home, triggered during the Covid-19 pandemic, affected the lives of university professors in Brazil in terms of health, daily routine and perception of happiness.	The results showed that teaching work from home caused problems in teachers' daily lives: difficulties in reconciling teaching, domestic tasks and childcare; work overload, difficulties in handling new remote work technologies.
Elenise Abreu Coelho Federal University of Santa Maria	2022	Characteristics of teleworking and burnout syndrome in basic education teachers during the Covid-19 pandemic	Dissertation	To evaluate the relationship between the characteristics of teleworking and Burnout syndrome in basic education teachers in the State of Rio Grande do Sul, during the Covid-19 pandemic.	The results of the studies indicated a negative perception of teachers, higher levels of burnout in teachers who already had a diagnosis of mental disorder among teachers who work in early childhood education, primary and secondary education. Correlations were identified between work characteristics and the dimensions of Burnout Syndrome.
Kaíza Rafaelle Lucas Martins Barros State University of Paraíba (UEPB)	2022	Burnout syndrome, social support at work and work-family conflict in teachers in the context of the Covid-19 pandemic	Dissertation	To analyze the relationship between the constituent factors of burnout syndrome and the factors of Social Support at Work and Work-Family Conflict in remote high school teachers from public schools in Campina Grande (PB) in the context of the Covid-19 pandemic.	The scarcity of Informational Support and the interference of professional schedules in private life are the main experiences of discomfort in the Covid-19 pandemic context. The teachers' home office work interfered with the time dedicated to their family, resulting in conflicts between work and family, with the words 'home' and 'time' being the most frequently mentioned, suggesting that the *home office* invaded the teachers' private lives, making it difficult for them to have time to dedicate themselves to their family.
Alciene Pereira da Silva Franciscan University	2022	Assessment of stress and empathy in teachers at higher education institutions in the context of the Covid-19 pandemic	Dissertation	Assess the level of stress and its relationship with the empathetic behavior of teachers at Higher Education Institutions during the Covid-19 pandemic.	As a result of the abrupt closure of Educational Institutions, the uncertainties caused by the pandemic and the lack of familiarity with distance education, the long term of the problem led to exhaustion. Among the psychological symptoms evaluated here, one of the most striking findings to emerge are those related to the relationship between some domains of stress.

Carolina Rocha Dulios Landim University of Vale do Rio dos Sinos	2022	Psychosocial risk factors for teleworking during the Covid-19 pandemic: a study with teachers at a private university in southern Brazil	Dissertation	To identify the most influential psychosocial risk factors for teleworking, during the pandemic, among professors at a private university.	The proposed model showed that the most influential risk factors in teleworking were: the work context and environment, organizational culture and management, personal experience and commitment, and health care and attention.
Camila Araujo Coelho Lutheran University of Brazil	2021	Well-being and lifestyle habits of university professors at the beginning of the Covid-19 pandemic in Brazil	Dissertation	Identify the perception of well-being and changes in teachers' lifestyle habits in the face of the challenges imposed during the beginning of the Covid-19 pandemic, in 2020.	The results showed that the teachers investigated are not completely satisfied with life during this pandemic period, as there were changes in the experience of well-being, nutrition, low frequency of physical activities and leisure. The data indicate that the activities that were carried out on a daily basis day have undergone changes with social isolation. Interventions, whether at the university or community level, aimed at promoting health, could result in improvements in the quality of life of this public during and after the pandemic.
Mônica Tavares França de Lima University of Vale do Rio dos Sinos	2022	Influence of the pandemic on education workers: the case of a federal education institution University education	Dissertation	Analyze the influences of Covid-19 on the work routine of education professionals, in the context of a federal public university, as well as propose people management strategies that contribute to the health and well-being of these professionals.	The pandemic has affected education workers physically and psychologically. Due to social isolation, the lack of interaction with colleagues, as well as personal relationships were harmed.
Luana dos Passos Bishop University of Pernambuco	2022	Remote teaching work in the context of the Covid-19 pandemic: repercussions on mental health in teachers at the Federal Institute of Sertão Pernambucano	Dissertation	To analyze the repercussions of remote work, in the context of the Covid-19 pandemic, on the mental health of teachers at the Instituto Federal do Sertão Pernambucano – IF Sertão PE.	The research showed the existence of stress, overload and emotional exhaustion in teachers, given the uncertainty of the changes that occurred due to changes in the ways of working.

Source: Prepared by the author based on research carried out through the CAPES and BDTD Database, 2022/2023.

TEACHER HEALTH: SITUATIONS OF VULNERABILITY AND FACTORS RELATED TO ILLNESS

In recent years, studies analyzing teacher health have advanced significantly, opening new paths to deepen knowledge about teaching work conditions, which makes it possible to map the main situations of vulnerability at work to which the category is subjected and their respective problems. of health. Among the main situations of vulnerability and factors that led to teacher illness during the Covid-19 pandemic period, are the psychological and social shocks caused by social isolation measures, difficulties in reconciling teaching, domestic tasks and family care, overload work conditions, difficulties in handling technology tools and a lack of appreciation for teachers, causing a worsening of teachers' mental health.

We live in a time of great transformations in the field of education, making the school context require rapid changes. The teacher needs to be aware of a variety of methodological strategies that meet the planning of their classes, so that they can contemplate the engagement of students in the development of their learning. As a result, there is a strain on the teacher's health, resulting in occupational illnesses.

In all professional careers, it is possible to identify intense workloads in the workplace, involving demands for goals and results, quality work and in a systematic way, for example. However, the teaching profession is one of the most affected by these factors of work overload, not only due to the demand for results, but due to several factors, which involve low pay, constant adaptation to different realities (Dworak; Camargo, 2017).

Understanding vulnerability as a state of human existence can expand this concept. Vulnerability gains prominence when it is recognized as a trait of the human condition, of its fragility, lack of protection, reduced capacity and precariousness, in which this condition is permanently exposed and is constantly injured. Reflecting on the dimensions of vulnerability that involve the individual and the community is understanding the essence of care in their presence (Florêncio *et al* ., 2021).

The teacher's work is immaterial, exhausting and requires time for planning and monitoring. In recent years, many changes have been occurring and have a plural character, require multidisciplinary knowledge and have been the object of study in many analyzes and debates, especially with regard to transformations in the teacher's work process (Cervilieri, 2021)

A study carried out by Cervilieri (2021) investigated the relationships between teaching activity and the health problems of teachers in the public education network in the state of São Paulo, in the municipality of Ribeirão Preto. Based on the findings, it was possible to identify that teachers' working conditions were precarious and exhausting, professionals often presented physical and emotional exhaustion as a result of their work, with serious health problems. Teachers are

overwhelmed by excessive work, making it necessary to compromise rest and leisure hours to carry out extra-class activities, increasing emotional tension, increasing the level of stress and anguish of workers, who start to fall ill due to the process. the feeling of impotence.

Given these results, it can be inferred that these factors mentioned are responsible for greater physical and mental illness, making it plausible to conclude that the activities carried out by public school teachers, as they are currently configured, negatively affect the health of these students. workers, leading to greater social and individual and pragmatic vulnerability. Therefore, the need for special attention from school management and the implementation of health policies in this scenario is evident.

In turn, Vieira (2021) analyzed the impacts of the Covid-19 pandemic on the mental health of Early Childhood Education teachers, in a municipal school in Campo Grande, Mato Grosso do Sul. The results indicated psychological and social impacts caused by preventive measures to contain the pandemic. Still according to the findings, the effects of quarantine and social isolation limited not only face-to-face interactions and social relationships, but also restricted the carrying out of leisure activities. Such factors triggered profound fatigue and occupational and emotional exhaustion in teachers, impacting health conditions.

The research developed by Silva (2021) sought to understand the causes and complaints of Basic Education teachers in the municipal education network of Quixadá, in Ceará. The results showed that the complaints were related to intense and frequent headaches, migraines, hypertension, nodules and cracks in the vocal cords, depression, voice difficulty, nervous gastritis, hearing loss, anxiety disorder, urinary infection, hoarseness, thyroid, stress, discouragement, fatigue, mental exhaustion, among other complaints linked to or enhanced by the work environment. The findings demonstrated that the teacher's illness during work was related to interpersonal ties at work, institutional demands for results, and the lack of appreciation for the teacher, which caused the worsening of the mental health of those studied (Silva, 2021). With the pandemic, the factors were accentuated, as many teachers found themselves alone, without being seen, heard or cared for.

With the Covid-19 pandemic, as already highlighted, the teacher's work began to receive new demands, adaptation to classes in a remote format, use of technologies, work in the family environment. The heavy workload led teachers to reduce their hours of rest, sleep and leisure activities to complete professional requirements, which increased gradually and daily.

Along these lines, Freitas (2021) investigated teacher emotional health and its relationship with the continuing education of teachers in the context of the Covid-19 pandemic. For the author, with the obligation to work remotely, teachers inevitably began to take on more care and concern for their own families, allocating less time to themselves, mainly because they are women. Ademias, highlighted denialism, a thought that there is no need to take care of mental and emotional health.

Such statements emphasize the lack of interest in teachers' health and this fact must be considered by studies focused on this topic. Therefore, teacher training can and should be a space for promoting emotional health and preventing illness.

The emotional and psychological illness of education workers, especially teachers in the workplace, caused by occupational stress, can influence physical and mental health, leading to the absence of teachers in schools, affecting quality of life, well-being and the performance of work activities.

Continuing, Teixeira Bispo (2022) investigated the level of stress in the work environment of high school and technical school teachers at the Federal Institute of Brasília (IFB), during the period of remote classes imposed by the pandemic, and the influence of stress on absenteeism of secondary and elementary school teachers. The results showed that the majority of teachers perceived themselves as having a high and intermediate level of stress (59.6%). The highest level of stress was identified for females (p=0.04). Teachers who received training that did not meet the needs for remote teaching had a high level of stress (p=0.01). The dimensions autonomy and control, roles and work environment were those that presented the highest levels of stress. On the other hand, teachers with a good relationship with their boss, interpersonal relationships, professional growth and appreciation presented the lowest levels. The results of this study contribute to actions aimed at the well-being of teachers in the workplace. It is suggested that teachers, managers and organizations carry out collective preventive actions in order to reduce the illness of these professionals, such as, for example, choosing training that best meets the demands related to the execution of teaching activities.

The study by Freitas (2023) examined the health vulnerability to Covid-19, between the years 2020 and 2022, of Basic Education teachers, in light of the subject-social model. The results showed that working conditions, especially excessive working hours and the situation of the work environment, showed practices and the physical situation at work as the biggest indicators of SV to Covid-19.

In 2020, teachers had more variables/concepts associated with Covid-19, highlighting conditions of precariousness and, consequently, potential for SV to Covid-19. Also in 2020, there were more concepts/variables about protective and health-promoting behaviors with an association. Throughout the period analyzed, working conditions, especially excessive working hours and the situation of the work environment, revealed practices and the physical situation at work as indicators of increased SV to Covid19 in teachers.

Furthermore, the research carried out by Waltermann, in 2021, aimed to understand how working from *home* , triggered during the Covid-19 pandemic, affected the lives of university professors in Brazil in terms of health, daily routine and perception of happiness. The results showed

that teaching work from *home* caused problems in teachers' daily lives, such as: difficulties in reconciling teaching, domestic tasks and childcare; work overload, difficulties in handling new remote work technologies. Furthermore, according to Waltermann (2021), these factors affected the physical and emotional health of teachers and interfered with family relationships, leisure and rest spaces, increasing stress. Furthermore, the researcher observed that remote professional work parallel to family and domestic life harmed emotional health and the perception of happiness, since the teacher was unable to allocate time to family, leisure and rest.

Burnout syndrome is a psychosocial phenomenon that emerged as a "response to stressors present in work situations, which affects professionals who maintain a constant and direct relationship with other people" (Coelho, 2022, p. 28).

The research by Barros (2022) reflected on the relationship between the constituent factors of Burnout Syndrome and the factors of Social Support at Work and Work-Family Conflict. It identified a significant percentage of teachers with Burnout Syndrome, and also found greater interference from Work in the Family. Working entirely from home (*home office*) and having irreconcilable professional and family schedules were the main sources of teacher discomfort during the pandemic. The research result denoted an important contribution so that school managers can rethink remote work, together with the teaching category, aiming to alleviate the mental exhaustion experienced in the Covid-19 pandemic.

Such findings encourage the need to carry out interventions that aim to promote teachers' mental health, which will only be effective through changes in the organization of work, considering the characteristics and specificities of each context of activity and level of education of each professional.

Coelho (2022), in his master's thesis, evaluated the connection between the characteristics of teleworking and Burnout Syndrome in Basic Education teachers in the State of Rio Grande do Sul, during the Covid-19 pandemic. The findings indicated that the main factors in the psychological illness of teachers were overload, exhausting working hours and intense work pace, lack of support and training, scarcity of teaching resources, inadequate infrastructure and conflicts with management, the low professional discredit from which it comes enjoying the category, mainly in relation to career and salary prospects. Due to all these factors, the organization of teaching work has characteristics that expose teachers to the risk of developing Burnout Syndrome.

Silva's Research (2022) sought to evaluate the level of stress and its relationship with the empathetic behavior of teachers at Higher Education Institutions in the five Regions of Brazil, during the Covid-19 pandemic. The main results demonstrated that stress and empathy levels in university professors were not statistically relevant in terms of health and lifestyle parameters. For the author, it is essential to highlight that:

> [...] the variances in the relationships between levels of empathy and stress can be a predictor that adaptation strategies to stressful circumstances can be aimed at solving problems, such as, for example, technological training and adaptation to remote classes in times of pandemic (Silva, 2022, p. 33).

Similarly, Landim (2022) sought to identify the most influential psychosocial risk factors of teleworking, during the pandemic, among teachers in Rio Grande do Sul. The study showed that, among the factors that increase damage to mental health, organizational management and personal experiences, or the way each individual internalizes events, proved to be more relevant than other factors when it came to satisfaction, performance and perceived positive aspects of teleworking (Landim, 2022).

Lima (2022) investigated the influences of Covid-19 on the work routine of education professionals at the Federal University of Rio Grande do Sul. Based on the findings, he found that the Covid-19 pandemic affected the physical and psychological health of workers education due to social isolation, lack of interaction with colleagues, as well as personal relationships, which were damaged. He observed that the psychosocial risk factors that can lead education workers to stress and illness, during and after the pandemic, present themselves as an important task for managers, who need to think about protective measures capable of reducing the impacts of Covid-19 on the physical and mental health of education workers, providing greater quality of life.

The research carried out by Bispo (2022) in the Master's Dissertation analyzed the repercussions of remote work, in the context of the COVID19 Pandemic, on the mental health of teachers at the Instituto Federal do Sertão Pernambucano – IF Sertão PE. The results showed the existence of stress, overload and emotional exhaustion among teachers, given the uncertainty of the changes that occurred due to changes in the way they work. However, the findings also demonstrated a feeling of pleasure and fulfillment on the part of teachers in carrying out their activities, even with the difficulties faced in the context of the Covid 19 Pandemic.

It is necessary to broaden the perspective on teachers' health, as, in addition to understanding the serious biological risks caused by the COVID-19 pandemic, there are other risks that interfere with the physical and mental well-being of teachers, such as stress, overload and emotional exhaustion in teachers, faced with the uncertainty of the changes that occurred due to changes in the way they work.

On the other hand, Vieira (2021) identified and learned about the mental health of Early Childhood Education teachers in the face of the Covid-19 pandemic, in a municipal school in Campo Grande, Mato Grosso do Sul. Depending on the findings, in addition to the direct psychological impacts related to Covid-19, the psychological and social shocks caused by preventive measures to contain the pandemic coexist, for example, the effects of quarantine and social isolation, which have

limited not only face-to-face interactions and social relationships, but restrict the carrying out leisure activities.

Coelho (2021), in his dissertation, investigated the perception of well-being and changes in teachers' lifestyle habits in the face of the challenges imposed by the start of the Covid-19 pandemic, in 2020. The results showed that the teachers investigated did not they were completely satisfied with life during the pandemic period, as there were changes in the experience of well-being, nutrition, and little frequency of physical activities and leisure. The data showed that day-to-day activities underwent changes due to social isolation.

Understanding the dynamics of diseases associated with a teacher's work requires a more human perspective on the professional, understanding that everyone carries out their activities in a certain way and not everyone reacts to the stimuli provided by their work in the same way. Thus, interventions, whether at the university or community level, aimed at promoting health, could result in improvements in the quality of life of this public during and after the pandemic.

According to Mocelini (2020), teachers need to be seen as promoting human development, they are committed and should direct, teach and correctly follow the members of a team, a group, an institution and, for this responsibility, it is essential to be prepared to contemplate everyone. To achieve this, it is necessary for the teacher to be an excellent communicator, facilitator, organizer, who knows how to train, delegate and supervise so that life projects can be carried out. The teacher needs to be the leader of his own life project, commanding, with self-confidence and autonomy, motivating and promoting human values, activating the best in himself, awakening his abilities through himself, not only accumulating results, but seeking your happiness and freedom, reinforcing your internal world and culture of prosperity, conquering the external world and your well-being, making your profession something that satisfies you, transmitting love for your work. It is a path of growth, both individual and collective.

Social responsibility for quality of life involves better working conditions, less institutional pressure and professional well-being. One of the possible paths will be to develop, together with professionals, a mental and psychological health policy, which can provide ways to understand teachers in periods of existential crisis and serve as a support network for the exercise of their profession (Oliveira, 2023).

Finally, the word cloud is used to highlight the vulnerable situations addressed by the studies, which impacted the worker's health, leading to the teacher's illness.

Figure 1 – Word Cloud



Source: Prepared by the author (2023)

Understanding what has led teachers to become ill is essential to encourage prevention and health promotion actions for these workers, contributing to improving their quality of life and well-being. Physical health and mental health are components that promote an individual's ability to live, work, manage their own life, remain functional and have a quality of life to overcome obstacles and challenges in everyday life, relate well to themselves and others. the others. Teachers often do not recognize themselves in the product of their work. There is an emptying of meaning in this worker, in the characteristics of emotional exhaustion, overload of working hours, loss or devaluation of professional identity. What in other moments was synonymous with achievement, through mental illness, loses its meaning of being.

FINAL CONSIDERATIONS

The results emphasized that the vulnerable situations experienced in daily school life, during the Covid-19 Pandemic and post-pandemic period, impacted the teacher's well-being, leading, in many situations, to mental illness and the presence of Burnout Syndrome. .

The present study identified, through the State of Knowledge, the main factors related to teacher illness, such as: socioeconomic pressures, overload of working hours, overload of multiple tasks, external demands, both from the state and from families. , poor mastery of technological tools, psychological shocks, lack of interaction with colleagues, stress, emotional exhaustion imposed by the pandemic panorama, loss or devaluation of professional identity.

In this sense, the research contributes by highlighting the factors that led/lead teachers to become ill, making them vulnerable and, given these results, it is urgent to plan actions to improve the quality of life, health and well-being of these professionals . Furthermore, institutions need to develop health promotion actions, in which teachers can express their emotions.

The Covid-19 pandemic has unevenly affected different population groups, especially teachers, despite there being studies focusing on teacher illness. There is little scientific evidence relating vulnerability in the context of Basic Education teachers, who are part of a group vulnerable to Covid-19 and all situations imposed by the pandemic scenario and the current education panorama.

It becomes relevant to investigate the situations of vulnerability experienced by Basic Education teachers during the pandemic period and after, since there are indications that they are experiencing processes of vulnerability, due to the living and working conditions to which they were subjected due to social distancing and for the suspension of face-to-face classes. To this end, it is necessary to develop studies that monitor the health status of these professionals and that can contribute to the implementation of health policies focusing on teachers.

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Digital educational resources and the flipped classroom in epidemiology teaching for undergraduate nursing

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ABSTRACT
Objective: To describe the teaching and learning process of the discipline of epidemiology for nursing, using the "flipped classroom" method and digital educational resources, in a higher education institution. Methods: This is a descriptive study, with a qualitative approach, experience report type, carried out during the first and second semesters of 2022, in two classes, with a total of 41 students. The flipped classroom was applied with the technological mediation of Google Classroom™ as a virtual learning environment. Bibliographic and audiovisual materials were used for the study of the contents, which also included the practical resolution of exercises, the presentation of seminars and the realization of research projects. Results: It was observed that this active methodology enabled the stimulation of critical thinking, the integration between theory and practice, the development of research skills, active engagement, a better use of time and a greater appropriation of the contents by the students, with the teacher monitoring and monitoring being a differential aspect in the process. Final considerations: The flipped classroom enhanced learning and enriched students' training as an innovative way that can reflect positively on the challenges of their professional practices.

Keywords: Teaching, Epidemiology, Nursing, Educational Technology, Universities.

INTRODUCTION

In nursing, the epidemiological method makes it possible to analyze the determinants and health problems, to observe the quality in which the discipline of epidemiology is offered for most undergraduate courses in the area of health, being interdisciplinary and extremely relevant in academic training in the broad content of public health,[1] Because, among other uses, the epidemiology contents also enable the student to know the importance of the method for the evaluation, whether of demand, need or process of health services, useful in any area of nursing.[2]

The epidemiological method in nursing makes it possible to analyze the determinants and health problems, observe the quality of the services offered and their efficiency, verify the effectiveness of interventions and evaluate hypotheses of disease causality, among several other actions.[3] Epidemiological information is produced by the nursing team in its professional work all the time, and data recording, analysis and correct use are indispensable contents in nursing education.[4]

In the teaching of epidemiology for nursing, the need for attractive and innovative pedagogical methods is becoming increasingly notorious, in view of the evolution of technological means, including active learning methodologies that can arouse interest and motivation in the contents, which are so relevant for training and professional development.[5] However, the flipped classroom method can be highlighted, which is a teaching methodology in which the content is previously studied in face-to-face or synchronous classes, providing the student with learning with an articulation between spaces and times.[6]

Flipped *classroom* is an approach that combines face-to-face activities and distance educational activities, carried out through Digital Information and Communication Technologies (DICT). With this method, the content on a given curricular subject is studied by students before they attend the classroom, which, in turn, becomes the place of active learning, where, with the support of the teacher, activities will be carried out encompassing problem solving, projects and discussions, in a collaborative way.[7]

From the dynamics of the flipped classroom, it is possible to increase the possibilities for the teacher to act effectively and innovatively, maintaining the engagement and interaction of students, in the face of the current scenario, which demands the implementation of new active methodologies to qualify teaching [6]. In turn, the use of digital technologies facilitates learning in an innovative way, as a viable educational tool that makes it possible to achieve objectives by producing results that impact the current challenges of work and education.[8-9]

In view of the need to observe innovative methodologies applied to teaching and the importance of teaching epidemiology for nursing, which has a direct impact on the professional performance of nurses in the Health System, the present study aims to describe the teaching-learning

process of the discipline of epidemiology for nursing, using the flipped classroom in a higher education institution.

METHODS

This is a descriptive study, with a qualitative approach. SR is a modality of academic-scientific writing that presupposes experience as the starting point for learning; having the ability to produce knowledge through critical-reflexive application, with theoretical-methodological support, which goes beyond the description of the experience.[10]

The analyzed experience corresponded to the application of the flipped classroom method for the pedagogical mediation of the epidemiology discipline during the first and second semesters of 2022, in two undergraduate nursing classes at the Fluminense Federal University (UFF), on the *campus* of Rio das Ostras, state of Rio de Janeiro.

In the first semester of 2022, 23 students attended the course and, in the second semester, 18 students. The SR presented itself from the perspective of the teaching practice and two monitors of the discipline who accompanied the process.

The construction of this report meets the criteria for not requiring evaluation by the Human Research Ethics Committee, as it refers to an activity carried out with the sole purpose of educating undergraduate students, without research purposes and without performing individual identification of subjects, according to Resolution No. 510, of April 7, 2016. of the National Health Council.[11]

DESCRIPTION OF THE EXPERIENCE

The experience corresponded to the use of the flipped classroom in the teaching-learning process of the discipline of epidemiology for nursing, which had the following objectives: 1) to understand the coefficients, indicators and indices most used in public health; 2) subsidize the use of epidemiological indicators in health planning practices; and, 3) to know and identify the types of epidemiological studies.

The contents of the course were addressed through two major modules: module 1, called "Basic concepts of epidemiology and collective health measures", contained the following themes: basic concepts and uses of epidemiology; introduction to epidemiological methods; natural history of diseases; frequency measures and frequency measures in public health; health indicators; and epidemic process and control diagram. Module 2, called "Distribution of diseases and types of studies", covered topics such as: epidemic process and control diagram; epidemiological surveillance; and design of epidemiological studies: cross-sectional, ecological, case-control, cohort, intervention, and meta-analysis studies.

The discipline was taught, mainly, with the technological mediation of the Google Classroom™ platform, using its resources for the creation and organization of content, tasks and publication of comments, allowing interaction between teachers, monitors and students. Other digital tools – such as Google Meet™, WhatsApp® and Google Forms™ – were used to carry out the telepresence meetings of the monitors, the communication and interaction between the participants of the discipline and the presentation and resolution of the exercises and evaluation activities by the students.

The contents of the modules were organized in Google Classroom™ by different topics for each week of class, presenting the topics with various educational resources, such as video classes recorded by the teacher of the subject, *slides* and bibliographic materials, such as articles and books. Each week contained a questionnaire with practical activities related to the themes and, at the end of each week, a document was posted with the resolution of the proposed exercises. Each module was formed for eight weeks.

In addition to the modules, the platform exhibited the topic "library", with the availability of various support materials on the themes of the discipline, and the topic "doubts", which served as a space for permanent interaction between students, teachers and monitors for the exchange of questions and solutions to the practical exercises of each week.

In module 2, in addition to the application of activities and exercises developed each week, a seminar was held with the availability of articles for each group of students to analyze and present the characteristics and structure of the types of epidemiological studies.

In the same module, it was also proposed to carry out the cross-sectional research project, as part of the evaluation and consolidation of the contents, enabling: practical application, elaboration of a directed project and schedule, bibliographic search and research. The research comprised the students as protagonists of an online interview activity, through the Google Forms™ tool, with the participation of other academic colleagues, collecting and analyzing data, based on a project previously approved by the opinion of the Ethics Committee of UFF.

The planning of the classes was carried out jointly by teachers, monitors and students of the discipline, who agreed on the dates for the delivery of activities and for the realization of the weekly monitoring meetings. Two monitors supported the didactic pedagogical development of the discipline and performed a student monitoring function.

Several evaluation methods, both summative and formative, were used: theoretical tests, seminars, research activities and directed studies. Participation during classes was considered for the mandatory criterion of the educational institution for the attribution of grades.

With the flipped classroom as an active method for the development of the discipline, audiovisual materials, readings and activities were made available a week in advance, through the

Google Classroom™ platform. Students had time to study the week's content and *feedback* on activities before face-to-face classes.

The weekly face-to-face classes lasted 4 hours, with a 15-minute break, and were developed based on the doubts that the students brought about the materials previously studied and the activities carried out. The teacher resumed the theoretical concepts on the theme of the week, and the practical exercises were corrected together. However, these activities previously posted on Google Classroom™ had already been evaluated on the platform through *feedback*.

As a strategy to monitor the teaching-learning process of the students, group activities were developed in the monitors, through the Google Meet™ tool. In the Telepresence meetings, workshops were held to solve exercises and review the study materials; teaching of synchronous content classes with the objective of addressing the doubts pointed out, an activity called "doubt shift"; and supervision of seminars and projects, according to the themes of the course syllabus.

In order to allow students to get closer to the monitor, the questions were answered by the monitors of the discipline in the shortest possible time, and, when necessary due to the complexity, they were discussed with the teacher to be answered together. In addition, the topic "doubts", available on the platform, was effectively used to post specific demands related to the resolution of the proposed activities. However, in case of more immediate questions, WhatsApp® groups were used, which also allowed the sharing of information on the themes of the discipline.

During the development of the course, a strategy was carried out to evaluate the teaching practice, with the aim of verifying the quality of teaching and the acceptability of the flipped classroom method by the students. In this way, the discipline had evaluation both of the process and also of the result through a weekly activity and at the end of the discipline.

Thus, at the end of each face-to-face class, a discussion space lasting approximately 15 minutes was opened, so that students could present their perceptions, feelings and opinions related to the achievement of the class objectives, the clarity and understanding of the contents, the pedagogical resources and educational technologies used, the experience of using the flipped classroom, the motivation to participate in the activities, the difficulties encountered, the teacher and the monitors as mediators of learning and the proposals for improvement. The evaluation of the process allowed the necessary adjustments to be made in order to improve the discipline. Communication channels such as Google Classroom™ interaction spaces, WhatsApp® groups, and telepresence meetings for monitoring also contributed to obtaining this data.

In the last week of the course, a conversation circle was held, as a final evaluation strategy, with the participation of all students and mediated by the professor and monitors. The activity lasted 30 minutes and was guided by a script that explored similar issues to each week's final discussions.

MAIN RESULTS AND DISCUSSION

The use of the flipped classroom in the teaching of epidemiology in nursing proved to be an adequate active learning method in two classes at UFF, *Rio* das Ostras campus. The results of the evaluations of the teaching practice and of the summative and formative evaluations of the students presented *positive feedbacks* on: (1) the blended teaching methodology, (2) the use of pedagogical resources, (3) the teacher mediation, (4) the academic support of the monitors, (5) the contents covered and (6) the evaluation process.

As a pedagogical innovation, the use of the flipped classroom was evaluated as creative and facilitating the achievement of the objectives of the course. The availability of study materials prior to face-to-face classes and telepresence meetings with monitors was evaluated as positive, in addition to verifying that students had frequent access and interaction in Google Classroom™, both for the consultation of the materials and for the subsequent delivery of the proposed exercises.

Through the Google Classroom™ platform, it was possible to highlight the resolutions of the students' activities, who, even with the possible mistakes in the elaboration, received *feedback* and grades. In addition, they had their doubts resolved in face-to-face classes and, complementarily, in monitoring. Thus, the method provided a learning process based on the construction of individual and collective knowledge.

In the flipped classroom, students study the content at home, through videos and readings, and carry out activities. Then, they discuss and apply what they have learned in the classroom, consolidating the knowledge acquired, providing a more dynamic and participatory learning environment [11]. It is important to select and create high-quality, relevant and interesting materials, promoting student motivation and interaction and validating the contents applied in each week of class taught [13].

It was observed that the hybrid flipped classroom methodology allowed a better use of time. For example, a complementation of the content usually taught in the subject in previous periods was carried out, providing a practical activity on the theme related to the design of epidemiological studies, based on the elaboration of a cross-sectional study by groups of students of the discipline. The group activities in the form of seminars and this activity, called "cross-sectional project and research", contributed to the learning of several epidemiological studies in a practical and different way from the usual way. The results of the studies can be disseminated later in order to strengthen the body of nursing knowledge.

One of the main advantages of the flipped classroom is that students have more control over their own learning process. Students can study the materials at their own pace and answer questions before going to class through platforms that allow teachers to use classroom time more efficiently,

focusing on hands-on activities, group discussions, problem-solving, and other activities that promote active learning.[4.8]

Similar to our findings regarding the optimization of learning time in the flipped classroom methodology, studies conducted by Rodrigues *et. al.*[5] and Bethânia *et. al.* [8] – who evaluated university students in health courses, such as psychology, nursing, among others –, observed that the method plays an important role in maximizing the contents taught and increases the students' performance coefficient, due to the consolidation of the contents and the effectiveness in correlating practice with theory. Both studies confirm our findings that it is important to use active methodologies because they are effective, facilitate learning and have high feasibility for the immediate need for new active methodologies for the academic environment.[14]

The flipped classroom method applied to the teaching of epidemiology corroborated the minimization of previous learning deficits related to the analysis of tables and graphs, mathematical and statistical concepts, through a previous diagnosis of these elements. Thus, there was an increase in interest and motivation, enabling a language accessible to students, corroborating communication between students and teachers, mediating wanting and knowing. Therefore, using several tools in teaching has the benefit of contributing to the development of studies, consolidating more content in less time, in a viable way. The use of technologies in teaching attracted creativity, aroused the interest of students and provided positive *feedback* from students in relation to teachers and monitors.

However, the development of this method may present challenges related to access to technological resources for home study and skills for the use of digital technologies; issues addressed through the prior verification of the viable technological means that the students had for the studies and, respectively, the support of the monitors for the resolution of doubts.

It is known that the modification of traditional teaching, through the flipped classroom, is in fact an inversion of what was obtained over the years, when the student was a mere listener in relation to the teachers, who needed to be the holders of knowledge and apply a teaching methodology instituted in the speech, on the part of the teacher. and in listening, on the part of the student. Thus, with the application of this method, teachers become facilitators and advisors, rather than providers of information, but they need to be willing to experiment with new approaches and to work collaboratively with students and monitors.[8; 12]

Experiences and changes in teaching methods, with technological means and the flipped classroom method, were defined, based on the results produced, as viable and effective educational tools. Complementary to digital tools in remote and hybrid teaching, it was an approach that emerged to meet the demand for remote teaching during the COVID-19 pandemic period, as studies have

shown, being implemented with good acceptability by teachers and students of public universities.[4.15]

Ries *et al.* [4] evaluated the pedagogical adaptation of three undergraduate classes in nursing and pharmacy in the transition from face-to-face to remote teaching, verifying that the use of active methodologies valued the student's prior knowledge, as well as provided the production of scientific materials and research in the field of epidemiology during the aforementioned study during the pandemic period. Similarly, Bethânia *et al.* [8], in a quantitative-qualitative study conducted with 132 teachers from an educational institution in Rio Grande do Sul, observed a very receptive academic disposition of teachers in relation to the flipped classroom teaching method in the pedagogical experience for remote teaching.

LIMITATIONS OF THE EXPERIMENT

The implementation of the flipped classroom required a significant change in the traditional teaching dynamics, requiring students to adapt to take an active role in learning. Future challenges include adapted experiences in other disciplines.

CONTRIBUTIONS TO PRACTICE

The reported experience provides the possibility of considering the use of active methodologies and digital technologies in nursing education as an innovative way, due to its ability to promote skills, attitudes and knowledge that can reflect positively on professional practice.

FINAL THOUGHTS

The flipped classroom enhanced learning by promoting active engagement, practical activities, the development of research skills, the stimulation of critical thinking, and the integration between theory and practice in the discipline of epidemiology for nursing. Teacher mediation and monitoring support made these results possible. The methodology enriched the students' training, overcoming the traditional difficulties of the topics addressed, advancing in the development of products that prepare them more effectively for professional challenges.

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Leishmaniasis in the contemporary clinical context and its therapeutics interventions: A review

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ABSTRACT

Leishmaniasis is a tropical disease categorized as neglected due to its impact on populations with limited access to resources. It is caused by various species of the parasite Leishmania, belonging to the Trypanosomatidae family within the order Kinetoplastida, and transmitted by sandflies (Phlebotomine sandflies) during the female's blood meal. Several mammal species, which often coexist closely with humans, serve as biological reservoirs. Leishmaniasis manifests in different forms, including cutaneous (CL), diffuse (DCL), mucocutaneous (MCL), visceral (VL), post-kala-azar dermal (PKDL), and mucosal (ML). In this context, our objective is to provide updated information to facilitate access to data for various specialists dealing with this parasitic disease. Simultaneously, we aim to contribute to public education, particularly among populations facing precarious living conditions and challenges in accessing healthcare services in endemic areas. A total of 135 articles on Leishmania were reviewed, sourced from 95 journals. This endeavor serves as a means to identify potential risks and formulate strategies for preventing and mitigating the consequences of leishmaniasis.

Keywords: *Leishmania*, Cutaneous, Diffuse, Mucocutaneous and visceral.

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INTRODUCTION

The genus *Leishmania* is a parasite of vertabrates and belongs to the Trypanomasomatidae family (order *Kinetoplastida*) (Melby *et al*., 2014; Li_evin-Le Moal *et al*., 2015; WHO, 2018; Taylor, 2016), responsible for causing leishmaniasis, a disease transmitted through the bite of sandflies (Melby *et al*., 2019). Classified as a neglected tropical disease, leishmaniasis stands as one of the most significant neglected infectious diseases (Rosário, *et al*., 2017; Azevedo and Marcili, 2020).

Indeed, parasitic diseases caused by protozoa represent a significant challenge for public health worldwide (Stuart *et al*., 2008; Alvar *et al*., 2012; Comandolli-Wyrepkowski *et al*., 2020), due to their high morbidity and mortality (Stuart *et al*., 2008; Alvar *et al*., 2012), among them leishmaniasis, a neglected tropical disease that affects more than 12 million people (WHO, 2015; Alvar *et al*., 2012; Rocha and Petroni, 2017 ; Amaral *et al*., 2019), being endemic in a total of 98 countries spanning five continents (WHO, 2015; Alvar *et al*., 2012; Akhoundi *et al*., 2016; Lara-Silva *et al*., 2017). Only in New Zealand and the South Pacific, there are no records of this disease (Alvar *et al*., 2012).

According to its clinical manifestations, this disease has different forms: cutaneous (LC), diffuse (LCD), mucocutaneous (LCM) and visceral (LV), these interact with the membrane receptors of neutrophils and macrophages (Alvar et al., 2012; Li_evin-Le *et al*., 2015; WHO, 2018), post-kalasar dermal (LDPK) and mucosa (LM) (Alvar *et al*., 2012). Leishmaniasis is regarded as a complex system involving interactions between the parasite and host cell. It features a multifaceted life cycle comprising two distinct forms: the amastigote stage within mammalian hosts and the promastigote stage within the invertebrate vector (promastigote) (Melby *et al*., 2019).

The disease cycle initiates when female Phlebotomus sandflies ingest infected tissue macrophages from mammalian hosts. Within the insect's gut, the membrane of these macrophages ruptures, releasing amastigote forms (lacking flagella) into the mosquito's digestive tract. Despite the presence of digestive enzymes and immune system responses, which could be lethal to the parasite, it is within this environment that the amastigote forms proliferate, transitioning into promastigote metacyclic (flagellated) forms. (Shital, *et al*., 2024). These flagellated forms migrate to the proboscis region, and when the mosquito is about to feed on blood again, the promastigote forms residing in the proboscis are injected into the host. Subsequently, these flagellated forms are phagocytosed by macrophages. Within the acidic environment of lysosomes, they lose their flagellum, transforming into amastigotes. This environment provides favorable conditions for parasite proliferation. The amastigotes then rupture the membrane of these cells, spreading parasites to be phagocytosed by other cells (Figure 1) (Podinovskaia and Descoteaux, 2015). In this process, the parasites interact with immune system cells residing in the epithelial tissue, remodeling the environment of the host's

phagolysosomes. They release molecular patterns associated with tissue damage, thereby establishing the infection (Kupani, *et al*., 2021).

Leishmaniasis can manifest as a zoonotic, anthropozoonotic, or anthroponotic disease, with only a few species being exclusively anthroponotic. Typically, female sandflies infect hosts such as dogs, rodents, marsupials, mongooses, bats, and hyraxes. This illustrates the involvement of various animals as non-human reservoir hosts, along with multiple vectors in the transmission process (Stauch *et al*., 2014). It's worth noting that only a small proportion of infected humans actually develop the disease (Singh *et al*., 2002). The establishment of leishmaniasis in a particular region and the subsequent clinical manifestation of the disease in patients result from a complex interplay of environmental, social, and economic factors, with environmental changes playing a pivotal role in this process. The encroachment of marginalized human communities into unsanitary conditions contributes significantly to this issue (Alemayehu & Alemayehu, 2017; Ellwanger *et al*., 2020), compounded by healthcare challenges across different regions (WHO, 2018; 2019). Human displacement and the loss of biodiversity further exacerbate the problem by promoting the proliferation and spread of blood-sucking insects that serve as vectors for various diseases, thus intensifying human interaction with these organisms (Rosário *et al*., 2017). The issue is compounded by the introduction of domestic animals into areas originally occupied by forests (Oliveira *et al*., 2020). Studies have indicated that vector insects tend to adapt to urban environments due to significant alterations in their natural habitats (Amorin *et al*., 2021), leading to a close interconnection between land use, occupation, and the advancement of the disease. This intricate relationship poses a challenge for the control and mitigation of leishmaniasis, particularly in hot and humid regions.

These factors may indeed impact the socioeconomic conditions of the population, underscoring the importance of maintaining vigilance in rural or endemic areas to identify potential risks. This facilitates efforts to prevent and mitigate the consequences of leishmaniasis. In this context, our objective is to update information variables, streamlining data retrieval for various specialists involved in managing this parasitic disease. Simultaneously, we aim to contribute to public education initiatives.

Figure 1. 1-Leishmaniasis is transmitted through the bite of infected sandflies (females). When feeding on blood, the sandflies inject metacyclic promastigotes (the infective stage) from their proboscis. 2- Promastigotes are phagocytized by macrophages and other phagocytic mononuclear cells. 3- Within these cells, promastigotes transform into amastigotes (the tissue stage without flagella). 4- Amastigotes multiply by simple division and infect other mononuclear phagocytic cells. 5-6 When feeding on the blood of an infected host, female mosquitoes ingest macrophages infected with amastigotes. 7- In the midgut of the sandflies, amastigotes transform into promastigotes. 8- From this point onward, promastigotes multiply, develop, and migrate to the proboscis. *Image of the Centers for Disease Control and Prevention, Global Health, Division of Parasitic Diseases and Malaria.*

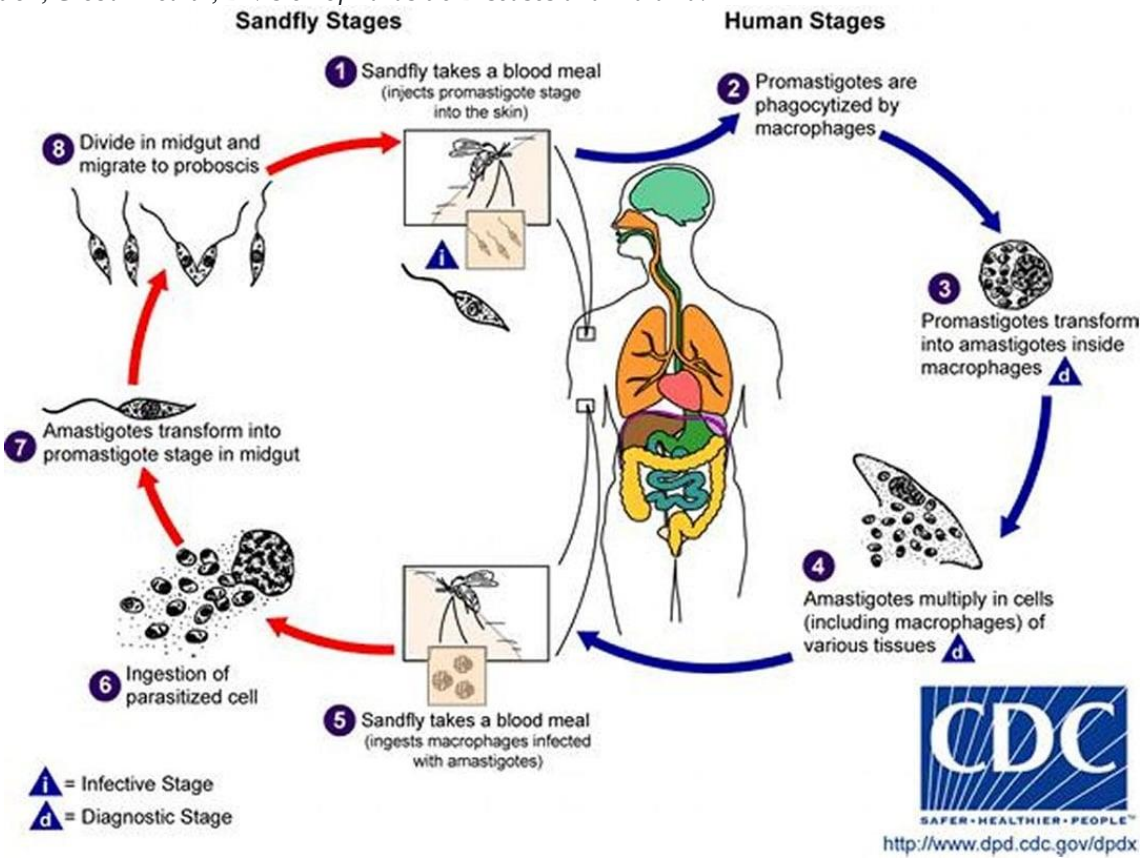
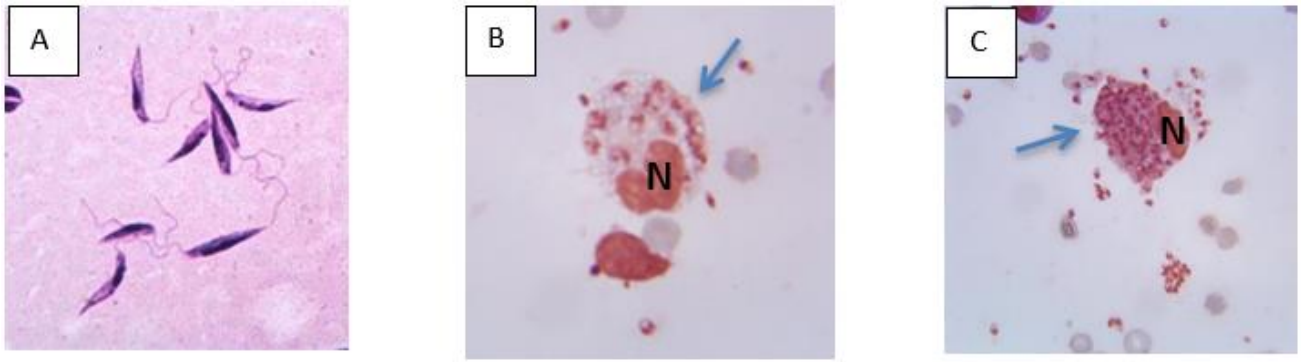


Figure 2. A: Metacyclic flagellated forms; B: Macrophage containing amastigote forms in its cytoplasmic interior (arrow), Nucleous (N); C: Macrophage saturated with amastigotes (arrow), which are released into the extracellular environment, Nucleous (N). 1,250x magnification



MATERIALS AND METHODS

We reviewed 135 articles related to the genre Leishmania, available in 95 different magazines. This also review facilitates the historical compression of the disease.

RESULTS

GENDER *LEISHMANIA*

The causing agent of the disease was discovered in 1898 and 1901 by P. Borovsky, W. B. Leishman and C. Donovan, and the gender Leishmania was first described by R. Ross in 1903 (Weyers, 2016).

HISTORY AND EVOLUTION

Through the study of samples of insects preserved in amber, *Paleoleishmania* proterus was identified, one of the first fossils of *Kinetoplastida* similar to the leishmania studied, demonstrating the protozoan-vector association that was already established in the Lower Cretaceous period (Poinar and Poinar, 2004), around 140 and 100 million years ago. Another study with an insect preserved in amber, identified a progenitor of at least one of the several existing Neotropical Leishmania clades, Paleoleishmania neotropicum, belonging to the Tertiary period, around 65 to 2.6 million years ago (Poinar, 2008).

A hypothesis for the distribution of Leishmanias throughout the world is based on the theory of the supercontinent Gondwana, in the Mesozoic era, that through the separation movement, the subgender Leishmania and Sauroleishmania would be involved in the region of Africa while the subgender Viannia would have developed in the region of the South America (Steverding, 2017).

In human history, in ancient times, through studies that analyze samples by sequencing DNA fragments, they suggest that the visceral variant of leishmaniasis, caused by *L. donovani*, was present in mummies of ancient Egypt (Steverding, 2017).

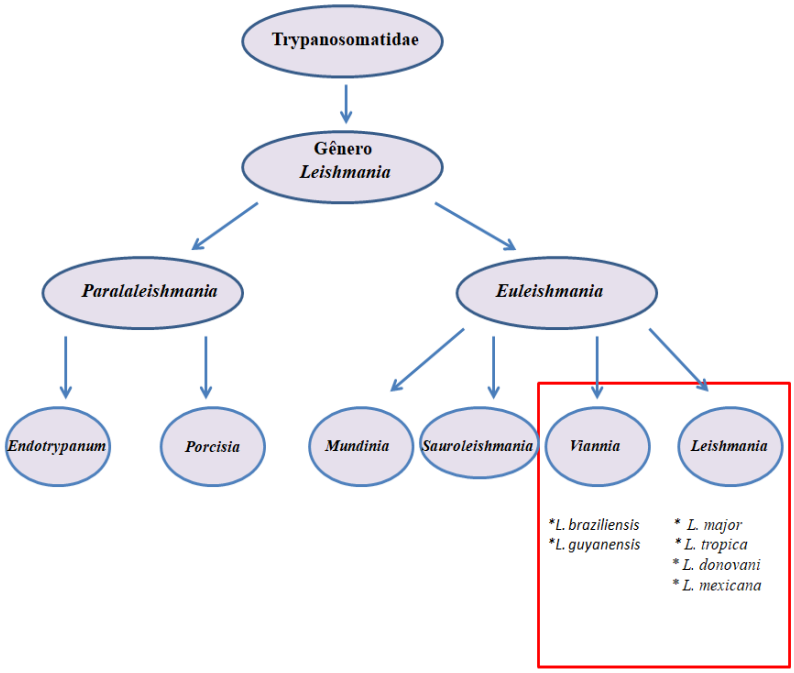
In the Middle Ages, records indicate that the variant of CL was present in the Baghdad region (Steverding, 2017). Other studies through molecular analyzis, indicate that there was the presence of the MCL variant for millennials, in altitude regions, at 2400 meters, more specifically, in San Pedro de Atacama, launching the hypothesis of population migration from endemic regions to areas of altitude (Costa et al. 2009).

A study with a 300-year-old naturally mummified body, in the Itacambira region, a small village in Minas Gerais, Brazil, which at the time was a mining region with a migration of people between Portuguese people and the local population. The experiment demonstrated through molecular techniques of DNA fragments analysis by PCR, that the analyzed sequence showed 100% similarity with *L. tarentolae*. The original host of this species is the lizard *Tarentolae mauritanica*. Even though there is no evidence that L. tarentolae causes disease in humans, the study in question managed to identify through the samples collected in the analyzed body, so that is to say there was enough material to generate a result, showing that the parasite has achieved some success in replication in a human being (Novo, *et al*., 2015).

Geographic distribution, Leishmania behavior, clinical manifestations, among others, were taken into account to separate Leishmania species, with the gender being divided into two subgenders; Leishmania and Viannia (Safjanova, 1982; Lainson and Shaw, 1987). In the beginning of 1970, immunology, biochemistry and molecular typing were taken into account for the identification of Leishmania, however at the end of the same year, the MON zymodeme system used in 1990 was considered (Akhoundi *et al*., 2016). Different concepts and methods were used for the classification of species of this genders, those that evolved later (Weyers, 2016).

There are 21 known species of Leishmania pathogenic to man (Akhoundi *et al*., 2016; 2017), of which we will only take into account in this work the ones represented in Graph 1.

Graph 1. Taxonomic classification of the genus *Leishmania*



Adapted from Akhoundi et al., 2016; 2017. * Each forms a complex of species

FORMS OF LEISHMANIA

Visceral leishmania (LV)

Among leishmaniasis, the visceral variant is the most severe clinical form of manifestation of the disease (Daoudi, *et al*. 2020), transmitted by the etiologic agent *Leishmania chagasi = infantum* to men and dogs as the main reservoir of the parasite, through the sting of the female flobotominium, in the urban environment (Cortes, 2012; Daoudi, *et al*., 2020), however, in the wild environment the following are part: *Dusicyon vetulus; Cerdocyon thous; Didelphis albiventris* (Lara-Silva, *et al*., 2015).

The incidence of VL is produced by the adaptation of the vector in anthropically modified areas (Teles *et al*., 2015), configuring one of the biggest public health problems. When left untreated,

it is responsible for 95% of mortality (Oliveira, *et al*., 2020). Actions to control the VL by government actions have shown low effectiveness, in addition to exposing the fragility of the situation, especially with regard to the processes of assessment and quantification of the disease scenario (Graepp-Fontoura, *et al*., 2020).

As this disease affects organs and viscera of the lymphohematopoietic system, such as the liver, spleen, ganglia and bone marrow, it can also be present in other organs such as kidney (Meneses, *et al*., 2020), and lung (Bispo, *et al*., 2020), with reports of transmission through infected blood in HIV patients at the time of syringe exchange during the use of illicit drugs. In this situation coinfection facilitates the evolution of HIV, through the process of immune exhaustion (Lindoso *et al*., 2012). On the other hand, the death produced by leishmaniasis, can be avoided with an early diagnosis (Sundar and Chakravarty, 2013).

Cutaneous leishmania (LC)

The manifestation of this variant occurs through a local dysfunction producing an erythematous pustule that progresses to ulcers with permanent scarring; in America it is caused primarily by *Leishmania peruviana, L. guyanensis, L. panamensis, L. braziliensis, L. amazonensis* and *L. mexicana*, whereas in Africa, Europe and Asia by *L. major, L. tropica* and *L. aethiopica* (Who, 2015). The parasite infects a variety of host cells, through a complex interaction, however, macrophages and dendritic cells are the main ones in this process. Faced with macrophages residing in the skin, promastigote forms are phagocytized. Inside the phagosomes, after fusion with lysosomes, the promastigote forms become amastigotes in the acidic environment of these organelles, the latter being the infective form of the parasite (Liu and Uzonna, 2012), inducing cell death in the epidermis, in the area parasitized (Martins *et al*., 2014).

Mucosa (LM)

Generally, it fundamentally covers the tissue areas of the nasal, oral, pharynx, larynx and genitalia mucosa, caused mainly by parasites of the *Leishmania viannia* group. The manifestation of this variant has a difficult diagnosis in the initial cases, hampered by the possibility of confusion with other diseases that affect mucous membranes, and must be confirmed with the IgG and IgM serological test (Sbroglio *et al*., 2020).

MECHANISM OF ACTION

The course of the infection is defined by a series of factors of the parasite (species, strain, evolutionary form, initial number) and host (cells of the innate and adaptive immune system, complement system, chemokines, etc.). The location of the parasite in the SFM cells, associated with

the immune response, stimulated by the presence of the parasitic antigen, produces an inflammatory reaction with cellular predominance (chronic inflammatory process of the granulomatous type). The interaction between parasitic multiplication and the host's immune response may produce a more or less severe infection and, depending on the species of parasite involved, tissue damage may occur affecting the cutaneous and / or mucous membrane (LT), or visceral organs (LV) (Conceição-Silva and Alves, 2014).

HOST

Among the hosts, dogs and cats have great importance as reservoirs of leishmaniasis, whether or not they develop the disease. Other mammals such as horses, have shown seropositivity for leishmaniasis (Gazzonis, *et al*., 2020). Cattle also appears as reservoirs (Alam, *et al*., 2018; Paixão-Marques, *et al*., 2019) and this variety in terms of hosts, increases the complexity in combating and controlling the disease, as the methodology currently used is the euthanasia of infected animals (Lopes, *et al*., 2017). However, the euthanasia of domestic animals such as horses, as well as dogs, entails ethical and even legal issues. Some studies reveal that the euthanasia of seropositive dogs demonstrates low efficacy in disease control, necessitating more effective solutions in controlling the spread of leishmaniasis (Passantino; Russo & Coluccio, 2010). Some types of reptiles appear as hosts. A study analyzed the blood of 13 species of lizards in China and managed to identify potentially pathogenic parasites in the animals analyzed, demonstrating that the lizards contribute to the dispersion of the parasites, conferring epidemiological importance (Zhang, *et al*., 2019), this host range reveals the complexity of the disease cycle, therefore the euthanasia procedure must be reevaluated.

DOGS: THE MAIN RESERVOIR IN LEISHMANIASIS

Despite the wide variety of animals classified as hosts, dogs serve as the primary reservoir for leishmaniasis, facilitating transmission of the infection to humans due to their close proximity and interaction with humans, particularly in the more severe cases of the disease, visceral leishmaniasis (VL). Other wild animals such as wolves, coyotes, foxes, opossums, as well as felines can affect this function for the parasite (Costa, 2011), and equines (Costa, 2011; Vieira *et al*., 2020).

Different authors question euthanasia as a treatment for the control of visceral leishmaniasis in seropositive infected dogs, since there is no evidence of efficincy with an increase in cases (Machado, 2016; Nery *et al*., 2017). In addition, other drugs have been used such as Milteforan (Greene and Vandevelde, 2015; Ribeiro *et al*., 2016.)

Allopurinol is a medicine for human use, used to control excess of uric acid (Tonhati, 2018), but when combined with other antimicrobial, antiparasitic and antifungal drugs, they acquire the

leishmaniostatic, leishmanicidal and immunomodulatory functions together (WSPA, 2011). It was also used: Domperidone (Gomez-ochoa et al., 2009); Miltefosine (Miró *et al*., 2009; Manna et. Al., 2009; Brazil, 2016; Nogueira, 2019); Meglumine antimoniate (Ikeda-Garcia *et al*., 2007; Manna *et. al*., 2008; Miró *et al*., 2009; Miró *et al*., 2011; Travi *et al*., 2018); Allopurinol (Miró *et al*., 2011; Greene and Vandevelde, 2015; Jericó *et al*., 2015); Pentamidine (Noli, 2005).

TREATMENTS FOR LEISHMANIASIS

An inconvenient reality is that these neglected diseases, such as Leishmaniasis, end up presenting few treatment alternatives due to the cost-benefit ratio. On the one hand, the cost of the research and development process for companies in the sector makes certain processes unfeasible due to the high costs involved in this process, a period of high investments and uncertain returns, on the other hand, more vulnerable sections of the population suffer from these neglected diseases, in this sense, the public sector such as universities, research institutes, has contributed greatly to the development of new therapeutic processes.

An exemple of this public sector interaction in the search for new treatments, a practically recent study, worked with lipid nanoparticles as carriers of an active ingredient, lupeol, a phenolic triterpenoid found and extracted from vegetables such as *Bauhinia variegata*; *Ehphorbia resinifera* and *Sterculea villosa*, researchers demonstrated positive effects against amastigote forms of visceral leishmania, effectively eliminating them from the spleen and liver of experimental hamsters (Jesus J.A., *et al*., 2023).). Another tratment more focused on natural bioactives uses the free propolis extract is commonly used in experimental models of leishmaniasis, the development of pharmaceuticals offering greater stability and preparations permitting controlled release, or even increased compound bioavailability, constitutes a substantial therapeutic advantage.(Silva R. J., *et al*., 2023).

Another possibility would be the development of vaccines against disease variants; however, currently, commercially effective vaccines against leishmaniasis in humans are not available (Singh & Sundar, 2012). In the interim, some research is advancing toward the development of vaccines, demonstrating efficacy for certain parasite species (Avendaño-Rangel, *et al*., 2024). While these advancements are not yet available in the market, the most commonly used treatment remains pentavalent antimony, which is the most accepted treatment for all forms of leishmaniasis (Meirelas, *et al*., 2017).

According to Table 1, Pentostam and Glucantime are medications for the treatment of leishmaniasis based on pentavalent antimonial compounds, and were introduced as chemotherapeutics in the 1940s, remaining the main drugs used in the treatment of leishmaniasis. They are associated with severe side effects, such as loss of appetite, nausea, muscular dysfunctions,

feelings of fatigue, among others. The principle of action of this class of drugs is based on the susceptibility of amastigotes to the medication in the process of inhibiting glycolytic enzymes and beta-oxidation of fatty acids (FIOCRUZ).

In most cases, treatment is often interrupted due to the severe side effects of antimonials, necessitating the application of a second-line treatment such as Amphotericin B (Carvalho, *et al*., 2019). Amphotericin B was developed for the treatment of systemic fungal infections through a mechanism of action involving binding and interaction with the lipid structures of the parasites' membrane, which are rich in ergosterol in contrast to mammalian cell membranes rich in cholesterol. This interaction increases the permeability of the parasites' cell membrane, leading to the loss of cations such as K+ and ultimately causing cell death. However, Amphotericin B is also associated with severe side effects, which may be minimized by its interaction with liposomal nanoparticles (Cháves-Fumagalli, *et al*., 2015).

Others drugs such as verapamil and nifedipine are calcium channel blockers, both producing similar effects and indicated for the treatment of hypertension, with Nifedipine being a sustained-release medication and Verapamil indicated for reducing high blood pressure crises. Their application in the treatment against leishmaniasis is based on the principle of inhibiting Ca2+ channels, interfering with the binding and interaction of parasites with macrophages, as this process of adhesion to macrophages is dependent on Ca2+ channels. However, no antiparasitic effect was observed (Misra, *et al*., 1991).

The compound 1,4-dihydropyridines, like those previously described, is also a Ca2+ channel blocker known as an antihypertensive agent. It has shown promising effects against visceral leishmaniasis, being able to reverse antimony resistance (Tempone, *et al*., 2009).

Miltefosine is an alkylphospholipid developed for the treatment of cutaneous tumors, which has also demonstrated activity against both cutaneous and visceral leishmaniasis. It was approved in India in 2002, however, it showed teratogenic effects, leading to its prohibition for use in pregnant women (Tiuman, *et al*., 2011). Miltefosine is not capable of causing direct cytotoxicity to the parasite, but it modulates the immune system to stimulate T-helper cells through the induction of Th1 cytokines. This mechanism is essential for treatment success (Palic, *et al*., 2019).

Amphotericin B has demonstrated activity against Leishmania parasites *in vitro* experiments; however, its clinical application is associated with severe side effects such as hypokalemia, renal dysfunction, and decreased hemoglobin levels. The liposomal formulation of amphotericin B could represent a better alternative for tissue absorption, consequently allowing for dose reduction and toxicity reduction. Clinical application in patients infected with visceral leishmaniasis treated with amphotericin B, both in its conventional and liposomal forms, has shown similar results, with around 96% cure rates (Moore and Lockwood, 2010).

Compounds such as ketoconazole, fluconazole, and itraconazole are azole derivatives, which are aromatic heterocyclic organic compounds containing a cyclic chain of five atoms, one of which is nitrogen. These compounds act on the ergosterol synthesis process by inhibiting the demethylation step, hindering lanosterol's development into ergosterol. Statistically, treatments with this class of drugs are similar to treatments with pentavalent antimonials; however, they have not shown satisfactory results against *L. braziliensis*, the species causing mucocutaneous leishmaniasis. The toxicity of these treatments presents certain characteristics that must be taken into account regarding individual patient profiles. It is safe to say that they cannot be used in pregnant women or in patients with hepatic, renal, cardiac, or pancreatic issues (López-Carvajal, *et al*., 2016).

Table 1. Treatments performed on different types of Leishmania. (HUMANS)

TREATMENTS				
VL	**CL**	**MCL**	**Used Drugs**	**References**
x			Nifedipina	Misra *et al*., 1991
x			Verapamil	Misra *et al*., 1991
x	x		1,4-dihidropiridinas	Núñez-Vergara *et al*., 1998; Palit e Ali, 2008; Tempone et al., 2009; Reimão et al., 2010
			Pentostam	Torres *et al*., 2010
		x	N-metilgucamina (Glucantime®)	Yan *et al*., 2003 ; Rath , *et al*., 2003 ; Berman , 2005; Torres *et al*., 2010; Tluman, TS *et al*., 2011; Vera *et al*., 2018; Cataldo , *et al*., 2018;
	x			Viana *et al*., 2013; Navarro *et al*., 2014; Chávez-Fumagalli *et al*., 2015; Miranda *et al*., 2015; Soares *et al*., 2017; Gelvez *et al*., 2018; Regli *et al*., 2018; Vasconcelos *et al*., 2018; Cardona-Arias *et al*., 2018; Da Silva *et al*., 2018; Uribe-Restrepo *et al*., 2018; Sousa-Batista *et al*., 2019; Brito *et al*., 2019; Gonçalves-Oliveira *et al*., 2019; Carvalho *et al*., 2019; Arboleda *et al*., 2019; Ribeiroa *et al*., 2019; Moosaviana *et al*., 2019.
x				Sundar e Chakravarty. 2014; Navarro *et al*., 2014; Chávez-Fumagalli *et al*., 2015; Ministerio da Saude, 2016; Sousa-Batista *et al*., 2019; Alborzi *et al*., 2017; Vieira-Araújo *et al*., 2018; Cardona-Arias, *et al*., 2018; Kasabalis *et al*., 2019; Camara *et al*., 2019;
		x		Alborzi *et al*.,2017; Vasconcelos *et al*., 2018; Cardona-Arias *et al*., 2018; Goyonlo *et al*., 2019; Brito *et al*., 2019; Akhtaria *et al*., 2019;
x	x	x	Amphotericin B	Furtado *et al*., 1960; Tluman *et al*., 2011; Chavez Fumagalli, *et al*., 2015; Cunha *et al*., 2015; Txwari *et al*., 2017; Vera *et al*., 2018; Carvalho *et al*., 2019.
x	x		Miltefosine	Tluman TS *et al*., 2011; Singh e Sundar, 2012; Sundar e Chakravarty, 2015; Twari *et al*., 2017; Vera *et al*., 2018; Soto *et al*., 2018; Carvalho *et al*., 2019; Bamorovat *et al*., 2019; Alonso *et al*., 2019; Palic *et al*., 2019;
TREATMENTS				
VL	**CL**	**MCL**	**Used Drugs**	**References**
x			Anfo b desoxicolato	Hiramoto *et al*., 2019
x			Antimonial Pentavalente	Hiramoto *et al*., 2019
x	x		Estibogloconato de sodio	Moore e Lockwood, 2010; Tluman TS *et al*., 2011
x	x		Paramomicina	Sundar e Chakravarty, 2015
x	x	x	Anfotericina B lipossomal	Wijanant *et al*., 2018; Vera *et al*., 2018; Carvalho *et al*., 2019; Hiramoto *et al*., 2019
	x		ketoconazol	McCall *et al*., 2015; López-Carvajal *et al*., 2016; Vera *et al*., 2018
	x		Fluconazol	López-Carvajal *et al*., 2016
	x		Itraconazol	López-Carvajal *et al*., 2016
			Azitromicina	Toledo-Junior , *et al*., 2014

x	x		Pentamidine	Basselin , *et al*. 2002 ; Croft e Coombs, 2003; Coelho , *et al*.,2003; TlumanTS *et al*., 2011; Singh , *et al*.,2012; Carvalho *et al*., 2019; Vera *et al*., 2018

Leishmania : cutaneous (CL), diffuse (DCL), mucocutaneous (MCL), visceral (VL).

DISCUSSION

Although the contemporary world is in an era of advanced technological development, neglected diseases such as leishmaniasis still plague populations, especially the poorest layers of society. The challenges to control and combat the disease are compounded by the issue of climate change, leading to consequences across various countries. Currently, there is still debate about whether the effects of deforestation and wildfires impact the global thermal cycle. Studies indicate an occurrence of temperature rise in certain regions of the planet; thus, the temperature increase affects the rainfall cycle and promotes uncontrolled cycles of vectors and parasites.

With the increase in concentrated rainfall in certain regions, floods and the spreading of water bodies are likely to occur. Subsequently, as water levels recede, areas that were previously submerged become muddy, forming suitable breeding grounds for sandflies and other vectors of various diseases. This proliferation of vectors is directly proportional or at least systemically interconnected with the loss of biodiversity and consequently, the loss of mosquito predators, leading to a massive increase in certain populations, namely disease vectors.

Thus, the scenario of leishmaniasis tends to become more complex with the advancement of populations into deforested areas, which is directly proportional to economic factors. In pursuit of opportunities, people leave their cities and migrate to these regions to establish themselves or simply generate resources through extractive activities, creating a complex interplay between economic and humanistic factors within a systemic situation.

Another issue to be considered is that protozoal diseases present certain peculiarities and challenges in treatments, and the challenges are greater for vaccine production. In light of this, the treatments currently available in the public health system include meglumine antimoniate, which is associated with heavy side effects and low efficacy. However, this low efficacy cannot be confirmed as a definitive statement, as it depends on many interdependent factors such as the stage of the disease, characteristics of the patient's immune system, adherence to treatment, quality of rest, environmental factors in which the patient is situated, among others.

Other drugs such as azole derivatives have demonstrated similar effectiveness to antimonials, yet for some Leishmania species, they have not yielded satisfactory results. The medication amphotericin B showed satisfactory results in in vitro experiments, but in clinical applications, it produced severe side effects in patients. Another medication, miltefosine, demonstrated teratogenic activities, leading to its prohibition for use in pregnant women. In Brazil, miltefosine is only

marketed for veterinary use, with a high cost for acquisition, thus restricting its widespread use in treating hosts such as domestic dogs.

In the face of all these issues, a tool that tends to yield results as a prevention strategy is information and education about the topic, aimed at raising awareness of the reality and involving concepts that should be addressed with a certain depth. This educational approach should be didactic and explanatory about the risks and characteristics of the disease. Issues such as cleaning households and their surroundings, observing the behavior of domestic animals, and especially the importance of seeking help at health centers when the first symptoms arise should be addressed.

To implement these actions, public policies aimed at these goals must be widely established, as well as combating deforestation. The latter is considered an important action to minimize the spread of the disease and mitigate the effects of climate change by modifying microclimatic factors relative to microregions. These microregions could be subdivided by hydrographic micro-basins, which would contribute to a more global scale in some way.

In addition to these educational activities, it is of utmost importance to incentivize new research in the development of new drugs as well as in the search for more effective active principles against leishmaniasis. This effort aims to improve the future prospects of the disease scenario by providing more effective medications with fewer side effects, thereby enhancing the quality of life and life expectancy of patients. While professionals in the scientific field work with numbers, statistics, and other metrics, the individual suffering caused by the disease is immeasurable.

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Accessibility through science, sustainability and technology as a tool for inclusion in early childhood education

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ABSTRACT

The theme of science, technology and sustainability are increasingly part of the contents of the curricula to be worked on in education according to the reality of each school unit. It is of great importance for the development of students' skills that the School Units work on themes related to nature, promoting sustainable activities in Early Childhood Education. Access to technology can provide knowledge to the themes developed through experiences lived from an early age. In this sense, the present study sought to reflect on the teacher's observations in her pedagogical practice applied in the context of Inclusive Education. An inclusive education can be understood as a comprehensive and conscious education, in which technology offers possibilities for a more accessible education. In this way, Early Childhood Education students can acquire knowledge and awareness about topics related to the environment, adopting daily attitudes of respect for the environment and sustainable practices. Thus, the objective of this work is to discuss technology and sustainability in the stage of early childhood education linked to playfulness as a pedagogical practice in which technology can and should contribute to the preservation of the environment, to the conscious use of natural resources and to sustainable practices in the process of developing students' skills in regular classes with inclusion.

Keywords: Sustainability, Technology, Environment, Early Childhood Education, Inclusion.

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INTRODUCTION

The objective of this study is to ratify that the proposals of activities applied by the teacher in a Child Development Space (EDI), in the Municipality of Rio de Janeiro, achieved excellent results in the analysis of participant observation carried out with Special Education students who attend regular classes of early childhood education.

The research intends to propose activities aligned with the BNCC that arouse students' interest and curiosity about teaching/learning, with pedagogical proposals having playfulness as an effective method of learning, as well as inclusion through affective bonds that allow the integration and socialization of students in the school space. The justification of the theme was based on the teacher's experience as an observer of her practice for the present research, in including in her pedagogical proposals the themes related to the environment, sustainability and technology. Seeking to insert the target audience of Special Education with their needs and deficiencies to be supplied in the realization of the proposals of activities, to express themselves and create in the experiences lived.

According to Kishimoto (1999), if children do not have the freedom to express themselves and use creativity, they will hardly be able to develop their autonomy and their own personality, as they will be bound by rules and exceptions, which will limit their ability to create. For the author, "[...] bearer of a specificity that is expressed through the playful act, childhood carries with it the games that are perpetuated and renewed with each generation" (KISHIMOTO, 1999, p. 11).

The child in this age group: 6 months to 5 years and 11 months of Early Childhood Education has a lot of energy and vitality, for this reason it is difficult for him to pay attention or concentrate for some time on a school activity, so it is necessary to use playful materials such as toys, games and games that are attractive and stimulating for the child, during the development of activities that explore both the previous knowledge and the systematized contents related to their level of learning, which are built from the teacher-student and student-student mediation.

Despite the challenges faced, there is a great motivation to improve studies and knowledge to apply them in teaching practice, with the aim of meeting the needs and needs of Special Education students and promoting effective and meaningful quality inclusion. The intention is for Special Education students to feel integrated into the Early Childhood Education class, welcomed and embraced through playful and educational activities that involve topics such as sustainability, environment and technology.

And within this context, innovative environments in education emerge with their technological pillars, driving the student to increasingly act as the protagonist of this learning process. However, always respecting the time, experiences, skills and abilities of each child.

METHODOLOGY

This study was developed through the participant observation method carried out during the year 2022, by the Basic Education teacher of the City of Rio de Janeiro. It is known that observation is very effective in the field of education, as it seeks to explain the problem, analyzing and presenting the interferences and conclusions in its purpose, by providing the opportunity for "prolonged experience with the population under study" (FELDMAN-BIANCO, 1987, p. 15).

As a teacher working in Early Childhood Education in regular classes with inclusion, I use proposals for activities with nature and technology that increase the appreciation of the potential for building these new learning environments. These environments are very rich in the exchange of learning, of knowledge, and they are not only based on technologies, applications, social networks, platforms, which are very important, because they are part of the experience of these children. However, this construction of new places needs to be grounded in the student's social context – such as the environment in which they live their experiences and what they bring to the classroom – in order to make concrete sense for their experience and knowledge.

Occupying different spaces during class time, especially to motivate and encourage students to live new experiences, is very important for their development and favors the knowledge of new learning. In addition to classroom practices, this study uses bibliographic research with the support of books, Rioeduca notebook, Rioeduca on TV, Rioeduca at home application, sources of theoretical research through the Google database, Google scholar, articles, theses, monographs. Such researches helped in the knowledge and development of the present work.

THEORETICAL FRAMEWORK

SPECIAL EDUCATION IN BRAZIL: ACCESSIBILITY IN INCLUSION

Early childhood education is called by the Law of Guidelines and Bases of Education (BRASIL/LDBEN/9394, 1996) as the first phase of basic education with the design of the integral development of the child from 0 to 5 years and 11 months, in its physical, psychological, intellectual and social aspects.

Article 4 of the National Curriculum Guidelines for Early Childhood Education (DCNEI, CNE/CEB Resolution No. 5/2010) defines a child as:

> Historical subject and of rights, who, in the daily interactions, relationships and practices he experiences, constructs his personal and collective identity, plays, imagines, fantasizes, desires, learns, observes, experiments, narrates, questions and constructs meanings about nature and society, producing culture (BRASIL, 2010 p.12).

The inclusion of children, young people and adults with special educational needs within the regular education system is the central issue on which the Salamanca Declaration[2] (1994):

Principles, Policies and Practices in the Area of Special Educational Needs. In the introduction, the Declaration addresses Human Rights and the World Declaration on Education for All and points out the principles of special education and child-centred pedagogy.

It can be said that the set of recommendations and proposals of the Salamanca Declaration is guided by the following principles: Inclusion of students with autism spectrum disorder; Regardless of individual differences, education is everyone's right; Any child who has a learning disability can be considered to have special educational needs; The school must adapt to the specificities of the pupils, and not the pupils to the specificities of the school; Teaching should be diversified and carried out in a common space for all children (Salamanca, 1994, p. 12).

> The fundamental principle of inclusive schooling is that all children should learn together, regardless of any difficulties or differences they may have. Inclusive schools must recognize and respond to the diverse needs of their students, accommodating both different learning styles and paces, and ensuring quality education for all through appropriate curriculum, organizational modifications, teaching strategies, use of resources, and community partnerships. Within inclusive schools, children with special educational needs should receive any extra support they may need to ensure an effective education (Salamanca Declaration, 1994, p. 15).

According to the Operational Guidelines of Special Education for Specialized Educational Service in Basic Education, Special Education is a teaching modality that crosses all levels, stages and modalities, provides specialized educational care, provides resources and services and provides guidance on their use in the teaching and learning process in regular education classes. (Brasil, 2008, p. 1). Special Education should cover individuals: a) Students with disabilities: those who have long-term impairments, of a physical, mental, intellectual or sensory nature, who, in interaction with various barriers, may have restricted their full and effective participation in school and society. b) Students with Pervasive Developmental Disorders - the medical nomenclature was changed to Autism Spectrum Disorder (APA, 2013): they are those who present qualitative alterations in reciprocal social interactions and communication, a restricted, stereotyped and repetitive repertoire of interests and activities. This group includes students with autism, autism spectrum syndromes, and childhood psychosis.

In a world with scarcity of natural resources and environmental degradation, sustainability at school is an increasingly important subject. The Common National Basis

[2]The Salamanca Declaration is a United Nations resolution that deals with the principles, policy, and practice in special education. Adopted by the General Assembly, it presents the United Nations Standard Procedures for the Equalization of Opportunities for Persons with Disabilities.

Curricular Curriculum (BNCC) places the theme as one of the skills that should be developed by students. With this, each educational institution can define the best way to include the subject, taking into account the context and reality of each location. The National Common Curriculum Base seeks to strengthen methodologies in which the student is active in the pedagogical process.

The BNCC describes the Rights of Learning and Development in Early Childhood Education:

> • Living with other children and adults, in small and large groups, using different languages, expanding knowledge of oneself and others, respect for culture and differences between people.
> • Play daily in different ways, in different spaces and times, with different partners (children and adults), expanding and diversifying their access to cultural productions, their knowledge, their imagination, their creativity, their emotional, bodily, sensory, expressive, cognitive, social and relational experiences.
> • Actively participate, with adults and other children, both in the planning of the school management and the activities proposed by the educator and in the performance of activities of daily life, such as the choice of games, materials and environments, developing different languages and elaborating knowledge, deciding and taking a stand.
> • Explore movements, gestures, sounds, shapes, textures, colors, words, emotions, transformations, relationships, stories, objects, elements of nature, at school and outside of it, expanding their knowledge about culture, in its various modalities: arts, writing, science and technology.
> • To express, as a dialogical, creative and sensitive subject, their needs, emotions, feelings, doubts, hypotheses, discoveries, opinions, questions, through different languages.
> • To know oneself and build one's personal, social and cultural identity, constituting a positive image of oneself and one's groups of belonging, in the various experiences of care, interactions, games and languages lived in the school institution and in its family and community context. (BNCC, p.38).

From this perspective, it is very attractive to create teaching environments such as thematic corners, green space and reading spaces to enhance learning with activities that include energy, water, waste and biodiversity. Promote various stimuli provided by these environments to allow the child to develop better skills of their preferences. Keeping students seated in chairs, especially at this stage of early childhood education, goes against the purpose of strengthening new learning environments.

The teaching-learning process happens through stimuli with mediation and not through control. Each child acquires knowledge in a different way, in his or her own time and according to his or her particularity. What is needed is that the learning objectives are known and from there the environments must be aligned with the proposal of enabling them to develop their skills with moving the earth, playing with their imagination in make-believe in nature with the use of leaves, pans, little things, etc. As well as offering games, educational videos that arouse curiosity, mainly through active methodologies, doing, performing, preparing these spaces of new digital technologies aimed at the improvement and development of learning.

In this sense, technological resources have become indispensable elements in the application and valorization of these new environments for the acquisition of knowledge, due to their mechanisms and equipment that work as complementary resources in teaching and learning in early childhood education: videos and resources of alternative communication for the target audience of

Special Education. According to França (2018), with technology, teachers have access to materials that enable a diversity of content, knowing how to use these resources and how to apply them can improve student learning and the teacher's routine. The educational directions given for an effective inclusion point to Alternative Communication as an instrument that can transit between the thought and language of the child who does not speak, modifying a reality by allowing child development to be supported by communication that interacts with his social life (VON TETZCHNER, 2005). Alternative Communication is one of the areas of Assisted Technology (AT) that aims to promote skills of people with functional limitations resulting from different disabilities.

Clearly, it can be seen that Special Education is not just another specific task to which the school must dedicate itself, but a horizon in which the school needs to be effectively inserted. That is, the school needs to transform itself in order to become fully inclusive. More than that, everyone involved – managers, teachers, parents, staff in the school context – needs to raise awareness and embrace a school for all.

RESULTS AND DISCUSSION

The place where the present study was carried out was the Child Development Space in question, which is ten years old and is located in the West Zone of Rio de Janeiro, coordinated by the 9th CRE – Organ of the Municipal Department of Education / SME. It is managed by the General and Deputy Director, articulating teacher, Early Childhood Education teachers, agents and employees of the Municipal Education Network, whose objective is to develop teaching-learning in students of Early Childhood Education of Basic Education, in a public school network in regular classes with inclusion.

Regarding the pedagogical actions that guided this research, the teacher carried out playful activities using proposals that involve the student and the environment, which show the importance of planting a tree, saving water, disposing of garbage correctly, this is done by taking the student out of the classroom, planting trees around the school, offering seedlings for the student to plant at home, in the care of the vegetable garden, made with the collaboration of the students, showing that even when watering plants and vegetables, care must be taken with the waste of water, identify that each trash can has its function in the storage and disposal of garbage. The student must learn that he is directly connected with nature, and all this transformation will have a direct impact on him and his family future. As well as, through explanatory videos on the theme with images and music, making the themes more expository and attractive for this age group. The children's interest and curiosity were aroused during the proposed activities, resulting in new discoveries for the whole class, including regular students and those with special needs. The objectives outlined for the execution of

the themes discussed in this article were successfully achieved, and this was noticed by the teachers during the activities.

FINAL THOUGHTS

Debating sustainability in educational institutions/EDI and in the family environment is of paramount importance for the awareness and preservation of the environment. It is by planting the "little seed" of knowledge in this age group of Early Childhood Education, with learning through play, that everything becomes more pleasurable. The use of technology through electronic games in conjunction with actions such as turning off the tap while brushing your teeth, turning off the lights when you leave the room, turning off the electronic device when you finish using it, is already propagated in the explanation of our children in their homes with the family and so, each one taking care of the "little world" a little bit we are developing good attitudes in taking care of our Planet correctly.

Finally, it is concluded that working on elements that contribute to a significant inclusion, through proposals with educational intentionality in contribution to the social and natural environment, favor the development of the concept that we are part of nature and must preserve it. Enabling experiences outside the classroom strengthens this bond with the environment and enriches pedagogical practice.

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Reasons for teachers' resistance to reforms ideas about education

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ABSTRACT

This article brings evidence that supports the hypothesis that, when there is dissonance between the logic of educational reforms and teachers' ideas about school education, consequently, there is some form of resistance to the former. Such ideas would come from the socialization of teachers, especially during the period of their basic education. This hypothesis contradicts the assertion of part of the literature about resistance, which attributes the resistance to reforms to poor teacher training. The arguments proposed here were elaborated in order to situate a research that was carried out on the ideas of teachers from São Paulo about school education.

Keywords: Educational reform, Teacher ideas, Teacher resistance.

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INTRODUCTION

The present text consists of an illustration of the hypothesis that there is teacher resistance to educational reforms, among other reasons, due to the discrepancy between the educational ideas contained in the reforms and the teachers' ideas about education. Thus, such resistance does not result from poor teacher training as the literature suggests. The hypothesis was outlined to situate research on educational ideas of teachers in public schools in São Paulo.

Although the literature points to several factors regarding teacher resistance, we chose to specifically analyze teachers' ideas about education, because, from the theoretical point of view of the structuralist approach to organizations (ETZIONI, 1974), the school is constituted as a normative organization with a cultural goal, that is, the preservation of cultural heritage and its transmission to younger generations. According to this approach, the main source of control of participants at the lower levels of the organization - for example, teachers - is normative power and, secondarily, remunerative power, since salaries are widely recognized as demeaning and the manipulation of payments and bonuses do not induce the internalization of values; they produce, at the limit, only a superficial engagement. In these organizations, consent (participation) is mainly based on the internalization of normative guidelines accepted as legitimate, and is designated as moral participation; For this to occur, it is necessary that the participants are in agreement with the ideas with which the organization operates.

The concept of educational reform employed here is based on Ghanem (2006) and Torres (2000), who consider reform as a logic that includes planning in the external scope of execution, broad scope, financial support, homogeneity and imposing character.

We use a broad concept of reforms. These encompass programs that constitute modalities of action, which may or may not have defined deadlines; such programs are the result of some political lines, such as those aimed at administrative modernization, personnel qualification, remuneration or certain inputs, as in the case of textbooks.

Teachers' ideas about education are those that guide their professional practice and indicate how they conceive education, how they see both the teaching and learning processes and the relationship between teachers and students. Also the relationship between them and knowledge and the purpose of school education.

The concern with resistance to reforms, teacher training and professionalization has been going on for decades and continues in a very strong way. These issues are at the heart of the debate on the quality of education. Researchers, educators, reformers, international organizations and organized civil society attribute what they call bad education to poor teacher training. In this way, they strive to unveil how a good teacher training is given and what knowledge is necessary for a good teaching to be constituted; However, they pay little attention to teachers' ideas about education, which

are the result of the socialization to which the people who make up the teaching category have been submitted.

APPROACHES TO TEACHER RESISTANCE

In the literature on educational reforms, many authors state that teachers are the obstacles to reforms, attributing this fact to the unsatisfactory nature of their training. Torres (1996; 2000), for example, indicates the existence of a historical conflict between this professional category and educational reformers worldwide, particularly in Latin America.The author describes the aspects of the teaching work classified by critics as those that would explain their poor training, such as: outdated educational content and methods; theoretical work detached from practice; encyclopedic teaching; outdated by new technologies, etc. These criticisms would have led the reform groups to make improvements in in-service training, not in initial training, not solving the issue.

Gusmão (2010) approached members of entities related to education in Brazil (Ayrton Senna Institute, Union of Municipal Directors of Education - Undime, National Conference of Education Workers - CNTE and National Campaign for the Right to Education) and found that, for those who are at the head of these entities, teaching is also conceived as a key piece or obstacle in educational transformations. Regarding teachers' appropriation and resistance to educational policies, Santos (2011) shows them as obstacles to the implementation of reforms. It argues that these are not implemented by teachers in the way that the reformist nuclei want, since the teacher does not feel that he participates in the reform and, therefore, acts according to the needs of his immediate action, of the reality of the classroom, according to the structural conditions he encounters, since he does not know the basis of the proposals and discredits them. Although these proposals cause uneasiness in the school, they are assimilated in a different way from that thought and proposed by the official bodies.

Regarding the educational reforms in the 1990s, specifically in Latin America, Oliveira (2016) states that teachers are considered by reformers to be the main responsible for the performance of students, the school and the system, and that they are also obliged, due to the reforms, to respond to demands that are beyond their training. Gajardo (1999), in turn, when referring to the general characteristics of these reforms, also refers to teachers as obstacles, pointing to the lack of human skills as one of the factors responsible for the timid results of the reforms, in addition to the incapacity of institutions and the absence of efficient information and communication networks that facilitate interaction between actors and involve society as a whole in the reform process.

Rego and Mello (2004), analyzing several studies in Latin America and the Caribbean, state that they attribute the success or failure of the reforms to the level of convincing and transforming teachers. As a result of this fact, they emphasize teacher training and list what they consider relevant lessons regarding the factors responsible for the good quality of education, namely: the level of

education in which the training is situated; the articulation between theory and practice; valuing the practice; the organic institutional link between training and the reality of primary and secondary schools; the articulation between initial and in-service training; the discrepancy of the concept of quality in primary and secondary schools in relation to contemporary demands; and, consequently, the desired profile of teacher. Then, some aspects related to these points are added, one of which is the fact that teacher training is detached from what will be required of him or her in basic education.The same authors also proclaim the need for in-service training courses to be based both on what the teacher has learned - and how he or she has learned - and on the contents that will need to be re-signified in order to gain meaning in academic and professional life.

Reinforcing the idea of poor teacher training and the need to improve such training, Vaillant (2004) - in a publication carried out by the *Program for the Promotion of Educational Reform in Latin America and the Caribbean* (Preal)[3] - analyzes the construction of the teaching profession in Latin America; It asserts that one of the main challenges faced by policies in the education sector today is the improvement of teacher performance. Latin American teachers are identified - in relation to teachers in developed countries - as those with less preparation, fewer years of schooling, coming from families with low cultural and economic capital, increasingly recruited in sectors with lower educational and cultural levels. In other words, teacher training in Latin America is one of the major obstacles to the development of education, since it comes from a basic education based on oral presentation and with poorly prepared educators (VAILLANT, 2004).

Navarro, Carnoy and Castro (2000) also consider initial teacher training to be bad, which needs to be improved because it is one of the crucial points for the success of reforms. They also point out that in-service training has not been able to cover the number of teachers, in addition to not having yielded results yet.

Broadening the view of teacher resistance in the American continent, it is essential to highlight Ravitch[4] (2011), who analyzed some educational reforms in the interior of the USA, especially the federal reform expressed in the *slogan No Child Left Behind* (NCLB), which occurred in the last decade of the twentieth century and at the beginning of this century. Ravitch (2011) comes to the conclusion that two decades of reforms did not improve education and what we saw were teachers and management creating strategies for students to achieve good performance in tests and, therefore, school curricula using such performance as a reference. She believes that one of NCLB's

[3]Preal is a program that aims to contribute to the improvement and equality of education through the promotion of educational debates and reforms. Created in 1996 and headquartered in Chile, it is co-directed by the Inter-American Dialogue, funded by the U.S. Agency for Economic Development (USAID) and BID.Cf. WERLANG, A. C.; VIRIATO, E. O. The Program for Educational Reform in Latin America and the Caribbean (PREAL) and teacher policy and training in Brazil in the 1990s. *Form. Doc*., Belo Horizonte, v.4, n° 6, p.10-23, jan./jul., 2012). Available at: <http://formacaodocente.autenticaeditora.com.br>. Accessed on: 11 feb. 2013.

[4] Researcher at New York University; in 1991, she served as assistant secretary of the National Bureau of Education in the George H. W. Bush administration and was also an advisor to the Bill Clinton and George W. Bush administrations.

mistakes was to judge those who worked in schools as incapable: "good education cannot be obtained by a strategy of testing children, shaming educators, and closing schools" (RAVITCH, 2011, p. 132). In these analyses, the teacher is considered an important part of the reform, an obstacle to its implementation, although he or she played into the hands of the reformers, contributing to the presentation of positive statistical results. There is a veiled confrontation with the reform, otherwise the contestations would be punished.

For the reform of the Portuguese education system[5], Vilar (1993) addressed the importance of innovation and research in education, also attributed the success to the teacher's commitment to the reform and indicated the training and improvement of teachers as one of the strategies for implementing the reform. Webb et al. (2004), in turn, in a comparative study between the teaching professionalism of primary school teachers in the United Kingdom and Finland, found, in both countries, the resistance of teachers to abandon the old practices and accept the reform led by the State.

In the report for the United Nations Educational, Scientific and Cultural Organization (UNESCO) of the International Commission on Education for the 21st Century, "Education: a treasure to be discovered", which served as the basis for UNESCO to guide several educational reforms, the new teaching attributions are explicit, which are totally different from the usual ones. The Commission also makes it clear that teachers are not prepared for the new assignments, points to the need to improve recruitment and to "[...] to rethink teacher training in such a way as to cultivate in future teachers precisely those human and intellectual qualities capable of fostering a new perspective of teaching in the direction proposed by this report" (p. 157).

In general, there is agreement on the issue of teacher resistance linked to poor training, therefore, some studies point to the need to reformulate undergraduate courses and insert in-service training.

TEACHER TRAINING AND IDEAS

Among the research on educational innovation, Huberman (1976) and Neirotti and Poggi (2005) warn of the complexity of resistance to reforms in the school environment, pointing out the importance of values and teaching practices. From this observation, we infer that values and practices are linked to the ideas that teachers have about education.

According to the Houaiss Dictionary of the Portuguese Language (2001), among the various existing meanings, the term "idea" corresponds to knowledge, information, notion of what it is; way

[5]The author refers to the first phase of the Portuguese Educational Reform (1986-1995). To learn more about the Portuguese Educational Reform, see LIMA, C. L. Administração escolar em Portugal: da revolução, da reforma e das decisões políticas pós-reformistas. In: CATANI, A. M.; OLIVEIRA, R. P. (Orgs.). *Educational reforms in Portugal and Brazil*. Belo Horizonte: 2000, Autentic. p. 41-76.

of seeing, thought or formulated opinion; intention to accomplish (something), plan, purpose, design; mind, thought; set of opinions of an individual or a group of people on any given subject. Therefore, it encompasses thought, beliefs, knowledge, representations, and knowledge.There is an epistemological discussion about ideas of the teaching profession within which are the concepts of knowledge, knowledge, thoughts, representations and beliefs of teachers, and these concepts appear, sometimes entangled, other times as synonyms and, sometimes, separated. Tardif (2002), in turn, created a model of analysis of teaching work that encompasses teachers' beliefs and knowledge within the concept of teaching knowledge.In 1991, Tardif proposed a model for analyzing the diversity of teaching knowledge, which differs from the typologies proposed by Gauthier, Schulman and García, authors who stood out in this field. Tardif (2002) conceptualizes teaching knowledge as knowledge, competencies, skills and attitudes of teachers, involving beliefs. It conceives it as a plural, temporal, rational and heterogeneous knowledge. Knowledge made up of several others (professional, curricular, disciplinary and experiential), coming from different sources (from the basic training institution, from the family, from professional training, from curricula and from daily practice) throughout the trajectory of teaching life. Professional knowledge is that transmitted by the institutions that train teachers, it is the pedagogical knowledge (conceptions or doctrines, such as, for example, pedagogical doctrines centered on the ideology of the New School) and the educational sciences (psychology of learning and development), which are articulated. Curricular knowledge is knowledge about school programs (contents, methods, objectives), social knowledge selected by the school as a model of erudite culture and education, which should be worked on by the teacher. Disciplinary knowledge is that of a specific area of knowledge (mathematics, chemistry, physics and others), acquired in university training courses. Experiential knowledge is that developed in the daily practice of school, "it is the teaching culture in action". The construction of this knowledge takes place in the school environment, in which the teacher interacts with the other actors of the school (such as the older peers, who transmit a collective experiential knowledge), submits his/her work to the various obligations and norms of the school (for example, the school programs) and to the hierarchical organization of functions that compose it. In other words, experiential knowledge is constructed under "certain conditions of the profession". Under these conditions, the teacher tests, filters, adapts, and retranslates the knowledge learned in initial training; Daily life requires improvisation and personal skill and, with this, the teacher develops a teaching style, a know-how, a know-how, and the process of constructing this experiential knowledge also becomes a training process.

> [...] Experiential knowledge emerges as the vital nucleus of teaching knowledge [...]. In this sense, experiential knowledge is not knowledge like other knowledge; they are, on the contrary, formed from all the others, but retranslated, "polished" and submitted to the certainties built in practice and experience [...]. (TARFIF, 2002, p. 54).

Due to the fact that teaching knowledge is temporary, future teachers, in their initial training and at the beginning of their careers, act according to the beliefs, values and teaching norms internalized in pre-professional training. Throughout the career, which is formative, these beliefs may or may not be reinforced, according to Tardif (2002).

Torres (1996) ratifies this weight of school socialization in teacher education by mentioning the importance of observing the school system (authoritarian, encyclopedic, passive, repressive) in which the teacher was trained, because, according to her, daily contact with such a school model leads to the internalization of values, methods and practices that will constitute future teaching practice.

> The school experience seems to have more strength than what is learned in teacher training. Retracing what has been done and unlearning what has been learned is difficult and often fruitless, when one has lived for many years with an authoritarian, rigid, disciplinary, passive educational model, as the only reference and even as a scholastic and socially recognized exponent of "good education". (TORRES, 1996, p.43).

THE MAGISTERIUM DISAGREES

As one advances in the examination of the available works, the relationship between the ideas of teachers and the resistance to educational reforms becomes evident, as if they worked with different logics. Carraro (2002), for example, interviewed forty teachers from two state schools in the interior of São Paulo, with the aim of investigating the beliefs and representations of elementary school teachers regarding constructivism, the National Curriculum Parameters (PCN) and pedagogical innovations. This author calls pedagogical innovations resulting from the Law of Guidelines and Bases of Education (LDB) of 1996 the continuous progression, the school cycles and information technology as a didactic resource. It is based on the principle (based on the literature on the subject) that the PCN are based on constructivist theoretical foundations and, in this way, propose new didactic and methodological techniques. Like the LDB of 1996, the PCN would have brought educational innovations engendering the implementation of school cycles, continued progression and a process of evaluation and methodological practice related to constructivist orientations.

However, that author verifies that, although the teachers felt pressured to work within the constructivist ideology, following the PCN, they revealed to have an inaccurate or mistaken notion about these same PCN, as well as in relation to the continued progression and the school cycles, also presenting insecurity to use information technology as a didactic resource. The research also revealed that, although they recognized the need for reforms, they did not agree with them because they did not know or did not agree with their principles, or because they had been imposed.

Carraro (2002) highlights, among others, the need for greater investment and commitment in the initial and continuing education of teachers. Thus, it shows that there is a problem with teacher training, hindering the implementation of reforms. It is important to emphasize that, among the

factors of non-adherence to the reforms mentioned, there is the disagreement of teachers regarding the principles of the reforms.

Addressing the impact that Proalfa (Literacy Assessment Program of the State of Minas Gerais)[6] can have on teaching practice, Carvalho and Macedo (2011) point out that the punctual resistance to the program derives from imposition, which generates the absence of more information and a feeling of not belonging. They say that there is recognition of the value of the material sent by the State Department of Education, even if it is produced by academics, but that the teacher does not use it in daily practice and does not appropriate the material offered, creating strategies to circumvent the guidelines with which he does not agree and act in the way he believes to be correct.

Regarding the implementation of learning cycles, Mainardes (2007; 2009) considers Brazil as a whole and Araújo (2006) only Mato Grosso do Sul, but the three studies point to the resistance of the teaching profession as one of the obstacles to cycled schooling. They attribute the resistance to the fact that the teachers' educational experiences are linked to the traditional school model (grading evaluation, failure, seriation, selection and others) and to the absence of school infrastructure for the implementation of learning cycles. Mainardes (2007; 2009) also adds as factors of resistance the imposing character, the complex nature of the cycles, the strategies used for implementation and the Brazilian school culture.

Still with regard to learning cycles, Cunha (2007) reveals that most of the authors he consulted point to teacher resistance to the policies for the implementation of cycles in school networks. The causes of this resistance, according to these authors, vary: some attribute it to a lack of knowledge of the characteristics and scope of the proposal; others, the lack of infrastructure and staff training; others, to the fact that it was the result of an authoritarian policy, without teacher participation; others, due to the fact that teachers are not able to get rid of the culture of seriation, of the already internalized conception of education. In some cases, the authors point to more than one cause. In the investigation in a school in the municipal network of São Paulo, Cunha (2007) also found the teacher's resistance to the cycles and to the continued progression for reasons similar to those listed above: authoritarian installation of the cycles and lack of consultation with the teachers, making it difficult for them to appropriate the proposal; superficial understanding of the subject; and discontent for conceiving the cycle only as a policy that aims to improve failure and dropout rates.

Jacomini (2004), based on the assumptions that the effectiveness of public policies depends mainly on teachers and that they resist the implementation of cycles and continued progression, analyzed the teaching performance in four episodes of implementation of cycles in the municipal and state public education networks of São Paulo: i) the Reform of 1967-1968 (state education network);

[6]Proalfa is a census assessment of the state of Minas Gerais for students in the 3rd year (aged 8 years) and a sample assessment for students in the 2nd and 4th years; It aims to assess the level of student proficiency.

ii) the implementation of the Basic Literacy Cycle in 1983-1984 (state education network); iii) the adoption of cycles and continued progression in 1992 (São Paulo municipal school system); and iv) the establishment of the Continuous Progression Regime in 1998 (state education network). The aim was to unveil the causes of this resistance; Three types of conditioning factors of [7] teacher resistance to learning cycles and continuous progression were analyzed, namely: i) materials (provision of adequate and sufficient physical space, necessary pedagogical materials, etc.); ii) ideological (beliefs that are historically constructed and that determine the way of thinking and acting of each person); and iii) pedagogical institutional (functional and organizational conditions of the school).

The researcher found that, to a certain extent, the conditioning factors are repeated in the episodes analyzed, that is: the faculty stated that they are in favor of cycles and continued progression because they provide the democratization of teaching and overcome school failure, however, they allege that, as there are no material, institutional and pedagogical conditions for their functioning, they should not be adopted. as they would further compromise the quality of teaching. For that researcher, however, it is the teachers' ideas about education that are the great factor of teacher resistance.

Reviewing the studies produced on learning cycle policies in Brazil between 1990 and 2005, Barreto and Souza (2005) state that teachers do not adhere to the cycles because they understand that, with the cycles, they lose the mechanism (failure) of control and power over students and also of the teaching and learning process. The same researchers see in this fact evidence that the information disseminated to teachers has not been able to break with teachers' conceptions about evaluation practices. They also point to the need to work more on school culture and values, in order to make inclusive education possible.

Regarding the continuous progression regime, when noticing teacher resistance in a state school in Campinas, Jefrey (2006) explained it by the lack of knowledge of the conceptions and guiding foundations of this regime by the teachers themselves, stating that they guide their practice by the fundamentals and conceptions they already knew, with which they feel safe, that is, those linked to seriation. The researcher highlights the teacher's concern to create their own dynamics to preserve their convictions and educational parameters.

Another case is that of part of the teaching profession that neglects the Common Basic Curriculum created by the Basic Education Curriculum Reform Project of the State of Minas Gerais. Greco (2012) points out that teachers did not have a broad understanding of the reform, and therefore of the curricular changes it demanded. This group of professionals uses as a reference mainly the

[7] The concept of conditioning used, according to Jacomini (2004), was based on PARO, V. H. *Inside the public school*. São Paulo: Xamã, 1996. 400 p.

textbook, the entrance exams of public universities and the evaluations applied to schools by the Union and the state of Minas Gerais.

Also regarding curricular reforms, Cruz (2007) points out the importance of the teacher in relation to its implementation and, after presenting some authors who share his reflection (such as, for example, Giroux[8] and Moreira[9]), concludes that, when there is a distance between the conception of the curricular reform and the teacher, its failure is a fact. The same occurs with the difficulty of the school to develop a collective work and, consequently, to implement the pedagogical project of the school according to article 12 (item I) of Law 9.394/96, of guidelines and bases of education. Azanha (2000; 1998) attributes this difficulty mainly to the tradition of teachers reiterated in their training and argues that, although the expansion of elementary education in Brazil has given rise to an institution that demands collective work, which breaks with the school "inspired by a preceptorial view of the pedagogical relationship" (p.11), teacher training continues to be based on methods and procedures of someone who teaches and skills. skills and psychological qualities of someone who learns. A tradition of ideas that have underpinned undergraduate courses since their creation in Brazil. The idea that a "good teacher" is one who is able to teach the subject of his choice well, persists. Therefore, the teacher who internalized the idea of individual teaching work would have difficulty understanding the educational task as collective, which goes beyond the limits of teaching and learning subjects.

It is also worth mentioning Franco (2008), who researched the logics[10] that govern teaching practice and found that its logic is different from that of professional training, as it is based on experiences prior to training and is organized around different epistemologies. By the logic of practice, teachers do not consider the scientific knowledge learned in professional training sufficient for the daily school reality, making use of cultural mechanisms learned in their own broad socialization process. In addition, Franco points out that teachers do not always put into practice what they think and what they say, since they act mechanically, not reflexively, and thus defend themselves from the destabilization that something new can cause; It would be a kind of survival mechanism against reforms.

[8] GIROUX, H. Teachers as transformative intellectuals. In fashion:_____. *Teachers as Intellectuals*: Towards a Critical Pedagogy of Learning. Porto Alegre: Artes Médicas, 1997., p. 157-164.
[9] MOREIRA, A. F. B. The crisis of critical curriculum theory. In: COSTA, M. V. (Org.). *The curriculum on the thresholds of the contemporary.* Rio de Janeiro: DP&A, 1998. p. 11-36.
[10] Franco (2008) works with the concept of logic in the sense of paths "constructed" by thought to explain and understand reality according to the way it presents itself with meaning to the subject. Conception based on CHARLOT, B. Enseigner, former: logique des discours constitués et logique des pratiques. *Recherche et formation*. Paris. Vol. 8, Oct., 1990.

THE PRIMARY SCHOOL OF THOSE WHO BECAME TEACHERS

Admitting the idea that basic education has a great influence on the training of future teachers, it became important to consider some characteristics of the history of the Brazilian educational system. Rego (2012) focused on the role played by schooling in the psychic constitution of people who attended public elementary school forty years ago; In this way, he identified the predominant pedagogical model at the time, based on the description that those people made. This model was centered on: the figure of the teacher; in repression; in the overvaluation of the transmission and memorization of knowledge to the detriment of the affective, bodily and social dimensions; rigid behavioral control; punishments; in abstract knowledge; and in the disregard of the cultural universe from which the student came. It also found that this school model, this school culture experienced by the students has impacts and consequences on their psychosocial formation, although other factors - the student's social and cultural context - also contribute to their psychosocial formation. These data reinforce the argument that future teachers, once trained in a given school model, tend to internalize the values and pedagogical practices conveyed by this same model, constituting an educational ideology from there.

Frigotto (2011) is one among others who interprets our colonial and slave past as a relevant factor in the delay in the constitution of the capitalist spirit and in the inability of the ruling class to complete the bourgeois revolution, facts that influenced the quality of education. He quotes Oliveira, for whom:

> [...] the class relations that were constructed in Brazil allowed only partially and precariously the validity of the Fordist mode of regulation, both in the technological and social spheres. In the same way, it occurs in the present, in the current scientific-technical change of a digital-molecular nature, which imprints a great obsolescence of knowledge. [...] A society, therefore, in which, in the international division of labor, activities linked to simple work and a few niches of complex work dominate. (OLIVEIRA, 2003, p. 87-88).

This approach reinforces the thesis of Moreira (1990), Romanelli (1978) and Moreira (1959) on the predominance of the classical school, with a scientific and cultural basis, in relation to technique, in line with the Brazilian economic and political model. According to these last two authors, the labor market trained its staff without the real need to go through technical school; Therefore, attending the classical school and obtaining academic degrees would yield *status* (it would free the individual from physical labor, frowned upon and disliked in a society with a long slave past), making it possible to enter higher education and social ascension.

This trend is evident in Souza's (2008) analysis of the history of Brazilian education, which explains the governmental difficulty in changing the classical humanist curriculum to the scientific and technical curriculum in the 60s and 70s, although the legislation so determined. The Law of Guidelines and Bases of National Education, Law No. 5,692, of 1971, with the same concern of

modernizing the curriculum adapting it to the economic and political moment of the time, also faced difficulty in enforcing itself, especially in relation to the professionalization of high school, having received several criticisms from various sectors of society, including students, intellectuals, teachers and owners of private schools. In the face of objections and difficulties, in 1982, the obligation to professionalize this level of education was definitively revoked.

Souza (2008) draws attention to the fact that the reformers sought, in that period, to give a new connotation to the concept of humanism, relating it to scientific knowledge, which would be indispensable for the formation of the individual, as a justification for changing the curriculum; An element that seems to highlight the function of the school, until then, as a civilizer, as a trainer of individuals with certain knowledge and behaviors from which they would become deserving of *social status*, recognition and distinction. This situation seems to have changed in the 1990s, a period of universal primary education and a strong expansion of secondary education. The legislation resulting from the new Law of Guidelines and Bases of National Education (1996), which consolidated the curriculum based on elements of scientific culture, brought to light some old proposals that were not consolidated, in most cases, because they were not accepted by society, such as, for example, cycles and diagnostic evaluation.

At the global level, in 1989, in Paris, the *Centre for Education Research and Innovation* (CERI) held a conference, in which mainly researchers in the field of education and psychologists gathered, in order to initiate studies and discussions on curriculum reform in the member countries of the Organization for Economic Co-operation and Development (OECD). Such reforms would have the objective of changing the fact that basic school education in these countries is limited only to the teaching of knowledge that traditionally makes up school curricula, thus also providing the development of the complex intellectual skills required by the labor market and for the exercise of citizenship in democratic societies. This concern was motivated by the understanding that the quality of education is essential to meet the growing and complex social and economic needs (AZANHA, 2006).

In the 1990s, the Brazilian Ministry of Education introduced teaching based on the development of competencies, thus guiding the structuring of teaching and defining "the contents" to be taught, as well as the way in which teachers should teach and evaluate. Official documents define competencies as structural modalities of intelligence, from which derive skills that would be in the field of action. Such complex changes within the educational system demanded a new teacher training, which did not materialize, but the reformer assumed that teaching practices would be transformed simply by the possession of new concepts and from the responsibility of teachers for their professionalization and the results of their performance (ALMEIDA, 2009). What has been forgotten, Carvalho (2011) points out, is that teaching practices are the result of ethical and political

principles, the culture of school institutions, the peculiarities of each social group in which they are inserted and which have been historically consolidated. Thus, the didactic-methodological propositions derived from theoretical perspectives that ignore these principles have not been and will not succeed, since:

> [...] The idea of competence, which is central to the proposal of the reform, continues to be subject to a distinct understanding or even ignored among the teaching staff and managers of the education systems, who continue to carry out educational actions based on their knowledge and pedagogical beliefs. (ALMEIDA, 2009, p. 89, emphasis added).

CONCLUSION

This set of results of systematic research allows us to highlight the importance of teachers' ideas for the success of educational reforms, as long as it is admitted, according to the structuralist approach of organizations, that it is necessary to engage the teaching staff for the school to achieve its objectives and the engagement of this agent depends on whether he is in accordance with the ideas from which the guidelines established for the organization in which he works originate.

In consonance, in the specialized literature, it was also possible to verify that teachers' educational ideas, although not the only one, are a major factor in teachers' resistance to educational reforms. Government programs based on ideas related to those in which teachers have been socialized are more easily acceptable than others that are based on other pillars.

On the other hand, admitting the theory of Tardif (2002), the educational ideas of teachers originate, above all, from socialization in basic school education, sometimes reinforced in professional training and during professional experience.

Therefore, the knowledge accumulated on the subject leads us to infer that, instead of assuming resistance to educational reforms due to poor teacher training, it is more appropriate to understand it as a discrepancy in teachers' ideas, resulting from their socialization processes, especially in the condition of basic level students, generally based on conflicting ideas with many of those that guide educational reforms.

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Potassium fertilization in radish plants: Production and quality of tuberous roots

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ABSTRACT

The application of mineral fertilizers provides advantages, especially in short-cycle crops such as radish. This is because it contains high concentrations of nutrients that make plants available faster, in addition to being easy to handle compared to organic fertilizers applied to the soil. The objective of this study was to evaluate the agronomic performance of radish under the effect of the application of different doses of potassium fertilizer in the region of Bom Jesus-PI. The experiment was conducted in the field in an experimental area of the Federal University of Piauí, at the Campus Professora Cinobelina Elvas, located in the municipality of Bom Jesus-PI. The treatments consisted of six doses of K using potassium chloride as a source of the nutrient. The experimental design was randomized blocks consisting of six treatments (K doses) with four replications. The results obtained with the application of potassium fertilizer suggest that the radish crop responds positively and differently to increasing doses of potassium. The different rates of topdressing potassium fertilization influence the productive attributes of radish plants and the P, K and M.O. contents of the soil. The increase in K doses applied in topdressing promotes higher plant yields when compared to the non-application of this nutrient. Under the conditions in which the experiment was carried out, it is recommended to provide 400 kg ha^{-1} of K2O for radish cultivation.

Keywords: *Raphanus sativus* L., Brassicaceae, Mineral fertilization.

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INTRODUCTION

Originally from the Mediterranean regions, radish (*Raphanus sativus* L.) is a crop that has globular roots with a reddish color on the outside and white pulp, with a spicy flavor and small size, being used by consumers in the form of salads and preserves and among other cold dishes (CASTRO et al., 2016). This vegetable was highly appreciated in the cuisine of the Egyptian, Roman, and Greek civilizations, as it has low calories, in addition to diuretic and stimulant properties (LIMA et al., 2019).

Radish cultivation has been gaining prominence among Olericulturists, due to attractive characteristics, such as short cycle, rusticity and quick financial return (MATOS et al., 2015). In addition to being a food consumed mainly *in natura*, it is rich in mineral salts, vitamins and nutraceutical compounds related to immunodefense (BANIHANI, 2017).

Compared to other crops, radish has several specificities during its cycle, including intolerance to transplanting practice, and it is recommended to sow directly in its definitive location (LACERDA et al., 2017). In planted areas and economically, it is not as expressive as other vegetables that have a greater commercial importance, such as onions, for example.

Some studies carried out with applications of different doses of mineral fertilizers have found that the agronomic performance of radish responds positively and differently according to the increasing doses of potassium and nitrogen fertilization (JILANI et al., 2010).

Potassium fertilization, regardless of nitrogen application, has positive effects on radish crop yield according to the increasing doses applied. Even with certain amounts of potassium available in the soil, potassium fertilization is recommended to obtain greater productivity in the radish crop, because during its cycle it forms large amounts of mass in the storage organ making the plant need a high amount of nutrients, where potassium stands out. This is because the plant demands a greater amount of potassium in relation to the other essential nutrients for root formation (CASTRO et al, 2016).

Compared to other vegetables, radish does not have such a high demand for nutrients, but some authors point out that in the field, as well as other vegetables, positive responses are observed when fertilizers are applied, as soil fertility directly affects root size (REIS et al., 2012).

Among the most widely used technologies in Brazilian agriculture, mineral fertilizers stand out. The main advantage provided by these fertilizers is the increase in productivity, even in the face of the limitation of the arable area (OGINO et al., 2021). In addition, mineral fertilizers offer faster nutrient availability to plants, which is particularly critical for short-cycle crops such as radish. Castro et al. (2016) report that the promising results of radish productivity with potassium fertilization may be related to the increase of available potassium in the soil, and with the function it

plays in the plant, being important in the translocation of carbohydrates, thus improving the efficiency of water use.

In this context, the objective of this study was to evaluate the agronomic performance of radish under the effect of the application of different doses of potassium fertilizer in the region of Bom Jesus-PI.

MATERIAL AND METHODS

CHARACTERIZATION OF THE EXPERIMENTAL AREA

The experiment was conducted in the field in an experimental area of the Federal University of Piauí, at the Campus Professora Cinobelina Elvas, located in the municipality of Bom Jesus-PI (09º 04' 28" S, 44º 21' 31"W and average altitude of 277 m) from July to August 2019. The climate of the region is hot and humid, classified by Köppen as Awa (Tropical rainy with a dry season in winter and an average temperature of the hottest month greater than 22 °C), with an average temperature of 26.2 °C and average rainfall between 900 and 1200 mm $^{year-1}$ (INMET, 2024). The soil of the experimental area was classified as Oxisol (EMBRAPA, 2013).

Before the installation of the experiment, soil samples were collected from the 0-20 cm layer in the experimental area and determined the chemical and physical characteristics of the soil. The soil was prepared by plowing and harrowing and, as a result of the soil analysis, liming and fertilization were carried out to meet the nutritional requirements of the radish, as well as the application of K doses of the pre-established treatments. The flowerbeds were made in a mechanized way with the enchanter.

TREATMENTS AND EXPERIMENTAL DELICTION

The treatments consisted of six K doses (0, 80, 160, 240, 320 and 400 kg $^{ha-1}$ of K2O) using potassium chloride as a source of the nutrient. The experimental design was randomized blocks consisting of six treatments (K doses) with four replications. The area of each plot was composed of four rows spaced 0.25 m apart and 2.5 m long, corresponding to 2.125 m2. The useful area of the plot was 0.5 m2 in two central lines (80 plants), neglecting 0.25 m at the beginning and end of the lines. The total area of the experiment was 105 m2 (6 m wide x 17.5 m long).

CULTIVATING AND CULTURAL TREATMENTS

Given the varieties available on the market, the choice of the radish cultivar Apolo da Isla, was due to its characteristics of adaptability to the climate of the region, which is characterized by Köppen, as hot and humid, in addition to having tolerance to cracking and isoporization, has a

pleasant flavor and has already been used in practical classes and presented good adaptation and precocity to the climate of the region.

Radish sowing was performed in beds with 0.25 m spacing between rows. At seven days after sowing (DAS), thinning was performed by removing excess plants and adjusting the spacing to 0.05 m between plants. Irrigation was carried out by micro-sprinkler with perforated strips, with daily irrigation shift divided into two applications (morning and afternoon). Weed control was done manually and periodically in the beds and streets, keeping them always clean during the course of the experiment, providing favorable conditions for crop development. Pest and disease control were not carried out, as there were no incidences of the same in the area during the experiment.

VARIABLES STUDIED AND STATISTICAL ANALYSES

Harvesting was carried out 30 days after emergence, when the tuberous roots reached the commercial diameter. At the end of the experiment, the following analyses were performed to obtain the agronomic performance of the radish crop:

- **Commercial yield (CP):** roots with more than 2 cm in diameter and without cracks and rots were considered commercial, being weighed on a digital scale with a capacity of 5 kg, and yield was estimated in t/ha;
- **Total yield (PT):** all plant roots harvested in the useful area were weighed on a digital scale with a capacity of 5 kg, and where yield was estimated in t/ha;
- **Shoot dry mass (MSPA) and tuberous root dry mass (MSR):** after harvesting the plants, the tuberous leaves and roots were washed with drinking water (running water) and distilled water and packed in a brown kraft paper bag, identified with a label and taken to a forced air circulation oven at a controlled temperature of 65ºC until it reached a constant mass. After this period, the dry mass of the aerial part and the dry mass of the tuberous root were obtained by weighing in an analytical balance with an accuracy of 0.001g;
- **P, K and M.O. contents in the soil:** after harvesting the plants, soil samples (0-20 cm) were collected in each experimental plot, where the samples were analyzed using the methodology used by the Soil Chemistry and Fertility Laboratory of the Federal University of Piauí, Professor Cinobelina Elvas Campus.

The data of the analyzed variables were submitted to analysis of variance using the F test ($\alpha \leq 5\%$). For K doses, polynomial regression studies were conducted by choosing the significant equation with the highest coefficient of determination.

RESULTS AND DISCUSSION

Based on the results obtained, there was a significant effect of the different doses of potassium applied on the following attributes: commercial yield, total yield ($p < 0.05$), root dry mass, shoot dry mass ($p < 0.01$) (Table 1). Also for phosphorus, potassium and soil organic matter contents ($p < 0.01$) (Table 2).

Table 1: Summary of the analysis of variance regarding plant height (PA); number of leaves (NF); commercial productivity (CP); non-commercial productivity (PNC); total productivity (PT); root dry mass (MSR); shoot dry mass (MSPA); cracked radishes (RR) and classification ≤ 45 mm (CLA) in radish plants as a function of potassium dose application.

FV	PC	EN	MSR	MSPA
	----------t $^{ha-1}$----------		------g planta^{-1}------	
K Doses (F)	3.33*	3.58*	13.21**	24.52**
DMS	10.60	11.55	0.20	0.10
CV (%)	16.63	18.83	10.05	8.55

C.V. = coefficient of variation, DMS = minimum significant difference; ^{ns} = not significant; ** = significant at the level of 1% probability *(P<0.01); * = significant at the level of 5% probability (P<0.05).*

Table 2: Summary of the analysis of variance regarding the contents of phosphorus (P), potassium (K) and organic matter (M.O.) in the soil under radish cultivation as a function of potassium dose application. Bom Jesus, PI.

FV	P	Towards	M.O.
	----------mg dm^{-3}----------		g $^{kg-1}$
K Doses (F)	12.55**	132.00**	9.85**
DMS	2.49	92.52	1.35
CV (%)	17.87	11.55	4.21

C.V. = coefficient of variation, DMS = minimum significant difference; ^{ns} = not significant; ** = significant at the level of 1% probability *(P<0.01); * = significant at the level of 5% probability (P<0.05).*

It was observed that both for the variable commercial productivity (Figure 1A) as well as for total productivity (Figure 1B) of radish, there was a linear increase in the values with an increase in the doses of K fed to the plants, with maximum CP and PT estimated at 33.84 t $^{ha-1}$ and 33.93 t $^{ha-1,}$ respectively, at the dose of 400 kg ha-1 of K2O (Figure 1B). recording that between the lowest and highest doses of K2O, there was an increase of approximately 31.38% in CP and 37.99% in TST. A study carried out by Castro et al., (2016) also observed positive results of potassium fertilization in increasing radish productivity. The response of radish yield to the increase in the supply of potassium fertilization may be related to the increase in its availability in the soil, a fact observed in the present study (Figure 2B).

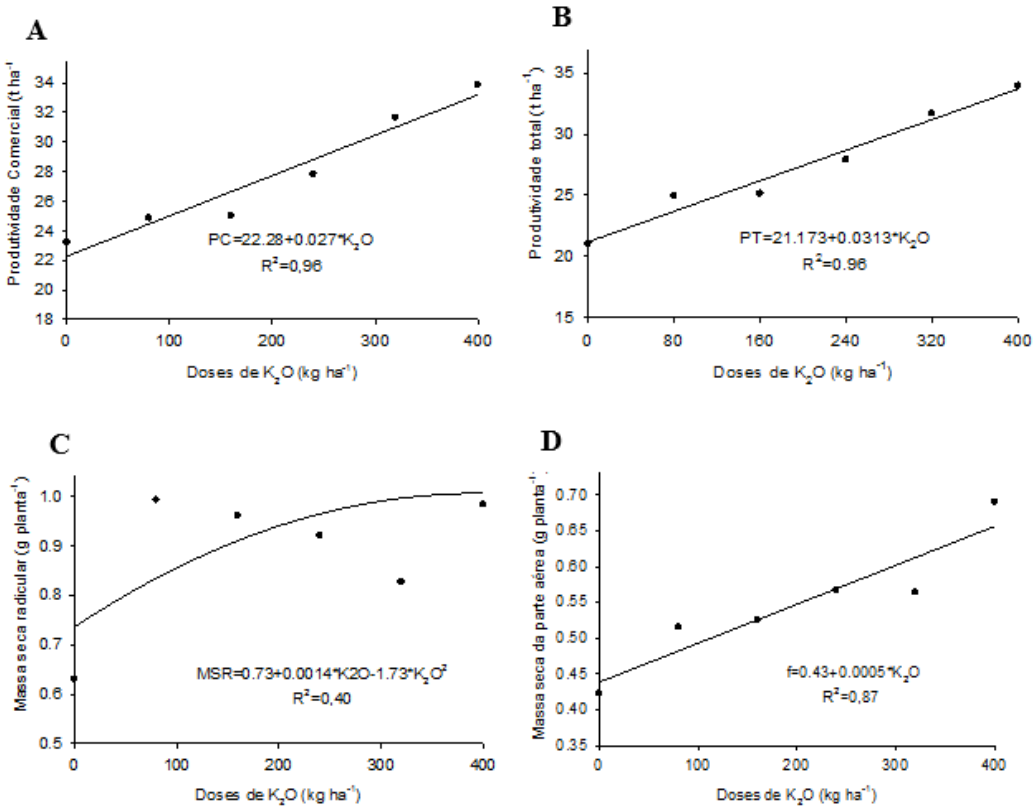
The literature presents substantial evidence on the importance of potassium (K) in radish culture. Souza et al. (2015) state that potassium is the nutrient most required by this crop, indicating the critical need for proper management of this element to optimize growth and productivity. Cecílio Filho et al. (1998) add that K application has a more pronounced impact on radish root production compared to shoot dry matter production. This finding suggests a greater allocation of resources for root development, which is critical for a crop where root production has commercial value.

Krauss (2005) reinforces this perspective by pointing out that this behavior is common in plants that store reserves in underground organs, as in the case of radish, which presents a significant increase in root productivity with the application of potassium.

These studies converge to an understanding that the management of potassium fertilization has a direct positive impact on radish yield, since the analysis of our data reveals a linear increase in the values of commercial productivity and total productivity with the increase of K doses applied. Therefore, the optimization of potassium doses is a fundamental agronomic strategy to maximize the productive efficiency of radish, directly reflecting on the economic gains and sustainability of the crop.

In addition, for Cecílio Filho et al. (1998), the application of K influences more on the production of radish roots than with fertilization with N, this may be related to the function that this nutrient plays in the plant, since K plays an important role in energy storage, in better efficiency of water use, due to the control of opening and closing of the stomata and greater translocation of carbohydrates produced in the leaves to the rest of the plant (TAIZ & ZEIGER, 2013).

Figure 1. Commercial yield (A), total yield (B), root dry mass (C) and shoot dry mass (D) of radish as a function of potassium doses.



In general, the results observed in the study concern the importance of fertilization with this macronutrient to increase the productivity of radish crops. According to Raij (1990), K is presented as a quality nutrient of agricultural products, which collaborates with beneficial effects on the color,

size, acidity, resistance, nutritive value and industrial quality of the crop. Demonstrating the importance of a balanced and balanced fertilization with K for the maximum productive potential of the radish crop. According to Rosolem (2005), when potassium fertilization is neglected, in general, crops respond with much smaller increases in productivity.

The root dry mass (MSR) results indicate that the accumulation of MSR in radish depends on the management of potassium fertilization (Figure 1C), it is observed that the worst results for this variable (0.630 g $^{plant-1}$) were found when there was no supply of K to the plants (control), a value that is 36.5% lower than the best value (0.993 g $^{plant-1}$) recorded at the dose of 400 kg $^{ha-1}$ of K2O.

Similar results were observed by Maia et al. (2011), who identified a significant impact of potassium nutrition on root dry matter (MSR) values. The study demonstrated a 100% increase in MSR values in plants fertilized with potassium, compared to plants in the control group. This result underlines the efficacy of potassium in promoting root development, which is essential for the agronomic performance of radish.

This positive response to the gain of MSR exemplifies the importance of adequate nutrition with this nutrient for the production of plants that store reserves in subterranean organs, largely due to the fact that K is a nutrient that participates in the activation of several enzymes during the biosynthesis of photoassimilates, transport of carbohydrates from the source (leaf) to the reservoirs or drains (roots) and enzymatic activator of starch synthesis (TAIZ & ZEIGER, 2013).

However, the results found in the present study differ from those reported by Souza et al. (2015), who studied the effects of the time of application and doses of potassium fertilizers for radish crops and did not observe positive effects of this nutrient on MSR at any time of application.

The literature on potassium nutrition in radish is still scarce, revealing a significant gap in this field of study and highlighting the need for further research (SOUZA et al., 2015). This scarcity of studies conducted so far highlights the importance of deepening knowledge about the role of potash in the development of this crop.

The disparity in the results found in this study in comparison with the existing literature on the influence of potassium fertilization on root dry matter and other parameters indicates the complexity of the topic and the variability of plant responses to nutritional management. While some studies, such as those by Cecílio Filho et al. (1998) and Maia et al. (2011), show a significant positive impact of potassium fertilization, other studies present less conclusive results.

This variability points to the need for further scientific investigations that can provide more consistent and robust results. It is imperative that further studies be carried out in order to better understand the specific conditions that affect the efficiency of potassium fertilization, such as time and form of application, influence of soil type and sources of potassium fertilizer, in order to develop more accurate management recommendations for radish crops.

The accumulation of shoot dry matter (MSPA) was significantly affected by the increase in potassium doses applied to the soil (Figure 1D), with a linear response of the data. At the maximum dose of 400 kg $^{ha-1}$ of K2O, a maximum accumulation of 0.690 g $^{plant-1}$ of MSPA was observed, representing an increase of 38.69% to the 0.423 g $^{plant-1}$ reported at the dose 0 kg $^{ha-1}$ of K2O. Coutinho Neto et al. (2010) reported that potassium fertilization significantly increased the dry matter production of radish shoots.

Souza et al. (2015) and Soares et al. (2020), on the other hand, reported that the dry mass of the aerial part of radish plants was not affected by the application of K. According to Filgueira (2008), topdressing potassium has shown few satisfactory results in some vegetable crops. However, this fact, according to Coutinho Neto et al. (2010), is dependent on the initial levels of K in the soil and the amount of K supplied, a fact observed in this study, since it was found that the increase in K doses promoted significant increases in the dry matter of the shoots of radish plants.

It is important to highlight that, in the aforementioned studies by Souza et al. (2015) and Soares et al. (2020), potassium fertilization used restricted doses up to the maximum concentration of 120 and 210 kg ha-1, respectively. In our study, we investigated the influence of potassium (K) fertilization up to a maximum dose of 400 kg ha-1. This increase in the range of doses applied may be a significant factor in the observed response of radish plants to potassium fertilization.

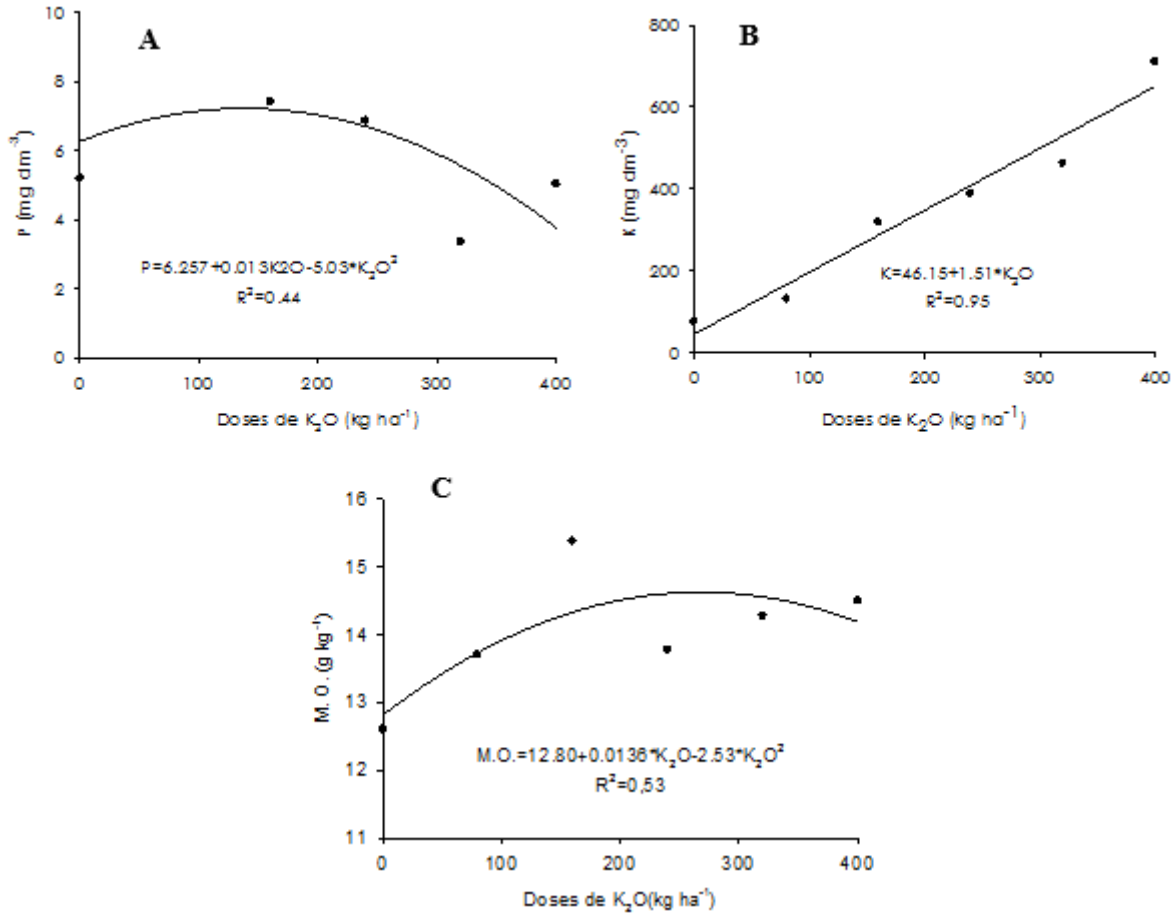
The variation in K doses used in the different studies highlights the need to adopt experimental regimens with a wide range of doses. This will allow a more detailed and accurate assessment of the dependence of potassium dose and its impact on dry matter production, both of the roots and of the aerial part of the plants. The inclusion of a variety of doses in future trials may elucidate the dose-response relationship in a more cohesive manner, allowing a better understanding of the optimal management of potassium fertilization for radish crops.

Our study suggests that higher doses than those traditionally investigated may offer greater gains in MSPA, prompting a perception different from that found in some studies in the literature to date. Therefore, further investigation is important to optimize the use of potassium.

Regarding the phosphorus content in the soil, it was observed that in the highest doses of potassium applied, there was a decline in the amount of this element in the soil (Figure 2A). Demonstrating that the fertilization of the radish crop, with the highest doses of K2O supplied to the plants under the conditions of the present work, may be the one that allows a more balanced absorption of nutrients by the radish plants, an event evidenced by the higher productivity of the crop at these doses (Figures 2A and 2B). According to Coutinho Neto et al. (2010), due to its rapid growth and short cycle, radish cultivation requires high levels of soil fertility, demanding large amounts of nutrients in a short period of time.

The amount of phosphorus absorbed by radish plants is one of the most influential in crop productivity, as this is recognized as one of the most important elements for plant metabolism, as it plays an essential role in the establishment and development of plants, providing beneficial effects both in the root system and in the aerial part (PRATES et al., 2012).

Figure 2. Phosphorus (A), potassium (B) and organic matter (C) in radish cultivation as a function of potassium doses.



For the K contents in the soil, a linear increase is observed with the increase of the doses of potassium fertilizer added to the soil (Figure 2B). Important results for the productivity of radish plants, according to Oliveira et al. (2014), even though they have a short growth cycle, they form a large amount of mass in the storage organ, requiring large amounts of potassium and nitrogen, and these two nutrients are needed in greater quantities for root formation (ISLAM et al., 2011).

On the other hand, the organic matter (M.O.) content in the soil was affected by the K rates applied. Lower values for OM were found in areas where potassium fertilization did not occur (Figure 2C). An increase of 13.75% of M.O. was obtained in the areas with the maximum estimated dose of 247 kg $^{ha-1}$ of K2O, reaching a value of 14.61 g $^{kg-1}$ in relation to the areas without K.O. application 2010).

The results obtained with potassium fertilizer application suggest that radish cultivation responds positively and differently to increasing doses of potassium. It is known that in radish cultivation, as in many others, there is the problem of providing a correct amount of fertilizers that can lead the plant to maximum production. According to Marschner (2005) and Malavolta (2006), for a correct recommendation of fertilizers, it is essential to know the nutritional dynamics of the plant, which is a function of the speed of plant growth and cultural ecophysiology, therefore, it is not recommended to extrapolate results obtained in other ecological systems.

CONCLUSION

The different rates of topdressing potassium fertilization influence the productive attributes of radish plants and the levels of K, P and M.O of the soil;

The increase in K doses applied as topdressing promotes higher plant productivity when compared to the non-application of this nutrient;

Under the conditions in which the experiment was carried out, it is recommended to provide 400 kg $^{ha-1}$ of K2O for radish cultivation.

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A proposal for a didactic sequence for the teaching of mobile cellular communications, integrating concepts of High School physics

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ABSTRACT

Developing and implementing didactic proposals to boost the High School Educational System are extremely important actions that can be carried out by the entire community. Thus, a Didactic Sequence based on the principles of Meaningful Learning was proposed, focusing on the teaching of the content of the Mobile Cellular System (Personal Mobile Service in the official definition of ANATEL), relating it to the content of Electromagnetic Waves of the discipline of Physics in High School. The Didactic Sequence, aligned with the official documents that guide Brazilian basic education, is an instructional resource for the contextualized teaching of the discipline of Physics and the purpose of its elaboration was to contribute in a participatory way to Brazilian High School. In addition, the Didactic Sequence was taught in High School classes at the Myriam Coeli State School, located in Natal-RN.

Keywords: Didactic Sequence, Mobile Cellular System, Physics, Middle school.

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INTRODUCTION

Surveys that prove the deficit in teaching-learning in schools, especially in disciplines involving calculus, as well as students entering STEM courses with deficits in physics and mathematics content, are themes widely studied in research and disseminated in the literature (TONIN, 2017). In this regard, it is essential that, in addition to testifying to these facts, there are initiatives to mitigate this problem. It should be considered that the contribution of the academic community in the educational formation of individuals, in order to minimize the difficulty that students have in the initial cycles of exact courses, can be initiated in the school phase, aiming that, by being present in the school life of the young person in high school, the academic community is able to corroborate so that the student has a greater preparation to continue in the engineering career, consolidating knowledge in a contextualized way (BARROS et al. 2012).

From this perspective, a Didactic Sequence (DS) was proposed, aimed at high school students, which was taught to a group of students from the public school system in the state of Rio Grande do Norte. And it was intended to exemplify how high school subjects can be passed on to students in a contextualized way with applicabilities seen in everyday life and studied in greater depth in higher education. For the construction of the Didactic Sequence, the theme of Cellular System in Telecommunications was chosen, since cellular mobile telephony is one of the fastest growing services in the world (Newton; Helou; Gualter, 2019) and young people are avid consumers of cell phones and the technologies associated with them (LIMA, 2006).

In addition, the theme is present in the Complementary Educational Guidelines to the National Curriculum Parameters (PCN+), in which the teaching of cellular telephony devices is suggested, describing antennas as good examples to explain the modulation, emission and reception of waves. In addition, the theme is also found in the Curricular Reference of Potiguar High School, document based on the Curricular Guidelines for Basic Education. The Referential presents the curricular matrix of the Physics component and among the skills expected of the student, it is to recognize wave phenomena, accompanied by the necessary conditions for their occurrence, and the objective of the knowledge of this aspect is the subject of Waves. Finally, the didactic suggestion presented by the document is the discussion about the Cellular System.

The document of the Curricular Guidelines for Basic Education reports that it is of paramount importance for educators to understand the proposals for structured themes, such as the one described, brought by the PCN+, assimilating them and creating consistent pedagogical projects, aligned with their educational institution, its circumstances and opportunities for implementation. Thus, the DS presented proposed a way of teaching physical principles, in a way associated with the Cellular System - which consists of Mobile Stations, Base Radio Stations and a Mobile Switching Center (RAPPAPORT, 2008) - seen in the Telecommunications Engineering course.

Knowing that the rise of science requires rules and methods that aim at new knowledge (MASSON, 2005), the elaboration of the written Didactic Sequence was based on Ausubel's Theory of Meaningful Learning, which is directed to learning in the classroom. To show how school learning occurs, Ausubel separated it into rote learning and meaningful learning (PELIZZARI *et al*, 2002). He defined that machine learning is stored in the human cognitive system in an arbitrary way, without attributing meaning. Meaningful learning, on the other hand, occurs when new information is linked to knowledge that the individual already had in his/her cognitive, thus managing to acquire meaning to the knowledge and build a conceptual hierarchy (MOREIRA, 1999). Thus, a meaningful way of learning was proposed, with content assimilation.

In this line of reasoning, the Theory of Meaningful Learning shows that the student must have in his cognitive structure some previous knowledge of a given subject so that he can anchor new related knowledge (SILVA; PÉREZ, 2018), thus, the study of the Mobile Cellular System is relevant, as it is part of the student's experience, being a tool for their communication, social interaction, and access to information (LIMA, 2006). In this sense, by recognizing and valuing the previous knowledge that students bring with them to school – which should not be underestimated, given their ease of access to information – students' interest in perceiving the importance and effectiveness of science in their daily lives is aroused (CELEDÔNIO, 2016).

Furthermore, another aspect brought up by Ausubel points out that the material used for the class must be potentially significant (MOREIRA, 1999), and must be applicable in the context of the student's life, providing examples, analogies, and illustrations (MOREIRA; MASINI, 2011). Thus, fundamentals of Physics were presented in a contextualized way with aspects of cell coverage, propagation and transmission/reception of signals. Using cell towers for example, Base Stations, antennas and transmission equipment that are geographically close to the student and/or that are part of their field of experience.

In this way, by using local examples, students are able to relate the concepts covered to their own reality and context in a more direct way (BRAZIL, 2006). This makes the content more meaningful and relevant to them, making it easier to understand. In addition, examples close to the students allow them to visualize in a concrete way how mobile communication technologies are present in their surroundings, strengthening the perception of the importance and impact of these technologies in their daily lives.

In addition, another proposed approach was to carry out a computer simulation, in which a feasibility study was carried out for a Point-to-point microwave radio link, within the city of Natal, through the use of the LINKPlanner software. The activity allowed students to understand in practice how transmission works in a wireless network, in addition to the analysis of the main parameters involved, such as signal strength, interference, transmission rate and distance between devices. In

this way, the intention was to provide an understanding Basic Operation of the Telecommunications System, its limitations, and possible solutions to ensure efficient communication. The simulation also provided the active participation of the students, contributing to the development of analytical and problem-solving skills, since it is a feasibility study.

Finally, it is emphasized that meaningful learning offers notable advantages, both in terms of enriching the student's cognitive organization and later recall and application in new learning experiences (PELIZZARI *et al*, 2002). Thus, the work was set out to develop a Didactic Sequence, based on Ausubel's Learning Theory, as a proposal for pedagogical enrichment in High School in the state of RN, and aimed to introduce students to other forms of knowledge that will subsequently be a contribution of experience to higher education.

DEVELOPMENT OF THE DIDACTIC SEQUENCE

There are a large number of paths that can be followed when developing a Didactic Sequence (DS), which vary according to the teaching objectives and characteristics of each institution. Therefore, it is up to the elaborator to select, prioritize and organize the specific path to be followed (BRASIL, 2006). The pedagogical project developed encompassed three main sections - defined in the **Table 01 -** which were the planning of the SD, the elaboration of the DS and the execution of the SD.

Table 01: Design of the procedures developed.

Sections	Procedures	What has been accomplished
I	Didactic Sequence Planning	▪ Definition of the topics taught in the field of Physics and their applicability. ▪ Definition of the pedagogical contribution used to enrich the teaching-learning process. ▪ Definition of the target audience to which the Didactic Sequence was taught.
II	Elaboration of the Didactic Sequence	▪ Elaboration of the visual presentation given to the students. ▪ Elaboration of the practical activity developed (feasibility study of point-to-point microwave radio link).
III	Execution of the Didactic Sequence	▪ Execution of the Didactic Sequence in the educational institution.

PLANNING OF THE DIDACTIC SEQUENCE

Topic taught

The PCN+ present six structured themes to assist the teaching of Physics, highlighting the importance of these themes for the organization of educational practice. For the elaboration of this Didactic Sequence, the theme proposed by the PCN+ called "Electrical Equipment and Telecommunications" was chosen. Within this theme, the thematic unit entitled "Senders and Receivers" was selected.

For the chosen thematic unit, the document states that today much of the information that circulates on the planet is through electromagnetic waves, so it is up to the student to understand the dynamics of how televisions and radios emit information. In addition, the document describes that antennas play a relevant role in explaining the process of modulation, transmission and reception of waves, as occurs in cell phone devices. Thus, in the planning of the DS, it was delimited that telecommunications subjects will be taught, with emphasis on the teaching of Electromagnetic Waves.

For the choice of the topic, it was also taken into account that the field of electromagnetism has a considerably abstract nature compared to mechanics, which can pose a challenge for students. This is because certain concepts, whether fundamental or more advanced, are not always properly understood due to the absence of models that can be easily related to their everyday experiences or previous knowledge (FERREIRA *et al*, 2019).

Pedagogical contribution

Moreover, in order for a transformation in the way the educational system works, it is essential not only to reformulate content, but also to rethink the methods used (PELIZZARI *et al*, 2002). Thus, the Theory of Meaningful Learning was articulated as a pedagogical contribution to the elaboration of DS, according to Ausubel. Considering that it is a Theory aimed at meaningful learning in the classroom (MOREIRA, 1999) and at school, the didactic relationship is established when there is a teaching project with the intention of learning (BRASIL, 2006).

David Ausubel's Theory of Meaningful Learning reports that meaningful learning occurs when new information is linked to knowledge that the individual already had in his or her cognitive, thus managing to acquire meaning to knowledge and build a conceptual hierarchy (MOREIRA, 1999). Thus, Meaningful Learning occurs from the connection between new information and previous knowledge, already existing in the individual's cognitive structure.

In this way, a pertinent pedagogical approach is created, since valuing the previous knowledge that students bring to school, in this case, knowledge about cell phones, allows capturing students' attention and concentrating efforts so that they recognize science as a relevant and effective branch of knowledge in their daily lives (CELEDÔNIO, 2016).

Alvo audience

The National Curriculum Guideline reports that considering the diverse and unequal reality of a large number of adolescents, young people and adults, Secondary Education must be committed to dealing with this situation, with the objective of seeking the transformation of the school,

recognizing that, although it is not capable of solving social inequalities by itself, it can contribute to social inclusion, providing access to science, technology and culture.

Subsequently, in order to ensure quality in the school, it is necessary that everyone involved in the educational process is committed, knowing that social responsibility is an educational principle (BRASIL, 2013). In addition, education is a right of young people guaranteed by the Federal Constitution of Brazil, and a duty not only of the State but also of society (UNICEF, 2021).

In this context, it is essential to develop pedagogical proposals that aim at the application of educational strategies to leverage high school education. Proposing, establishing, and progressively executing pedagogical projects allows not only to improve student learning in high school, but also fosters curricular diversity and establishes connections between theory and practice in the fields of science, work, and technology (BRASIL, 2016).

In this vein, this project was structured to be applied in high school classes, aligned with the physics subjects present in the National Curriculum Plan (PCN), which are part of the students' curricular structure.

ELABORATION OF THE DIDACTIC SEQUENCE

The elaboration of the Didactic Sequence was divided into two stages, namely, the elaboration of visual elements for the teaching of the classes and the example to be demonstrated of the feasibility study of point-to-point microwave radio link by means of software. **Table 02** will show that each activity is linked to the development of skills in the discipline of Physics, as established by the National Curriculum Parameters (PCN).

Table 02: Competencies to be developed by high school students through SD.

Activity performed by the student	Competence to be developed
Attend a class on Mobile Cellular Communications, with integration of Physical concepts.	Research and understanding: • To understand the Physics present in the world in which we live and in technological equipment (BRASIL, 2006).
Point-to-point link feasibility study.	Research and understanding: • Construct and analyze problem situations in physics and identify solutions (BRASIL, 2006). • Discovering the functioning of technological devices (BRASIL, 2006).

Presentation making

It is essential that the student perceives the meaning of Physics at the moment he is learning, and not at some later time, and it is crucial to achieve this goal, to take into account the students' experiential world, their close reality and the objects and phenomena with which they effectively deal (BRASIL, 2006).

Thus, in addition to bringing a theme that is present in the students' daily lives, the main examples of the Mobile Cellular System should be elaborated according to the geographic location of the school in which DS is being taught.

In addition, the slides should focus on a progressive construction of ideas of the topic addressed, starting from the basic principles of electricity and magnetism to the practical aspects of cell telephony, trying to bring the subject clearly and with plenty of visual elements. So that a potentially significant material would be produced.

Breakdown of activities

Next, the contents to be taught in the Didactic Sequence and the objectives linked to them will be listed in detail. As well as strategies on how to explore the themes during classes.

Content:

Introduction to Electricity and Magnetism:

- Benjamin Franklin and his contributions.
- A little history of Electromagnetism.

Objectives:

Understand fundamental concepts that have contributed to the understanding of electromagnetism.

Strategies:

The class should begin by explaining to the students that the subject of electromagnetic waves will be explored, highlighting how telecommunications use them to enable wireless communication. It should be explained, that the physical processes behind the connectivity of mobile devices and how the laws of physics play a crucial role in their functionality will be discussed.

It can be explained that several types of waves are part of our daily lives, such as the waves used in telecommunications (radio waves, television waves, and microwaves).

Therefore, tell the story of Benjamin Franklin and minister a little about the history of Electromagnetism and Electromagnetic Waves. Aiming for the student to make the connection of physics not only as an applied mathematics but also as part of history. Since, many times, the disciplinary contents presented in textbooks are so simplified that the student does not feel the need to ask where this knowledge came from (BRASIL, 2006). The idea is to pass on to the students that, in order for us to reach the stage of knowledge about telecommunications that we currently have, many thinkers made their contribution.

Thus, dedicating part of the class to discuss these scientists and their discoveries in an educational environment is an appropriate method to broaden the student's understanding of physical content and human aspects, in addition, this practice encourages the participation of students who have a greater affinity with the human sciences (FERREIRA *et al*, 2019).

Content:

Electromagnetic Waves:

- Fundamentals of electromagnetic waves.
- Frequency and Wavelength.

Objectives:

Introduction to the fundamentals of electromagnetic waves, including frequency and wavelength.

Strategies:

Explain to the student the explanation of electromagnetic waves. In which, the student must have the understanding that they are formed by two variable fields, one electric and the other magnetic, which propagate. And that this propagation can occur in a vacuum and in certain material media. In addition, explain the concept of frequency and wavelength, with the addition of talking about examples of electromagnetic waves, in which radio waves can be mentioned, including AM (Amplitude Modulation) and FM (Frequency Modulation), TV waves, microwaves, among others.

Questions that can be asked at this stage of the project, aiming at the participation of the students are "Why is it impossible for us to hear, here on Earth, a solar flare?" and/or "Why do we perceive the light of a lightning bolt before hearing the sound of it?"

Content:

Antennae:

- What is an antenna?
- Types of antennas and examples.

Objectives:

Introduction to antennas as essential components in the transmission of electromagnetic waves, as well as explain their operation.

Strategies:

In this part of the class, it should be exposed to the student that after the discovery of electromagnetic waves, electronic devices were created that were capable of emitting them in space, this device being called antennas. The student must understand the fundamentals that make the antennas able to transmit or receive information at well-defined frequencies. The presentation of how an antenna works is a key point in the presentation of DS, as students are users of electronic devices that need an antenna signal, but most do not know how they work in full (OLIVEIRA, 2018). It is important to know that antennas can be divided into different categories according to their applications and that their geometric shape is crucial for their operation.

In addition, antennas are good examples to explain the modulation, emission and reception of electromagnetic waves. A useful resource in explaining the concept of electromagnetic wave radiation is its analogy with soap bubbles, providing a clearer understanding for students. By comparing the propagation of an electromagnetic field, generating waves that close and radiate away from their sources, we can visualize this situation in a similar way to a soap bubble breaking off from a straw. As a sufficient amount of air is accumulated, the soap bubble grows in relation to the point of origin until it detaches (RIBEIRO; MARETTI; CARNIELLI, 2019).

Content:

Signal Transmission:

- FM Radio Broadcasting.
- TV station broadcasting.

Objectives:

Explore how signals are transmitted through electromagnetic waves, starting with radio and TV.

Strategies:

The purpose of this content is to explore how signals are transmitted through electromagnetic waves, bringing the example of radio and TV broadcasting. Through these examples, it is possible to work on different phenomena of physics that allow the waves to propagate through space and reach the receptors.

The point that can be worked on is the explanation that in order for these waves to be message carriers, they must be modulated, that is, they must undergo variations in their amplitudes (AM) or in their frequencies (FM). In which the difference between AM radio and FM radio can be explained to the student.

Other points that are important to work on in these slides is the conversion of the audio signal into an electrical signal. Explain that the audio signal is frequency modulated. And the frequency-modulated signal is then sent to the broadcaster's transmitter, where it is amplified. Making it clear to the student that this process is aligned with the fundamental laws of electromagnetic waves, which include straight-line propagation.

Continue the reasoning, showing that the transmitting antenna converts the electrical signal into electromagnetic waves, which are radiated into space, explaining to the student aspects such as the antenna that is designed to direct the signal in the desired direction, taking into account polarization and orientation, and mainly reinforcing the physical concept of radiation.

At all times in this process, mentions must be made to the field of physics, such as the explanation that electromagnetic waves propagate through space, undergoing reflections and diffractions. And that interference between waves can occur, affecting the quality of the received signal. Thus bringing in the physical concepts of reflection, diffraction and interference.

To conclude, the student may be asked if the waves captured by the receiving antenna should be converted into electrical signals, so that through the answers the doubts about the operation of the antennas are solved.

Content:

Cellular System:

- Introduction to the Cellular System.
- The three components of the Cellular System.
- Examples of Telecommunications Towers.

Objectives:

Introduction to the cellular system as a specific application of signal transmission.

Strategies:

In this content, the introduction is made to the cellular system as a specific application of signal transmission. It will be showing the student that the The main characteristic of mobile telephony is mobility, in which the user can establish telephone contacts even when moving. Showing that this is possible because communication is done without the use of wires, using electromagnetic waves. It is of fundamental importance to talk about the physical concept of the frequency used, to awaken the attention of the students that the telephone when it is within its coverage area is located even inside cars, such as inside clothes or inside our homes, showing that the wave in these cases is detected after undergoing reflections, refractions and diffractions. And that the

waves used in cellular telephony diffract very easily in small cracks, such as in the almost invisible holes in textile weaves (NEWTON; HELOU; GUALTER, 2019).

In addition, in this phase of DS, the student will be shown that the cellular system is formed by three components, making a brief explanation of each one of them. Explain the Mobile station, which is the cell phone itself, the base station, which is the antenna responsible for forwarding the calls, and the switching and control center, which is the brain of the system, responsible for managing calls and connecting to other base stations (NEWTON; HELOU; GUALTER, 2019).

Looking back on what has already been studied during this SD, the student may be asked the question "What are the main components of a mobile device (such as a smartphone) that make it a Mobile Station?", to form and reinforce points already worked on such as the antenna. Another question that can be asked is "What is the importance of mobility in a Mobile Station?". Leaving this moment so that students can participate in the class, with questions and answers.

tag. It is important to show the student examples of RBS concentration in the city in which he lives. This moment of the presentation should explain a little more about the RBS and bring questions such as "Why do you think that when walking on the streets we find so many antennas?". In addition, this part of the DS opens space for interesting discussions that can arouse the student's interest, such as 3G, 4G and 5G technology, the discussion on non-ionizing radiation, how the frequency band is regulated, discussion on the internet of things and satellite communication, among several other topics that can be incited by the teacher for the development of productive and enriching conversations of the student body.

Content:

Cell Structure:

- Cell and its importance.
- Base Station.

Objectives:

Explain the importance of the cell in cellular telephony, along with the Base Radio Station and comprehensive examples such as antennas in buildings.

Strategies:

In this part of the lesson, we will go into new details of the Cellular System, the first of which is the Cell. In which, it should be conveyed to the student that the coverage of each base station transmitter is limited to a small geographical area, called a cell, so that the same radio channels can be reused by another base station located at a certain distance (RAPPAPORT, 2008).

It is interesting to show the cell phone system as a whole, in a certain geographical delimitation. In which, students must be told that the geographic coverage of a cellular phone network is managed by several Base Radio Stations (RBS), which are installed in strategic locations to ensure the provision of services. And the geographic coverage strategy involves dividing the service area into cells, and each cell is serviced by an RBS.

The student should understand the main aspects of cell opening, such as the fact that the service area is divided into relatively small cells, to improve spectral efficiency and allow the reuse of frequencies in different cells, increasing the capacity of the network.

A very important point of physics that can be worked on at this point is power, in which the student can be reminded of the concept of power and talk about the transmission power of RBS and how they should be adjusted to ensure an effective range within each cell.

Finally, show an example of RBS close to the student, to reinforce past knowledge. The student may be asked, "We know that each cell is served by an RBS, but what equipment is part of an RBS?" After the answers given, a brief survey of the antennas and transmission and reception equipment can be made.

Content:

Mobile Telephony:

- Example of cell phone near students' school.
- Cellular antenna in the mall.
- Antennas on the façade of buildings.

Objectives:

Include practical examples close to the students' school to contextualize the concepts. And other examples with the antennas present in the mall.

Strategies:

Explain that RBS are installed in strategic locations such as towers, tall buildings, or elevated structures to ensure effective coverage. And that, careful network planning is carried out to optimize the arrangement of RBSs, taking into account factors such as population density, geographical features, buildings and natural obstacles.

Knowing that the student already has a good knowledge base of Mobile Cellular Telephony, it is essential Use local examples, so students can relate the concepts covered more directly to their own reality and context (BRAZIL, 2006).

One idea is to explore the geographical location of the students, presenting the school as a reference point for the example to be developed. Present the base stations that surround the students' school, showing in an illustrative way, the infrastructure behind the mobile communications they use in the school. Knowing that the role of contextualization in teaching is to present scientific knowledge so that, a posteriori, the student feels the need to insert it in his field of perception (BRASIL, 2006).

Thus, it is essential to present the RBS's, which are often imperceptible in the field of observation of students, despite being pillars that enable the connectivity of their cell phones. To illustrate this concept in a practical way, a simple example can be proposed, involving a RBS near the school. A suggested proposition to students is as follows: "Let's imagine that you are at school, concentrating on class, when suddenly your cell phone rings, and it is a call from your mother. What allows this call to happen involves the base stations close to the school. These stations act as messengers, transmitting your mother's voice to your cell phone and vice versa." Thus, the student can have the easy understanding of RBS's as invisible "messengers" that ensure that mobile communications happen efficiently, allowing them to receive important calls.

The physics behind mobile communication must be presented. Exploring that when the mother in the example spoke on the phone, her voice is converted into electrical signals, which are then transmitted as electromagnetic waves by the antennas of nearby base stations. Waves that travel through space, overcoming obstacles and traveling distances until they reach the antenna of the student's cell phone. I remind the student that, in the process of reception, the antenna of his cell phone converts these electromagnetic waves back into electrical signals, enabling him to hear his mother's voice.

Recapitulating, in this scene, fundamental concepts of High School Physics, such as frequency, propagation of electromagnetic waves, influence of distance on signal strength and absorption by obstacles present in the environment. Thus, students can connect a personal experience to the science that shapes the technological world.

Content:

Propagation of Signals:

- Reflection, refraction and scattering in mobile telephony.

Objectives:

Address the phenomena of reflection, refraction, and scattering that occur in the propagation of signals.

Strategies:

This part of the Didactic Sequence will reinforce to the student that when using the cell phone at school to send messages, make calls or simply surf the internet, one is using physics phenomena. In which, the properties of the waves involved in this process can be deepened. Concepts such as reflection, direction, diffraction and scattering are explored, all of which are essential to understanding how waves move and interact with the environment when they reach your cell phone.

It is also the purpose of this content to connect the context of Base Radio Stations (RBS) with the urban dynamics, using the specific example of the students' city. The idea is to show students that just as it happens geographically close to their school, there is also a mobile communication infrastructure in every city where they live, with strategically distributed RBS. Illustrative images should be shown, in which the presence of these RBS in the city can be highlighted, revealing how they form an intricate network to ensure efficient coverage.

By means of an illustrative drawing of cell coverage, the arrangements of RBS in cells should be discussed. In which, the student must have the knowledge that each RBS occupies a cell, with its overlapping coverage areas, forming a continuous mesh. And this arrangement of RBS in cells is crucial to optimize network capacity and ensure stable connectivity, allowing people to move between the entire city without losing signal.

Content:

Call Management:

- Mobile mobility.
- "Handoff" ("Handover").

Objectives:

Explore how mobility is managed on mobile, including Handoff.

Strategies:

This topic brings up aspects of cellular mobility, an essential feature of mobile communications. Understanding how it influences signal quality is crucial. The student should be shown that when moving with a cell phone, one is constantly moving in relation to the RBS and this generates a dynamic between the signal level and the distance from the cell phone to the tower.

In this part of the DS, the concept of power can be addressed. Showing that, the signal strength decreases as the distance between the cell phone and the tower increases. An easy-to-understand analogy to make is to compare this to a flashlight, saying that the farther away you are from the light source, the less intensely you will perceive it. Similarly, the farther away you are from

the tower's range, the lower the signal strength your cell phone receives. This phenomenon can be explored in the classroom, allowing students to understand the inverse relationship between signal strength and distance.

Here, too, the concept of handoff can be worked on, which allows a call to proceed without interruptions when the user moves from one cell to another (RAPPAPORT, 2008). And the concept of roaming, arousing the curiosity of students with the following question: "How do we receive calls when we change state?", knowing that to understand this process, it is crucial to understand how mobile communication networks collaborate to ensure a continuous experience, even when we are outside our area of origin.

It should be explained that when we change state and enter a new service area, outside the coverage of our home operator, roaming is triggered. In this scenario, the local operator temporarily takes over the management of our mobile device. In which can be mentioned the process of identification and registration of the mobile device, communication between operators, call redirection and mobility since, during roaming, the CCC also monitors the location of the mobile device and manages handovers between cells as necessary to maintain the continuity of communication.

Content:

Network Infrastructure:

- All Base Stations connected to a CCC.
- Interconnection of Telephony between different cities (Microwave Radio Links with Repeaters).
- Repeaters.

Objectives:

Explain how base stations are connected and the interconnection of telephony between different cities.

Strategies:

It should be noted that all RBS's in a mobile communication network are interconnected to a Switching and Control Center (CCC). And that, the CCC plays a central role in the coordination and efficient management of communication traffic. Functioning as the brain of the network, facilitating the exchange of information between RBS and mobile devices, as it manages resource allocation, device authentication, call and data routing, as well as monitoring signal quality.

In this part of the SD, two crucial elements in the mobile communications infrastructure will be addressed: repeaters and telephony interconnection.

It should be noted that repeaters play an essential role in expanding coverage and overcoming physical obstacles. Showing that they are strategically installed in elevated locations, such as towers, to receive and relay signals, increasing the effectiveness of mobile communication.

Knowing that repeaters play a vital role in overcoming rough terrain, tall buildings, and other barriers that could hinder signal quality, in this part of SD it can be talked about interference and different wavelengths. An interesting analogy is to compare this process to the echo of a voice on a mountain, where repeaters "reflect" the signal to ensure wider and more efficient coverage.

It is important to take care of the interconnection of telephony. The student is presented that this refers to the connection between different communication networks and this aspect is crucial to enable calls and data exchanges between different carriers and geographical regions. Teaching that by connecting the various parts of the telephone system, interconnection allows users to communicate without obstacles, regardless of the carrier of origin or geographic location.

Point-to-point microwave radio link design

Real-world problems tend to provide more creative solutions and are presumably more meaningful and stimulating than artificial problems (BRASIL, 2006). In this way, it is proposed that students do the feasibility study of a point-to-point microwave radio link between points, chosen by the students, in the city where the DS is being presented.

To do this, two specific software is used for this purpose, Google Earth and LINKPlanner. In this experiment, the following should be addressed: the geographic study via software for the allocation of RBS and possible repeaters, the importance of having a link with direct targeting and how some parameters, such as frequency range, tower height, antenna height, antenna gain, influence the link. The entire demonstration should be done by contextualizing the physical principles that govern the functioning described.

This phase of the teaching of the class has the direct participation of the students, in which they are encouraged to actively participate in the construction of the bond. Students are asked questions such as "Where do you believe is a suitable point to allocate an RBS?", "In an urban environment, what geographical barriers can be found so that the signal does not reach the receiving antenna? And in a rural setting?" What is the relationship between the frequency used and the distance of my link? Will any frequency be appropriate?"

Thus, by involving the student in challenges, estimating, quantifying or seeking solutions to real problems, it is intended to detach the paradigm that has been occurring in the teaching of

physics, by presenting physical knowledge only as a final result, leading students to conclude that there are no more relevant challenges to be solved (BRASIL, 2006).

EXECUTION OF THE DIDACTIC SEQUENCE

The proposed activities were developed in high school classes at the Myriam Coeli State School of Natal-RN, with two 3rd year classes and one 2nd year class, totaling 50 students who participated in the project.

The planned activities were developed in a time of 120 minutes. It takes 80 minutes to teach the dialogued class with presentations in the *data show* and 40 minutes to elaborate and discuss the radio link microwave point to point together with the students. Thus, the described time of 120 minutes for the application of the DS is composed of 2 classes of 40 minutes for the dialogued class with presentations in the *data show* and 1 class of 40 minutes for the elaboration of the radio link.

Figure 01 shows students from different shifts in the classroom watching the DS presentation.

Figure 01: Students attending an expository class on Mobile Cellular System.



In the initial minutes of the explanation, it was observed that the students did not formulate many questions and participated through stimuli by answering questions such as "Why in a storm, do we first see the light, and only then hear the sound of thunder?". However, the study of electromagnetic waves, initially with the absence of questions from the student body, took on a greater meaning when linked to the functioning of the cell phone, in which a greater participation of students interacting with the class through questions and answers was observed.

The above shows that it is of paramount importance that the learner demonstrates a willingness to establish relationships between the contents (MOREIRA, 1999), and that this disposition can be stimulated with the student's understanding of the relevance and applicability of knowledge (MOREIRA; MASINI, 2011).

As the presentation progressed, it was also observed a greater participation of the class with questions when the teaching of telephone call management began and the demonstration of examples

of Cellular Telephony that were geographically close to the school, which reinforced once again the idea that by using local examples, students are able to relate in a more direct way the concepts addressed with their own reality and context (BRASIL, 2006).

During the presentation, the students were shown that school subjects are the foundation of the functioning of what surrounds them. Since, many students who currently attend an educational institution unfortunately see knowledge as something distant from their reality, with little use or relevance for their daily needs (PELIZZARI et al, 2002).

In addition, after presenting local examples and demonstrations on how cellular mobile communication occurs, positive feedback was obtained from the students' participation. During the activities, in which they raised questions such as "How is an international call made?", "Can the cellular system affect our health with radiation?", and "What about the internet over Wi-Fi? How does it work?" Thus, the active interaction of the students and their thought-provoking questions demonstrated a significant engagement with the concepts presented, further enriching the learning experience.

In addition, it was noticed that during the exhibition of the radio link experiment, the constant interaction between theory and practice, through the construction of the link via software and stimulation of the active participation of the students were key elements throughout the exhibition, in which the students were enthusiastic, especially to choose the locations of allocation of the RBS's and the link parameters. such as tower height and antenna height, which contributed to the consolidation of the concepts presented. Reinforcing the educational principle that in order to assist and contribute to the construction of students' knowledge in school disciplines, the method of contextualizing the subjects that are seen in school and their applicability experienced by the student in the technological field is effective (BRASIL, 2006) and that in teaching, one must take into account the students' experiential world, their close reality and the objects and phenomena with which they effectively deal (BRASIL, 2006).

Finally, at the end of the lecture and radio link project stages, each student was given a sheet with six questions related to DS, so that the students' opinion about the DS taught could be surveyed. **Table 03** will present the first five questions asked, as well as the students' answers. It was reported that the student could answer the questions with "YES" or "NO".

Table 03: Questions asked to students at the end of the DS administration, with their respective answers.

Quiz Question:	Number of students who answered **YES** to the question:	Number of students who answered **NO** to the question:
Did the presentation contribute to increasing your interest in the discipline of physics?	42	8
Has the integration of physics concepts with the Cellular System made learning more interesting and motivating for you?	41	9
Do you feel that the class has broadened your view of the practical applications of physics in the real world?	48	2
Did participating in this project lead you to reflect on your career choice?	16	34
Do you believe that the experience gained from the project can be useful for your future academic or professional trajectory?	31	19

Something relevant, knowing that, in future moments, the school and the teacher assume a secondary role, and it is expected that the student will be able to establish learning relationships independently, with the knowledge acquired at school (BRASIL, 2016).

Overall, the positive impressions of the feedback indicate that the Didactic Sequence was well received, contributing to the students' understanding of the topic addressed.

RESULTS

The Law of Guidelines and Bases of National Education (LDB), highlights in item VIII of article 41, that it is the duty of Higher Education to exercise its function in promoting the democratization and improvement of basic education, through the implementation of extension programs that bring the two educational stages closer together. In this sense, the extension project entitled "A Contribution of Fundamentals of Telecommunications to Support the Learning of Physics in High School" was created by the Department of Communications Engineering of UFRN, with the aim of bringing together the spheres of Higher Education and Basic Education, meeting the established legal guidelines.

This Extension Project aims to work in high schools in order to contribute to the increase in the motivation of students for the study of Physics, exposing a direct connection between theory and practice, with the presentation of didactic material in schools.

Thus, the Didactic Sequence for the Teaching of Mobile Cellular Communications, integrating concepts of High School Physics, is a contribution of the Telecommunications Engineering Course to the Basic Education of the State, knowing that, by carrying out extension programs that integrate the knowledge and resources available in Higher Education with the specific needs and challenges of High School, It seeks not only to meet legal requirements, but also to strengthen collaborative ties between educational institutions.

But not only that, the project, in addition to providing benefits such as expanding access to educational resources, also gives students the opportunity to have contact with the academic community, which is of great importance, since, by being present in the school life of the young person in high school, the academic community is able to corroborate so that the student, consolidate knowledge in a contextualized way (BARROS et al. 2012), thus enriching the educational experience in the basic education phase.

CONCLUSION

Knowing that the lack of didactic materials is a common obstacle found in educational practice initiatives (BRASIL, 2006), the written Educational Product is a tool that tries to contribute to overcome this gap in Brazilian Basic Education. By offering a structured resource, being elaborated based on a research aligned with the official documents that guide Brazilian basic education and comprehensively addressing different concepts. In addition, its adaptability allows it to be used in different contexts and levels of education, promoting accessibility and the democratization of knowledge.

Furthermore, according to Ausubel, the material used for a class should be potentially significant (MOREIRA, 1999), and should have applicability in the context of the student's life, providing examples, analogies and illustrations (MOREIRA; MASINI, 2011). Which reinforces, once again, the importance of Educational Products like this produced. Since, when the disciplinary contents are presented only in textbooks, they are presented in such a simplified way that it seems to the student that it is only necessary to memorize the formulas and the main concepts (BRASIL, 2006) and if the student is restricted in memorizing formulas without understanding the basis of the theory, it will result in a fragmented and transient knowledge (ANTONOWISKI; ALENCAR; ROCHA, 2017), characterizing Mechanical Learning (MOREIRA, 1999).

Finally, it is stated that education in high school should provide young people with the opportunity to acquire knowledge that enables them to understand and explain physical phenomena (BRASIL, 2013), which was proposed by this work.

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Scientific articles in engineering: Constituent and distinctive elements of the genre

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ABSTRACT

This research originated from the need to better understand the structure and composition of the scientific article genre, with an emphasis on the field of Engineering I. The objective was to analyze this genre in terms of its textual and discursive characteristics to aid researchers and students in writing their own articles. An exploratory and descriptive research was conducted, employing a methodology based on the rhetorical moves outlined in John Swales' (1990) CARS (Creating a Research Space) model, with further developments studied by Swales (1981; 1990; 2009), Motta-Roth and Hendges (1996; 1998), Santos (1995), and Berdanier (2019). The genre elements analyzed in detail included the discourse community, the statement of the research problem, the abstract, the introduction, and the methodology section. As a result, a mapping of the rhetorical moves and the main syntactic-semantic structures involved in each of the sections studied was created, based on their recurrence in 50 articles published in prominent journals in the fields of civil engineering, environmental and sanitary engineering, and transportation engineering.

Keywords: Textual genres, Engineering I, Scientific article.

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INTRODUCTION

Among engineers, there is a recurrent opinion that there are persistent difficulties in writing and disseminating knowledge, and those who do so construct their texts intuitively, learning from the mistakes and successes of their peers. This scenario indicates the need to investigate the existence of a specific form of writing in the area of Engineering, so that students can get to know and join this discursive community of research engineers. It is hypothesized that, by knowing the reading requirements of a genre, students and researchers could meet the expectations in the production of texts in these discursive situations in a more proficient way.

Studies related to textual genres seem to be an effective means to investigate this reality that involves the reading and production of academic texts. By approaching the text both in its materiality and as a discourse, these studies encompass a broad understanding of the text, its production and reception.

Mikhail Bakhtin, who elaborated this notion of textual genres at the beginning of the twentieth century, established that genres need to be considered in their structure, composition, and style (BAKHTIN, 2003). According to him, because of the polyphony in interactions, no speech is original or dissociated from a context. In addition, genres are always changing, as the needs of users provoke new uses and the creation of new structures. He also devised a classification for discourse genres, dividing them into two types: primary discursive genres and secondary discursive genres. The primary discursive genres correspond to those that are simpler and used in everyday life, produced within groups of human activities, such as informal dialogues, notes or letters. Secondary discursive genres, on the other hand, are more elaborate and formal, usually produced in writing and commonly present in environments that require formality, such as the scientific environment, for example. (BAKHTIN, 2003).

The concept of textual genre is complex, however, and has led to different views among researchers who distinguish between text, genre and discourse, since their definitions complement each other. Charles Bazerman (2015, p. 59), for example, states: "genres are not just forms. Genres are ways of life, ways of being. They are frames of social action." Marcuschi (2008) also contributes to this understanding, differentiating between "textual genre", "textual type" and "discursive domain". According to him, textual genres are fixed forms of structural sequences, while textual types are combinations of these forms in specific contexts, resulting in an almost infinite variety of combinations, as also pointed out by Bakhtin (2003).

In all these definitions, the influence of a conception of language related to its use in enunciation is highlighted. Bonini (2004) presents another definition of gender, to which he adds a purpose previously conceived by the discursive community. Thus, "[t]he genre demarcates, through a purpose and form agreed upon in a discursive community, a textual unit that can be constituted by

one or more enunciative actions" (BONINI, 2004, p.06). This concept brings together the notions of genre and text, since, for the author, discourse constitutes a discursive activity composed of text, purpose, context and interlocutors.

In the sphere of academic texts, each genre is differentiated by the use of structures and terms specific to a particular community, where the authors seek to insert themselves by following communicative purposes already established by the more experienced members. Swales (2009) noted that identifying a genre solely for its communicative purpose is not enough; It is also necessary to consider the textual and contextual procedures involved.

To meet the main objective of this analysis, which is the exploration of scientific articles, it was useful to observe rhetorical movements in the study of genres as proposed by Swales (1981, 1990, 2009). Both Swales and Bakhtin (2003) see language as an inseparable part of a rhetorical action, always approaching texts in relation to their use. For this reason, Swales was taken as the theoretical axis for this work. It presents the following definition of gender:

> A genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constraints choice of content and style. Communicative purpose is both a privileged criterion and one that operates to keep the scope of a genre as here conceived narrowly focused on comparable rhetorical action. In addition to purpose, exemplars of a genre exhibit various patterns of similarity in terms of structure, style, content and intended audience. If all high probability expectations are realized, the exemplar will be viewed as prototypical by the parent discourse community (SWALES, 1990, p. 58).

In a more condensed form, genres can be said to be a "class of communicative events with a shared common purpose, the exemplars of which may vary within established limits." Thus, in this study, the genre Scientific Article in Engineering is analyzed in relation to two aspects listed in Swales' definition: the communicative event and its structural and stylistic patterns. For this analysis of the genre, the intended audience is also considered as part of the discursive community that legitimizes it.

THE SCIENTIFIC ARTICLE AS A TEXTUAL GENRE

With the development of science, the exchange of information between researchers has become increasingly supported by writing. Since the seventeenth century, with the emergence of the first scientific journals, scientists began to adopt an increasingly standardized way of presenting their findings to the scientific community and society (SWALES, 1990). The knowledge constructed and established began to be systematized through these publications, mainly scientific articles and other monographic works (books, reports, dissertations, theses).

Among these genres, scientific articles are the most recurrent and impactful in the life of the scientific community, due to their timeliness and the ease of circulation of information. In the analysis of texts of this genre, structures and terms common to each area are used, fundamental for the understanding of activities and essential for communication between professionals in related areas. Therefore, it is a textual genre whose production must follow norms established by scientific writing. However, this is not always the case, raising questions about how researchers and academics elaborate their texts in comparison to the conventions of the discursive community of the genre.

In the textual procedure of analysis, the structure, content and style must be considered, covering the textual and linguistic aspects, as well as the communicative purpose, to define the genre. In the contextual procedure, gender recognition begins with the context, identifying the discursive community in terms of values, objectives, material conditions, work rhythms, expectations, genre repertoires, and norms of behavior. After identifying the genre according to the discursive community, the communicative purpose is redefined, characterizing its specificities.

The various approaches to textual genres show that, in addition to written textual manifestations, scientific articles also need to be considered for their communicative purpose and for the acceptance of the community that uses them. Writing an article is a discursive activity that presupposes the appropriate use of the genre, according to its composition, structure and style, to meet a purpose established by the academic community: to widely disseminate scientific information.

RHETORICAL MOVES

According to Swales (1990) and Aranha (1996; 2004; 2007), the elaboration of scientific articles arises from a need for researchers to disseminate their theses and seek recognition within the academic community to which they belong or in which they wish to join. The production of an article, however, depends on knowledge not only about the object of research, but also about the textual genres that comprise scientific writing and the author's discursive community. Swales (1990) states that individuals can belong to various discursive communities, varying only the shared genres. This means that each author needs to know the linguistic agreements of all the discursive communities of which he or she is a part, in order to move through them with ease and, in more restricted communities such as the academic one, to be included as a member.

According to Aranha (1996), the academic discourse is strongly influenced by the social factor, with each researcher seeking recognition for his or her work. In 1981, Swales presented his first model, known as *CARS: Creating a Research Space*[2] , in which he outlined movements that

[2] The CARS model was conceived from the observation of the structure of the Introductions of scientific articles, which were the part of the text in which the research was presented, its objectives, method and synthesis of the results. This structure was then applied to the elaboration and analysis of abstracts and expanded to other sections of the article.

could be used by the author of the article to structure the production of his abstract. These movements became known as rhetorical movements (SWALES, 1981). These movements were appropriately developed in Swales's later works, as presented in the following table:

Table 1. *CARS template* for the introduction section.

Movement 01	**Establish Territory**
Step 01 Step 02 Step 03	Claim of centrality and/or Production of thematic generalization and/or Review of previous research items
Movement 02	**Establish a Niche**
Step 1A Step 1B Step 1C Step 1D	Construction of counter-arguments or Indication of absences or Proposition of questions or Continuation of the tradition
Movement 03	**Occupy or niche**
Step 1A Step 1B Step 2 Step 3	Goal Outline Announcement of the research proposal Announcement of central findings Indication of the structure of the Scientific Article

Fonte: Adapted from Swales (1990, p. 141).

This was the milestone that encouraged several researches in this area. Subsequently, Swales (2009) improved the CARS model, from which each researcher sought to improve the analyses carried out in different areas of study.

A clear example of this was the model presented in Brazil by Santos (1995), in which, based on the CARS, the movements that guided the elaboration of academic abstracts were schematized. Santos' model was so well accepted in the academic community that it was also the object of study for other researchers, such as Motta-Roth and Hendges (1996), who, based on the analysis of abstracts in English and Portuguese, using the second model of Swales (1990) combined with the model proposed by Santos (1995), reworked the CARS model for abstracting research articles.

Table 2 and 3 show the model proposed by Santos (1995) based on the analysis of 94 abstracts of articles and the model of Mota-Roth and Hendges (1996):

Table 2: The five rhetorical movements of the summary, according to Santos

Movement 01	**Situating the research**
Submove 1	citing previous research
Submove 2	Presenting current knowledge
Submove 3	Extending Prior Research
Submove 4	Presenting a problem
Movement 02	**Introducing the methodology**
Submove 1	Indicating Key Characteristics
Submove 2	Indicating the main objective
Submove 3	Hypothesizing
Movement 03	**Describing the methodology**
Movement 04	**Summarizing the results**
Movement 05	**Discussing the research**
Submove 1	Drawing Conclusions
Submove 2	Making Recommendations

Source: Santos, 1995, p.40.

Table 3: Model reworked by Motta-Roth and Hedges

Movement 1	
Sub-function 1A	Establish professional interest in the topic
Sub-function 1B	Make generalizations on the topic
Sub-function 2A	Cite previous research
Sub-function 2B	Extend previous searches
Sub-function 2C	Counter-arguing prior research
2D sub-function	Indicate gaps in previous research -
Movement 2	**Present the research**
Sub-function 1A	Indicate the main characteristics and/or
Sub-function 1B	Present the main objectives and/or
Sub-function 2	Hypothesize
Movement 3	**Describe the methodology**
Movement 4	**Summarize the results**
Movement 5	**Discuss the research**
Sub-function 1	Draw conclusions

Fonte: Motta-Roth e Hedges, 1996, p.59.

In more recent research, Berdanier (2019) segmented the scientific article into 09 major rhetorical movements. For the study of the methodological section, we took as a basis movement 4, which refers to the description of processes and methods. In this section, you should be able to find the following steps:

Table 04: Rhetorical Movement for the composition of the methodological section

	Movement 04
Step 01	Identify research objectives or questions
Step 02	establish a justification, reasoning, or meaning related to the method
Step 03	List materials, tags, or resources
Step 04	cite established procedures and protocols
Step 05	detail research tasks, procedures, analyses, or instrumentation techniques
Step 06	Identify challenges and limitations
Step 07	explain the scientific mechanisms by which the method works.
Step 08	

Fonte: Berdanier, 2019.

From the use of these previously established models of the rhetorical movements present in the studies of the listed researchers, we sought to identify the presence of movements, functions and steps in the chosen articles. This observation also led to the detection of differences between the writing methods of foreign periodicals and those that circulate in the Brazilian context, as will be demonstrated in the analysis proposed in this work.

METHODOLOGY

To achieve the objective of knowing the structure and the discursive community that supports the genre Scientific Article in Engineering, an exploratory and descriptive study was carried out, with bibliographic and documentary research in primary and secondary sources. The linguistic corpus consisted of scientific articles from the area of Engineering I (Civil Engineering, Transport Engineering, Environmental Engineering and Sanitary Engineering). The choice was based on two main factors: exclusion and prioritization. Engineering is divided into four major areas according to Capes, with very different objects of study and research methodologies, which would require a longer and more voluminous work or a superficial treatment of the texts if one chose to approximate, for example, articles on Electrical Engineering with Environmental Engineering. The prioritization of this area occurred because it includes three courses offered contiguously to the BICT as Second Cycle degrees (Civil Engineering, Environmental and Sanitary Engineering and Transport Engineering), which have the highest demand among bachelor's students. This allows for greater efficiency and reach when meeting the demands of the students in the course.

The selection of abstracts began in online journals, with the help of the Sucupira Platform, in which it is possible to find the classification of scientific production within the scope of scientific articles (CAPES, 2017). On the platform, filters were applied to adjust the searches: area of expertise (Engineering I), classification (B1) and publication period (journals evaluated in the 2013-2016 quadrennium[3]). The result of this search provided journals with such qualifications, facilitating the use of another platform, the Web of Science, where we filtered academic texts based on the publishing institution.

The corpus was limited to texts in Portuguese due to the abundance of studies on academic writing in English and the need to more readily serve undergraduate students, most of whom have not yet mastered English. In addition, the specificities of the use of the Portuguese language by Brazilian researchers in the Scientific Article genre are still little explored. The initial sample consisted of 18 articles for the study of the discursive community, expanding to 50 articles for the study of textual structure and restricting itself again to 20 articles for the study of the abstract, in

[3] In the period when the *corpus* was selected, CAPES had not yet made the 2017-2020 quadrennial classification.

order to maintain proportionality between civil engineering and environmental and sanitary engineering journals.

The analysis of the texts, based on the studies of John Swales (1990), considered criteria such as length, references, syntactic and lexical characteristics, textual organization and sections. Priority was given to the sample of texts containing original material, excluding literature review articles. The textual analysis of the sections aimed to identify the specificities of the area in its interdisciplinary relations, using the idea of recurrence of patterns called Rhetorical Movements (SWALES, 1981; 1990). The categories listed by Swales (1990, 2009), Motta-Roth and Hendges (1996) and Berdanier (2019) supported the tabulation of the occurrences of rhetorical movements and structures in the articles analyzed.

Table 5: Articles selected to understand the discursive community – 18 articles.

MAGAZINES	**NUMBER OF ARTICLES ANALYZED**
AGRIAMBI Built Environment Tree	1 4 1
Sanitary and Environmental Engineering	4
School of Mines	1
IBRACON – Structure and Materials	1
Transport	6
TOTAL	**18**

Source: Elaborated during the research

Table 6: Number of articles selected per journal in the sample of 50 articles.

Magazine	**Number of items**
AGRIAMBI	3
Built Environment	21
Tree	1
Ceramics	4
School of Mines	2
Sanitary and Environmental Engineering	6
IBRACON – Structure and Materials	2
Transport	11
TOTAL	**50**

Source: elaborated during the research

Table 7: Distribution of abstracts by area of expertise and journal, in the sample of 20 articles.

Area of Study	**Periódicos - Qualis B1**	**Number of Abstracts**
Civil engineering	IBRACON – Structures and Materials	2
	Built Environment	6 2
	School of Mines	
Sanitary Engineering	Sanitary and Environmental Journal	6
	Brazilian Journal of Agricultural and Environmental Engineering	3
	Tree Magazine	1

Source: elaborated during the research

RESULTS AND DISCUSSION

THE DISCURSIVE COMMUNITY IN ENGINEERING I

The analysis of scientific articles around Engineering I provided relevant information about several aspects of this textual genre, whether related to its production context or structural elements. For the observation of the discursive community, attention was paid to the way in which engineers access the vehicles for the publication of their articles, the degree of demand and specificity of the journals, as well as the stylistic-lexical preferences, according to the description of Swales (1990) about the characteristics of this type of community:

- Common Goals
- Participatory mechanisms
- Intercom mechanisms
- Specialized genres and terminologies
- Specialized terminologies
- Levels of expertise

From the observation of the journals analyzed, it was noticed that the delimitation of the researchers' access to the community occurs mainly through the recommendations for publication provided by the editorial teams. The main requirements are:

a) Originality: The articles must be unpublished, the result of original research, and must not have been submitted to other media outlets in parallel;
b) Length: There are restrictions on the size of the text. Some magazines limit you to a number of words (7000, 8000) or pages (maximum of 20);
c) Thematic adequacy: There are limitations as to the theme and/or area of knowledge to which each journal is dedicated, with no mention of the publication of thematic issues or special print runs;
d) Structural adequacy: The journals are specific regarding the publication instructions for the authors, mentioning, in some cases, NBR 14.724:2011 (ABNT, 2011) as a parameter for the writing, structuring and formatting of the text;
e) Evaluation: Even journals that charge a fee for publication in *the open access* format maintain a system of evaluation by reviewers with blind review (*blind review* or *double blind review*);
f) Other requirements: Timeliness of the references cited in the article and specific formatting of visual data such as diagrams, graphs and tables.

Regarding the periodicity of publication of the journals, the circulation can be monthly, bimonthly or quarterly, demonstrating the constancy in maintaining the information and the interest of the researchers in using the journals to publish their results and consult published materials. The

magazines' websites indicate a high number of visits, with "170,000 monthly visits" (ESCOLA DE MINAS, s.d.) or an average of "200,000 hits" (AMBIENTE CONSTRUIR MAGAZINE, s.d.), for example.

We did not find a minimum requirement for the researchers' degrees to publish the articles. An exploratory research was then carried out in the Lattes curricula of the authors of the articles to verify the degree of specialization of the members of the discursive community.

Table 8: Percentage of Researchers' Cumulative Specialization Levels

Graduation	Masters	Doctorate	Post-Doctorate
100,00%	87,10%	75,81%	22,58%

Source: elaborated during the research

Thus, although no degree is required for the submission of articles in the journals analyzed, all authors have at least a bachelor's degree in their curriculum and, among the members of the same work, at least one has a stricto sensu graduate degree. This demonstrates the need, even if implicit, to have academic qualifications to publish the articles.

With regard to the development of one's own style, the analysis of lexical marks reveals the construction of a specialized lexicon. This lexicon is characterized by the use of a recurrent terminology specific to engineering activities, as shown below:

> Sampling, structural analysis, systemic analysis, environmental assessment, shear, coefficient of expansion, coefficient of expansion, concrete compositions, compression, phytosanitary conditions, contamination, water bodies, water bodies, environmental degradation, mechanical performance, sustainable development, environmental diagnosis, elasticity, cracks, bending, transport infrastructure, survey, urban fabric, cementitious materials, mechanisms, mobility, modulus of Deformation, modulus of elasticity, new technologies, pavement, planning, product porosity, pressure, environmental problems, water resources, environmental impact reduction, reinforcement, abrasion resistance, compressive strength, tensile strength, compressive characteristic strength, mechanical strength, flexural strengths, asphalt coating, coating, basic sanitation, systems, tension, maximum tension, landscape typology, workability, traction, transportation stresses, and thermal variation (CAMPOS, 2020, p. 13-16).

THE ACADEMIC SUMMARIES IN ENGINEERING

Academic abstracts find a particularity in the composition of Scientific Articles. Although they take part in this analyzed genre, they also circulate independently in search engines as a means of quick access to the content of articles. Thus, in addition to containing the main information about the work, they need to be attractive to the appropriate readers to ensure that they will seek to have knowledge of the work in full. Given this characteristic, there is an increase in its relevance and greater care is needed in the preparation of this type of abstract, as this may be, in some cases, the only contact that other researchers will have with the published research, if the intended interest is not generated.

In the discursive environment of engineering, the abstracts in the analyzed articles are uniform, demonstrating how the data that would possibly be useful to the reader were obtained and the relevance of these data to their community. As the most recurrent elements, the presence of more technical elements is notorious, such as the presence of exact measurement values, for example, when outlining the methodology of the works. However, the absence of some movements, even without compromising the clarity of the text, denotes the lesser importance given to elements that could enrich the search for articles, such as motivation and contextualization of the research.

In Brazil, there are specific norms for the production of abstracts, such as NBR 6028/2003 (ABNT, 2003b), which denotes the concern to systematize and prescribe the writing of abstracts in detail, including the use of a single paragraph, acceptable verb tenses and even the number of words according to the type of document that the abstract will accompany. However, although there is this general norm that guides the work of Brazilian researchers, it is common for each technical-scientific means of publication to have a style or model of structure for the article to be published, based on the NBR or other foreign standards, and must be categorically followed to adapt to the editorial standards of each journal. This is because the editing process of a scientific journal is a crucial part of preserving the quality of the content disseminated and even influences its impact factor in a given field of study.

Basically, the abstract directed to publications in journals has a similar structure, both in size and content, and should respond to information about the original text, with cohesion and clarity of ideas. However, it is easy to see that in practice there is no detailed and prescriptive guidance in the submission rules of journals regarding the use of models or conventions, including those already provided for by the Brazilian standard. These indications, which are usually vague, do not allow the creation of a model for the authors that would actually lead the reader to perceive the content of the full text, clarifying doubts, so that he could decide whether the complete text would help him in his studies.

The analysis observed the articles according to the rhetorical movements listed by Santos (1995) and reworked by Motta-Roth and Hedges based on the CARS model, since the abstract would be responsible for disposing strategies that would help the author to express the content of the research for a broader reach. Regarding the model, the civil engineering articles, in general, obtained 72% of the movements present in the texts, which is a good percentage, since the only discrepancy occurred in movements 4 and 5 with 50%, which indicates the deficiency in results and more forceful discussion/conclusion at the end of the text. Tables 09 and 10 show the distributions of movements in the abstracts of the civil and sanitary engineering areas, respectively:

Table 09: Occurrence of rhetorical movements in 10 abstracts in the area of Civil Engineering.

Rhetorical Moves	Occurrences of movements	Percentage %
Movement 1	9	90%
Movement 2	8	80%
Movement 3	9	90%
Movement 4	5	50%
Movement 5	5	50%
Total occurrences	36	72%

Source: Prepared by the authors

Table 10: Occurrence of rhetorical movements in 10 abstracts in the area of Sanitary Engineering.

Movements:	Occurrence of movements	Percentage %
Movement 1	6	60%
Movement 2	10	100%
Movement 3	10	100%
Movement 4	7	70%
Movement 5	9	90%
Total occurrences	42	84%

Source: Prepared by the authors.

It was found in the abstracts analyzed in the area of sanitary and environmental engineering that all movements were well distributed, with the exception of movement 1, but the structure present in the abstracts shows enough information for the reader to decide if the entire work can be useful for reading in its conception.

Table 11 shows the number of words in the abstracts, according to the request of each journal:

Table 11: Average number of words in abstracts per journal and recommended amounts.

Magazine	Average Words Present	Quantity indicated according to the magazine
IBRACOM	153	300
Built Environment	168,86	100 a 200
REM :Revista Escola de Minas	181	150 to 250
Environmental Sanitary Journal	213,33	100 to 250
Brazilian Journal of Agricultural and Environmental Engineering	179,6	250
Tree Magazine	198	280

Source: Prepared by the authors.

The values show that the length of abstracts is already standardized and does not seem to be a problem for the authors. This is probably due to the strict limit of pages for publications and the explicitness of the rule through the editorial teams of the journals. No truncated or cut abstracts were found due to excessive text, but the averages point to a concern of the authors to stay within the word limit, writing texts much shorter than those required, which can lead to the suppression of movements, that is, the authors fail to describe sections of the article for fear of exceeding the word limit.

Table 12 presents an overall average of the use of movements in all abstracts, by area:

Table 12: Number and average of rhetorical movements in the abstracts by area of expertise

Area of Expertise	Quantity of Rhetorical moves	Average of rhetorical movements
Civil engineering	36	7,2
Environmental Engineering	42	8,4

Source: Prepared by the authors.

Based on the information obtained from each publication, it was found that, in relation to compliance with the requirements of the journals and NBR 6028/2003 (ABNT, 2003b), only the School of Mines, regarding the range of 150 to 250 words, and the Brazilian Journal of Agricultural and Environmental Engineering, regarding the total number of words, follow this standard.

In the abstracts analyzed, common structures were found that allowed the identification of most of the movements, except for movement 1, which is a preamble to exemplify a problem and elaborate a hypothesis. In movement 2, the occurrence of demonstrative pronouns to present the research was observed, as in "**This work evaluates". For the methodology, verbal expressions were used to describe actions, such as "identified**", "**used**" and "**verified**". The results presented sentences marked by expressions such as "**the results obtained**" or "**the results achieved**". In the discussion of the results, there was a mixture of linguistic structures of the other movements, with expressions such as "**verified**" and "**what is verified**".

The texts comply with the ABNT standard regarding clarity and conciseness: "The abstract must be composed of a sequence of concise, affirmative sentences and not an enumeration of topics. The use of a single paragraph is recommended" (ABNT, 2003b, p.2). Regarding the use of verbs, the norm is also followed: "The verb should be used in the active voice and in the third person singular" (ABNT, 2003, p.2). This ensures the objectivity of the data and makes it easier for the reader to decide whether to access the original text.

The predominance of movements 1 and 3 in civil engineering abstracts shows the authors' concern to contextualize the research and situate the reader in the methodological procedures. Contextualization serves the sub-functions of establishing professional interest and making generalizations on the topic. The richness of detail in the methodology demonstrates the authors' awareness that readers will be attracted by the methods adopted.

The sanitary engineering summaries focus on movements 2 and 3, indicating the need to expose the objectives and methodology in detail. The recurrence of structures that spell out the objectives shows that researchers believe in the importance of clearly communicating their objectives to readers. Often, movement 3 merges with movement 2, presented in a single sentence.

The analysis demonstrates that there is no shortage of space to present all aspects of the research in the abstracts. Most researchers understand the need to expound on the essential points of research, allowing abstracts to fulfill their discursive functions adequately.

THE INTRODUCTION SECTION IN ENGINEERING ARTICLES

The introduction study was based on Swales' (1990) original model, CARS – Creating a Research Space (see table 01). From the observation of the movements in the sample of 50 introductions, the rhetorical movements and steps found were presented in the form of a table. For better visualization, the data were separated according to the journal from which the articles were taken, but also show the overall result.

Table 13 – Rhetorical movements found in introductions of scientific articles in each journal.

MAGAZINES	MOVEMENT 1	MOVEMENT 2	MOVIMENTO3
AGRIAMBI	100%	100%	100%
Built Environment	95%	86%	90%
Tree	100%	0%	100%
Ceramics	100%	100%	100%
Sanitary and Environmental Engineering	83%	33%	67%
School of Mines	50%	100%	50%
IBRACON	100%	0%	100%
Transport	82%	64%	100%
TOTAL	**90%**	**72%**	**90%**

Source: MOTA, 2022.

Movement 1 was the most present in the introductions studied, thus demonstrating the concern to situate the reader in relation to what will be addressed in the journal. These intentions corroborate the orientation of Swales (1990), who emphasizes the need to contextualize the theme that the article addresses. However, it was noted the absence of Step 3, in which the review of topics present in previous research is made. On the other hand, Step 1, which concerns the establishment of the importance of the work, and Step 2, which points out facts or generalizes about the theme, make up the bulk of the characterization of Movement 1. Therefore, the authors of the engineering areas choose to present the context, exposing facts and the relevance of the content addressed.

Movement 2 is defined, essentially, by indicating the problem to be solved by the creation of scientific study. It is, therefore, an extremely valuable element for the formulation of a good introduction, but in comparison with the other movements, this was the one that showed the lowest number of occurrences. In this movement, Steps A and B are specified by elaborating counter-arguments and indicating absences, that is, verifying the flaws in the studies already carried out on a given topic. From another point of view, Steps C and D seek to highlight the problem in an indirect way, making the reader deduce the subject through questions.

In a specific phase of the research, observations were made on how to establish the research problems, that is, Movement 2 of the introductions of academic texts, which presents the research,

mentions the factors that motivated that study and generally induces relationships between problems and the search for solutions by verifying the form and presentation of the research.

In this case, it was observed that in most of the articles there was no explicit distinction between scientific research and technological innovation, except for some cases in which they mentioned research with similar themes or in situations of total pioneering in the area studied. In general, in fundamental research, the researcher obviously takes more time in explaining concepts due to the insertion of a new approach.

Regarding the interdisciplinary performance, it is observed that almost in its entirety there was interaction with several other areas and disciplines such as: Chemistry, materials, transportation, public policies and among others, with each area of knowledge contributing to the research according to the interest of the study.

In the texts analyzed, common structures were found that allowed the clear identification of most of the research problems in the introductions, especially in the articles in the area of civil engineering, when they were presented, they almost always took into account the indication of standards and techniques or their inefficiencies.

Finally, Movement 3 generally promotes the completion of the ideas presented in the introduction and the *CARS model* designates 4 Steps that compose it. In general, the Steps are intended to expose the objective of the study, possible solutions to the problem indicated in Movement 2 or to show what was obtained and the structure of the scientific article. That said, there is a lower number of occurrences of Step 3 in relation to the others, so this demonstrates a lack of interest on the part of the authors in pointing out how the article is arranged, probably because it is a recurrent structure. On the other hand, most decide to employ Steps A and B.

It is understood that there is a predominance of the choice of objective and factual steps adopted by scientists. In view of this, Aranha (2007) states that the communicative purpose established by the introduction of an academic journal aims to contextualize the subject to be addressed as a whole, therefore, by suppressing the use of certain steps, writers consequently reduce the probability of writing a good introduction.

When analyzing the introductions, it was noticed the existence of common linguistic structures when identifying a certain movement. In movement 1, the author seeks to establish the territory, citing references and demonstrating mastery of the research topic (ARANHA, 2007). Frequently, when referring to previous research, conformative subordinating conjunctions were used, such as ***"Segundo",*** or the prepositional locution ***"According to".*** There are also several other structures, for example**, *"In the work done by", "In previous study", "The results obtained by",*** among others.

Movement 2 presents the relevance of producing the research, indicating the problem to be solved. A fundamental piece to perform such an act is the production of counterarguments, the structures found were, essentially, adversative conjunctions, such as, ***"However", "however", "In addition", "Although", "However", "In spite of", "In spite of", "In the meantime", "However", "On the other hand".***

Pointing out gaps in previous works is also part of the constitution of movement 2, being the most direct way to point out the research problem. The authors adopted sentences that indicate absences, for example: ***"there is, therefore, a gap", "little scientific evidence", "it is perceived that there is no study that", "causes of the inefficiency of", "no studies are observed in the literature", "difficulty is observed",*** and others.

Thus, it was noted that there was greater comprehensibility in recognizing the problem that would be addressed in the articles when, in their introductions, linguistic structures were applied. The same can be said of Movement 3, which will be exemplified below.

In the CARS model, Movement 3 is responsible for "Occupying the niche", that is, designating what the work will contribute to within the scientific community in which it is inserted. In view of this, it was possible to observe that most of the introductions analyzed when manifesting the Mov. 3 chose to do so when declaring the objectives of the research, in view of this, we have as an example: "**Thus, this research had as its objective...", "Thus, the present work aims to...", "In this context, this work evaluated...**". That said, it was found that the linguistic structures observed can facilitate the creation of better introductions, since they allow the establishment of a certain pattern. To elucidate this, it can be suggested that, when making counterarguments, the authors always start the sentence with some adversative conjunction, or, when announcing the objectives, use sentences, such as, **"Thus, this research aimed to..."** and derivatives.

THE METHODOLOGICAL SECTION IN ENGINEERING ARTICLES

Berdanier (2019) also developed, for engineering, a modified pattern of analysis of rhetorical movements, based on Swales' CARS (1990). This study revealed a few more steps and movements that help in the development of the genre, in addition to expanding more details about them and being concerned with developing them in a coherent and saturated way, in such a way that new movements are not necessary. However, although this research generated a total of 9 rhetorical movements, it was taken as the basis for this work only with regard to methodology, Berdanier's movement 4.

Movement 4 refers to the description of processes and methods. In this section, according to Berdanier's (2019) research, it should be possible to find the following steps:

- identify research objectives or questions;

- establish a justification, reasoning, or meaning related to the method;
- list materials, tags, or resources;
- cite established procedures and protocols;
- detail research tasks, procedures, analyses, or instrumentation techniques;
- identify challenges and limitations; and
- explain the scientific mechanisms by which the method works.

According to the study, these should be the characteristics present in a methodological section, and it is possible to see that they cover several characteristics, ranging from small "introductions" to the methodology in question, to explanations about problems that occurred or situations that delayed the research. However, in scientific engineering articles, this pattern is not always observed. The reasons for this derive, in general, from the fact that some steps shown in Berdanier's study are not used, and others are structured differently, thus generating differences between the foreign study and the Brazilian reality.

In this way, it was possible to analyze and make a comparison, at certain points, of the articles on Berdanier's research, indicating the steps not used by the Brazilian authors and what differences exist between them, not exclusively in the methodology, since, as it will be possible to see, some steps were expanded to other parts of the articles.

The following is a general table that shows in percentage how many steps were found in the 50 articles analyzed:

Table 14: Occurrences of the steps present in the rhetorical movement 4

Steps	Occurrences	Percentage
Justifications, reasonings, meanings, and introductions related to the methods. (Step 1)	29	58%
Cite and detail the procedures and methods, analyses or techniques used. (Step 2)	46	92%
Materials and resources used and their definitions/explanations (Step 3)	26	52%
Complete Structure of Materials (Step 3.5)	11	22%
Citations of the methods used (Step 4)	26	52%
Detail specific procedures or techniques of instruments used. (Step 4.5)	15	30%
Identify the goal of the project or what it will produce. (Step 5)	21	42%

Source: Elaborated during the research

With the data presented in Table 14, it is possible to see that step 1 obtained 29 occurrences, demonstrating a significant concern in situating the reader in the article. This part includes introductions, justifications, reasoning, and meanings in relation to the method. Compared to Berdanier's (2019) research, there is a divergence: 86% of the articles in the base research used initial justifications, while in Brazil, 58% of the articles analyzed included this step. Step 2, detailing procedures, methods, analyses or techniques, was the most present, fundamental for the creation of a good engineering article. In Brazil, 92% of articles included this step, compared to 58% in Berdanier's research, indicating a significant difference. Step 3 explains the materials and resources

used, often at the beginning of the methodology. In Brazil, 52% of the articles used this resource, similar to the 48% found by Berdanier. The existence of step 3.5, an expansion of step 3, was observed in 22% of the Brazilian articles. Citations of methods used are dealt with in step 4, with 52% presence in Brazil, compared to 58% in Berdanier's research. Step 4.5, detailing specific procedures, was found in 30% of the Brazilian articles, compared to 100% in Berdanier's research, possibly because details in Brazil are often found in the introductions. Step 5 identifies the objective of the project, which is present in 42% of the Brazilian articles, compared to 88% in Berdanier's research. Some steps, such as "identifying challenges and limitations" and "explaining the scientific mechanisms", were not sufficiently frequent for analysis.

There is an equivalent predominance in the steps adopted by scientists, despite the differences between Brazilian and foreign contexts. Following these trends or developing the methodological section in a similar way can increase the quality of an article.

The analysis of the languages used in the texts showed that the writing of the methodology is marked by the use of recurrent expressions, as shown below:

- **Step 1**: Justifications, reasoning, meanings and introductions, using expressions such as "**second**", "**according to**".
- **Step 2**: Procedures, methods and analyses, explaining methods and instruments, with structures such as "**to perform the analysis**", "**for the intervention**".
- **Step 3**: Materials and resources used, with structures such as "**the materials used in the research are/were**", "**the following material was used**".
- **Step 3.5**: Expansion of step 3, with structures such as "**the following materials were used**", "**the materials used in this research**".
- **Step 4**: Citations of methods, with structures such as **"adopted", "the method used".**
- **Step 4.5**: Breakdown of specific procedures, with structures such as **"the procedures of", "have been prepared by the method".**
- **Step 5**: Identification of the project's objective, with structures such as **"had/aims to present", "in order to characterize".**

Linguistic models help to create textual structures that are better suited to each step, establishing useful standards for authors in the field of engineering.

FINAL THOUGHTS

In view of what was investigated, it was possible to perceive a high application of rhetorical movements in scientific articles, producing recurrent patterns considered relevant for scientific dissemination in the discursive engineering community.

As for the discursive community, there is an interest in establishing a standard of quality in publications. However, the low quality of the guidelines provided by the publishers is highlighted, as they are not always clear about the required standards and structures, leading researchers to follow their own intuitive strategies to organize data, problems, methodology, results, and discussions.

The application of linguistic structures that reflect the rhetorical movements in the sections studied was proven. Most of the observed expressions consisted of objective phrases and words, making clear the purpose of each part of the text. The recurrence of lexical and syntactic choices indicates a tendency to adopt safe forms of language to ensure clarity and objectivity.

The greatest difficulty faced by researchers in the area of Engineering I is to expose the research problem. The absence of a standard causes authors to present their work based on gaps or needs for a practical solution. Clear elucidation of research questions is crucial to improve writing and comprehension, elevating the quality of scientific products.

As for the other sections, most of the articles analyzed complied with the established norms, but they were insufficient from a theoretical point of view, not being supported by the models of structuring the scientific article genre (abstract, introduction, methodology) proposed by the authors studied. The lack of knowledge of the theoretical proposals and norms hinders the elaboration and understanding of the articles, due to the absence of necessary information in the text.

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The teaching of plasma membrane through the elaboration of an educational booklet

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ABSTRACT

In the plasma membrane content, it is observed that both structure and transport encompass complexity and abstraction in concepts. This study brings together the results of a formative experience involving the elaboration of booklets on the importance of the plasma membrane in an educational context. The proposed activity has a qualitative character with a didactic-experimental approach and began in the face of the problem-situation. Initially, the structural and functional aspects of the plasma membrane with activities in the laboratory were presented. For the elaboration of the booklet, the following steps were followed: definition of the texts, choice of letters and colors, insertion of images, elaboration of interactive activities and formatting of the booklet using in the layout booklet design models already available in Canva. In the evaluation criteria, the dialogues in the classroom, analysis of the results of complementary activities and the evaluation of the elaboration of the booklet were considered. In this study, the elaboration of an educational booklet stimulated interest and curiosity and diversity was observed among the works presented, but all the materials sought to arouse the attention of readers, with the distribution of concepts interspersed with images and activities. In their reports, the students considered that the activity was pleasurable and constructive from the moment they researched the application of abstract concepts. This study points out that the elaboration of a didactic resource through an investigative activity is important and results in significant learning, since it places the student as the main agent in the construction of knowledge.

Keywords: Cell biology, Learning, Educational resource, Education.

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INTRODUCTION

The plasma membrane content, involving structure and transport, is presented to students entering the Bachelor's Degree in Biological Sciences. As it is an introductory course, there is great difficulty in establishing an abstract thought in the contents covered, especially plasma membrane. Such difficulties may be related to the conceptual basis acquired during basic education. To the extent that the complexity and abstraction of the scientific concepts addressed in the classroom, on the one hand, show the need to make them more accessible to students, on the other hand, they challenge teachers regarding teaching methodologies, their pedagogical practice and the knowledge that underlies it, particularly pedagogical knowledge (CAMPOS & BORTOLOTO, 2002; RANDO et al., 2020, CAMPOS et al., 2023).

The plasma membrane is a three-dimensional, fluid structure where macromolecules interact synergistically, providing adaptability to different environmental stimuli, such as osmotic, thermal and hydrostatic stresses (ROMANTSOV, GUAN, WOOD, 2009; ALBERTS et al., 2017). The membrane's main functions are the transport of substances, the maintenance of integrity, and cell-to-cell recognition (GONÇALVES, 2021).

The plasma membrane is a content addressed in different stages of Basic Education, being better detailed during the 1st year of High School as part of the Biology content, more specifically in the area of cytology. At this stage, the structure of the membrane, fluidity, permeability, and the types of transport carried out, are among the topics that are difficult to understand for the student in learning, due to their complexity. In this context, the use of alternative and didactic teaching methods, which provide the student with more interactive learning, presents itself as an alternative for teaching, since it provides the assimilation of content by the curiosity inherent to each individual (FRANÇA & SOVIERZOSKI, 2018; GONÇALVES, 2021; SILVA et al., 2021).

Among the didactic resources, the didactic booklet makes it possible to approach different subjects with a simple and accessible language and represents a pedagogical tool close to the students. In this resource, the contents are exposed in a didactic, summarized, illustrated and accessible way to the different audiences to be reached. This is also a material that is widely accepted among teachers and students (MENEZES et al., 2020; THURSDAYS, 2022).

The structure of a booklet can also provide a search for knowledge from the students and the teacher himself, with the interaction of links on pages that provide a complementary reading or *QR code* (DANTAS et al., 2022). In addition, because they have a format and size similar to magazines, booklets present a greater amount of information than pamphlets, allowing the subject to be worked on in more detail (MARTEIS, 2011). Since they use simple language, the booklets make it possible for difficult topics for students to be worked on and presented in a way that is easier and more

pleasant to understand (SOUZA, 2009). According to DIAS (2018), booklets stimulate students' reasoning and creativity when placed in context and with coherent objectives.

In the teaching of Biology, booklets are used, as they are an instrument to facilitate the teacher's work, favoring it in classes and bringing the content closer to the student (QUINTAS, 2022). Thus, the ability to produce material that is easy to read and understand, richly illustrated, makes the booklet an important resource for classes on plasma membrane in high school.

OBJECTIVE

To develop a booklet for the teaching of plasma membrane: structure and transport, aimed at high school, as an educational resource.

METHODOLOGY

The proposed activity has a qualitative character with a didactic-experimental approach with a methodological basis proposed by PEREIRA et al. (2018) for considering the specificities of the process of knowledge acquisition by students/future teachers in the process of elaborating an educational booklet and for trying to understand and describe what happens to students in the face of a problem-situation.

The study began with the presentation of a problem-situation that would have to be solved based on classroom discussions. Such discussions took place between student teacher, monitor student and student-student. The problem situation was the following: How to make concepts about plasma membrane that are so abstract understandable using a primer? From this questioning arose the possibility of constructing a booklet with knowledge about the plasma membrane, its structure and types of transport. The idea was to develop a booklet to be used by high school students.

The activities were developed by 38 students of the 1st Period of the Degree Course in Biological Sciences of the Federal University of Catalão, divided into groups, during the discipline of Cell Biology. This course is the first to address the concept of plasma membrane in the course and aims to allow the student to develop an integrated view of cell structure and function. The classes are divided into dialogued theoretical, illustrated by micrographs, ultramicrographs and laboratory practices involving transport across the membrane.

STAGES OF THE PREPARATION OF THE BOOKLET

Initially, the professor presented the structure of the plasma membrane and how it works to control the entry and exit of substances. This presentation included two theoretical classes that involved questioning and an evaluation activity. Then, the students were taken to the laboratory and with the help of the monitors, the students had the opportunity to verify the structure of the plasma

membrane in a three-dimensional didactic model in *biscuit*. Transport by osmosis, using potatoes, beets and peripheral blood was discussed individually and in groups.

For the elaboration of the booklet, it was necessary to master the content and be monitored by monitors and the regent teacher. In order to master the content, it was essential that the student sought support in a theoretical framework, especially when considering that the booklet presents the content in a synthesized way. In the first month, the students chose the support material, a textbook used in high school that supported (conceptually and pedagogically) the booklet to be produced. The preparation of the booklet took place in the second and third month, in this period the student used the time after the end of the practices to expose their doubts and also their material under construction.

For the elaboration of the booklet, the following steps were followed:

A) Definition of texts
B) Choice of letters and colors
C) Inserting images
D) Elaboration of interactive activities
E) Formatting the booklet

The educational booklet was prepared according to the recommendations for the design and effectiveness of educational materials, involving the following aspects: scientific accuracy; content; literary presentation; illustration; specific and understandable material; quality of information (VIEIRA et al., 2023). It is, therefore, a methodological study for the elaboration of an educational booklet on plasma membrane with a focus on high school students, considering that this population can act as a propagator of knowledge in the family and community. The illustrative images and formatting were produced with the help of the specific program Canva (https://www.canva.com/pt_br).

DATA ANALYSIS

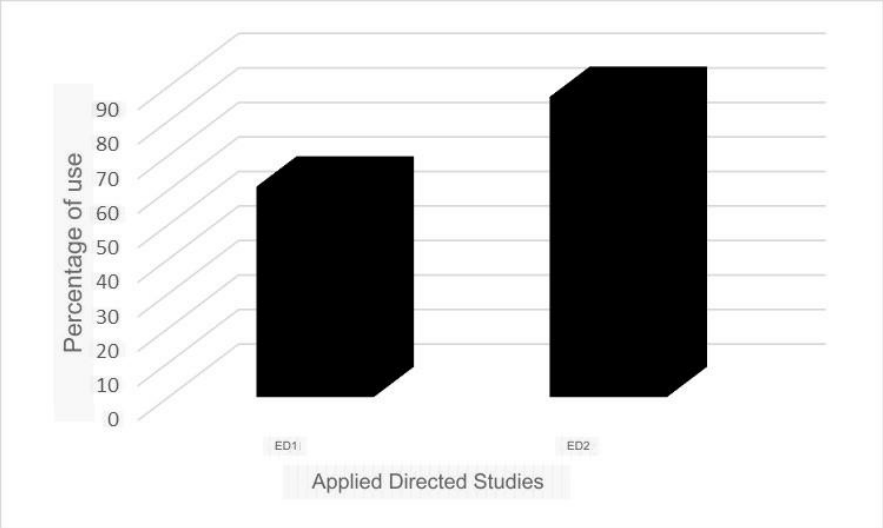
For evaluation, the following data collection instruments were used: classroom dialogues, analysis of the results of complementary evaluation activities and evaluation of the elaboration of the booklet. All evaluation criteria were presented to the students. For the analysis of the data on the students' impressions in relation to the work, only the answers representative of the group were used, after the self-evaluation and critical evaluation of the other works developed. At the time of the reports, notes were made of the most discussed points and the discursive textual analysis (DTA) proposed by MORAES was used; GALIAZZI; RAMOS (2012). It should be noted that, in addition to the presentation of the resource in the classroom and the justification in relation to the educational space, there was a stage in which it was concerned with developing its evaluation, at least

preliminarily (i.e., based on the apparent potential of the materials produced, without considering their application itself). Two studies were conducted in pairs, one before the construction of the booklet and after the presentation of the content, and the other after the preparation of the resource. To evaluate the resource, it was verified if it presented the essential components of a booklet, applicability and the concepts addressed.

DEVELOPMENT

Before the preparation of the booklet and immediately after the presentation of the theoretical-practical content, a directed study was applied. The results are presented in figure 1, where there is a 26% increase in the average grades obtained by the students.

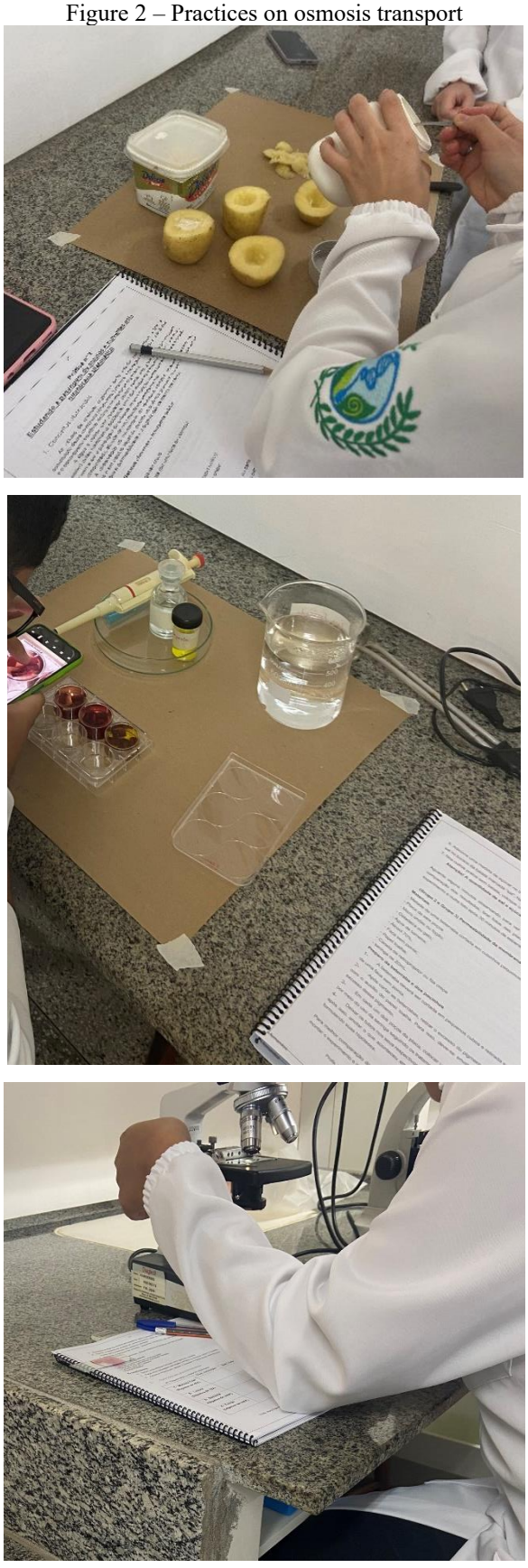
Figure 1 – Average of the grades obtained by the students in the directed studies



School performance is remarkable when students are involved in the production of material, the act of building stimulated interest and curiosity (PAULA et al., 2007; SILVA et al., 2021), enabling different ways of learning about the plasma membrane. In this work, as already pointed out by QUINTAS (2022), the booklets prepared provided a "know-how", where, when researching, students committed themselves to thinking, creating, and producing.

The students participated in practical activities in the laboratory where they were able to observe the transport by osmosis using potatoes, beets and peripheral blood (Figure 2).

Figure 2 – Practices on osmosis transport



From the proposal for the elaboration of the didactic resource and the explanation about biological knowledge, the students started research about the plasma membrane. After defining the book to be used, the questions began. The students presented a prototype of the booklet for content

adjustments. These prototypes were evaluated and returned to the students for adjustments. It was observed that the content presented in the textbooks alone was not sufficient for the elaboration of the booklet, requiring an in-depth study of the content. The participation of all members in most of the groups was evident.

In the layout of the booklet, the students used booklet design templates already available in Canva. On these models, the colors of the pages and texts were changed and the previously prepared texts and illustrations were inserted. We sought to produce a booklet that would arouse the readers' attention, both by the colors and illustrations, as well as in the explanatory texts, in order to facilitate understanding. After the layout stage, the booklet was converted to PDF format in order not to lose formatting. In this study, it was observed that there was diversity among the studies presented even though they were based on the same orientation. Even though it was a group work, we noticed that the groups interacted with each other. This exchange of ideas is essential in learning and the individual reports in groups showed the importance of interaction between group members and between groups. As already well pointed out by SALAS (2021), collaboration favors the advancement of learning in group work. In figure 3 it is possible to observe fragments of the covers of part of the booklets elaborated.

Figure 3- Covers of booklets prepared by students of the 1st period of the Bachelor's Degree in Biological Sciences. Authors' names have been protected



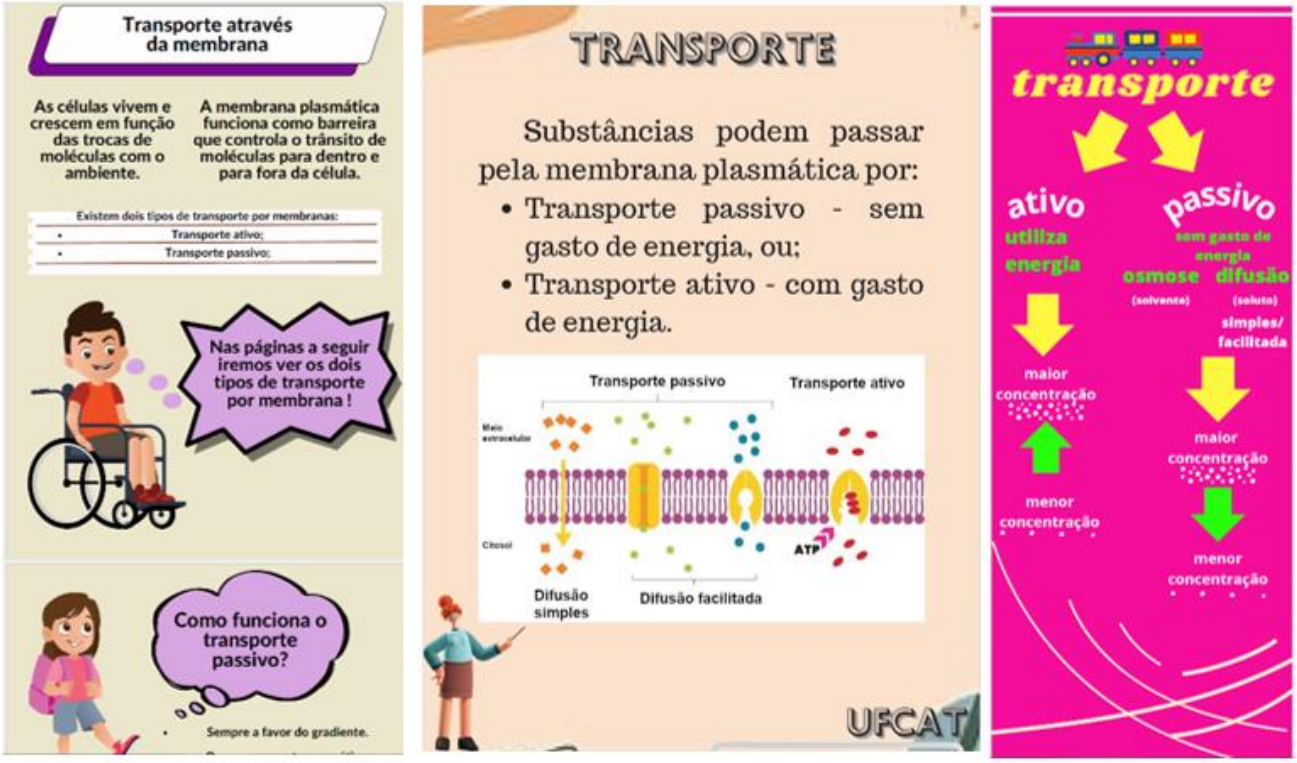
To present the theoretical content, the students used creativity. The distribution of concepts was interspersed with images and activities. The result of part of the presentation on structure is

shown in figure 4 and on transportation in figure 5.

Figure 4. Part of the content on the structure of the plasma membrane



Figure 5 – Part of the content on transport across the plasma membrane

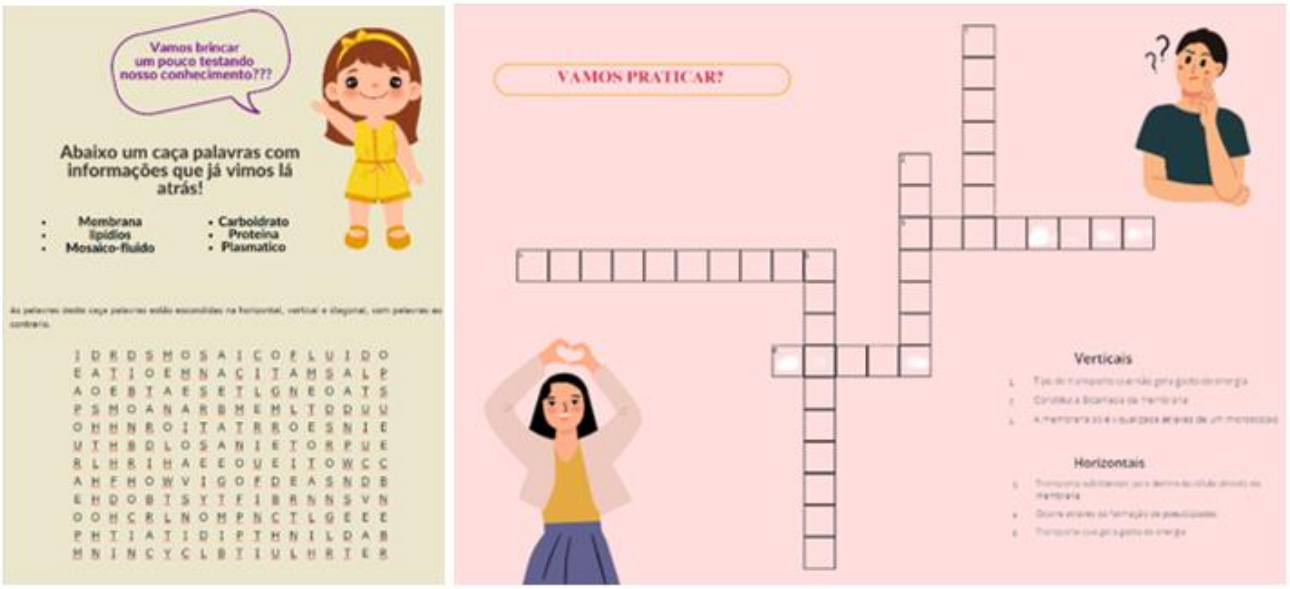


The part considered by the students as the most difficult was to explain transmembrane transport briefly and in a playful way. At that moment, they sought conceptual answers in the support books. In this study, the discussion and the need for pedagogical support and books were remarkable,

because transcribing the content into a booklet, in a summarized form, was not an easy task for the group of students involved. This is partly explained by a certain degree of passivity on the part of the students, acting as spectators (PONTES, REGO & JUNIOR, 2006; CEZAR *et al*., 2010) and the difficulty of establishing a connection with the world around them, a consequence of memorization learning that resulted in the false impression of learning (FERREIRA & ALMEIDA, 2013).

Initially, the students disbelieved in the activity as a learning tool. However, at the time of inserting activities to test knowledge, they themselves (personal reports) realized that they learned more in the midst of the search for answers beyond the pleasure provided by the game itself (CARNEIRO *et al*., 2016). The students had doubts about whether to insert the activities right after the text or only at the end of the booklet. Most of the groups inserted activities right after the presentation of the contents. Word searches and crosswords were the main activities presented (Figure 6). At the end of the booklets, all activity proposals had the answers in the form of an appendix.

Figure 6- Some activities proposed in the booklets



In addition to the text and image content, QR codes have been added to the booklet, which direct the reader to videos with additional information on some topics discussed (Data not shown). The use of QR codes as a technological tool for teaching and learning has proven to be very attractive, due to the fact that students have easy access to cell phones, and QR codes allow quick and wide access to resources and data, such as videos, documents, infographics, among others (RIBAS et al., 2017).

In the presentation, the students explained how the booklet was made and the main points highlighted. In addition, they emphasized the applicability of the practice as a whole. It was noted

that when students did not seek bibliographic references or did not exchange experiences with colleagues, the presentation and discussion were compromised. The booklet is a pedagogical tool for dissemination, bringing together verbal and non-verbal elements in the same space and has been increasingly used in school spaces, being a resource for the dissemination of scientific knowledge and promoting the popularization of science (MENDES 2017; ALVES 2019; NASCIMENTO, 2020). To prepare the booklets, students need to understand the content, sense of responsibility and follow-up of the entire process, as already pointed out by SOARES et al. (2021).

FINAL THOUGHTS

The booklets produced here sought to respond to the problem situation presented with elements and clear, simple and objective language, as well as explanatory illustrations, which allow them to be read by high school students.

Several studies show that the use of didactic resources helps in the understanding and interest of students in the subject worked. Therefore, the booklet becomes an additional resource to introduce and facilitate student learning in a more dynamic, visual and attractive way. With this, it is hoped that the booklet, when applied to high school, can really serve as a good tool for understanding and immersion in abstract concepts about plasma membrane, in the students' learning processes, and be complementary to the materials used by basic education teachers.

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Public Policy for Higher Education and Research. The Fundação para a Ciência e a Tecnologia, Instituto Público; the last common denominator of Science in Portugal and the home of PhDs

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ABSTRACT

Until the Constitution of the Portuguese Republic of 1976 – hereinafter CRP – higher education was an area of restricted access to elites. The CRP of 1976 aimed to expand this access and from the 80s of the last century onwards we have seen the first steps taken towards the implementation of a public policy for Higher Education and Research. In the 80's numerous legislation was produced in order to create a system of Higher Education, approving legal regimes and creating new institutions adapted to the new operating dynamics. With Portugal's entry into the European Economic Community –EEC, currently the European Union; EU –the identification and implementation of nudeges for scientific competition in an increasingly globalised world was realised. The constitutional revision of 1989 not only introduces changes in the structure of public administration as a result of this entry into a broad market, but also places the theme of higher education and research within the scope of the external market and the competition promoted in it. If in the 1980s the foundations of this system were created, it was in the 1990s that it became densified, probably reaching its maximum expression in the 21st century. We will follow this path, mapping what was happening in Portugal in this area and which at some point culminated in the creation of the Fundação para a Ciência e a Tecnologia IP as the main funding agency for science in Portugal.

Keywords: Public Policies, Higher Education, Research and funding.

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INTRODUCTION

BRIEF NOTES ON PUBLIC POLICIES

In order to be implemented, a public policy needs to observe the following procedures: identification of the problem (public) and definition of the agenda; formulation of the resulting policy; adoption of courses of action (cost-benefits have a great preponderance in this phase, but also in the next); implementation (exercise of free decision-making margin) and finally its evaluation. The contextualization of public policies and their identification is verified in contemporary times, when the right to education is replicated in a right to technological and scientific education - defined as its role as a differentiating factor in the current competitive dynamics between states. As BUCCI points out[2], public policies as a legal branch are integrated into a political discourse for the realization of social rights. In this essay, we will focus on what ANDERSON[3] means by public policy. "(…) a policy is defined as a relatively stable, purposive course of action followed by an actor or set of actors in dealing with a problem or matter of concern." The *paper* was based fundamentally on the collection of legislation on the subject, on the research of relevant bibliography and information collected from the archives of the Fundação para a Ciência e a Tecnologia IP – hereinafter FCT – seeking to pursue a systemic analysis of all the information collected. We also underline the relevance of the statistics made publicly available by FCT on its *website*, which gave the work a triangular dimension of cross-referencing data between theory, legislation and empirical elements that reveal the results obtained in this public policy. We recommend reading the graphs, laws and acronyms at the end of this chapter.

PUBLIC POLICIES AND THEIR CONSTRAINTS

If there is a vector of consensus regarding the object of study of this work, it lies in the fact that its implementation is effectively detected in ways that lead us to believe that it is a State policy.[4] In this context, it can be understood as a policy that goes beyond economic, political and social conjunctures or the existence of temporally variable *lobbies*[5] or the constant international and national dialectics of tension[6]. Nevertheless, we must point out that even though it is conceived by us as a national state policy, it is not completely unrelated to certain types of political, economic and

[2] Cf. BUCCI, Maria Paula Dallari, "The concept of public policy in law.", in Public Policies: Reflections on the Legal Concept, (BUCCI, org.) São Paulo, 2006, p.3-5.
[3] Cf. ANDERSON, James E.," The Study of Public Policy" in Public policymaking: An introduction, Boston: Houghton, Mifflin Company, 2003, p.2.
[4] Cf. BUCCI, Maria Paula Dallari, "The concept of public policy in law.", in Public Policies: Reflections on the Legal Concept (BUCCI, org.) São Paulo, 2006, p.18-19.
[5] Cfr. ANDERSON, James E.," The Study of Public Policy" in Public policymaking: An introduction, Boston: Houghton, Mifflin Company, 2003 p. 12 – 13.
[6] DELEON, Peter, "The Historical Roots of the Field.", in The Oxford Handbook of Public Policy, Edited by Robert E. Goodin, Michael Moran, and Martin Rein, 2008, p.49.

social constraints.[7] We adopt a perspective that underlines the existence of a social arena in which some socially well-structured and well-placed socio-historical groups assert their power – through capital of economic, intellectual, symbolic, financial, religious, and political prestige.[8] These capitals, which derive from their easy access to resources, depending on the *networks* to which they access, are managed in supra-hierarchical social networks, which implicitly establish the existence of socially hierarchical networks/groups/professional classes. We add another argument to the statement made above made above, based on the fact that we can see that those who govern or legislate in a country are those who are best prepared to do so. Such a presumption is based on an academic path that prepared them for it, a path from which various prestigious capitals emerge and consequent access to specific social networks.

(...) the *fields* are conceived by Bourdieu as specific areas of organization of the institutional social, generators of social capital corresponding to these valued specificities, capitals that facilitate access to the management of resources located in social relations (Coleman, 1990) or, depending on the perspective, which we do not subscribe; owned by the individuals (Bourdieu, 2002). In this way, Bourdieu's field places the agents as non-equals, instituting the dominance of some over the other (Vasconcelos, 2002), mediated by the *fields* where they are structured and act, taking into account the fulfillment of their own and the group's expectations.[9]

From the above understanding, we emphasize the fact that, for us, the isolated individual does not exercise capital or access resources. Both are operationalized in social interaction. In this context, GIDDENS[10] conceives the reflexive capacity supervening from the proliferation of specialized knowledge characteristic of postmodern globalized societies, as a differential power that is fenced on the social stage. Therefore, we reiterate the perspective that asymmetric power relations between

[7] Cfr. QUIGGINA, John, "Economic Constraints on Public Policy." in The Oxford Handbook of Public Policy, Edited by Robert E. Goodin, Michael Moran, and Martin Rein, 2006, p.549: "A economia é commumente, descrita, como a ciência que aloca recursos escassos ou a arte do possível." e WEISS, Carol e BIRCKMAYER, Johanna, "Social Experimentation for Public Policy" in The Oxford Handbook of Public Policy, Edited by Robert E. Goodin, Michael Moran, and Martin Rein, 2008, p.819:Interests are always powerful influences on policy. Drug manufacturers, farmers, radio station owners, state and city service workers, trial lawyers, charities, utility companies, universities, hospitals—almost every organized body in the nation seeks to promote its own well-being through public policy. The jostling among organized interests provides much of the drama in the policy arena.

[8] Cf.. BOURDIEU, Pierre, Sketch of a Theory of Practice, preceded by Three Studies in Cabila Ethnology, Celta Editora, 2002. Here we are faced with the classic question of structure vs action. In our view, to affirm, as Bourdieu does, that resources reside in individuals is to affirm a great autonomy in relation to them, to say that they fluctuate in the relations between individuals is to affirm the relevance of norms, constraints and deontologies in the processing of interaction. However, and to the extent that we only envision subjects that exist from the interaction in which they actually participate, there is no interaction without subjects, nor subjects without interaction. That is, there are no subjects and no action without powers that somehow condition them. Cf.. also COLEMAN, James, Foundations of Social Theory**.** Harvard University Press, Cambridge, 1990. and ORTNER, Sherry, "Theory in Anthropology since the Sixties", Comparative Studies in Society and History, Vol. 26, Nº 1., (Jan., 1984), p.151.

[9] LUÍS, Francisco, "Brazilian Transvestites in Portugal, Pathways, Identities and Ambiguities in the Context of Prostitution", PhD Thesis in Social and Cultural Anthropology, FCSH, UNL, 2016.

[10] GIDDENS, Anthony, The Constitution of Society. Outline of the Theory of Structuration, Polity (publisher), Cambridge, 1984

individuals and structures, or between groups of individuals, are a constant predicate in social relations. WEISS and BIRCKMAYER[11] observe, in the same vein, that:

The jostling among organized interests provides much of the drama in the policy arena. The scene is marked by the formation and dissolution of temporary coalitions of interests as the issues on the agenda shift and change. Nor does social science represent the only form of legitimate information. The policy world is awash with formation. Lobbyists hawk their own version of past events and futures. Media columnists and editorial writers add to the stew. Many organizations have their own in-house information resources - databases, research units, news services.

PUBLIC POLICY ON HIGHER EDUCATION AND RESEARCH: THE CONTEXT.

In the case of the policy followed in relation to higher education and research - hereinafter PPESI - we find that some factors are combined, which have made it possible for the definition and implementation of PPESI to be generally stable over 40 years; firstly, because since the political class is an integral part of an academic elite, knowledge of the cultural patterns of the "*culturally alien other"* is not required here as the target of a plastic [12]public policy, secondly, the consensus - especially from 1986 onwards with the entry into the EEC and in 1989 with the revision of the CRP - that competing in the area of science, technology and research was essential, thirdly, because it was the academics themselves who played and assumed decision-making powers. Take, for example, the case of Dr. Mariano Gago – himself a researcher – who began his career in the administration of the *res publica* when he assumed the presidency of the National Board for Scientific and Technological Research – henceforth JNICT, now FCT – later becoming Minister of Science and Higher Education.

BOBROW[13] states that cultural constraints emerge as factors of great importance in the identification and definition of a public policy. Although corroborating this argument, we deepen it with the importance of the discourse/utterance produced from a given object. In fact, speech and behavior are mutually integrated, making each other intelligible. Everything that is not an object of a discursive utterance production, simply does not emerge socially.

In Portugal, at the 1980s, the desire for change was eagerly breathed. Looking to other European countries, with in the hope of a better future, free of dictatorial constraints, which existed until not much time ago. In this case, not only the awareness of the need for a PPESI flowed from the

[11] WEISS, Carol e BIRCKMAYER, Johanna, "Social Experimentation for Public Policy" in The Oxford Handbook of Public Policy, Edited by Robert E. Goodin, Michael Moran, and Martin Rein, 2008, p.819.
[12] Cf. BOBROW, David B., "Social and Cultural Factors: Constraining and Enabling" in The Oxford Handbook of Public Policy, Edited by Robert E. Goodin, Michael Moran, and Martin Rein, 2008 p.578.:"In sum, which and how many differences get recognized (or denied) are political and cultural matters. Public policies shape and are shaped by those recognitions, especially with regard to the processing of actual experiences into notion-related interpretative precedents, maxims, fables, and warnings. Unfortunately, a number of often thought to be general tendencies for public policy get in the way of facing up to variety, and favor downplaying it."
[13] Cf.. BOBROW, David B, "Social and Cultural Factors: Constraining and Enabling" in The Oxford Handbook of Public Policy, Edited by Robert E. Goodin, Michael Moran, and Martin Rein, 2008

political class and academics, but also from civil society itself, which saw access to education as a free pass for a future full of successes for their children. "The analysis of the evolution of the portuguese cientific system cannot (...) be dissociated from the evolution of the higher education system in Portugal."[14]At the same time, the openness to a world that was beginning to globalize[15], allowed that more structured discourses on the need for a PPESI, had consequences at the level of a positive echo into a popular opinion and feeling, consistently supported by a Europe that seemed closer[16] and by a world system that looked like having welcomed us with open arms. It is in this context that PPESI becomes a national goal.

PPESI AND ITS ORIGINS

The Estado Novo was responsible for the creation of some laboratories. In 1946 LNEC or INSA in 1971, however, more than scientific policy objectives, these laboratories aimed to address sectoral and contextual problems of the State.[17] As we are told by CANDEIAS and SIMÕES[18] , the literacy rate in Portugal in the 50s was around 55%, which means, almost 50% of the population was illiterate. It was a school for elites and one that essentially served those elites. Public policies in the area of education formed the ruling classes in the areas of science that served their policies. There was no policy of integrative science.

In the context of 1974, Portugal is therefore faced with a clear situation of lack of qualification of human resources. The motto is given by the CRP in 1976 in article 77, which defined that the areas of research were "encouraged and protected by the State", with the main purpose of "the progressive liberation from external dependencies, within the scope of cooperation and exchange with all peoples". Currently, research and science are integrated in article 73 of the CRP under the heading Cultural Rights and Duties, within the scope of its article nº 4 which proclaims:

[14] HEITOR, Manuel, "Science and knowledge in the modernization of Portugal: the formulation of public policies in overcoming scientific backwardness and democratizing access to knowledge", in 40 Years of Science and Higher Education Policies in Portugal, Almedina, 2015, p.22-23.
[15] In terms of technological globalization and the speed with which the flows of people, goods, commodities, images or capital – among others – occur. To trace the beginning of the processes of globalization, we would have to go back 500 years, to the date when the Portuguese discoveries began.
[16] To assess the social impact on Portuguese national emotionality – in which the self-centered discourse was subtracted from the unidirectionalism of the inevitability of *fado* – we note the effects that the entry into the then EEC caused in other geopolitical locations, namely in the Brazilian media: "A situation so attractive that it even managed to create a flow of emigration of Brazilians to Portugal." (Magazine *see* 7/29/87). "The Portugal that attracts thousands of Brazilians is not the *small*, provincial and impoverished country of the past." (Magazine *See* 11/21/88)[16]
[17] Cf. RODRIGUES, Maria de Lurdes and HEITOR, Manuel (org.) *40 Years of Science and Higher Education Policies in Portugal*, Almedina, Coimbra, 2015, p.3. During the dictatorship, some laboratories were created in Portugal, namely the IBM – Institute of Marine Biology in 1950, the LNIV – National Laboratory of Veterinary Research in 1957, LNFEN. National Laboratory of Physics and Nuclear Engineering in 1958 or INSA – National Institute Dr. Ricardo Jorge in 1971, among others. See list of acronyms at the beginning of this work.
[18] CANDEIAS, António and SIMÕES, Eduarda, "Literacy and school in Portugal in the twentieth century: National Censuses and case studies" in *Análise Psicologica*, 1 (XVII), 1999, p.168.

Scientific creation and research, as well as technological innovation, are encouraged and supported by the State, in order to ensure their freedom and autonomy, the strengthening of competitiveness and the articulation between scientific institutions and companies.

Nº 4 of the article 73º does no more than welcome the neoliberal ideologies - then emerging - with the implicit market rules that underpin them, placing the emphasis on applied science to the detriment of pure science. From the Estado Novo, the creation of JNICT in 1967 marks what for some authors is considered the beginning of science policy in Portugal, although admittedly hesitant.[19]

PPESI IN DEMOCRACY

In this context, although the CRP of 1976 immediately gives prominence to the field of education, science and research, until 1984 there was some noticeable lack of coordination in terms of organic changes in the laboratories of the state, governments and tutelage. It was only in 1980 that the research career was defined – Decree-Law 415/80, of 27 September – but still integrating the researchers into the civil service bodies of the Ministry of Education and Science (MEC), namely the National Institute for Scientific Research. In 1983, the Technological Centres (CT) were created and the technological development plan (PDT) or national technological plan (PTN) was approved, at the time as a result of the impulse promoted by LNETI.[20] Nevertheless, at this stage scientific projects were still integrated into the Ministry of Industry (MI). This example of tutelage shows the uncertainty that prevails with regard to the coordination of the PPESI. It was also at this time that an attempt was made to legislatively organize the system of social support to be granted to higher education students, even if through loans – Decree-Law Nº 132/1980, of 17 May – however, the evident dispersion and lack of coordination of legislative measures promoting the PPSEI, only allowed the issue of social action in higher education to be dealt with in 1993.[21] As we have been analysing, in this period and since 1979 we have witnessed several experiments in the tutelage and administrative organization of science policy, from being outside the tutelary scope of the Ministry of Education and therefore, outside education, first, framed in the Ministry of Culture (MC) or, at a later stage, in the Ministry of Finance and Planning (MFP). During this period, emphasis was placed on applied science, which, in this respect, despite all the improvements made subsequently, remained

[19] Cf. RODRIGUES, Maria de Lurdes and HEITOR, Manuel (org.) 40 Years of Science and Higher Education Policies in Portugal, Almedina, Coimbra, 2015, p.5 Cf. RODRIGUES, Maria de Lurdes, "Science policies in Portugal in the 40 years of democracy" in Revista Ibero-americana de Ciencia, Tecnología y sociedad, 2017 e http://act.fct.pt/acervodocumental/registos-de-autoridade-arquivistica/junta-nacional-de-investigacao-cientifica-e-tecnologica/, accessed on 12 November 2017.

[20] José Veiga Simão, president of the LNETI installation committee (1977-1979) and president of LNETI (1979-1992). LNETI – National Laboratory of Engineering, Technology and Research.

[21] Cf. RODRIGUES, Maria de Lurdes and HEITOR, Manuel (org.) 40 Years of Science and Higher Education Policies in Portugal, Almedina, Coimbra, 2015, p.11.

the cornerstone of the administration of science until 1995. Between 1985 and 1995, science was under the supervision of the Ministry of Planning and Spatial Planning (MPOT) through the superintendence exercised over JNICT. This evident functional and substantive entropy is reflected in the relations between the very organic structure of the Public Administration and between it and the citizens.

Until 1985 there was an institutional tension involving JNICT, INIC and LNETI (created in 1977), a tension that resulted in difficulties in defining their respective competences, responsibilities for coordination, execution and funding of research activities.[22]

PPSEI AND THE DEFINITION OF PRIORITIES

It was only during the second half of the 1980s and within the framework of European integration that the scientific policy mechanisms were strengthened and JNICT introduced the first Integrated Plan for Scientific and Technological Development (PIDCT). This programme envisaged well-targeted measures for the development and implementation of science policies, also focusing on a research dimension. The JNICT thus raised awareness of the need to strengthen the mechanisms and means of scientific policy, reinforcing its funding instruments and, at the same time, proactively promoting the increase in joint scientific work initiatives with external partners. Between 1987 and 1991, still denoting reminiscences of the work carried out by Mariano Gago at the head of JNICT (1986/1989), were instituted the National Days of Scientific Research and Technology and the Science and Technology Mobilizing Program (PMCT). National Days of Scientific Research and Technology and the Science and Technology Mobilizing Program (PMCT). These events mark the change in the paradigm that guides the support and incentives granted by science and research policy to applied scientific activity. From this moment on, a movement was generated for the inclusion of all areas of advanced training in scholarship programs, also encouraged by the approval in the Assembly of the Republic of Law Nº 91/1988, of May 13. This law calls on the public authorities to implement an agenda, advocating a period of 10 years for support to science and technology to reach 2.5% of GDP.[23] However, historical facts tell us that only in 2007 was 1% of GDP reached, a percentage that is substantially different from what was initially forecast.[24]

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[22] Cf. RODRIGUES, Maria de Lurdes and HEITOR, Manuel (org.) 40 Years of Science and Higher Education Policies in Portugal, Almedina, Coimbra, 2015, p.7.

[23] It also coincides with this moment the accession of Portugal to CERN - European Organization for Nuclear Research - and the preparation of the agreement with ESO - European Southern Observatory. "CERN was established in 1953 and, according to the Convention signed by the Founding Members, the main objective of this scientific organization was the "promotion and collaboration between European countries in the area of fundamental research in the field of High Energy Physics (HFS), in order to allow Europe to lead in this field". Since then, CERN has been the largest particle physics laboratory in the world, located in the northwest region of Geneva on the French-Swiss border. Available in http://www.fct.pt/apoios/cooptrans/cern/index.phtml.pt, accessed November 12, 2017.

[24] HEITOR, Manuel, "Science and knowledge in the modernization of Portugal: the formulation of public policies in overcoming the Delay, Scientific and the democratization of access to knowledge", in 40 Years of Science and Higher Education Policies in Portugal, Almedina, 2015.

In this context, we can see, from what we have been expounding, that even in a matter of general consensus, the practical guidelines of the PPESI often reflected a certain degree of navigation in sight, oscillating according to the individuals who assumed the leading role at the decision-making level. If there is a basic consensus, we find that different sensibilities are formed and instituted among the elites themselves, both with regard to the organic structure that supports politics and with regard to its *governance.* It should be noted, however, that until Mariano Gago assumed the presidency of JNICT, no other position had been assumed by someone who had been *politically generated* from the National Scientific and Technological System – SCTN. Thus, the starting point commonly accepted by most of the ruling elites in a still embryonic phase of the process, was only gaining consistency as steps were taken in this direction, while, at the same time, the external socio-political referents made it operable. In this sense, we also consider it evident, that it reflects the lack of studies prior to the application of this public policy. It had only been passed about 15 years since the revolution that had overthrown Portugal's dictatorial yoke and public policy itself, as a branch of law reflecting this, was also still in an equally gestational phase. In any case, it seems curial to us to state that, having identified the need for a public policy, there were doubts and divergences regarding its application; There was no empirical knowledge of its field of implementation, of how to implement it, and the sociocultural segment that could provide it through a study compared with other European cases, was not yet properly settled. At the same time, we must take into account the instability introduced at the level of public policies by the vulnerability that scenario projections reveal in the current globalized international contexts, in which multiple and divergent interdependencies are generated.

Even so, in the face of the operationalization of yet another attempt at organic reorganization of the administration of science policy, with the extinction of the INCT in 1992, JNICT assumes preponderance as a financing institution of the National System of Science and Technology, through the management of funds from the 1st Community Support Framework.[25] This phase of organic restructuring was also echoed in the creation of the Innovation Agency and the FCCN (Foundation for National Scientific Computing) – whose mission was the management of the RCTS (Science, Technology and Society Network) – through which projects for the creation of infrastructures and the acquisition of equipment were supported. As a result of time, the new technologies began to gain their space in the scientific and social panorama Portuguese, as well as in parallel there was a process of affirmation of national science. This statement materialized, for example, when in 1989 university

[25] Cf. RODRIGUES, Maria de Lurdes and HEITOR, Manuel (org.) 40 Years of Science and Higher Education Policies in Portugal, Almedina, Coimbra, 2015,p.11:The Science Programme, the Creation of National Science, Research and Development Infrastructures, and the Structural Programme for the Development of Scientific and Technological Research, investment in Science is now included in the Community Support Frameworks of the EEC.

professors left FENPROF and organized themselves into the Union of Higher Education Teachers – SNESUP.

PPESI AND ACCESSION TO THE EEC

It was already with FCT in 1997 – after the extinction of JNICT in 1996 – that we witnessed the creation of research centres related to universities, which became, as legal persons, recipients of multi-annual funding. It was at the same time that science in Portugal was showing signs of strengthening that some emigrant PhDs returned, finding in these research units the necessary space for the development of their research areas. At the same time, but no less important in future terms, we are witnessing a massification of access to higher education. In 1980, 80,000 students had entered Portuguese universities and in 1995 this number more than tripled, reaching 290,000 individuals attending higher education institutions – at the time, already public and private, since the public ones no longer had the capacity to absorb student demand.[26] It is also at this moment that an emblematic episode occurs in our country, the revolt of the students regarding tuition fees and the declaration by the constitutional court of the unconstitutionality of the law that had approved this regime, Cf. SAMPAIO and the judicial control of public policies.[27]Cumulatively, there is also a strengthening of the coordination and supervision of higher education and research. The ANI – National Innovation Agency – leaves the tutelage of the Ministry of Economy (ME), which is assumed by the Ministry of Science (MCa)[28] It was then that Portugal began a process of internationalisation of its science with the integration into renowned European scientific institutions, such as EMBL, ESA and ESO, as Mariano Gago had advocated in the MCP in 1990. This snowball effect – which cannot be dissociated from demographic factors – means that in 2002 the number of students attending university and polytechnic education reached its maximum value, 400,000, and from 2003 onwards the demand was lower than the supply of education. In an obvious evolution of the SCTN, FCT sets up, Cátedras Convidadas, Ciência, Welcome e investigador FCT programs[29], establishing and

[26] Cf. HEITOR, Manuel, "Science and knowledge in the modernization of Portugal: the formulation of public policies in overcoming scientific backwardness and in the democratization of access to knowledge", in 40 Years of Science and Higher Education Policies in Portugal, Almedina, 2015, p.22-23: "The analysis of the evolution of the scientific system cannot Portuguese be dissociated the evolution of the higher education system in Portugal and the increasing qualification of the workforce in Portugal, in particular the qualification of groups younger ages. In the period under review, o Total number of enrollees not higher education in the age group of 20 to 23 years old increased about 10%, reaching 33% of this group age (compared to 30% in 2005). In other words, one in three 20-year-olds was enrolled in higher education in Portugal in 2010."

[27] Cf. Ruling nº 148/1994, of 3 May and SAMPAIO, Jorge Silva, Controlo Jurisdictional das Políticas Públicas de Direitos Sociais, Coimbra Editora, 2015 and KONDER, Fábio, "Ensaio sobre o juízo de constitucionalidade de políticas públicas" in Brasilia, a 35, nº138, April/June 1988, p.39: "With the widespread acceptance of the principle of judicial review of laws and acts of the Public Power in the light of the Constitution, including the judgment of unconstitutionality by omission, one had the impression that the long road leading to the so-called Rule of Law had finally arrived, on this threshold of the twenty-first century (...)" In 1989, another front of contestation by students emerged, the PGA – General Proof of Access.

[28] As can be seen throughout this work, after passing through the supervision of the MFOT, ME and MC, science sees its importance recognized with the creation of its own Ministry, which in the meantime has been assuming several designations, being today the Ministry of Science, Technology and Higher Education.

[29] Available in https://www.fct.pt/apoios/outros/catedras/index.phtml.pt and https://www.fct.pt/ciencia2008.phtml.pt, accessed November 13, 2017. The Science program has already ended, although there are still ongoing processes to close accounts; Plan to hire PhD researchers, started in 2006, with the aim of recruiting 1 000 PhDs by 2009. These programmes were implemented through a public tender (in 2006 and 2008) to which national R&D institutions competed, submitting applications for the hiring of researchers, for further analysis by FCT, and signing contracts. The Invited Chairs Program

promoting partnerships with international educational institutions, as MIT, CMU, UTA, HMS, etc.[30] Another dimension of the development of science and research in Portugal has to do with the REJIES approved by Law Nº 62/2007, of 10 September. Within its scope, some public higher education institutions have been opting for a private law regime, by assuming the nature of public foundations of a foundational nature. This legal figure allows them, broadly speaking, to access non-public accounting typologies, to receive multiannual budget allocations, to expedite negotiations with the financial sector and therefore to be able to strategically project their long-term future

CONCLUDING REMARKS

Evaluating the PPESI, we can say from the outset that the objective of massifying access to higher education was achieved with distinction and based on the data provided in the annex to this chaptear, which we advise the reader to consult, regarding the numbers refered bellow, that many of the policies for financing advanced studies have proved to be equally successful. Let's pay attention to the following data, that many of the policies for financing advanced studies have proved to be equally successful. Let's pay attention to the following data; Master's scholarships reached their maximum value in 1996 with 1247 applications, and in 2009 they did not exceed 9.[31] If we compare the PhD scholarships in a similar time gap, we see that since there are records – dating back to 2000 – there are about 700 PhD scholarships awarded and only in 2004 and 2005 reached the value previously mentioned for Master's scholarships - 1247.[32] This means that the PPESI began to be applied to access to higher education and that in the 1990s it was focused as its natural sequence in master's degrees. In this context, we can conclude that in 2004/2005 such a lengthy process was carried out with the award of PhD scholarships to an already considerable level of candidates[33] . As for the type of PhD scholarships awarded, we can see that this is an area more likely to be influenced by contextual political choices; if we look at the graphs - in annexe - relating to this distribution, we see that in 1994 the number of grants awarded to the social sciences it was smaller if compared to the area of engineering sciences and technology, a deficit that would be attenuated between 2004 and

continues to receive applications in 2017, more specifically 3. The Wellcome Programme aimed to attract European researchers, with PhDs, allowing the recruitment of European researchers who wanted to work in Portuguese research institutions, after three years in research in third countries. In 2011/12, contracts were signed with 38 researchers of seven nationalities, in addition to Portuguese: Germany, France, United Kingdom, Italy, Serbia, Sweden, Hungary. The FCT Investigator Programme is focused on the researcher, being a highly competitive programme for the recruitment of the most creative and innovative PhD researchers, who demonstrate the capacity for independence and leadership in their scientific area. Launched in 2012, the programme aims to hire 1,000 FCT Researchers by 2016. Available at https://www.fct.pt/apoios/contratacaodoutorados/index.phtml.pt, accessed November 15, 2017.

[30] Cf. HEITOR, Manuel, "Science and knowledge in the modernization of Portugal: the formulation of public policies in overcoming scientific backwardness and democratizing access to knowledge", in 40 Years of Science and Higher Education Policies in Portugal, Almedina, 2015, p.21.

[31] Cf. graph 2, annexes.

[32] See annexes, Graph 4.

[33] In 1980 it was around 80,000 students attending higher education, in 1995 it more than tripled, with 290,000 students and in 2002 it reached its maximum value, 400,000 students.

2011.[34] We also get to the conclusion that the years with the highest number of applications for successful PhD scholarships are concentrated in the years between 2004 and 2011, with the maximum number of scholarships awarded being reached in 2007.[35] From 2013 onwards, PhD grants fell by less than half when compared to 2007, denoting in this aspect the economic constraints resulting from the *subprime crisis.*[36] As for the number of candidates for PhD scholarships, we found that contrary to the economic cycle, it was in 2012 that about 4400 students applied,[37] and only 1200 scholarships were awarded.[38]

In this panorama of general progress, however, the last five years mark a period of contraction in investment and initiatives, which can be attributed first (though not exclusively) to the international and national financial crises. This contraction translated not only into an immediate reduction of many activities, but also into the interruption of long-term strategies and the installation of an environment of great retraction, which not only affected organizations fed by public money but extended to private companies, making it particularly difficult to find sponsorship for scientific culture activities.

Compared to 2007, the year with the highest number of scholarships awarded – 2000 – the number of applications increased from 3600 to 4400 in 2012. As for the post-doctoral fellowships funded by FCT, it was in 2006 that they reached their maximum number with 710 fellowships awarded. Comparing with 2013 – 410 – and 2015 – 520 – the downward curve already observed and corroborated by GRANADO and MALHEIROS is confirmed. In any case, it should be noted that we look at different dimensions of the PPESI when we compare postdoctoral and doctoral fellowships.

Comparing the year 1970, in which 60 individuals received their doctorates, with the year 2015, in which 2969 new doctors successfully defended their thesis, we see the exponential increase in this variable.[39] Moreover, when we compare the number of PhDs per 100,000 inhabitants between several countries, not only belonging to the EU, we find that if in 2004 they represented 8.5 in Portugal, in 2015 they already represented 22.7 individuals.[40]

Turning now to the public policy of science and technology in contemporaneity, we highlight the recently approved REC[41] - during the month of November 2017 - which provides for the

[34] Cf. annexes, graph 5.
[35] See annexes, Graph 4, and Graph 5.
[36] Cf. attachments, graph 5, and graph 7.
[37] Cf. graph 3.
[38] Cf. in a complementary sense GRANADO, António and MALHEIROS, José Vitor, Cultura Científica em Portugal, Fundação Francisco Manuel dos Santos, 2015, p.11.
[39]Available at https://www.pordata.pt/Portugal/Doutoramentos+realizados+em+Portugal+ou+no+estrangeiro+e+reconhecidos+por+universidades+portuguesas+total+e+por+sexo-681, accessed November 15, 2017.
[40] Cf. anexos.
[41] REC- Regulation of Scientific Employment, available in https://www.fct.pt/apoios/contratacaodoutorados/docs/RegulamentoDoEmpregoCientifico.pdf, accessed on November 15, 2017.

possibility of individual and institutional applications for employment contracts for PhDs for less than 6 years. In this context, the REC is the most recent FCT regulation that implements the government's policy of replacing post-doctoralscholarships with employment contracts -which the call for its attribution via FCT took place in 2016. Within the scope of projects and research units, post-doc grants still remain an available instrument. Although, shortly after, as Decree-Law 57/2016 of 29 August 2016 produced its effects, post-doc came to an end.

Finally, we note that the challenge currently lies in the design of the policies to be adopted to absorb all these doctorates, whose number has been systematically increasing, as we hope to have demonstrated. Decree-Law Nº 57/2016 of 29 August and Law Nº57/2017 of 19 July [42] correspond to instruments destinated for the implementation of a public policy, which may get a solution to this problem. Promising greater security in research work by promoting fixed-term or uncertain-term employment contracts – for a maximum period of 6 years – depending on whether the contracting educational/research institutions are public or private.[43] However, we also find that new *players* appear in the arena of social and political pressures – more or less diffuse – not only does the current governmental solution open new doors, closing others, but also the PhDs apparently begin to speak with one voice in the field of negotiations with the political and legislative power, through the ABIC lobbying . Scientific research grantees are apparently united in an attempt to end the precariousness that has accompanied them for decades. It should be noted that from 2002 to 2017 the value of the "maintenance allowance" of doctoral and postdoctoral scholarships did not change at all.[44]

Returning to FCT and its role in the application of Decree-Law Nº. 57/2016, as amended by Law Nº. 57/2017. Apparently, this boils down to the application of article 23 of the above-mentioned norm –a transitional rule/norma transitória – leaving the burden of contracting to educational institutions and research centres, with the obvious budgetary problems that emerge from this imperative.[45] The initial version of Decree-Law Nº 57/2016, of 29 August, considered as eligible under the transitional rule all post-doc scholarship holders who until 1 September 2016 performed functions under the EBIC and who, at the same time, accounted for 3 consecutive years of scholarship measured on that date. Many scholarship holders with an accumulated track record of activity of more than 3 years, but who at that moment for any reason were not exercising, would,

[42] "The legal regime for hiring doctorates, created by Decree-Law 57/2016, and amended by Law 57/2017, of 19 July, aims to stimulate scientific and technological employment in all areas of knowledge, promote the rejuvenation of institutions and value scientific research, technological development, management and communication activities of science and technology. The entities of the National Scientific and Technological System (SCTN) now have a new mechanism to stimulate the hiring of PhD researchers, with a view to their integration into the entities of the SCTN, as well as in their multiple partnerships and collaborative forms with the economic and productive, social or cultural fabric." Available at https://www.fct.pt/apoios/contratacaodoutorados/index.phtml.pt, accessed November 15, 2017.
[43] Decree-Law nº 57/2016, of 29 August, in its article 6, paragraph 1, a) and b).
[44] Cf.. Table available in https://www.fct.pt/apoios/bolsas/valores.phtml.pt, accessed November 19, 2017.
[45] We know, however, that the scenarios are volatile and FCT will have to readapt its procedures to any new indications received from the tutelage.

according to the interpretation made by FCT, be excluded from this transitional rule, as well as those who accounted for 3 interpolated years. This transitional regime included the eligible scholarship holders to enter into an employment contract - after a tender procedure carried out by the teaching or research institutions - through a program contract signed with FCT. According to this Decree-Law, the new contracts would enter into with the placement in remuneration position 28, however, negotiations carried out by the grantees managed to ensure that the entry position corresponded to remuneration position 32 – currently 33. Especially the first aspect, which excluded scholarship holders with 10 or more years of scholarship, but who on September 1, 2016 were not carrying out any activity - also due to the precariousness that characterized their contracts - raised a great deal of controversy. ABIC and the parties to the left of the Socialist Party have rebelled against this and other aspects of the law. For a year, the problem was discussed in parliamentary committees, to which the president, the vice-president - members of the FCT's Board of Directors - were summoned, as well as the doctoral fellows who worked in science and technology management at the FCT. The overwhelming majority of institutions attentive to this political and negotiation process suspended the application of the transitional rule –article 23 –of Decree-Law 57/2016, and only 10 institutions carried out and sent their tender procedures to the FCT for validation. Of these, about 7 procedures were considered eligible after analysis carried out by the Division of Scientific Employment and, following the hierarchical procedures foreseen, sent to the Board of Directors for subsequent approval by the Ministry of Science, Technology and Higher Education and the Finance Ministry. At this point, November 2017, although the employment contracts had already been signed – some since February – the bureaucracy at the highest level had not yet made it possible to sign any program contract to finance them.

With the change implemented by Law 57/2017 of 19 July, the reference minimum remuneration position become the 32 – since 2024- 33 –not 28 – and scholarship holders who carry out research activities within the scope of the scholarship they have received under the EBIC - for more than 3 consecutive or interpolated years - are now covered, also contemplating two new deadlines for carrying out tender procedures; until 31 December 2017 and another, until August 18, 2018. As of the publication of this law and despite months of waiting for its regulation, the tender procedures were suspended under Decree-Law 57/2016, which provided for a deadline for carrying out the tender procedures between 1 September 2016 and 31 August 2017. Only those that were carried out until July 19, the date of publication of Law 57/2017, followed the normal regulated procedures. Nevertheless, and as a question which is not for us to go into in depth here, the basic problem remains; how would institutions be able to make funds from their budgets available to hire researchers/fellows who, because they are outside the scope of application of the transitional rule, would not be funded by FCT when Decree-Law 57/2016, amended by Law 57/2017, indicated that

researchers and post-doc fellows should they be hired by the institutions? Will the institutions have an increase in the budget allocation or is it intended to induce a resurgence of *private funding*? In the latter case, private funding will naturally go to applied science. What will happen to pure science? These questions remain open, which will certainly require the study, definition, analysis of cost/benefits and establishment of courses of action for the implementation of a policy that can solve a problem that, although expected, is recent in the field of science, research and technology in Portugal. Currently, the contracts signed under Decree-Law 57/2016 of 29 August are ending and a question arises; will the remaining instruments created be sufficient to absorb existing PhD researchers? Tenure, the non-academic competition, the competitions for the associated laboratories, in short. It is in this context that the creation of a research career at the FCT is being discussed in 2024 - the positions of assistant researcher have already been created, although the career does not yet exist institutionally. What solution will be provided for the PhDs hired under Decree Law 57/2016, whose contracts are coming to an end? How will the situation of FCT doctoral graduates - not hired under Decree-Law 57/2016 - who claim discrimination against colleagues hired under Decree-Law 57/2016, due to the disparity in salary, be resolved? These are crucial times for important and hopefully fair decisions.

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CASE LAW

See TC Ruling Nº 148/94, of 1994-05-03 (Declares the unconstitutionality of Articles 6(2) and 11(1) of Law Nº 20/1992, of 14 August).

LEGISLATION

LAWS

Law Nº 65/1979 - Official Gazette Nº 230/1979, Series I of 1979-10-04 – Approval of the principle of freedom of education.

Law Nº 121/1986 - Official Gazette Nº 122/1986, Series I of 1986-05-28 – Regulation of *Clausus* numbers for Higher, Private and Cooperative Education.

Law Nº 91/1988 - Official Gazette Nº 187/1988, Series I of 1988-08-13 - Law on Scientific Research and Technological Development.

Law Nº 54/1990 - Official Gazette Nº 205/1990, Series I of 1990-09-05 – Statute and autonomy of polytechnic higher education institutions.

Law Nº 20/1992 - Official Gazette Nº 187/1992, Series I-A of 1992-08-14 - Establishes rules regarding the tuition fee system. (See TC Ruling Nº 148/94, of 1994-05-03, declaring the unconstitutionality of Articles 6(2) and 11(1)).

Law Nº 38/1994 - Official Gazette Nº 269/1994, Series I-A of 1994-11-21 - Evaluation of Higher Education and its constituent institutions.

Law Nº 28-B/1996 - Official Gazette Nº 81/1996, 1st Supplement, Series I-A of 1996-04-04 - Establishes the regime of access to higher education.

Law Nº 113/1997 - Official Gazette Nº. 214/1997, Series I-A of 1997-09-16 - Defines the basis for the financing of public higher education

Law Nº 40/2004 - Official Gazette Nº 194/2004, Series I-A of 2004-08-18 – Statute of the Scientific Research Grant Holder.

Law Nº 38/2007 - Official Gazette Nº 157/2007, Series I of 2007-08-16 - Approves the Legal Regime for the Evaluation of Higher Education / creation of the Agency for Assessment and Accreditation of Higher Education – AAAES.

Law Nº 62/2007 - Official Gazette Nº 174/2007, Series I of 2007-09-10 - Legal Regime of Higher Education Institutions, amending Law Nº 38/2007, of 16 August.

Law Nº 12/2013 - Official Gazette Nº 20/2013, Series I of 2013-01-29 - First amendment, by parliamentary appreciation, to Decree-Law Nº 202/2012, of 27 August, which makes the first amendment to the Statute of the Research Grant Holder, approved in annex to Law Nº 40/2004, of 18 August.

Law Nº 57/2017 – Official Gazette Nº 138/2017, Series I of 2017-07-19 – Approves amendments to Decree-Law Nº 57/2016, of 29 August – Legal Regime of Scientific Employment.

DECREE-LAWS

Decree-Law Nº 270/1975 - Government Gazette Nº 124/1975, 2nd Supplement, Series I of 1975-05-30 – Abolition of the aptitude exam for access to higher education.

Decree-Law Nº 217/1974, Government Gazette Nº 123/1974, Series I of 1974-05-27 – Recognition as management bodies of universities of the basic commissions created following the processes of dismissal and reorganization of rectors.

Decree-Law Nº 807/1974 - Government Gazette Nº 303/1974, 6th Supplement, Series I of 1974-12-31 - Recognition as management bodies of universities of the basic commissions created following the processes of dismissal and reorganization of rectors.

Decree-Law Nº 304/1978 - Official Gazette Nº 235/1978, Series I of 1978-10-12 – Defines – but does not approve – the rules relating to the various degrees awarded by higher education institutions. Only approved with regard to master's degrees, by Decree-Law Nº 263/1980 - Official Gazette Nº 181/1980, Series I of 1980-08-07.

Decree-Law Nº 448/1979 - Official Gazette Nº 262/1979, Series I of 1979-11-13 - Approves the first Statute of the University Teaching Career.

Decree-Law Nº 132/1980 - Official Gazette Nº 114/1980, Series I of 1980-05-17 - Defines the general principles that define the structure of social services in higher education. First attempt to reorganize the support provided to families and students in higher education.

Decree-Law Nº 263/1980 - Official Gazette Nº 181/1980, Series I of 1980-08-07 – Establishes the rules regarding the creation of master's degrees in universities.

Decree-Law Nº 415/1980 - Official Gazette Nº 224/1980, Series I of 1980-09-27 - Defines and structures the scientific research career.

Decree-Law Nº 310/1981 - Official Gazette Nº 265/1981, Series I of 1981-11-17 - Regulates Teaching Cooperatives.

Decree-Law Nº 100-B/1985 - Official Gazette Nº 81/1985, 1st Supplement, Series I of 1985-04-08 – Established the General Rules of Private and Cooperative Higher Education.

Decree-Law Nº 245/1986 - Official Gazette Nº 191/1986, Series I of 1986-08-21 – Approves the Statute of the University Teaching Career – ECDU.

Decree-Law Nº 344/1988 - Official Gazette Nº 225/1988, Series I of 1988-09-28 – Creates a subsidized credit line for the acquisition of new facilities and equipment in Private and Cooperative Higher Education.

Decree-Law Nº 108/1988 - Official Gazette Nº 76/1988, Series I of 1988-03-31 - Integration of private and cooperative schools in the school network and approval of the Regime of Autonomy of Universities provided for since the CRP of 1976.

Decree-Law Nº 129/1993 - Official Gazette Nº 94/1993, Series I-A of 1993-04-22 – Defines the Policy for Social Action in Higher Education, creating CNASES.

Decree-Law Nº 28-B/1996 - Official Gazette Nº 81/1996, 1st Supplement, Series I-A of 1996-04-04 – Establishes the National Examinations, abolishing the General Access Test – PGA.

Decree-Law Nº 292/1997 - Official Gazette Nº 245/1997, Series I-A of 1997-10-22 - Grants tax benefits for the year 1997 to corporate income tax taxpayers who incur expenses with research and development.

Decree-Law Nº 123/1999 - Official Gazette Nº 92/1999, Series I-A of 1999-04-20 - Approves the Statute of the Scientific Research Grant Holder – EBIC.

1- Law Nº 40/2004 - Official Gazette Nº 194/2004, Series I-A of 2004-08-18 – Approves the new Statute of the Research Grant Holder.

2- Decree-Law Nº 202/2012 - Official Gazette Nº 165/2012, Series I of 2012-08-27 - Amends Law Nº 40/2004.

3- Decree-Law Nº 89/2013 - Official Gazette Nº 130/2013, Series I of 2013-07-09 – Proceeds to the third amendment to the EBIC.

4- Decree-Law Nº 233/2012 - Official Gazette Nº 209/2012, Series I of 2012-10-29 – Deferring the effects of the new exclusive dedication regime, introduced by Decree-Law Nº 202/2012, of 27 August.

5- Law Nº 12/2013 - Official Gazette Nº 20/2013, Series I of 2013-01-29 - First amendment, by parliamentary appreciation, to Decree-Law Nº 202/2012, of 27 August, which makes the first amendment to the Statute of the Research Grant Holder, approved in annex to Law Nº 40/2004, of 18 August.

Decree-Law Nº 125/1999 - Official Gazette Nº 92/1999, Series I-A of 1999-04-20 - Establishes the regulatory framework applicable to institutions dedicated to scientific research and technological development.

Decree-Law Nº 369/2007 - Official Gazette Nº 212/2007, Series I of 2007-11-05 - Creates the Agency for Assessment and Accreditation of Higher Education and approves its statutes – AAAES.

Decree-Law Nº 309-A/2007 - Official Gazette Nº 173/2007, 2nd Supplement, Series I of 2007-09-07 - Aims to create a specific system of loans to students and scholarship holders of higher education, researchers and institutions of scientific research and technological development

Decree-Law Nº 205/2009 - Official Gazette Nº 168/2009, Series I of 2009-08-31 - Amends the Statute of the University Teaching Career, approved by Decree-Law Nº 448/79, of 13 November.

Decree-Law Nº 207/2009 - Official Gazette Nº 168/2009, Series I of 2009-08-31 - Proceeds to the amendment of the Statute of the Career of Teaching Staff of Polytechnic Higher Education, approved by Decree-Law Nº 185/81, of 1 July.

Decree-Law Nº 57/2016 - Official Gazette Nº 165/2016, Series I of 2016-08-29 - Approves a regime for the hiring of doctorates aimed at stimulating scientific and technological employment in all areas of knowledge.

RESOLUTIONS OF THE COUNCIL OF MINISTERS

Resolution of the Council of Ministers Nº 135/2002 - Diário da República Nº 268/2002, Série I-B de 2002-11-20 – Defines the new institutional framework for the Government's activity in the field of information society, innovation and e-government. Creates the Information and Knowledge Mission Unit – UMIC.

Resolution of the Council of Ministers Nº 107/2003 – Diário da República Nº 185/2003, Série I-B de 2003-08-12 – Approves the Action Plan for the Information Society, the main instrument for the strategic and operational coordination of the policies of the XV Constitutional Government for the development of the information society in Portugal.

REGULATORY OFFICES

Legislative Order Nº 340/1993 - Official Gazette Nº 252/1993, Series I-B of 1993-10-27 - Approves the rules for the awarding, in the academic year 1993-1994, of tuition subsidies to students of private and cooperative higher education.

ACRONYMS

AAAES- Agency for Assessment and Accreditation of Higher Education.

ANI – National Research Agency.

CERN- European Organization for Nuclear Research.

CT - Technology Centers.

CNASES- National Council of Social Action for Higher Education.

CMU – Carnige Mellon University.

CRP - Constitution of the Portuguese Republic.

EBIC – Statute of the Scientific Research Grant Holder.

ECDU- Statute of the University Teaching Career.

EMBL- European Molecular Biology Laboratory.

ESA – European Space Agency.

ESO – European Southern Observatory.

FCCN- Foundation for National Scientific Computing.

FCT – Fundação para a Ciência e a Tecnologia IP, which replaces JNICT in 1996/97.

FENPROF- National Federation of Teachers.

HMS – Harvard Medical School.

INIC- National Institute for Scientific Research.

INSA – Instituto Nacional Dr. Ricardo Jorge.

JNICT- National Board for Research in Science and Technology.

JNICT a)- National Days of Scientific Research and Technology.

LNEC – National Laboratory of Civil Engineering.

MC- Ministry of Culture.

MCa – Ministry of Science.

MCP – Science Portugal Manifesto, dating from 1990, by Mariano Gago.

ME – Ministry of Economy.

MEC – Ministry of Education and Science.

MFP- Ministry of Finance and Planning.

MI – Ministry of Industry.

MIT – The Massachusetts Institute of Technology.

MPOT- Ministry of Planning and Spatial Planning.

PASI- Society and Information Action Plan.

PIDCT - Integrated Plan for Scientific and Technological Development.

PDT - Technological Development Plan or PTN - National Technological Plan.

PGA- General Access Test instituted in 1989 and abolished by Decree-Law 28-B/1996 that institutes the National Exams.

PMCT - Science and Technology Mobilizer Program.

PPESI- Public Policy for Higher Education and Research.

RCTS - Science, Technology and Society Network.

REC – Regulation of Scientific Employment.

REJIES - Legal regime of higher education institutions, first approved by Law Nº 38/2007, of 16 August, amended by Law Nº 62/2007, of 10 September.

SCTN- National Scientific and Technological System.

SNESUP- National Union of Higher Education Teachers following the creation of the University Teaching Career.

UNIC- Information and Knowledge Mission Unit.

UTA – University of Texas at Austin.

ATTACHMENTS

Image 1 - number of PhDs per 100,000 inhabitants

Groups/Countries	PhDs per 100,000 inhabitants	
Years	2004	2015
European Union (28 countries)	16,8	N/Available
Germany	28,0	35,8
Austria	29,9	25,4
Belgium	14,2	24,8
Bulgaria	5,1	20,1
Cyprus	1,8	9,1
Croatia	8,3	20,9
Denmark	14,6	38,3
Slovakia	15,9	35,3
Slovenia	17,8	48,5
Spain	19,0	24,4
Estonia	15,3	15,8
Finland	26,8	36,5
France	N/Available	20,7
Greece	11,8	N/Available
Hungary	8,8	12,3
Ireland	16,8	37,4
Italy	14,7	17,3
Latvia	3,7	12,9
Lithuania	8,9	14,4
Luxembourg	N/Available	18,8
Malta	N/Available	6,9
Netherlands	16,5	27,5
Poland	14,3	10,0
Portugal	8,5	22,7
United Kingdom	25,4	40,9
Czech Republic	17,0	23,1
Romania	12,5	20,1
Sweden	30,6	37,2
Iceland	3,4	N/Available
Norway	16,5	27,1
Switzerland	37,5	46,5
United States of America	16,4	N/Available
Japan	11,9	N/Available

Sources/entities: Eurostat | UNESCO-UIS | OECD | National Entities, Eurostat | NU | National Institutes of Statistics, PORDATA.
Last update: 2017-09-25. Available at https://www.pordata.pt/Europa/Doutoramentos+(ISCED+8)+por+100+mil+inhabitants-2409, accessed on November 17, 2017.

Graph 1

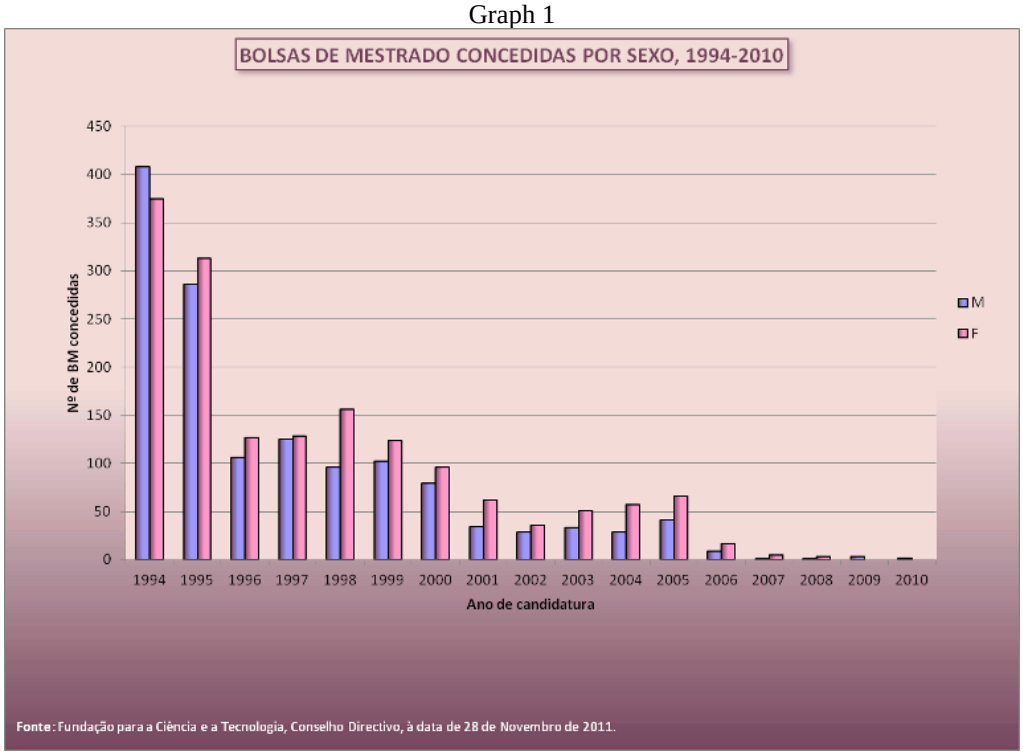


Figure 2

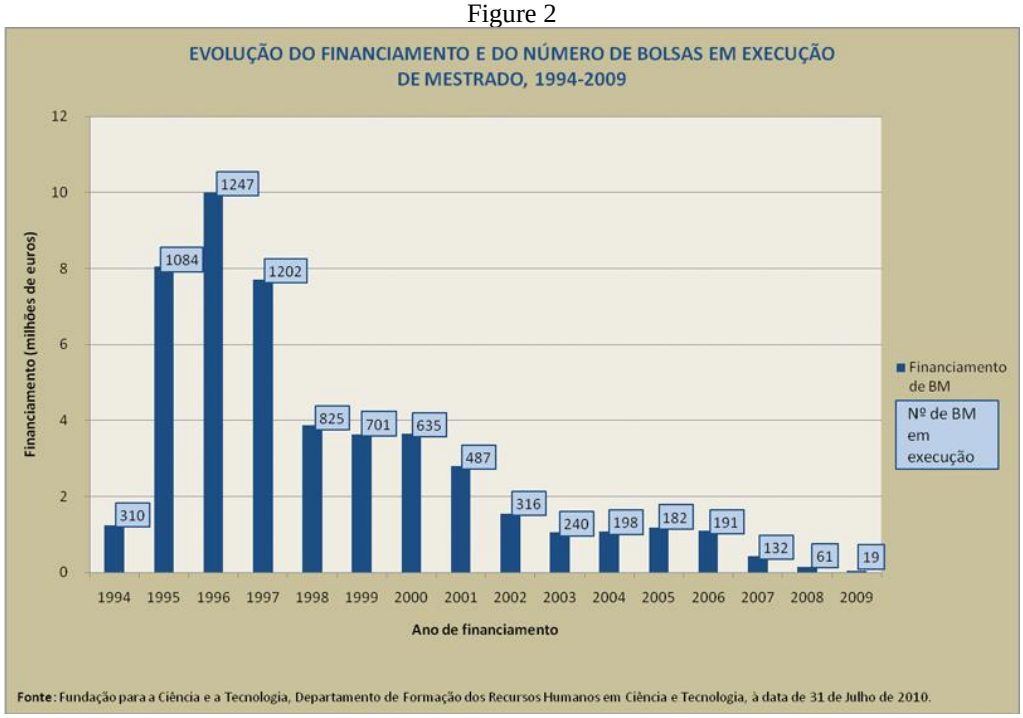


Figure 3

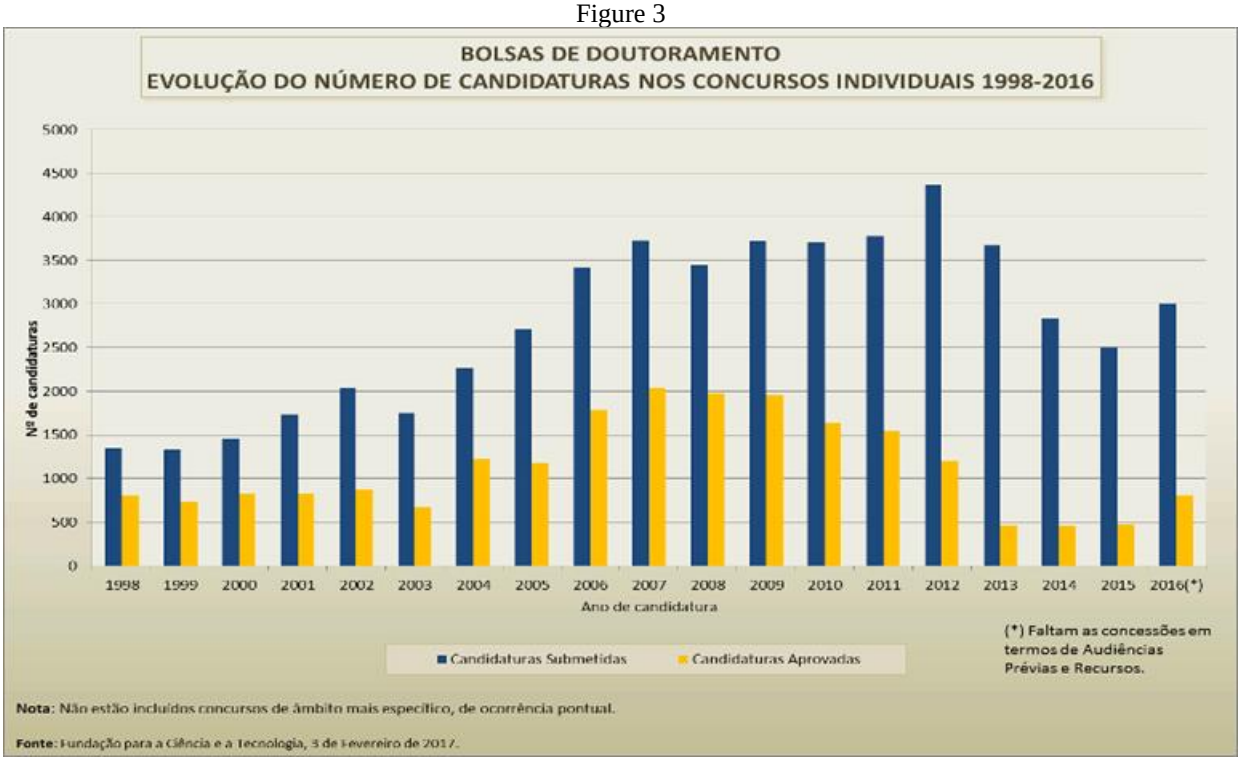


Figure 4

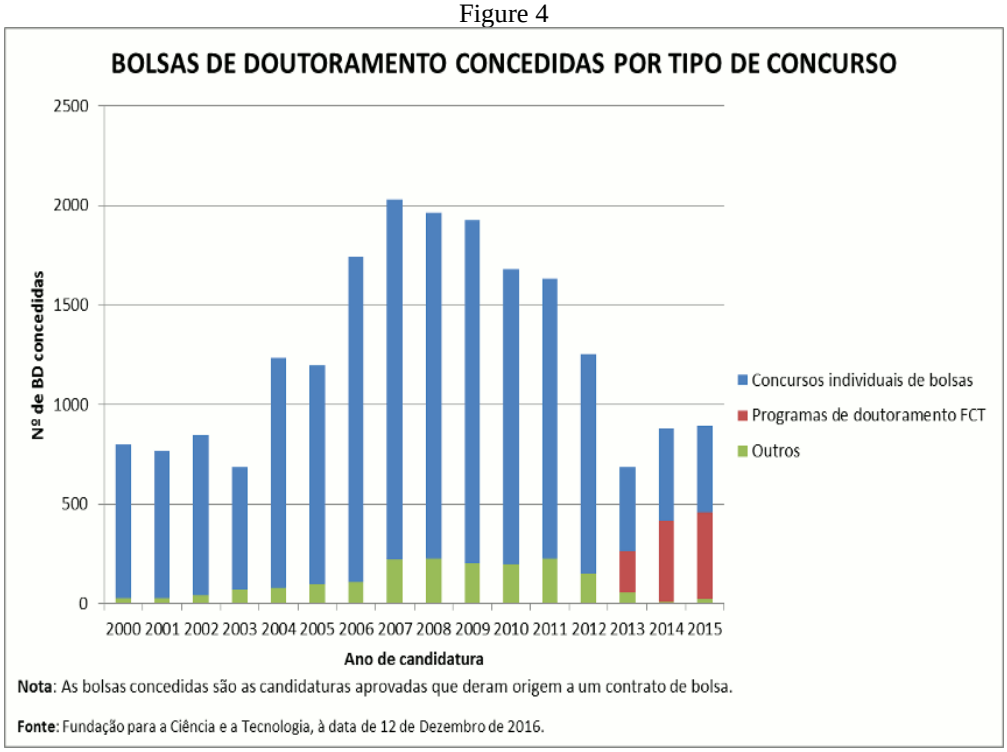


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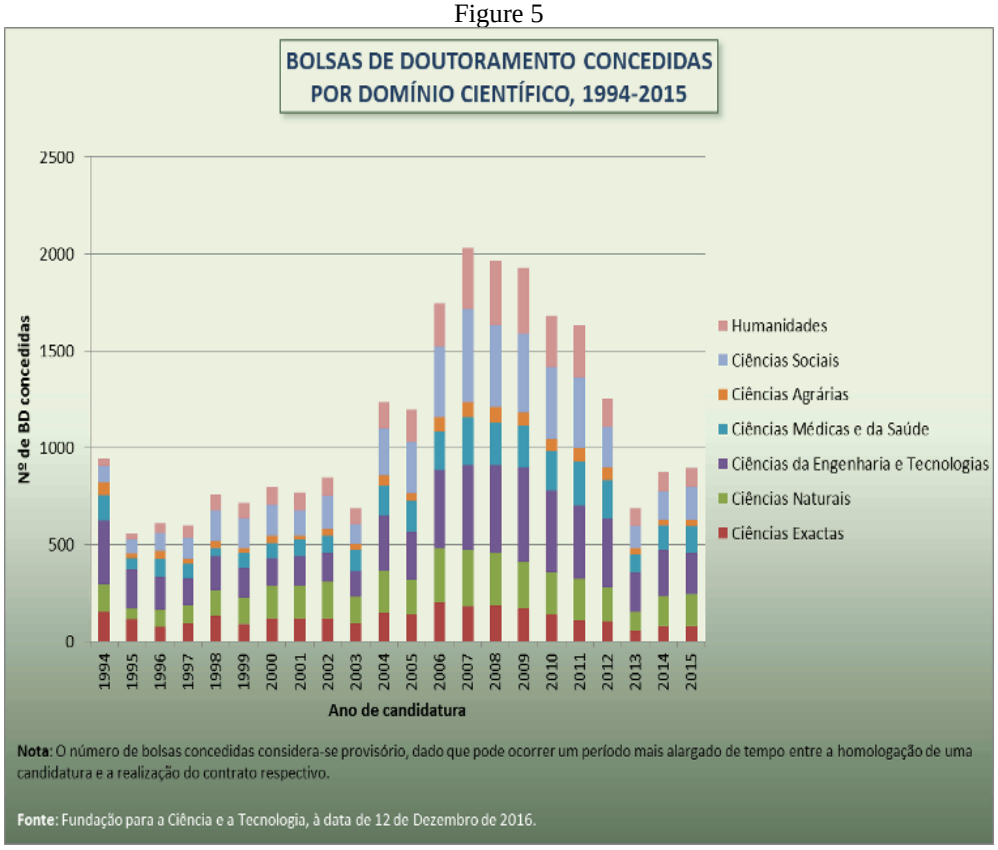


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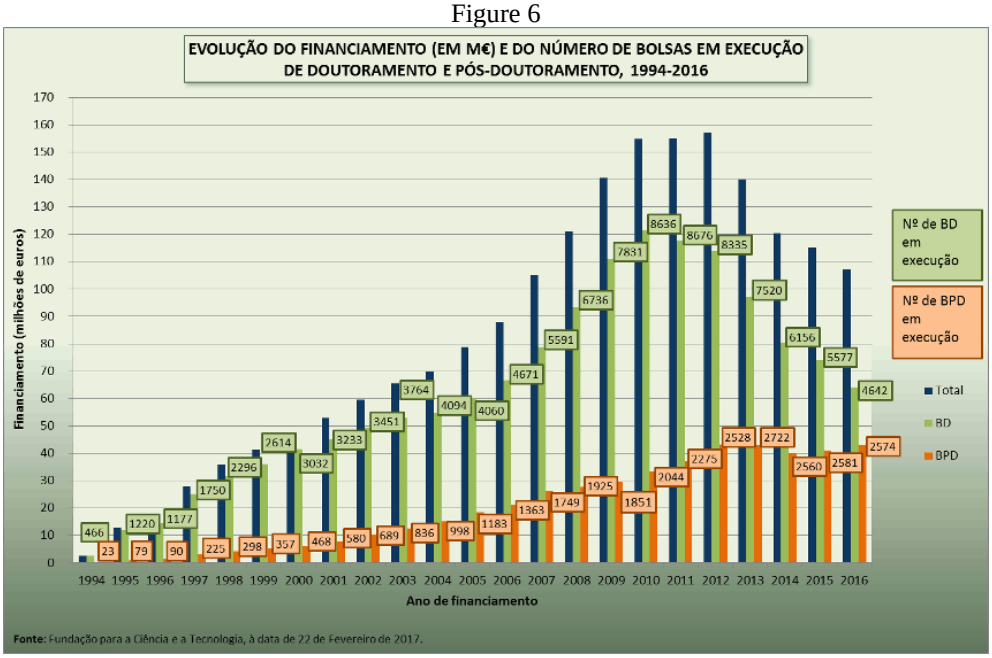


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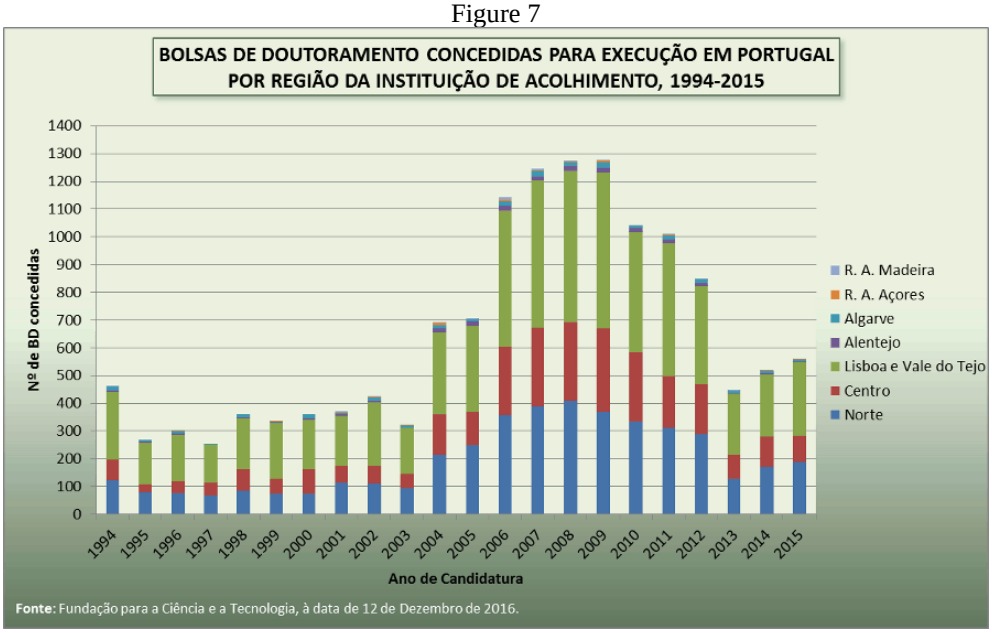


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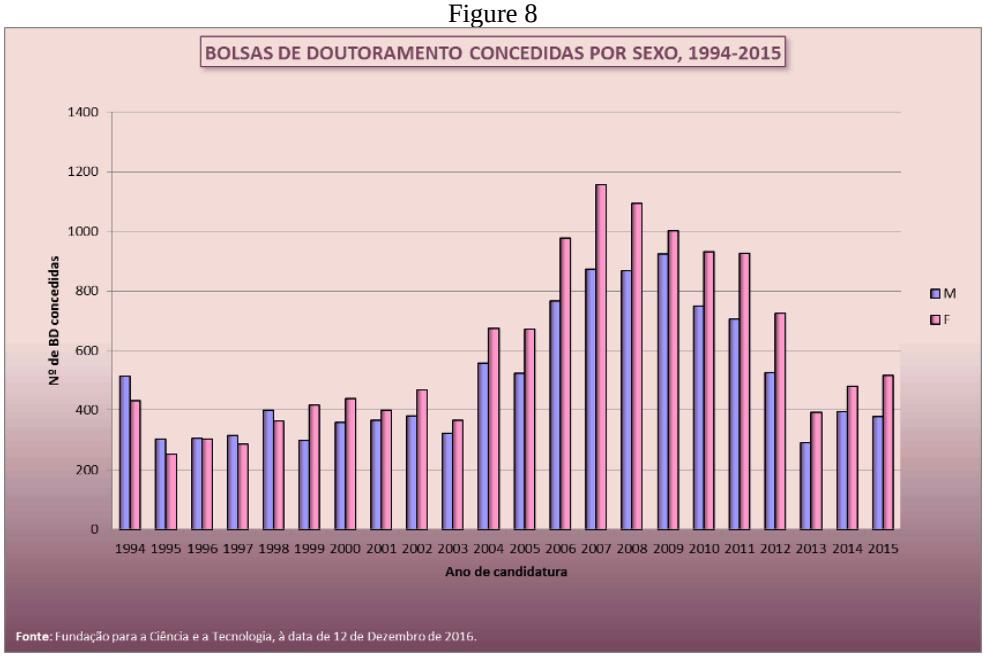


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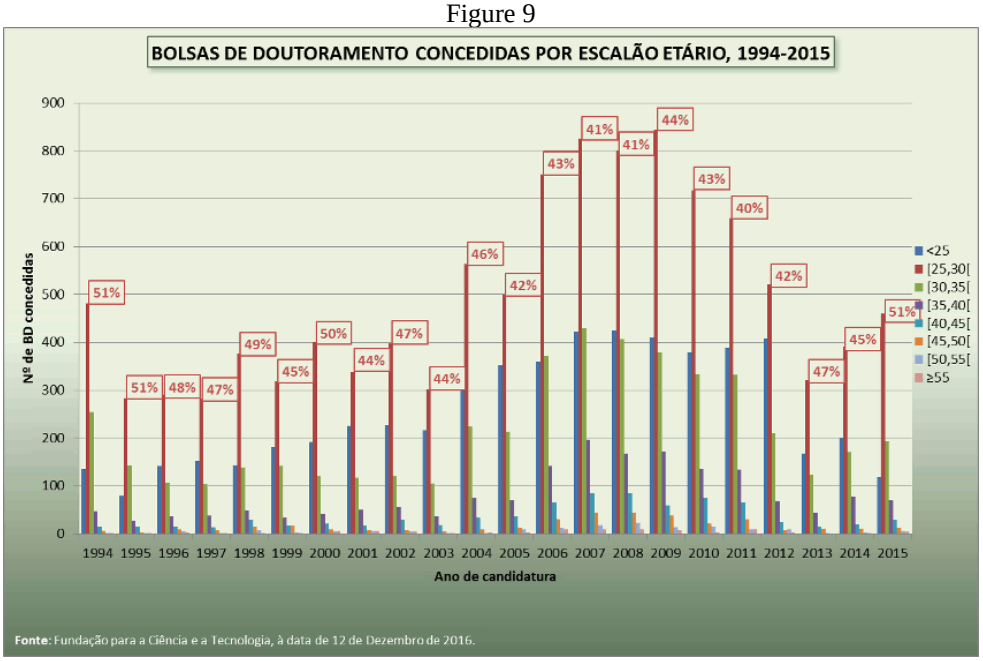


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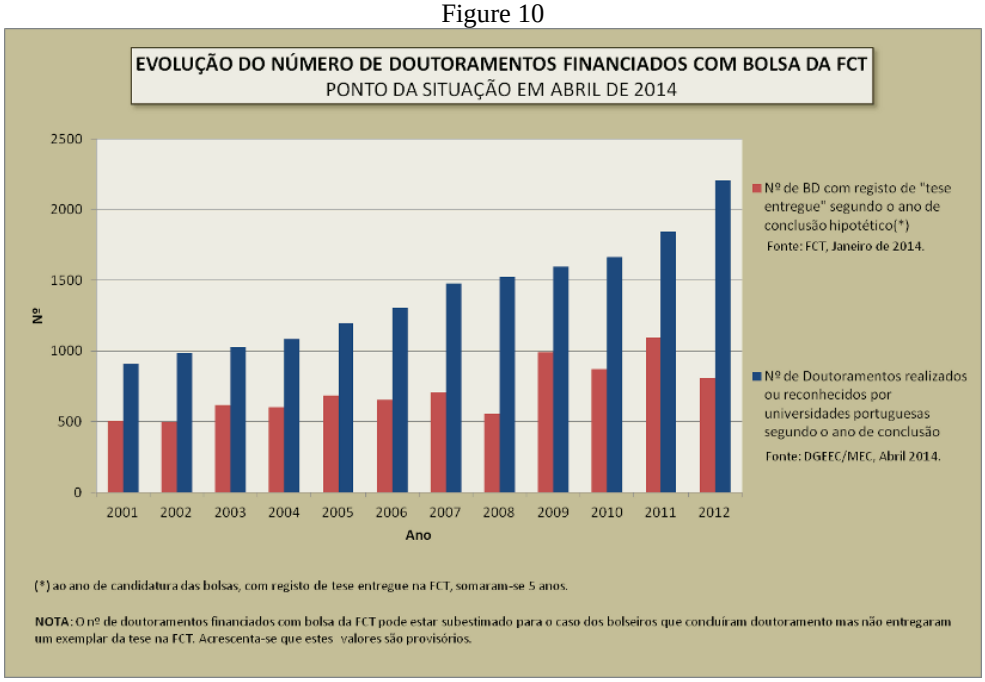


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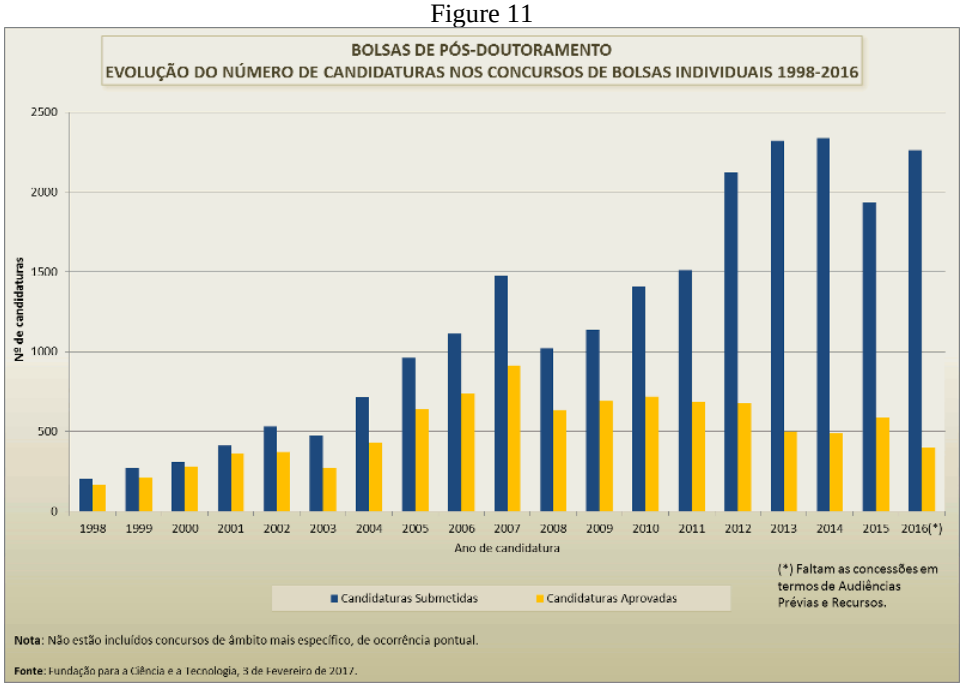


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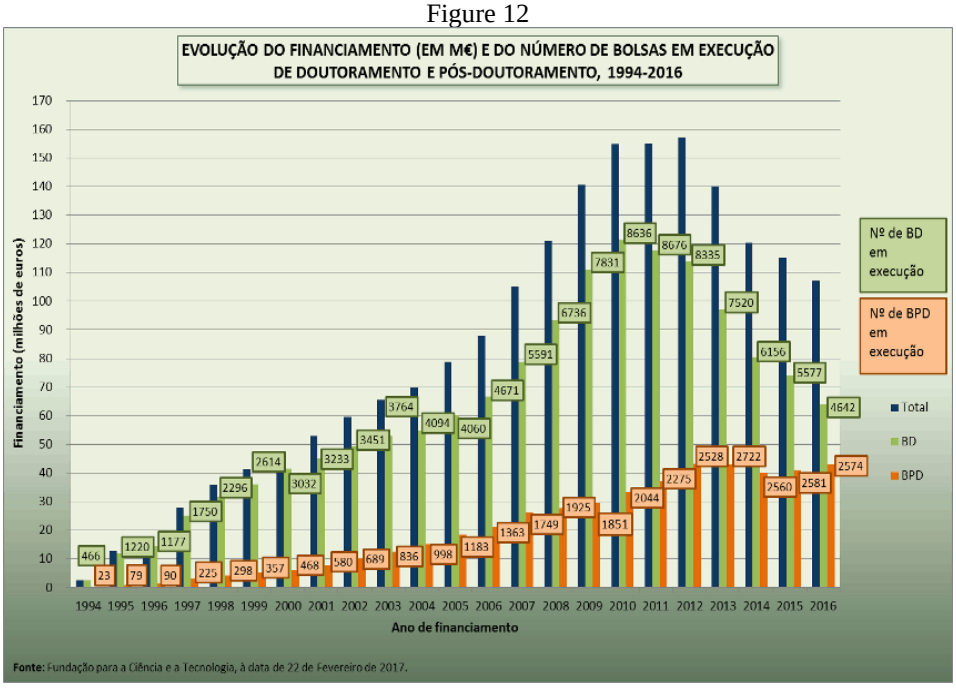


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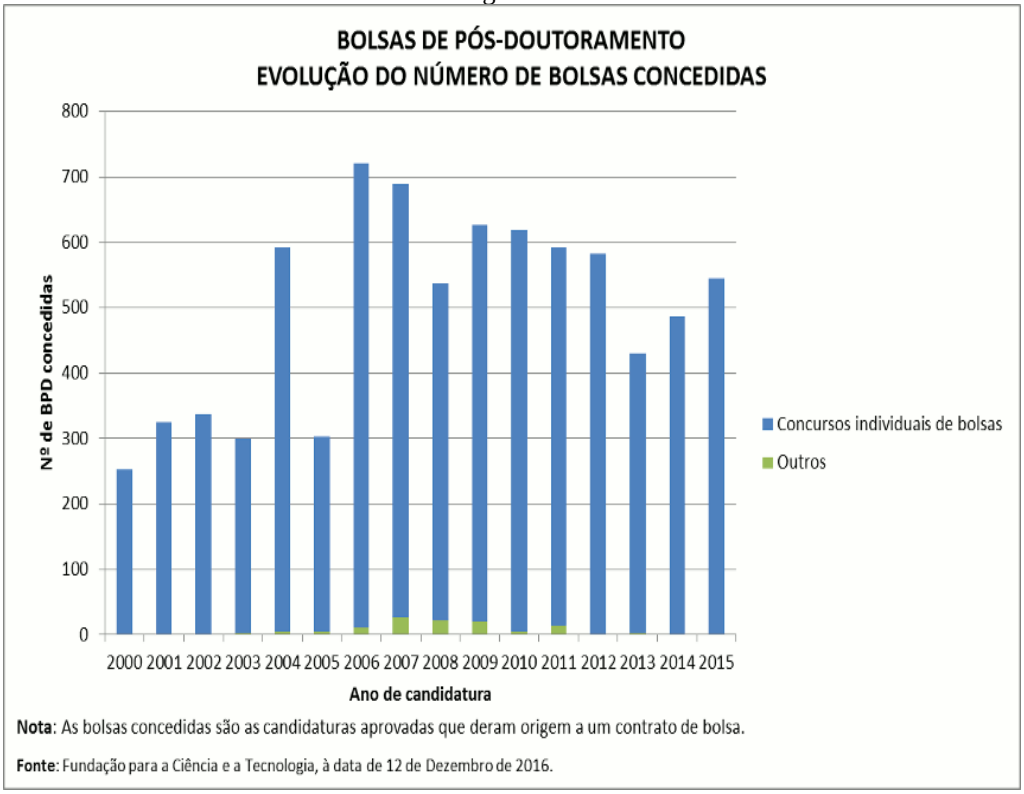


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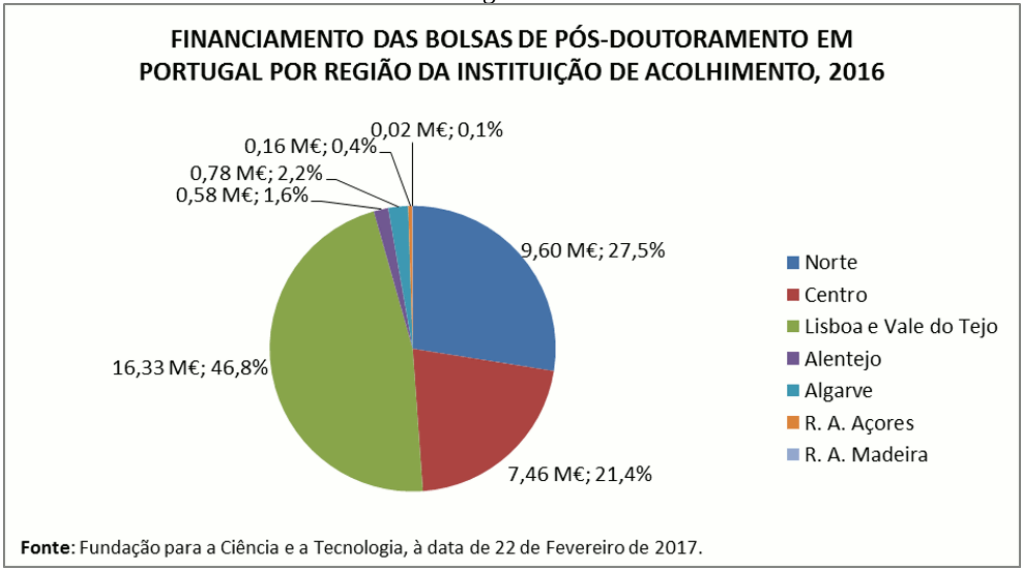


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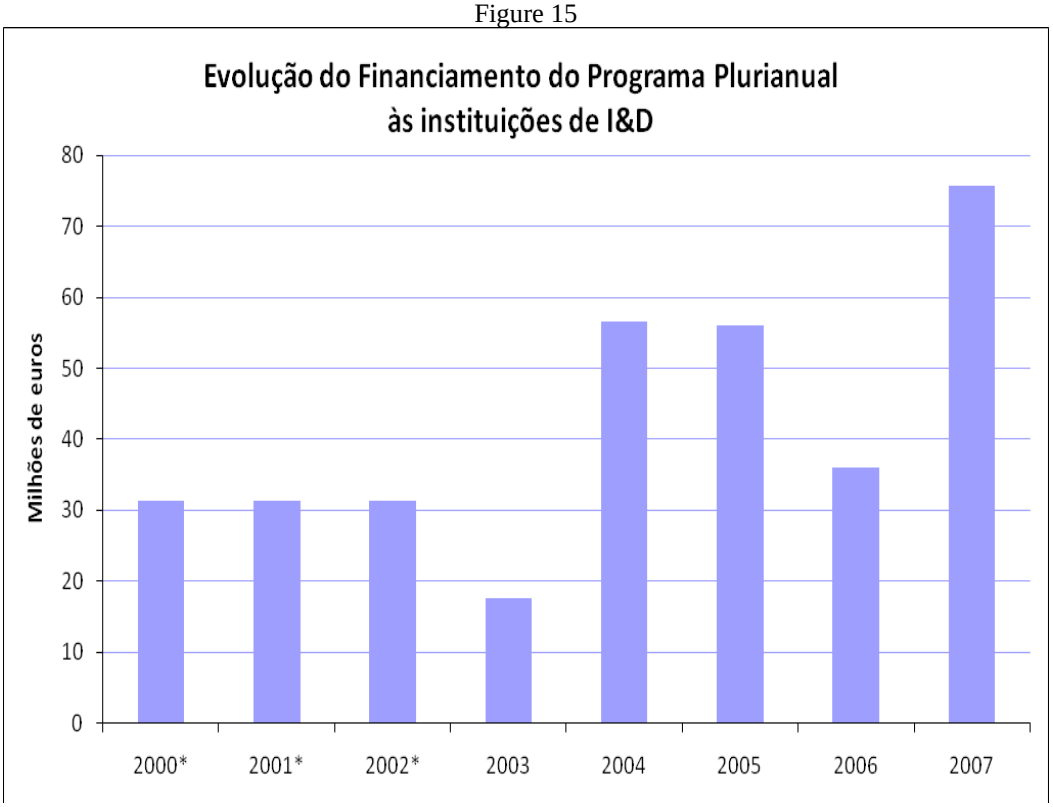
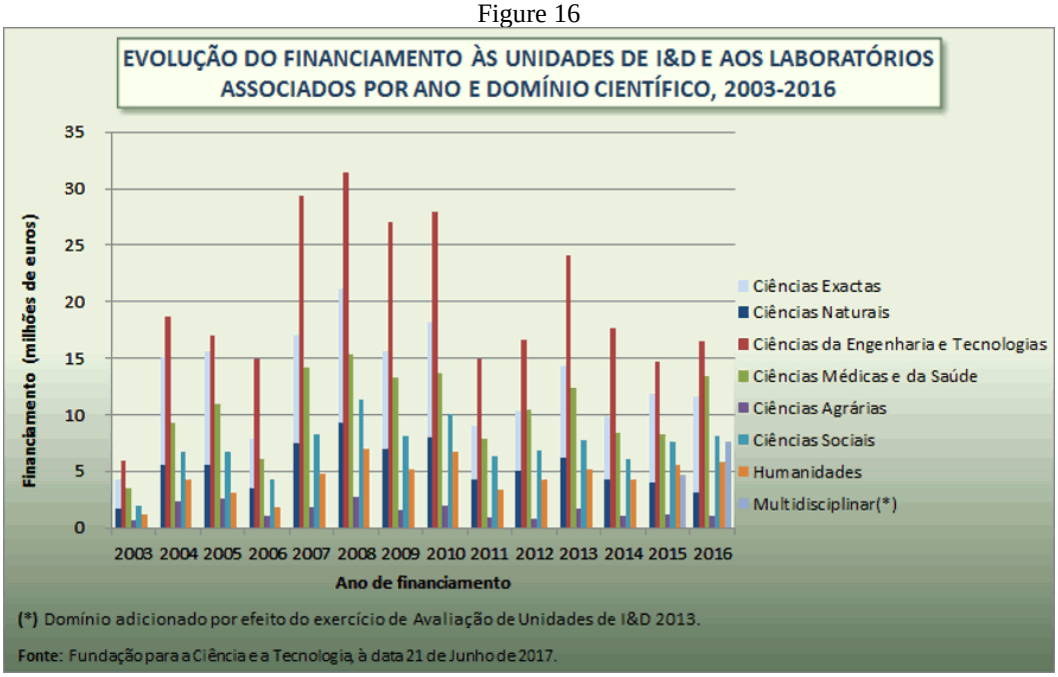
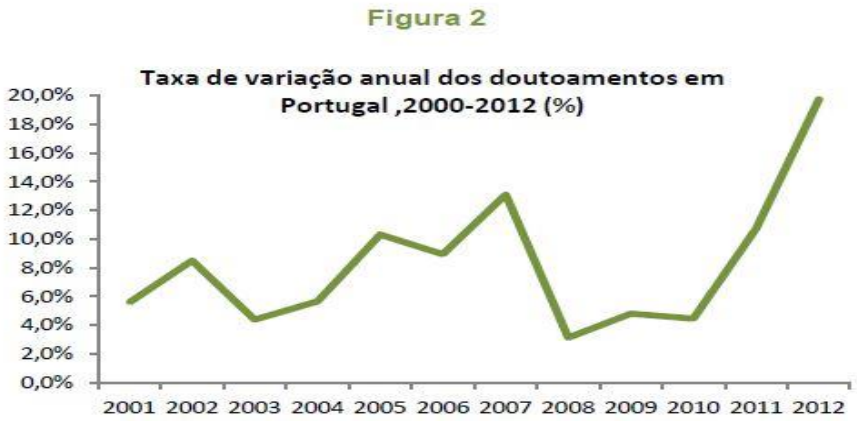


Figure 16



All charts are available in https://www.fct.pt/apoios/bolsas/estatisticas/index.phtml.pt, accessed November 13, 2017.

Figure 17



Available at https://www.ipl.pt/iplisboa/comunicacao/noticias/numero-de-doutorados-aumenta-em-portugal, accessed November 17, 2017.

Environmental chemistry applied to High School through laboratory experiments

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ABSTRACT

The educational process must be attentive and be an agent that brings together the moments and changes that are occurring in the world, aiming at the present and future of man, as it is essential that human beings know and understand the functioning of the main industrial processes that are relate, directly or indirectly, with nature in the face of countless technological accidents that have left traces of destruction across the globe. Consequently, knowledge of Environmental Chemistry in secondary school must be one of the formal vectors of transformation at the teaching level, aiming and encouraging the formation of critical awareness in the processes in which chemical and related technologies can influence levels of environmental contamination. The purpose of this work consists of developing a learning process based on the construction of didactic models, whether using specific equipment or even using certain everyday objects, with the intention of creating in experiments the necessary and fundamental conditions for knowledge of Environmental Chemistry is both critical and systemic. To exemplify the teaching program, two themes were selected: the deterioration of batteries in the environment and the pollution and destruction of monuments and urban furniture. Based on these themes, laboratory experiments were developed to demonstrate how such products contaminate the environment. It is believed that the way of thinking in Environmental Chemistry, associating the fundamental concepts of Chemistry with the parameters that make up an environmental system, are closely linked to "feeling" or imagining the observed facts, natural or induced, that flow from the experiment.

Keywords: Environmental chemistry, Batteries, Environment, Environmental contamination.

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INTRODUCTION

Water, air, soil, flora and fauna are the pillars of physical, chemical and biological support for life on this planet where man, throughout his own history, has been modifying and transforming the environment in order to meet to its direct and indirect objectives. As examples, we can mention the diversion of rivers, the creation of large hydroelectric plants and nuclear power plants, the genetic transformations of plant or animal species, the devastation of forests, immense fires, the development of highly toxic chemical products and inconsequential industrial dumping. .

Since the beginning of civilization, waste from production systems, whether artisanal or semi-industrialized, was released into the environment, mainly into waterways or atmospheric air. There was, however, a concern about the bad smell or the black and aggressive smoke that such systems exhaled, to such an extent that both in Greece and in Ancient Rome, silver and copper foundries, olive oil factories, tanneries and The slaughterhouses were located in uninhabited areas and far from the city. With the growth of cities, these systems became increasingly closer, the aggressiveness and discomfort became a concern again, so the polluting bodies were transferred further away again. The environmental problem continued, as it was simply transferred from place to place [1-3].

In this way, it is evident that the degradation of the environment in all aspects did not appear suddenly, it was accumulated throughout distant history. But, in the last seventy years, man has observed, participated or even waited in anticipation of the development of industrial processes and energy generation, the creation, production, directly and/or indirectly, of a series of chemical products, materials and equipment used in everyday life and in most industrial segments. In this way, chemical accidents, the production of inappropriate materials and chemical and biotechnological waste dumped into the environmental system have left marks of destruction in various parts of the planet [3].

There are several historical references to societies that, in isolation, prevented or delayed the advancement of industrial civilization, however, the Industrial Revolution that took over the world from the 18th century onwards directed and propelled its industries into unbridled production, seeking the coveted markets at any cost. . For some time now, many voices have been raised in defense of the ideals of environmental preservation and conservation. However, they were trampled on, silenced and buried under the compulsive wave of industrialization driven and directed by the interests of economic power.

Since then, industrial production processes, especially chemical ones, have continued to exert strong pressure on the environment, given the risks inherent in their manufacturing processes, when they incorporate current topics: effluents, waste, leaks, packaging, garbage toxic etc., which most of the time are confused or interconnected. In rapid march, as if defying common well-being, highly corrosive and toxic pollutants ascend to the skies or enter the earth, making the harmful chain of

phenomena of varying toxicity increasingly gigantic. Apart from the elementary ethical principles of the right to life and enjoyment of citizenship, industrial enterprises gain space in an unusual march to the expected scientific-technological order in favor of ecological activities [4, 5].

The Industrial Revolution over the last hundred years has contributed to the development of culture and the well-being of people, but it has also, decades after decades, left trails of destruction in the exhaustion of natural resource sources, in the contamination of seas, rivers, air and soil. , in the disfigurement of the landscape and even in the destruction of monuments that perpetuate the history of Humanity. Human activity has transformed the environment in which it lives and in which it lives, fundamentally altering natural characteristics and threatening, directly or indirectly, human survival.

In this same dimension, the Environmental Management Programs adopted by companies with a vision of the future aim at the obligation to comply with all legal requirements, whether municipal, state and federal, and other standards disseminated in society so that they can become competitive in an increasingly globalized market and demanding regarding environmental issues. Technologies and products that do not consider environmental preservation should soon be banned from commercial routes.

However, the fact that nature has fundamental and inalienable rights, rights endorsed and vitalized by past generations, rights assured by survival and wisdom, ends up generating dissatisfaction and indifference. In this way, it is important to build critical awareness that involves the transformative and regulatory actions of technology, disorderly development, industrial contamination, poverty, ignorance and public health aiming at a better quality of life for the Earth's inhabitants.

Recognizing the rights of nature is recognizing the rights of education. Ensuring education rights is recognizing the right to citizenship. Recognizing the right to citizenship implies establishing a subject of law who now has legal capacity based on the country's constitution [4]. Therefore, education has to be present, attentive and be an agent that brings together the moments and changes that are occurring in the world , aiming at the present and future of man, as it is essential that human beings know and understand the functioning of nature.

Education focused on the environment must be the formal vector of transformation at all levels of education, encouraging the formation of public awareness of environmental knowledge. Where the current concept of environment must be broad in covering the physical, chemical, biological, economic, sociological, anthropological, ethical, philosophical and legal domains.

The constant presence of Chemistry in the various industrial segments and also in everyone's daily lives is one of the main reasons to justify the importance of teaching chemistry at all levels of the educational process, as attested by Professor Attico Ignácio Chassot [6-8] when he says:

> "...we must teach chemistry to allow citizens to interact better with the world around them". "Understanding science also makes it easier for us to contribute to controlling and predicting the transformations that occur in nature. This way, we will be able to propose these transformations, so that they lead to a better quality of life".

There is a growth in social ordering by establishing concepts of limits, distances, times, responsibilities in relation to natural resources, seeking the best quality of life, etc. This culture in formation can be called post-modernity, characterized by the post-industrial economy and the understanding of man as a multidimensional being. The speed of transformations is no longer measured by mechanical modules but by digital electronics, consequently generating new ideas and new scientific and technological directions, which are quickly disseminated and absorbed by the productive sector and society in general. These facts are consensus among teachers, scientific associations and educational policy leaders, causing the need for changes in educational parameters in the face of advances in science and technology [9].

There are still undergraduate courses in the country, including those in Chemistry, which adopt the model of technical rationality, in which the theoretical focuses of the content are approached in a way dissociated from practical activities, which reinforces the mistaken conception that these two aspects of knowledge They are sides of the same coin that can be examined separately.

In view of this, upon finishing his undergraduate course in which he acquired theoretical knowledge about teaching, the teacher dedicates himself to the practical facet of pedagogical work, entering the school environment, keeping in mind the application of concepts studied in his undergraduate course, in an attempt to build a pedagogical practice that will translate your professional "doing".

To raise awareness and clarify knowledge and related information, two issues were highlighted in this chapter: pollution and corrosion of historical monuments and urban furniture and corrosion from the deterioration of electrochemical batteries discarded in the environment.

POLLUTION AND CORROSION OF MONUMENTS AND URBAN FURNITURE

According to Hinrichs et al. [10], air pollution levels in a given area depend on the quantity and type of pollutants emitted by polluting sources and the meteorological conditions that lead to the dispersion of pollutants. Discharges from chemical and petrochemical industries, steel mills, motor vehicles and waste incineration are largely responsible for the pollutants found in the atmosphere. These pollutants can be gases, fine or thick chemical mists, dust, smoke or combinations of these emissions. Among the most common are carbon dioxide (CO_2), carbon monoxide (CO), sulfur dioxide (SO_2), ammonia (NH_3), hydrogen sulfide (H_2S), nitrogen oxides (NOX), hydrogen fluoride (HF), sulfate, in the form of H_2SO_4 and some organic compounds such as methane, ketones, alcohols, benzene, etc.

Research work on atmospheric pollutants shows that the SO_2 content present in the atmosphere, estimated at around 160 to 180 million tons per year, comes mainly from the burning of fossil fuels and the oxidation of sulfur and hydrogen sulfide. SO_2 has harmful effects on human health, vegetation and metallic and non-metallic materials. Part of this emission is oxidized to sulfur trioxide (SO_3) which can be converted into sulfuric acid, whose formation depends on the moisture content, ozone, nitrogen oxides, particulates present in the atmosphere, temperature and ultraviolet light intensity [10-12].

Historical monuments and all the urban furniture that surrounds a city suffer daily from the perverse association of corrosion with environmental pollution [13] according to the deterioration traces in the photographic sequence presented in Figures 1 to 3.

Figure 1 – Aspect of corrosion on electricity poles

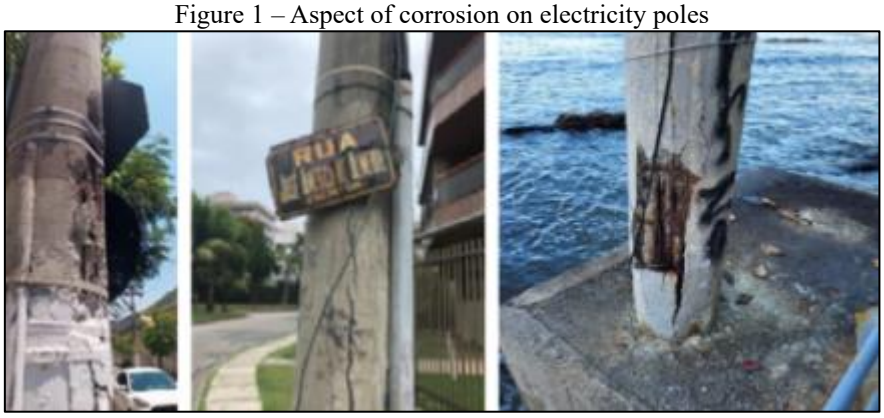


Figura 2 Corrosão em praças públicas



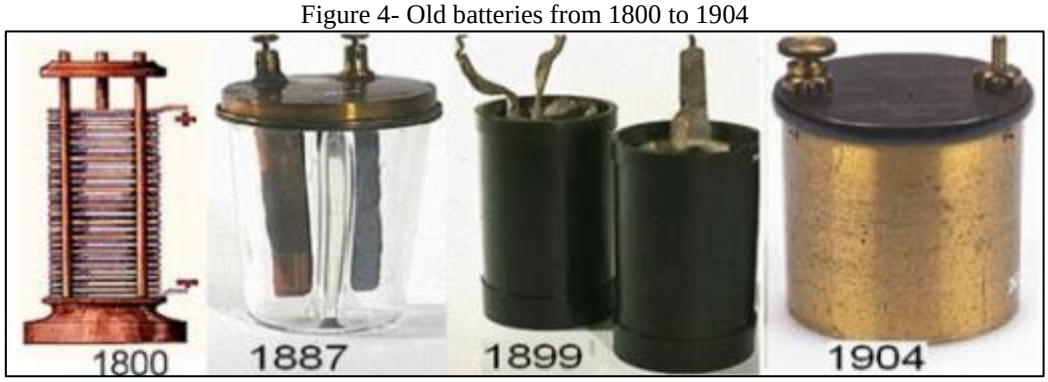
Figure 3 – Corrosion on street furniture



BATTERIES AND ENVIRONMENTAL CONTAMINATION

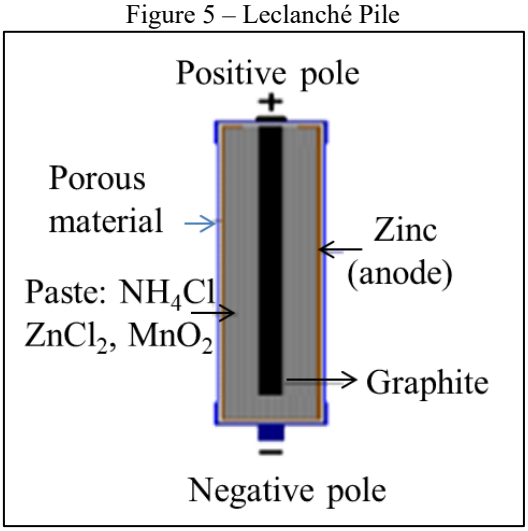
The first pile built in the world is credited to Alessandro Volta, who on March 20, 1800, demonstrated in the presence of Sir Joseph Banks, president of the Royal Society, in London, that a pile of silver and zinc discs, arranged in a Shaped like a column and separated by cards soaked in salt water, it spontaneously generated electricity, without the need for any electrostatic machine. In figure 4, below, the Volta battery (1800) and other old batteries are shown.

Figure 4- Old batteries from 1800 to 1904



Dry batteries, spontaneous energy processing, similar to current batteries, called Leclanché batteries (Figure 5) were basically made up of a zinc electrode and a graphite electrode, surrounded by manganese dioxide (MnO_2) and placed in a porous medium, together with an ammonium chloride solution (NH_4Cl). Zinc constitutes the negative pole and graphite, the positive pole, thus providing a potential difference of 1.3 to 1.5 Volts.

Figure 5 – Leclanché Pile



The reactions involved in this stack are:

Anodic reaction: $Zn \rightarrow Zn + 2\ e$

Cathodic reaction: $2\ NH_4^+ + 2e \rightarrow 2\ NH_3 + H_2$

The gases generated in the cathode area can inhibit the energy supply process and cause an explosion due to the presence of hydrogen. Manganese dioxide (MnO_2) present in the paste oxidizes hydrogen to water, while NH_3 in gaseous form it is absorbed by zinc chloride ($ZnCl_2$) as shown in the following reactions:

$$2\ MnO_2 + H_2 \rightarrow Mn_2O_3 + H_2O$$

$$ZnCl_2 + 2\ NH_3 \rightarrow Zn(NH_3)_2Cl_2$$

As the battery is used, the quantities of substances that react will reduce the production of electrical energy and, consequently, the battery will wear out.

Batteries and cells are made of metals and metallic salts with high polluting power, such as mercury, cadmium, zinc and lead. Some have an acidic character (H_2SO_4, $ZnSO_4$, $ZnCl_2$) and others have an alkaline character (KOH).

The battery is an example of non-spontaneous energy production. The Ni-Cd batteries shown in Figure 6 are used in various electronic devices.

Figure 6 – Nickel-Cadmium (Ni-Cd) Batteries



The reactions involved in this battery are:

Anodic reaction: $Cd + 2\ H_2O \rightarrow Cd(OH)_2 + 2H^+ + 2\ e$

Cathodic reaction: $2NiO(OH) + 2\ H_2O + 2e \rightarrow 2\ Ni(OH)_2 + 2OH^-$

Global reaction: $Cd + 2\ NiO(OH) + 2\ H_2O \rightarrow Cd(OH)_2 + Ni(OH)_2$

One of the advantages of this battery is that it continues to operate regularly even with a high degree of discharge.

The Ministry of the Environment in Brazil calculates that 152 million common batteries and 40 million alkaline batteries and around 12 million cell phone batteries are discarded into the environment annually in São Paulo, according to data from CETESB (the company from S.Paulo (Brazil) of environmental sanitation). The sum is more than 200 million units each year. In Rio de

Janeiro, the annual estimate is 98 million units, totaling around 11 tons of batteries deposited in landfills per year.

Due to their chemical composition, batteries are considered toxic waste in domestic waste. They exemplify the complicated relationship between the consumer and the environment. Daily life in society shows a significant increase in the use of batteries from the most diverse electronic equipment used by modern societies, such as calculators, portable radios, flashlights, cell phones, etc., generally discarded in household waste. Consequently, the most dangerous elements found in landfills are mercury, lead, zinc and cadmium.

METHODOLOGY

According to Chassot [7-8], many ideas have been discussed to guide proposals aimed at a more critical Chemistry Teaching. It is important that Chemistry is seen as a whole, regardless of its areas (General Chemistry, Physical Chemistry, Inorganic and Organic Chemistry, etc.), making it more effective in finding solutions to problems that high school students face. yourself daily.

Knowledge must be closer to things in nature, “so that real life and school experience coexist in a more dynamic and interactive way”. Scientific understanding must be achieved by understanding action, moving Chemistry away from the theoretical field and bringing it to reality. Laboratory experimentation, with a demonstrative nature, must give way to a type of experimentation, through which knowledge can be constructed.

Based on this, experimental models are proposed that aim to build scientific knowledge in chemistry, opening a way to critically understand environmental problems that, for the most part, arise from chemical processes, precisely industrial chemical processes.

RESULTS

EXPERIMENTOS COM PILHAS

The batteries were chosen to develop an experimental model, taking into account the contamination problems generated by their unconscious disposal in the environment. The gelatinous electrolyte is prepared by adding 12 g of colorless gelatin with 50 mL of cold water, in a 500 mL beaker. The solution is left to rest for 5 minutes, and is then placed on the heating plate (temperature 70□C), until all the gelatin is dissolved. The volume of the solution is made up to 500 mL with an aqueous solution containing 3.5% (by mass) NaCl.

First, the gelatinous mass, still hot, is placed in the transparent plastic container (dimensions: 10 cm x 10 cm x 5 cm), in such a way that it occupies half the volume of the container. Then the gelatinous mass is left in the refrigerator to harden for about 12 hours.

When the gelatinous mass is hard, various types of piles are placed and then the volume is filled to the brim and left in the refrigerator to harden for around 12 hours as shown in Figure 7.

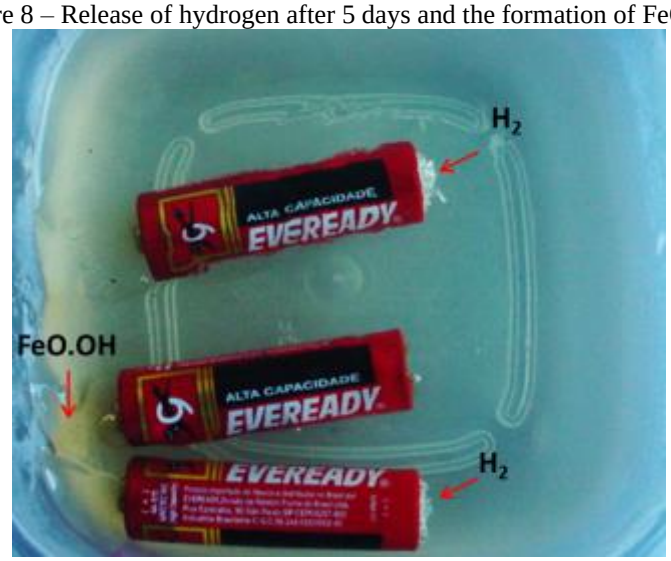
The aim, through these experiments, is that students are able to: visualize the gradual deterioration of batteries in the soil, understand the mechanisms of the reactions involved, compare and estimate the deterioration of various types of batteries in the environment and critically evaluate environmental contamination caused by heavy metal contamination in the soil.

Figure 7 – Used batteries immersed in gelatin with the addition of 3.5% NaCl



Next, the experiments to demonstrate the deterioration of used batteries are presented in Figures 8 to 10.

Figure 8 – Release of hydrogen after 5 days and the formation of FeO.OH



In Figures 9 and 10, after three and four weeks of immersion in the gelatinous saline solution, intense corrosion of the carbon steel casing that surrounds the batteries can be observed, with the release of hydrogen and the formation of hydrated ferric oxide, as shown below. reactions:

$$2\ H_2O + 2e \rightarrow H_2 + 2\ OH^-\ (\text{cathodic reaction})$$

$$Fe - 2e \rightarrow Fe^{2+}\ (\text{anodic reaction})$$

$$Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$$

$$2\ Fe(OH)_2 + H_2O + \tfrac{1}{2}\ O_2 \rightarrow 2\ Fe(OH)_3$$

$$2\ Fe(OH)_3 \rightarrow 2FeO.OH\ + 2\ H_2O$$

Figure 9 – Corrosion of the carbon steel casing; (A): 3 weeks of immersion; (B): 4 weeks of immersion

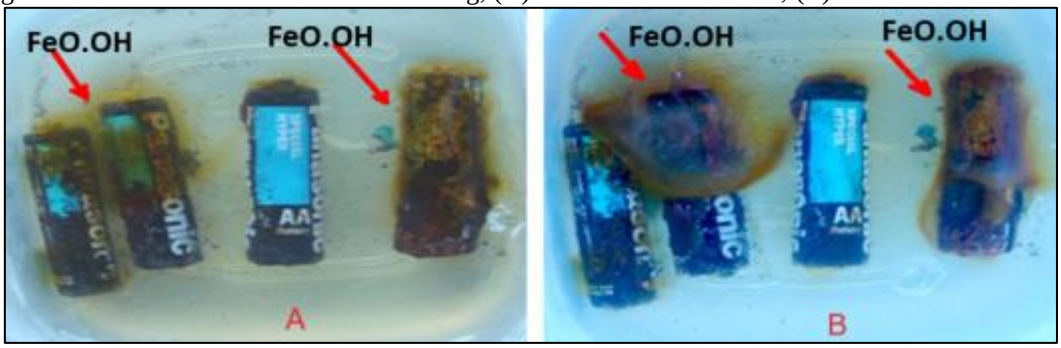
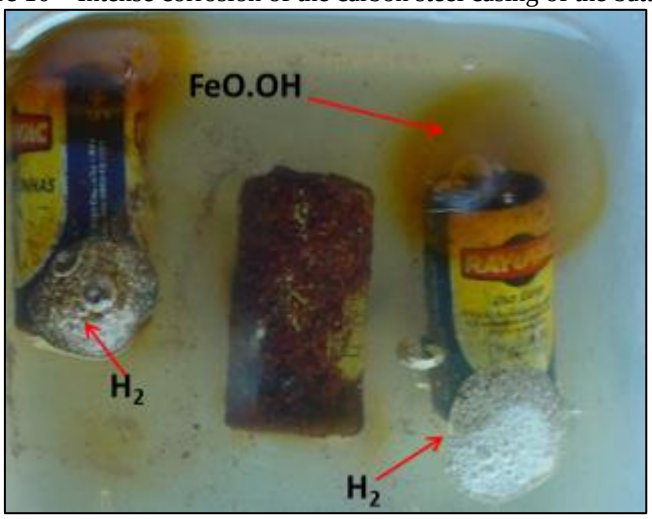


Figure 10 – Intense corrosion of the carbon steel casing of the batteries



In order to make students aware of the environmental problems generated by the disposal of batteries in the environment, visits and interviews should be scheduled with battery manufacturers, distributors and even with street vendors who change used batteries in wristwatches. Interviews must be semi-structured, carried out with groups of students, based on the following basic questions:

- Is there any guidance from the manufacturers of these batteries regarding disposal?
- How are they disposed of in urban waste?
- Do you know if these batteries cause pollution problems?

EXPERIMENTS AIMED AT EVALUATING THE CORROSION OF MONUMENTS AND URBAN FURNITURE

In order to create a saline and polluting environment to evaluate the deterioration caused in monuments and urban furniture, an experiment was developed under accelerated conditions, essentially consisting of a transparent plastic chamber, with a capacity of 50 L, where humidity is

continuously maintained. reignant (95 to 100%), saline and pollutant through continuous bubbling of air in the two internal containers containing, respectively, a 3.5% sodium chloride solution and a 2M sodium acid sulfite solution ($NaHSO_3$) as shown in the scheme in Figure 11. The bubbling system with the diffuser is shown in Figure 12. The exposure time established for the test was 600 hours and the internal temperature in the chamber must be stabilized between 24 and 25 °C.

Figure 11 – Schematic and transparent plastic chamber where the tests were carried out under simulated conditions of SO2 and NaCl at 100% humidity

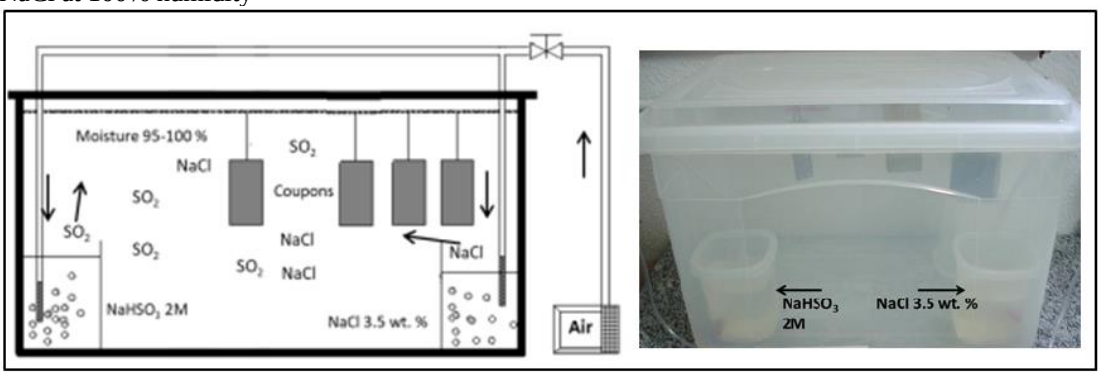
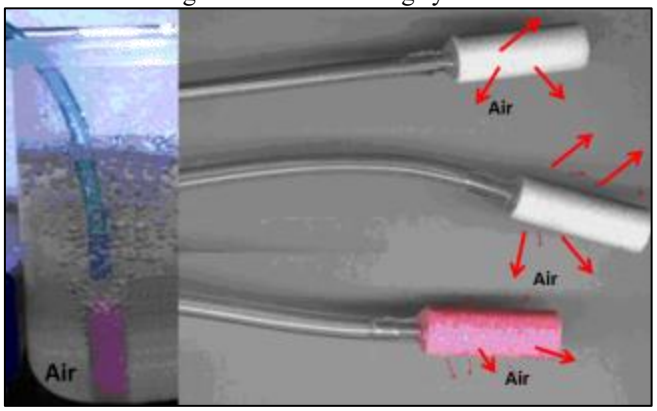


Figure 12- Air bubbling system



The specimens that represent the constituent materials of monuments and urban furniture and participate in the experiment are: concrete, bronze (copper and tin alloy), carbon steel, painted carbon steel.

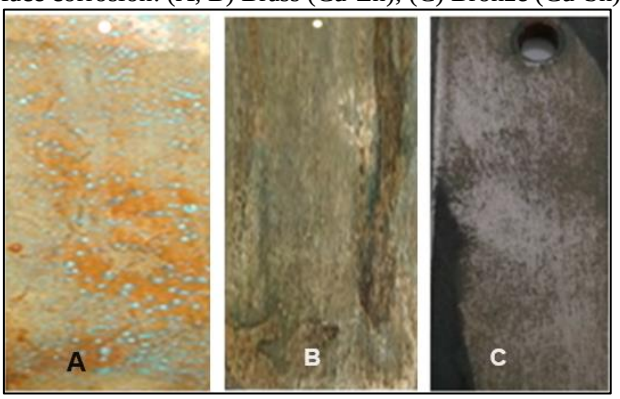
Figures 13 to 16 show the corrosion aspect of the specimens after 600 hours of testing.

Copper and its alloys such as bronze (Cu-Sn alloy) and brass (Cu-Zn) are generally part of monuments and urban furniture and consequently suffer from industrial saline atmospheric corrosion, mainly in public squares located in the port area. industrial, where salinity and pollution represented by gases CO_2, NO_X e SO_X are present.

In this specific test it is verified that in coupons made and referred to as brass (Cu-Zn alloy) and bronze (Cu-Sn alloy) a layer of Cu_2O (cuprous oxide) is initially formed, dark in color and with a small amount of CuO (cupric oxide). However, when considering the oxidizing conditions in this test, the following compounds can be found on the surface of the test specimens: Cu_2O, CuO,

$Cu(OH)_2$, CuCl, $CuCl_2$, $CuSO_3$, $CuSO_4$, $Cu(OH)_2.CuCl_2$, etc. forming various dark and greenish colors [14-16].

Figure 13 – Aspects of surface corrosion: (A, B) Brass (Cu-Zn); (C) Bronze (Cu-Sn) after 600 hours of testing



The carbon steel sheets subjected to the conditions prevailing in the test referred to in Figure 14 suffered surface corrosion based on the following reactions:

$$H_2O + ½\ O_2 + 2e \rightarrow 2\ OH^-\text{(cathodic reaction)}$$

$$Fe - 2e \rightarrow Fe^{2+}\text{ (anodic reaction)}$$

$$Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$$

$$2\ Fe(OH)_2 + H_2O + ½\ O_2 \rightarrow 2\ Fe(OH)_3$$

$$2\ Fe(OH)_3 \rightarrow 2FeO.OH + 2\ H_2O$$

In the tests referring to Figure 15, carbon steel sheets coated with low quality paint were used to demonstrate that when choosing paints for external painting in industrial saline environments, the quality and application of the paint are fundamental issues. The appearance of the test specimens shows the development of the intense corrosive process.

Figure 14 – Surface aspects of carbon steels after 600 hours of testing

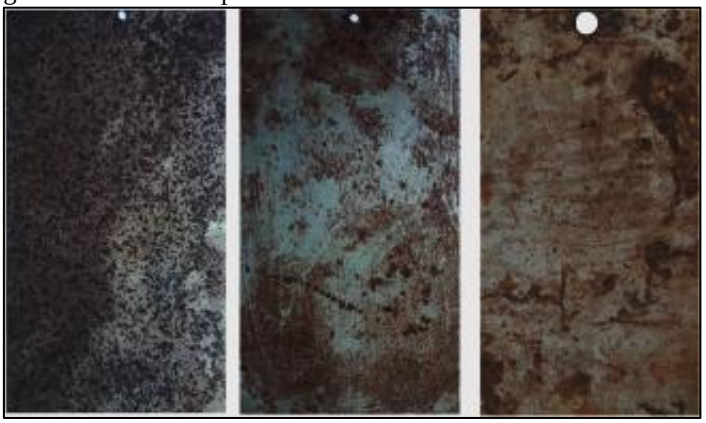
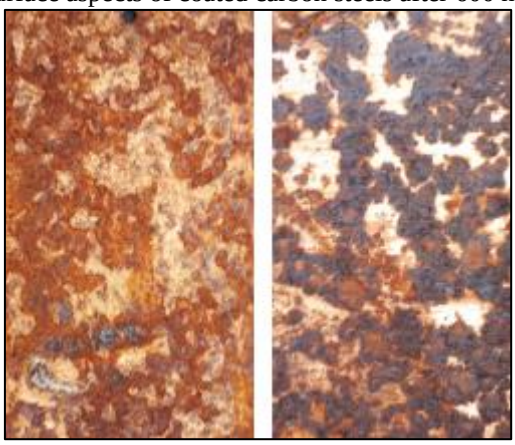


Figure 15 – Surface aspects of coated carbon steels after 600 hours of testing



The concrete specimens subjected to the corrosion tests, shown in Figure 16, were polished to highlight the attack with small cavities suffered by the saline and acid corrosive medium of the test.

Figure 16 – Surface aspects of concrete specimens after 600 hours of testing



The aim, through this experiment, is for students to be able to: visualize the gradual deterioration of the materials that make up monuments and urban furniture; understand the mechanisms of the reactions involved and critically evaluate the atmospheric pollution caused in cities.

In order to make students aware of the relationship between the causes and effects of atmospheric pollution that deteriorates monuments and urban furniture, visits and interviews should be scheduled with those who frequent squares and public places and with those responsible for maintaining public heritage.

Interviews must be semi-structured, carried out with groups of students, based on the following basic questions:

- Is there any effect of air pollution on monuments and urban furniture?
- Do buses, cars and trucks contribute to an increase in air pollution?
- Do you know of any type of protection used to conserve this heritage?

CONCLUSIONS

- Laboratory experiments must be constructed with the aim of identifying and characterizing the scientific methods used in Chemistry and the recognition of scientific parameters and laws that govern environmental phenomena.
- In the development of the learning process, in terms of environmental education based on Chemical Science and laboratory experiments, a progressive interpretation of neural events is essential, as there is a need to develop a series of parameters, such as: active and progressive search , selection, exploration and integration of new experiences. All of these factors aimed to build a conscious mind, which relates knowledge to critical vision, a fundamental item in the process of interaction and interrelationships between Chemistry and the Environment.
- Laboratory experiments must be concerned with guiding participating students to develop curiosity towards research and questioning, giving them basic experience in the type of that leads to qualitative and quantitative results aimed at relationships with the environment

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Secondary school reform and its implications in Brazilian school Physical Education: An integrative review of academic productions in the period 2014-2019

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ABSTRACT

As an area of knowledge, physical education has historically been linked to prevailing conceptions of each era, however, over time, it has shown itself to be of paramount importance for the community, it has been strengthened and consolidated as a mandatory curricular component in basic education. However, the changes made in the Brazilian educational legislation can directly influence this consolidation. Thus, the present study aimed to analyze the scientific discussions about the implications that Brazilian school physical education will face after the reform of high school. To this end, the integrative review was used as a research method, with exploratory, descriptive and qualitative approaches. To obtain and construct the results, the studies were selected from the following databases: Bireme, Lilacs, Medline and SciElo. A total of 34 articles were obtained, and after applying the inclusion criteria, 7 studies were analyzed, synthesized in a comparative table. After correlating the respective studies with the changes made in the Law of Guidelines and Bases of National Education No. 9394/96 and with the final version of the National Common Curriculum Base for high school, it was found that school physical education, specifically in high school, will face implications that will lead to a new crisis, especially of legitimacy. and with that, difficulties to materialize as a curriculum. These implications will directly affect the performance of the physical education teacher and the academic training in physical education.

Keywords: Reform, High School, Implications, Physical Education.

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INTRODUCTION

School Physical Education (PE) aims at the study and development of the body culture of movement, with the objective of inserting the student in this culture with a view to making them critical individuals, capable of reflecting, transforming, and reproducing the body culture historically constructed by humanity (SOARES et al., 2012). Acknowledging, therefore, the fundamental role that PE develops in the teaching and learning process for the integral formation of the student and with an emphasis on basic education, this work emerges in the light of the debates and reflections developed in the academic and school spheres regarding the reform of secondary education (ME) (Law No. 13.415/2017), and the changes maintained in the final version of the National Common Curricular Base (BNCC) for MS.

The present work is based on the conception that for the teacher to develop a good work, it is necessary to know intrinsically the obstacles and possibilities existing in the area of knowledge that concerns him/her teaching. By highlighting this principle, it is proposed to bring us closer and clarify the new paths to be followed by the school PE after the reform of the MS.

It is known that as an area of knowledge, PE was for a long period linked to the prevailing conceptions of each era, however, over time, it proved to be of paramount importance for the collectivity, strengthened and consolidated, among other aspects, as a mandatory curricular component in basic education (CASTRO, 2017). Its insertion in the school environment is marked by the reform of primary education carried out in the Municipality of Corte by Viscount Couto Ferraz in 1851. After three years of reform (1854), PE was used as a compulsory content in basic education: in primary school it was a subject of gymnastics, and in secondary school it was developed through dance (BETTI, 1991).

During the process of standardization of basic education, the Federal Constitution of 1937 instituted PE as a mandatory practice in all federal schools, so it was used as a means of propagating the interests of the Vargas government, which seeking to improve society for the labor market instigated it to develop a eugenic and hygienist education that lasted until the beginning of the twenty-first century (CASTRO 2017).

His relationship with the MS was accentuated in 1961. The first law of Guidelines and Bases of National Education (LDB No. 4,024) was enacted, which, among other things, established the duration of four years for primary education, and MS, in two cycles, junior high and high school. In this context, PE became mandatory at both levels of education for students up to 18 years of age, maintaining as its main attribution the initiation to sport (CASTRO, 2017).

In the second LDB (No. 5,692), enacted during the Military Government (1964-1985), primary education became compulsory with a duration of eight years, and the inclusion of studies in Artistic, Moral and Civic Education, as well as PE and health programs in all establishments that

offered primary and secondary education (ME) was mandatory. At this juncture, PE gained greater repercussion, and in 1971 Decree No. 69,450 was published, which gave school PE at both levels of education the duty to develop physical fitness, moral and civic values, psychic and social skills, health conservation and leadership spirit (DARIDO, 2003).

After the end of the Military Government, PE found itself in the search for a new identity, different from those attributed to it in the past; although permeated by several problems regarding the formulation of this identity, in education it established itself as a science of the body culture of movement (SOARES et al., 2012). And with the enactment of the third LDB (No. 9,394/1996), it can be developed with more autonomy, the school was integrated as a mandatory curricular component adjusting to the age groups and the needs of the Brazilian school context, being provided only in night school. The MS, in turn, assumed the responsibility of enabling the deepening of knowledge, preparation for work, citizenship and the development of critical and autonomous thinking (BRASIL, 1996).

School PE has maintained an intrinsic relationship with health, in its historical context, since its moment of origin. In Brazil, she experienced the hygienist period and, consequently, the moment of promoting physical fitness. Although it had different ideological conceptions, one cannot lose sight of the fact that PE has a strong existential relationship with health in its existential "cradle" (SANTOS; CARDOSO, 2012). Based on Devide (2002), Santos and Cardoso (2012) argue that this relationship is modified through different conceptions, which on the one hand try to strengthen it and on the other hand attenuate it. However, in the school environment, the relationship between PE and health is established under two aspects: health promotion and prevention. Although there may be problems about how PE develops health promotion and prevention, Santos and Cardoso (2012) show that, unlike in the past, today the relationship between PE and school health has been established through global and humanized knowledge that considers economic, social, cultural and historical determinants (SANTOS; CARDOSO, 2012).

In this context, it can be seen that school PE is updated and observant of the social problems that permeate the school, therefore, it becomes an indispensable ally in the prevention of diseases, and consequently in the promotion of health. In this way, PE assumes the role in the intervention of the problems that have been affecting the global population, and the sedentary lifestyle is pointed out as one of the main responsible for the frightening picture of adults and children with health problems related to the sedentary lifestyle, namely that "the lack of physical activity is still one of the major causes of childhood obesity. [...]", and it should be noted that technological trends and influences have increasingly directed to screens. Thus, "these children have a greater tendency to be obese than those who play or practice any type of sport" (SILVA FILHO, 2013, p. 18).

In this scenario in which sedentary lifestyle is conceived as a disease of the century, being one of the direct responsible for the spread of several diseases, among them, especially obesity, PE emerges as a direct facilitator of changes in this reality, being presented as a potential intervenor both in health education, providing the awareness of cause and effect for a quality life, as an instrument for the development and encouragement of sports and leisure practices, since childhood, because children start to attend the school environment from the age of five, and through experience they positively assume the basis for the formation of a conscious adult, and healthy habits.

The World Health Organization (WHO) estimates that 41 million children under the age of 5 are obese or overweight worldwide, characterizing a global epidemic. According to the Brazilian Association for the Study of Obesity and Metabolic Syndrome (ABESO), obesity is growing more and more, surveys highlight that more than 50% of the population is overweight, that is, in the overweight and obesity range, these data are also alarming among children, and it is found that 15% of children are in this condition, It is noted that 80% of obese children become obese adults. Under this analysis, the Brazilian Institute of Geography and Statistics (IBGE) according to the 2010 census, found that in the age group of 10 to 19 years, overweight increased six times for men and three times for women, signaling that there was a continuous growth in the last 34 years, between 1974-75 and 2008-09, this is more noticeable in males. in which the index changed from 3.7% to 21.7%. Among young women, the statistics tripled: from 7.6% to 19.0%. By mentioning Viuniski (1999) and Silva Filho (2013), it is possible to see that it is not just about aesthetics, as there are deeper problems than simple appearance, these children or adolescents may be causing serious cardiovascular problems, hypertension, diabetes and high cholesterol, which are diseases found in adults.

Therefore, considering the existing relations between PE and health, it can be seen that this discipline assumes the role of an active instrument in the prophylaxis of diseases, with the trend of the globalized world, becoming increasingly essential its role for society, being essential in the school environment. According to Martinez (1996, p.61) "it is important to promote health in the school environment and to be part of the school political-pedagogical proposal, as it is essential to the education of the personality and lifestyle of individuals".

However, the advent of the ME reform enacted in 2016 seemed to disregard the importance of PE and its historical relationship with ME. The reform carried out through Provisional Measure (MP) No. 746/2016 disregarded PE as a mandatory curricular component in MS. And only after intense demands from the academic and scientific society in the area, the definitive document of the reform (Law No. 13,415/2017), reconsidered the obligation of PE in MS, however, with several uncertainties, as it was not clear how the presence of PE in MS would take place after such reform (BASTOS; SANTOS JUNIOR; FERREIRA, 2017).

Another situation that caused annoyance and contributed to the uncertainties was the fact that Law No. 13,415/2017, without consensus of the academic and scientific society, made several changes to LDB No. 9,394/1996, and left so many attributions on the permanence of EF to a document (BNCC) that for the MS was not yet concluded, and, therefore, it was not possible to clearly see the protagonism and place of PE in this new context (SOUZA; RAMOS, 2017).

Based on this conjuncture and the uncertainties raised by several authors about the presence of PE in MS after reform, the present study aimed to analyze the scientific discussions about the implications that Brazilian school physical education will face after the reform of secondary education.

MATERIALS AND METHODS

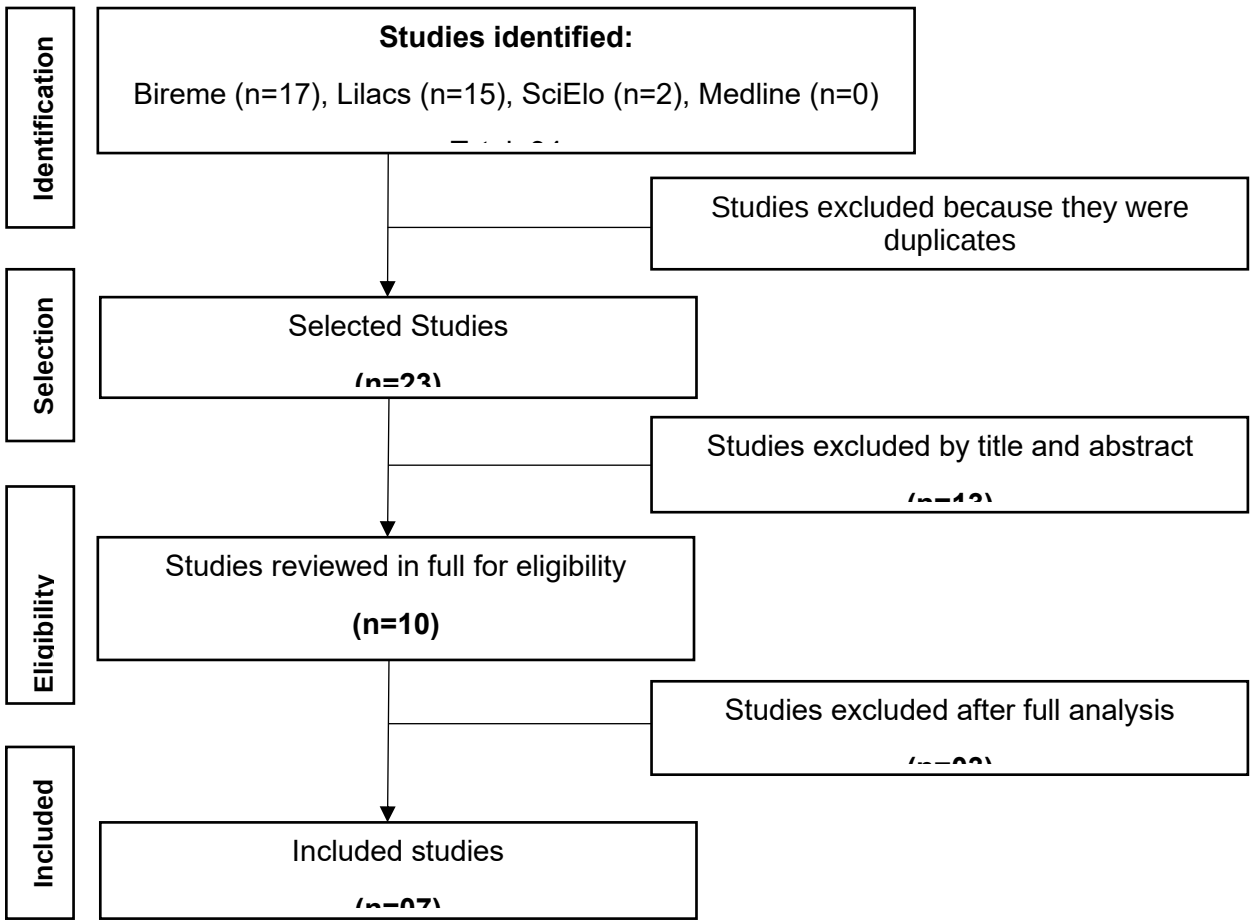
The present work is the result of an integrative review, which, according to Souza, Silva and Carvalho (2010), is characterized as a research that makes it possible to aggregate various information to understand the analyzed phenomenon, making it possible to synthesize the definition of concepts, review of theories and evidence, considering approaches from the theoretical and empirical literature, maintaining reliability during the analysis. It is characterized as an exploratory, descriptive research, which for Gil (2008) allows a closer approach to the object of study investigated, improving or verifying ideas in order to describe the phenomena involved. It has a qualitative approach that, according to Minayo (2001), is developed with a wide and deep universe of meanings about phenomena that cannot be verified by numerical variables.

To obtain the studies of this review, searches were carried out in the following databases: Bireme, Lilacs, Medline and SciElo, considering the descriptors: "Physical Education", "High School", "Reform", "High School" and "National Common Curricular Base", combined using the logic operators AND and OR (SOUZA; SILVA; CARVALHO, 2010).

As inclusion criteria, we considered studies that proposed to discuss: A) Physical Education in the National Common Curricular Base; B) Physical Education in the reform of High School; C) the reform of Secondary Education and the possible implications for Brazilian school PE; D) studies published in the existing time frame between 2014 and 2019; E) studies published in Portuguese in full format. And for exclusion purposes, it was decided to: A) disregard the studies that did not discuss the implications of the education reform in Brazilian school PE (SOUZA, SILVA AND CARVALHO, 2010).

Figure 1 shows the selection process of the studies found in the databases using the respective descriptors.

Figure 1 – Flowchart of the selection process of the studies included in the review.



Source: The authors.

To obtain the answers sought in this research, the seven studies were analyzed using the techniques for content analysis presented by Bardin (2011).

RESULTS

Chart 1 shows the seven studies included in this research with identification of the databases, types and titles of the studies, names of the authors, journals of publication, and main notes of the authors. From the content analysis, 4 categories emerged: Implications for the legitimacy of PE in ME; Implications of the MS reform in School PE; Implications for the PE teacher's performance in EM and Implications for academic training in PE.

Chart 1 – Describes the studies and the main notes of the authors

DATABASE	TYPE AND TITLE OF STUDIES	AUTHORS	NEWSPAPER (VOL, N, PAGE, YEAR)	NOTES
Bireme/Lilacs	ESSAY The Attributions of School Physical Education: a Special Focus in High School	CASTRO V. M.	Motrivivência, 29 (52),124-135, set 2017.	The loss of space of EF in the EM is a result of the historical mode operated by the market need. He points out that under this situation the EF will face yet another crisis, above all of legitimacy in the MS.
Bireme/Lilacs	ESSAY Physical Education in High School or Understanding the Ice Age	NETO, V. M. et al.	Motrivivência, 29 (52),87-105, set 2017.	To see in the historical aspects that determined the reform of the MS conditioning factors that led PE to neglect, which consequently limited the student's access to the content of the body culture of movement, and weakened the performance of the professional trained in PE.
Bireme/Lilacs	ESSAY The "New" High School: implications for the legitimation process of Physical Education	GADO J. Â.; JUNIOR, A. S. A.; OLIVEIRA, C. M.	Motriexperience, 29 (52),53-70, Sep 2017.	They argue that the loss of space and legitimacy of PE in the MS is a reflection of the matrices that constitute it, which were currently not under the determinants of the market and, therefore, it is no longer necessary for it.
Bireme/Lilacs	ESSAY Physical Education and the World of Work: A dialogue with the current High School Reform	SOUZA, M. D. S.; RAMOS, F. K.	Motriexperience, 29 (52),71-86, Sep 2017.	In the general context, PE had its matrices brought back to the dictates of the market, which increasingly volatile caused it to lose its essence in the school environment, especially in MS, which had made it an optional component of studies and practices.
Bireme/Lilacs	ESSAY High School Reform And Physical Education: An Abyss To The Future	BASTOS, R. D. S.; JUNIOR, O. G. D. S.; FERREIRA, M. P. D. A.	Motrivivência, 29 (52) 38-52, Sep 2017.	They show that in the reform of the MS, PE will become inferior to the other disciplines because it is not known in which year it will be developed, so the teacher's performance will lose space, which will culminate in the reduction of the Bachelor's degree courses and increase in the number of Bachelor's courses in PE

Bireme/Lilacs	LITERATURE REVIEW Physical Education in the "New" High School: the rise of notorious knowledge and the return of the athletic and "sporting" vision of life	BUNGENSTAB, G. C.; FILHO, A. L.	Motriexperience, 29 (52),19-37, Sep 2017.	note that the entry of professionals of notorious knowledge and the return of technical and professional training will imply a possible crisis for PE as a mandatory curricular component of MS
Bireme/Lilacs	ESSAY Physical Education, High School and Youth: Let's Talk About Crisis?	BUNGENSTAB, G. C.	Thinking Practice 22, 1-10 2019	The reform of the EM led PE to a third moment of crisis, this time characterized by uncertainties and loss of legitimacy in the school environment, more precisely in the MS.

Source: The authors.

Below, we will present a synthesis of the studies with the main implications that school PE may face after the reform of the MS. It is worth mentioning that the questions raised in six of the seven studies were asked before the final wording of the BNCC, and that the study by Bungenstab (2019), although it emerged after, did not seek to confirm the problems pointed out. Therefore, they all need to be verified. To this end, the correlation between the implications identified by the authors, LDB No. 9,394/1996 and the final version of the BNCC, will be developed in the discussion section.

IMPLICATIONS FOR THE LEGITIMACY OF PHYSICAL EDUCATION IN SECONDARY EDUCATION

In this category, four studies are listed, which sought to discuss and point out the reasons that led PE to occupy a timid space in MS after the reform maintained by Law No. 13,415/2017.

Castro's (2017) study demonstrates that historically PE has been linked to the prevailing mercantile needs in each era, and that today, as in the past, its attributions and legitimacy are defined according to the prevailing social needs, for him PE has lost its space in EM because it is dissonant from the current needs of the market. Gariglio, Almeida Junior and Oliveira (2017) see in Bracht (2001) that the "[...] the foundations of support of the model that legitimized Physical Education in schools would be eroded because we are facing significant social changes" (GARIGLIO; ALMEIDA JUNIOR; OLIVEIRA, 2017, p. 61). For them, PE materializes under another identity, physical fitness is less important, health is no longer linked only to the concept of the biological body, and leisure occupies a space as important as work. Therefore, PE becomes dispensable in an educational reform that regresses EM to a technicist model consistent with the needs of the market.

Sousa and Ramos (2017) also agree that the implications of the current MS reform in PE are

historically linked to the modes of market operation. However, they point to another path for its loss of legitimacy in the MS. They argue that from the 1980s onwards, although it had found an identity, and began to question the biological hegemony that prevailed in it, from the 1990s onwards, under the strong influence of the Toyotist system, PE began to be brought back to the dictates of the market, which according to them was confirmed in the regulation of the profession in PE (Law No. 9696/1998) and in the division of PE between bachelor's and licentiate degrees (CNE/CES Resolution No. 07/2004, and Resolution CNE/CES No. 04/2009). For Sousa and Ramos, "This reality demonstrates, once again, that Physical Education adapts to the dictates of capital, continuing a history of subordination, in which the market dictates the rules [...]" (SOUSA; RAMOS, 2017, p.78). They soon conclude that, in an increasingly volatile market, PE loses its essentiality, and in an educational reform based on competencies "[...] remains on the margins, relegated to a position merely of "studies and practices" (SOUSA; RAMOS, 2017, p.81).

Castro (2017) emphasizes that under such a conjuncture "[...] in the first decades of the twenty-first century, school Physical Education is going through a crisis of legitimacy, especially with regard to its mandatory curriculum in the new high school" (CASTRO, 2017, p.133). According to Bungenstab (2019), EF, in the face of MS reform, faces a third moment of crisis in its existential lapse. It demonstrates that "the first and second 'moments' of crisis of PE were related to the crisis of modernity itself and its dissonant relationship between theory and practice (BUNGENSTAB, 2019, p. 6). The third, in turn, "[...] the formulation of questions about the legitimacy of this discipline within the school, more precisely in the MS (BUNGENSTAB, 2019, p. 6) is directed.

IMPLICATIONS OF THE REFORM ON THE TEACHING OF SCHOOL PHYSICAL EDUCATION

The five studies listed in this category discuss and point out the possible implications that the EM reform will bring to the teaching of school PE.

Castro (2017) points out that such a reform, by integrating PE in the axis of Languages and its Technologies, will lead it to a position of optional content, as the student will only be required to attend only one of the five thematic axes, therefore, there is no guarantee that the axis chosen will be that of PE; Therefore, it will not be experienced by students who choose vocational education, which will consequently reduce their workload. Bastos, Santos Junior and Ferreira (2017). They emphasize that, under conditions, "it will become secondary to other subjects in the school curriculum, because, unlike Portuguese and mathematics, it is not clear at what point in the three years Physical Education will be compulsory (BASTOS; SANTOS JUNIOR; FERREIRA, 2017, p. 50).

Molina Neto et al. (2017) argue that the removal of the obligation of PE in MS reduces the student's access to the content of the body culture of movement provided for in school PE. Thus, it

reduces the possibility of choice, protagonism and judgment of the students about their education for health, leisure, society, culture, politics and economy. As a systematized practice, in the face of the reorganization of ME, as in the past, it will become exclusionary, once again developing pedagogical action with a view to selecting the most skillful students (SOUSA; RAMOS, 2017).

For Bungenstab and Lazzarate Filho (2017), this new reality will weaken the body culture of movement and promote the rise of the sportivist technical bias and the return of the dualistic conception between body and mind that has long been overcome.

IMPLICATIONS FOR THE PERFORMANCE OF PHYSICAL EDUCATION TEACHERS IN HIGH SCHOOL

Three articles have been listed in this category, and they talk about the possible problems that PE teachers may face after the MS reform.

In this sense, Bungenstab and Lazzarotti Filho (2017), when conducting a literature review on the studies retrieved in the journals, Movimento, Motrivivência, RBCE, Pensar a Prática and Motriz, found that in the last 15 years MS has been little explored in terms of research and reflections on PE. In short, "the disappearance of the category "vocational training" may, unfortunately, give a signal that little has been invested in the debates on the PE teacher in MS. In this case, the Brazilian educational reform opens the door to the "notorious knowledge" (BUNGENSTAB; LAZZARATE FILHO, 2017); emphasize that the amendment to article 61 of Law No. 9394/1996 given by Law No. 13,415/2017, now guarantees, in addition to professionals with a diploma, the performance of professionals with the so-called notorious knowledge, setting precedents for the performance of military personnel, former athletes, or any other person who knows about existing bodily practices. For Castro (2017), the entry of these professionals is the result of neglect and devaluation of PE teachers.

Bastos, Santos Junior and Ferreira (2017) warn that "if the teaching of Physical Education is not mandatory in the three years of high school, consequently, there may be a significant reduction in the workload and remuneration of teachers who already work in this stage of education" (BASTOS; SANTOS JUNIOR; FERREIRA, 2017, p. 50); point out that the insertion of professionals with notorious knowledge "[...] to work in the teaching of Physical Education will collaborate to reduce the number of teacher vacancies in public education to new graduate teachers, in addition to creating a dispute between these workers (graduates and professionals with notorious knowledge)" (BASTOS; SANTOS JUNIOR; FERREIRA, 2017, p. 50); for them, the work of the PE teacher in the school environment runs "[...] the serious risk of being compared to that of a coach, due to the resumption of the technicist/sportsmanlike conception as a guiding proposal for their pedagogical action" [...] (BASTOS; SANTOS JUNIOR; FERREIRA, 2017, p. 50).

IMPLICATIONS FOR ACADEMIC TRAINING IN PHYSICAL EDUCATION

Although only one study is listed, this category is of paramount importance because it demonstrates that the implications arising from the EM reform have gone beyond the "walls" of schools and reached the university environment.

For Bastos, Santos Junior and Ferreira (2017):

> [...] A new clause (§ 8) included in Article 62 of LDB/96, determines that "the curricula of teacher training courses shall have as reference the National Common Curricular Base". In other words, the conception of education aimed at basic education will also determine teacher training (BASTOS; SANTOS JUNIOR; FERREIRA, 2017, p. 50).

They point out that the limited space for PE teachers in MS will induce a significant reduction in undergraduate courses, and an increase in bachelor's degree courses in PE; will intensify the antagonistic conflict, bachelors X graduates in PE. In undergraduate courses, there will be a consequent devaluation of the contents of human sciences to the detriment of technical sports practices.

DISCUSSION

The studies included in this research, although they propose to discuss specific aspects of a certain point of the MS reform, as a whole, seem to complement each other, have in common the thought that in greater equivalence the MS reform was determined according to the order of the current economic needs. And as such, it sustained the emergence of harmful problems that made the permanence of PE in the MS unstable.

Molina Neto et al. (2017) demonstrate that, in an attempt to determine the matrices of MS, a clash of antagonistic ideologies has historically been established, sustaining a dualism that continues to corrode the meshes of the democratization process of this stage of education. It argues that in the last decade, social discourses and academics have accepted the consensus that the way in which EM was developing could not meet the social demands or the perspectives of the students. It points out that such a situation led the academic and scientific society, in a democratic way, to discuss and weave documents seeking a possible knowledge for the problems identified in the MS.

Bastos, Santos Junior and Ferreira (2017) conceive that an educational reform in Brazil has been necessary for a long time, but the one presented through MP 746/2017 disregarded the various debates, and propositions that occurred in conferences and in the National Education Plan (PNE), showing itself to be very far from what was intended by academic and social movements.

According to Gariglio, Almeida Junior and Oliveira (2017, p.59-60):

> The educational perspective expressed in the counter-reform of High School is diametrically opposed to the idea of an integral education whose character is not guided by the instrumental logic of formation. Thus, it was not surprising that the presence of Physical

> Education in the High School curriculum was questioned and its permanence, as a mandatory curricular component, was put in check. Such a counter-reform, therefore, ends up reinforcing the fragmentation and hierarchy of school knowledge that the National Curriculum Guidelines for Secondary Education, widely debated, sought to address.

That said, and the general terms of the seven studies inferred, among other things, that PE has lost space in EM not only because it is close to an integral educational perspective (GARIGLIO; ALMEIDA JUNIOR; OLIVEIRA, 2017), if it is dissonant from the demands of the market (CASTRO, 2017), or even that it has bent to such demands and thus become volatile (SOUSA; RAMOS, 2017). It loses ground because it is also used in the correlation of forces between antagonistic world projects. In this regard, studies in general terms discretely convey the idea that PE should be a means for the construction of an educational, economic and social world opposed to the operating modes of capital now prevailing in ME.

Therefore, it is not intended here to deny this premise, but rather to elucidate the fact that by employing PE as a potential means to achieve transcendence in world projects, it has contributed over time to its concreteness as a science and discipline indispensable to the collectivity. The result of this is that, unlike Portuguese and mathematics, it has not been able to transgress the different perspectives of training for MS, and now, as demonstrated by Bungenstab (2019), it is in a third moment of crisis. Above all, of legitimacy in the EM.

Concerning the precepts previously discussed and presented by the authors as hypotheses that can become reality compared to the final version of the BNCC (2018), for MS, the emergence of such a crisis proved to be increasingly closer to reality and, therefore, sustainable.

As expected, Castro's (2017) notes became possible; the final version of the BNCC does not bring significant changes different from those established by Law No. 13,415/2017. It argues that

> In the area of Languages and their Technologies, Physical Education enables students to explore movement and gestures in bodily practices of different cultural groups and analyze the discourses and values associated with them [...] (BRAZIL, 2018, p. 483),

Therefore, even though it is considered a mandatory curricular component of MS, as demonstrated by Castro (20170 can indeed assume a position of optional discipline, this is observed when the document takes the training itineraries as

> [...] strategic for the flexibility of the curricular organization of High School, as they allow students to choose from – they can be structured with a focus on an area of knowledge, on technical and professional training or, also, on the mobilization of competencies and skills from different areas [...] (BRAZIL, 2018, p. 477)

In these terms, it can be seen that PE is part of the MS curricular flexibility strategy, and as such will be at the mercy of the student's choice, who in the search for early training may choose another itinerary and/or technical training, and thus not attend it. As indicated in the studies listed in

the second category, PE will not be offered to all students, it will become inferior to other subjects. And as a deeper consequence, it will not have the same space to materialize its curricular matrix, consequently there will be a reduction in the field of action of the teacher trained for school purposes.

In general, the final version of the BNCC presents content on PE in MS integrated with the axis of Languages and their Technologies, but does not specify the competencies and skills, as occurs in the other disciplines, which more explicitly present how teaching should be.

Thus, the questions previously exposed by the authors reaffirm the instabilities that this discipline suffers, with the lack of description, by axis, that can clarify the curriculum, the Political Pedagogical Project (PPP) of the school, and consequently the teachers regarding the application of the basic contents for their professional performance.

As for the performance of professionals of notorious knowledge, previously pointed out by the authors as a possibility, it can be seen that they can in fact act as PE teachers. The possibility is supported, first, in the updates maintained in article 61 of LDB 9.394/1996, which now guarantees the performance of these professionals in technical and vocational training. And secondly, in the text of the final version of the BNCC, which, by arguing that the formative itineraries "[...] can be structured with a focus on one area of knowledge, on technical and professional training [...]" (BRASIL, 2018, p. 477), in these terms, "doors" are opened for action and a possible meeting between these professionals and the student who choose to attend the physical education itinerary in vocational technical education.

This finding, together with the fact that school PE remains in only one axis (Languages and their Technologies) and consolidates a harsh reality; teachers trained for school PE run the serious risk of having a reduction in their workload and consequently a reduction in their salaries.

It can be seen that most of the implications pointed out in this research are yet to happen. The reform of the MS, in fact, led the Brazilian school FE to a third moment of crisis.

In view of these findings, it is prudent to relate the notes of the authors who proposed to direct solutions to overcome this crisis, and thus legitimize PE in ME, in this perspective, Molina Neto et al. (2017) asserts that the crisis becomes a good time to reflect on the university training of PE teachers, and even on pedagogical practices at school, with emphasis on the experiences lived by students in this environment and outside of it.

For Gariglio, Almeida Junior and Oliveira (2017), the answers to this dilemma, of PE in EM, go through a process of confronting the bases that sustain the "new" High School. They highlight the need to expand research and studies in the academic and school spheres that discuss the presence of PE in MS.

Bungenstab and Lazzarotti Filho (2017) argue that it is essential to discuss the importance of

teacher training to work in Brazilian MS. They also emphasize that the debate is open and that there will always be a place for PE in MS, however, it is necessary to fill it not only with presence, but also in thought, because the uncritical and technicist ideas had already been overcome in academic production.

FINAL THOUGHTS

The purpose of the respective research was to answer what would be the implications for school PE when it was submitted, conceived and developed in line with the current reform of MS, in a satisfactory way it can be seen that the advent of the reform corroborated the rupture of historical ties between PE and this stage of basic education. Based on the studies included in this research and on the inferences made about the latest version of the BNCC, it can be stated that, in fact, PE faces a third moment of crisis, this time with the loss of significant space in basic education. Having, among other implications, a reduction in their workload, restriction in student access, and consequently a reduction in the field of action of PE teachers.

By providing further clarification on the situation of school PE in the MS reform, this research is of paramount importance to society, especially to PE professionals. It clarifies to them the new reality to be faced in the school environment. Thus contributing to better performance and search for new strategies and perspectives for school PE.

In general, it allowed us to realize that the reform of the MS, although necessary, under the terms of law 13.415/2017, disregarded much of the debate and the propositions made by the academic and scientific educational society, maintained strong links with the current economic system, causing controversy and opposition. It can be noted that in this context, PE has lost ground because it has a dissonant curricular matrix, and, therefore, the new teaching requirements for MS are unnecessary.

In view of this, it is considered prudent to join forces and point out means to overcome such a crisis, and thus legitimize PE as an indispensable science to the collectivity, thus sustaining the desire for a PE that does not bend to the dictates of the market, but that manages to transgress the different perspectives of educational training. An FE that, in general terms, respects and does not degrade the critical, reflective and philosophical aspects. That respects and does not degrade the aesthetic, biological, health, sports, leisure, etc. aspects. A PE that, although it is a "tool" of different projects in the world, can overcome the antagonistic clashes that involve the area, and the problems in the training and performance of PE professionals. Perhaps, in these terms, PE will be able to find ways to show itself to be of paramount essentiality, and thus indispensable in any educational, economic, and/or social projects that involve it.

Finally, it is necessary to see the development of new research that can follow the changes of

the MS reform on the "floor" of the school, to point out the new possibilities and obstacles for PE in this new conjuncture, and especially to identify which solutions have arisen to overcome the crisis established in the PE of ME.

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The transformative integration of university extension and education in communities

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ABSTRACT

This article explores the transformative integration of university extension and education within communities. Universities play a central role in society through three pillars: education, research, and extension. Historically, the emphasis was on research and teaching, with little consideration for the potential of university extension. The latter represents a vital force in the practical application of academic knowledge, promoting social engagement and community transformation. Originating in 19th-century England, university extension in Brazil began in the early 20th century, evolving into a participatory model that values community knowledge. During the democratization of the 1980s, university extension gained prominence with the creation of the National Forum of Extension Pro-Rectors (FORPROEX), which institutionalized and organized extension activities nationwide. The 1988 Constitution and the National Extension Plan (PNExt) reinforced the importance of extension, promoting the integration of teaching, research, and extension, and encouraging social transformation through knowledge. University extension provides an interface between research and community, promoting sociocultural development, entrepreneurship, and environmental sustainability. For students, participation in extension projects offers opportunities to apply theoretical knowledge in practical contexts, developing skills such as leadership and teamwork, and fostering social responsibility.

Keywords: Community, University, Student participation, Extension.

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INTRODUCTION

Universities have a central role in society, they are recognized by three key elements: education, research and extension, which in a hierarchical way work together, contributing to the intellectual formation and development of society. For much of the history of higher education, the main purpose of universities was research and teaching, with little consideration of the potential of applying acquired content as a tool in community service and social engagement. In this context, university extension represents a vital force considering today the current understanding we have of the concept of education and its potential with regard to social transformation. Although essential and integral to the educational mission of higher education institutions, academic extension is still an incipient practice and, therefore, faces challenges in attracting investments and resources that allow the expansion of its potential in order to highlight the practical benefits that extension programs can provide to society. University extension plays a fundamental role in the transformation of the contemporary educational context, transcending the conventional boundaries of academia, and expanding the concept of learning, applying content in a practical way, beyond the physical walls of the university.

UNIVERSITY EXTENSION

Becoming one of the three fundamental pillars of the structure of universities, along with teaching and research, extension occupies a prominent place in the practical application of academic knowledge for the benefit of society. University extension must be democratic and protagonists in the dialectical process between theory and practice, identifying and solving challenges that, in most cases, demand an interdisciplinary approach. In this sense, university extension acts as a mediator and integrator of knowledge through the development of activities and programs that directly connect the university with society in a practical way, promoting the exchange of knowledge and experiences.

Emerging in England during the nineteenth century, from the 1870s onwards, universities began to offer extension courses for adults outside the traditional university environment that encouraged access to knowledge, allowing the community and people from different backgrounds and levels of education to enjoy learning from different subjects, from literature and history to natural sciences and mathematics. With this initiative, it contributed to establishing the foundations of university extension as a tool for the dissemination of knowledge and the promotion of continuing education.

In Brazil, the first reports of the implementation of extension programs occurred at the beginning of the twentieth century, carried out by the Free University of São Paulo, with the aim of taking knowledge from the classrooms outside the university walls, in order to decentralize academic

knowledge and establish contact between intellectuals, technicians and the community. The need for dialogue and interaction between these three agents becomes especially pronounced in a historical context in which the community outside the academic environment was often stigmatized, perceived as a social group incapable of understanding academic values and solving challenges that required theoretical knowledge. It is important to highlight that this initial extension model did not critically address the social and economic contradictions that generate the problems faced by the community, thus offering a limited view of the transformative potential of the actions carried out. However, throughout the development and refinement of its practices, university extension has evolved into a more participatory and collaborative model, understanding the value of the community's practical knowledge and promoting a true partnership for social development.

In the 1980s, the process of national redemocratization had a direct impact on the concept and applicability of university extension. Created in 1987, the National Forum of Pro-Rectors of Extension of Brazilian Public Universities (FORPROEX) provided significant advances for the institutionalization, elaboration and organization of extension activities in the country. This forum promoted greater integration between universities and the community, reinforcing the social role of higher education institutions.

The 1988 Constitution in Brazil recognized the importance of university extension, highlighting the need to promote a more substantial relationship between teaching and research. In the years 2000 and 2001, the National Extension Plan (PNExt) was created, establishing guidelines for this practice, essentially directed to the possible social and regional impacts of the practice of academic extension, the dialogic interaction between university and society, interdisciplinarity and the integration between teaching, research and extension. The PNExt reflects a modern and plural vision of the potentialities offered by university extension, seeking to promote social changes and strengthen the civic commitment of students.

KNOWLEDGE INTEGRATION

Emerging trends, contemporary challenges, and future opportunities for the practice of extension in higher education are points resulting from studies and activities in the field, highlighting its unique ability to catalyze personal and social transformation through knowledge, collaboration, and community involvement.

The extension offers a diversity of areas of practical application, within which it is possible to observe positive effects of transformation and socio-cultural development of communities. The dialogue between research, extension and the community drives and promotes substantial changes when actions are applied to socio-cultural movements, encouragement of entrepreneurship, environment, health and well-being, among others, a range of opportunities is created for work that

can be carried out in conjunction with research. Thus, as it is part of the university triad, the research is directly linked to the practices that can be exercised in the extension, establishing a relationship of exchange between the intentionist and the community contemplated with the project. In this context, all empirical demands found in extension work can and should be taken into universities, where they can be studied and improved. Subsequently, the results of this theoretical refinement are returned to society in a practical way, uniting social actions with scientific knowledge. This dynamic interaction between research and extension allows not only the practical application of academic knowledge, but also contributes to the social, economic and cultural development of the communities involved, where dialogue is established, and is a crucial factor for the development of a whole.

Still dealing with the exchange relationship over extension, the integration between research and extension also offers significant benefits for the university students themselves. By participating in extension projects, students have the opportunity to apply the theoretical concepts acquired in the classroom in real situations, developing practical skills such as leadership, teamwork, and communication. This practical experience enriches your academic training, promoting interdisciplinary reasoning for the solution of challenges and demands of the labor market and thus promoting a more complete academic experience. In addition, participation in extension projects stimulates collective awareness and a sense of social responsibility and citizenship among students, encouraging them to make positive changes in their communities. Thus, the articulation between research and extension promotes positive social impacts, as well as contributes to the personal and professional development of university students themselves.

The importance of university extension as an integral part of the academic path and in the process of training the student as an agent of social transformation is a crucial theme in the contemporary educational context. University extension is a valuable tool that complements classroom teaching, providing future professionals in training with the opportunity to apply their theoretical knowledge in practical and real-world situations, promoting engagement with the community and the development of social and professional skills.

INTEGRATION OF THEORETICAL AND PRACTICAL KNOWLEDGE

University extension gains even more importance when we consider the guidelines established by educational legislation. Law No. 13,005/2014, which approves the National Education Plan (PNE) 2014-2024, determines goals and strategies for the improvement of the Brazilian educational system. Within this context, university extension is recognized as an essential component for the fulfillment of these goals, promoting integration between the university and the community and contributing to the improvement of the quality of education.

Decrees such as Resolution No. 7, of December 18, 2018, issued by the National Council of Education (CNE), reinforce the relevance of university extension as part of the training of students, establishing that "all undergraduate courses must have 10% (ten percent) of the workload of their curricular matrix allocated to extension activities" (CNE, 2018, p. 2). Such determinations reflect the official recognition of the transformative potential offered by extension as an integral part of the educational process, ensuring that students have the opportunity to engage in practical activities whose results directly and objectively impact the community of which they are part during their academic training path.

In this way, university extension enriches the academic training of students, allowing them to experience in practice the concepts learned in the classroom, providing a deeper and more comprehensive understanding of the dissemination, decentralization and applicability of knowledge, promoting critical thinking and interdisciplinary skills to solve challenges and demands in the field of practice. Following an example, a university student who participates in an extension project that provides technological solutions to a disadvantaged community not only applies their knowledge, but also develops social characteristics such as empathy, social responsibility and a sense of community. The interaction between the student and the community is fundamental for the fulfillment of the role of the university institution as a promoter of social transformation, crucial for the contribution to the regional and national development of individuals, professionals and communities.

Outreach projects that target the delivery of services to the community (such as legal assistance, health care, or business consulting) not only directly benefit the population, but also provide students with a broader perspective on the complex challenges and needs they face outside the classroom.

ADEQUACY AND REFINEMENT OF UNIVERSITY EXTENSION PRACTICES

University extension is, in fact, a dynamic field that develops in response to social, economic and technological transformations. Progressively, higher education institutions have adapted to meet the demands that accompany any and all social development processes, expanding and redefining practices in order to better serve local, national and global communities. As social issues emerge and evolve, universities respond to these changes by redefining and redesigning their extension programs to work proactively to address these issues. We can mention, as an example, the growing concern with environmental issues, which has led many institutions to develop extension projects for the dissemination of information about environmental sustainability. Such social demand has driven the development of programs aimed at recycling, conservation of natural resources, and environmental education for local communities.

In times of adversity and collective challenges, such as the COVID-19 pandemic, extension programs play an even more relevant role within the basis of education and as a tool for social transformation. The protagonism of university extension programs as agents for the dissemination of knowledge and in the provision of services shows the practical potential of contact between future professionals and community demands. Such programs had a strong and positive impact on the availability of practical support to those who needed objective clarification, physical care and practical solutions in order to control a situation of collective calamity.

In conclusion, university extension programs greatly enrich the academic experience through the opportunity offered to students to apply knowledge in a practical and objective way, at the service of many social demands. The articulation between extension, research and community is essential for the professional enrichment of students and for social development at local and global levels. The opportunity to experience the contrasts between theoretical knowledge and the practical application of this content provides the intellectual enrichment of those who are part of the academic environment, as well as fosters the dissemination of information and makes knowledge available to those who are on the margins of the university institution.

However, it is essential to highlight the constant need for improvement and refinement of the practices and guidelines that regulate university extension programs, considering the constant social changes. It is essential that extension programs actively monitor social demands in an analytical and objective way, in order to explore all the transformative potential that this tool offers.

Finally, the dialogue between research, extension and the community offers a unique platform for the construction of critical thinking, collective thinking and social responsibility. The interdisciplinarity and synergy between the community experience, the academic path and the exchange of knowledge offer a unique potential for individual and collective growth for the professional in training.

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The literacy process of children in the early years of schooling

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ABSTRACT

This article aims to analyze how children build their thoughts while literacy, presenting the discussions of the works of Emilia Ferreiro and Ana Teberosky, Ana Smolka and Magda Soares. Blacksmith in his works presents us with the writing hypotheses that are constructed by children in the literacy phase. These writing hypotheses are elaborated by the children as they walk the path of reading/writing acquisition, until they reach the domain of functioning of the mother tongue. The child needs the interventions and mediation of his teacher during this initial stage of literacy of reading and writing of his language, while the child acquires knowledge and becomes a literate reader in the Brazilian Portuguese language. This article has the interest of a dissertation on how literacy teachers from the early years of schooling have understood about the elaboration of writing hypotheses of children during this school experience.

Keywords: Literacy, Writing hypotheses, Teacher mediation.

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INTRODUCTION

I write on the topic of literacy because I am excited about it. Research on children's literacy occurs because I consider it relevant to investigate how children understand and understand the process of written reading of the language. The innumerable difficulties encountered by teachers in teaching literacy is a subject that has meaning and importance in my professional life. Searching in literature for the paths that the child takes during the process of building and acquiring mastery in reading and writing enriches my work as a literacy teacher throughout my life. In the work and practice of pedagogue, we need to know how children learn to read and write, including to guide teachers who act as children's literacy teachers. In public schools, we need teachers with theoretical and technical attributes to mediate students in this literacy process during the early years of elementary schooling. When assuming the proposal to carry out this research, some reflective questions arise in thought: "*How do children in the initial phase of literacy understand writing?"; "How does the literacy teacher understand the role of mediator in the initial phase of literacy?".*

The main focus of this work is to research how the child learns to read/write, and how literacy teachers have or do not have the possibility of interfering in the process of the child's acquisition of writing in this initial stage of literacy, during the first years of schooling. In this academic article, I come to investigate issues that involve the literacy process of children in the first years of schooling. To investigate how children learn at this stage, during the initial phase of reading and writing. To report on the mediating role of the literacy teacher in the initial phase of children's literacy.

The research was based on readings and descriptive activities in articles, books and periodicals, which describe specific pedagogical practices to assist the teaching-learning process of students. The article is based on the works of authors who address the process of reading and writing, with special attention to Emília Ferreiro's discussions on the constructions of writing hypotheses formulated by children during the literacy phase. Other authors, such as Magda Soares and Ana Smolka, address the process of construction of reading and writing, literacy and the intervention work of literacy teachers in public schools. This work has as its methodology the bibliographic research.

THEORETICAL FRAMEWORK

HOW THE CHILD UNDERSTANDS WRITING

Children's literacy is a laborious and complex activity. I started teaching literacy to children a few years ago, later I got to know the work of the authors Ana Teberosky and Emília Ferreiro "*The Psychogenesis of Written Language"* (1985), I began to discover a way on how children learn to write. In the approach of the work, the author talks about the children in the process of initial learning of their writings, how they think and express their comprehension formats while discovering the systematic social code of alphabetic writing. The child goes through this moment in his school life

when he is at the beginning of literacy, he formulates the writing hypotheses, advancing in the process through the mediation of his teachers in the phases and hypotheses of writing until they understand the formal writing system established in society.

> The invention of writing was a historical process of constructing a system of representation, not a process of codification. Once constructed, one might think that the representation system is learned by new users as a coding system. However, this is not the case. In the case of the two systems involved in the beginning of schooling (the system of representation of numbers and the system of representation of language), the difficulties that children face are conceptual difficulties similar to those of the construction of the system and therefore it can be said, in both cases, that the child reinvents these systems. (FERREIRO, 2011, p. 17)

In literacy, the teacher looks for in the child his/her learning phase, the one he/she is experiencing, which writing hypotheses she is expressing in his/her notes to identify how the pedagogical intervention with the child will be, in this way the teacher helps her students to advance in these phases, to reach the next stage, going from one writing hypothesis to another. During this transition phase, for the child there is difficulty in understanding the system and to overcome this moment of not mastering the code, the child reinvents writing as he understands it. To represent the words, the child writes in his own way, within the studies of the author Ferreiro and Teberosky, the child creates and recreates the writing in a process prior to the mastery of the socially constructed alphabetic system, which the child is learning.

While the children create their way of writing, in this process of reinvention of writing, the child in his way of writing uses quantitative and qualitative axes, following Ferreiro's speech in "*Reflections on Literacy"* (2000). In the forms of writing of a child during the initial phase of reading and writing, the author refers to the quantitative axis, in which the child in the literacy process can use the variation of the number of letters to differentiate one word from another, for example. And as for the qualitative axis, the child distinguishes his writing by changing the letters he knows, varying the position of the letters he remembers and wants to use.

The child, when writing as he understands the formalized code, although he does not yet have mastery of the writing system, offers to the literacy teacher his real identity of the moment and phase of the writing hypothesis that he is experiencing, so the teacher can follow the phases of her students to plan activities as the child can perform, adapting the subsequent classes and mediating so that their students advance in the phases and hypotheses of writing during the learning of the literacy process. According to the writings of Emília Ferreiro (2011), when the child is being taught to read and write, he writes as he believes it should be done, and it is in this way of thinking about the writing of words that we will analyze and find the interpretation, the reading of the literate world that the child is building.

> Children do not use their intellectual efforts to invent new letters: they take the form of society's letters and adopt them as they are. On the other hand, the children dedicate a great deal of intellectual effort to the construction of forms of differentiation between the writings and this is what characterizes the following period." (BLACKSMITH, 2011)

The literacy teacher will be appropriating such an interpretation and evaluating in which moment of writing experience the child is. Subsequently, the teacher has the opportunity to offer lessons and activities for the children that challenge them to continue thinking and interpreting the code of social writing that we want the children to appropriate. In the literacy process, with this proposal presented by the author Emília Ferreiro, the child is a participant in the construction of his/her learning, the child is the author. She, the child acts during the process, because she thinks about the construction of writing, represents in writing her way of understanding and comprehending the system, because it will be precisely in this circumstance that the teacher makes the intervention, helping the child to reinvent writing again. Progressing gradually, the child makes new reasoning about writing, experiences his moments of reconstruction of learning to write the code of the alphabetic writing system, advancing in the phases of writing hypotheses, until reaching the stage of understanding the code of our language as it was established in society.

Smolka (2003) presents in his work a defense in which the child writes with the child does not merely memorize letters and phonemes to make copies, the child thinks about the text, about the construction of the word, creates and applies his knowledge,

> It does not merely copy or repeat, but it processes, elaborates this knowledge dynamically, discursively. And this happens at every step, at every moment of writing: the child "writes" in different ways at different moments of the same text.

The construction of the child's writing needs to be the main point of the literacy process. In traditional literacy methods, the child's writing is ignored and seen as an error, because the cognitive evolution of the child's writing is not recognized, the decoding of syllables is paramount, the child is not recognized as an author in his literacy process, the teacher loses the role of acting as a mediator and intervenor in the phases experienced by the child while reinventing the writing system of the language. In the literacy of children in the first years of schooling, the writing hypotheses that Ferreiro presented to us are of immense relevance that the literacy teacher knows, studies and identifies them in the writings of her students. Identifying the stages experienced by children is essential in the pedagogical work of the literacy teacher, so that she can plan and intervene in order to favor advances in the learning of the alphabetic system of language writing by children.

In Ferreiro's speech, he clarifies that the traditional way does not value the child's writing as it is, how it is done, how it is thought about writing, all the childish construction is ignored (FERREIRO, 2011). In the book "*The Psychogenesis of Written Language"* (1985), by the authors Ana Teberosky and Emília Ferreiro, he presents the writing hypotheses that children experience

during the process of acquisition and appropriation of the language writing system. In "*Reflections on Literacy"* (2000) by Emília Ferreiro, the author discusses children's literacy, their writings elaborated within the writing hypotheses experienced by children during the acquisition of the alphabetic system of language writing. The hypotheses of writing based on the works that Emília Ferreiro presents to us are: pre-syllabic, syllabic, and alphabetic.

THE WRITING HYPOTHESES

According to Emília Ferreiro's work, we will have three periods in which there are multiple views on the construction of children in relation to the alphabetic writing system, about these periods the author refers to three moments: in the first moment, the distinction between the iconic and the non-iconic mode; in the second, the construction of ways of differentiating in qualitative and quantitative axes; and in the last, the phonetization of writing, which began in the syllabic period.

> "[...] • distinguishing between iconic and non-iconic mode of representation; • the construction of forms of differentiation (progressive control of variations on the qualitative and quantitative axes);
> • the phonetization of writing (which begins with a syllabic period and culminates in the alphabetic period)." (BLACKSMITH, 2011)

In Ferreiro's texts, the reader is presented with the hypotheses of writings elaborated by the children during the learning phase of the acquisition and mastery of the alphabetic system of writing. Teachers who work in the early years of schooling work with children researching these hypotheses of children's writing and investing in advances from one hypothesis to another, in order for children to become fully literate. In my classroom experience teaching literacy in public schools, I have noticed and observed some practices and understandings that I come to report here in this document. The writing hypotheses that schools work on are: pre-syllabic, syllabic and alphabetic. In the syllabic phase, children express in their writings the understanding that words are structured by syllables, representing an element for each syllable, and we will perceive the sound value with emphasis on vowels or consonants, sometimes alternating one or another, or even without the sound value. In pre-syllabic, the child does not yet make a syllabic association in his writings, he makes representative records about his written way of communicating using drawings, letters, numbers. And in the alphabetical stage, the child demonstrates that he has begun to understand the system as it was socially established. The children act out their way of understanding in writing and the literacy teacher does the reading.

Pre-syllabic



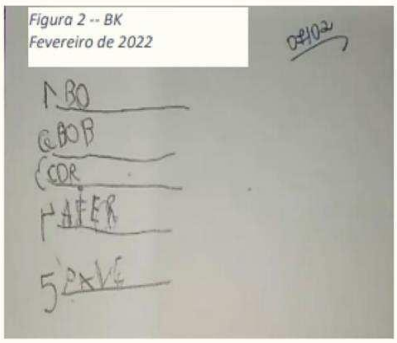
Figure 1 shows the so-called diagnosis made in February 2022 in the class where I conducted the research. This material was made by A1. Here I understand the child in pre-syllabic writing hypothesis. A1 used drawings to represent words. We made toy list and then the dictation. The words of the saying were:

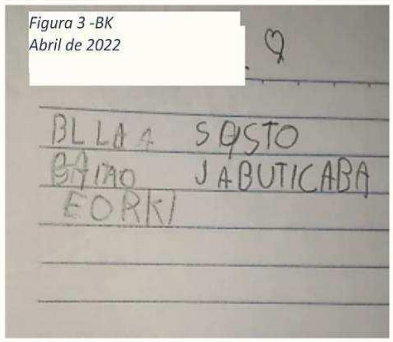
1- BALL; 2- DOLL; 3- ROPE; 4- HOPS; 5 – SKATE.

Syllabic

In this activity, we have student A2 (figure 2), who was elected class representative. Activity was done in February 2022. Here, I understand the student transitioning from pre-syllabic to syllabic. We made toy list and then the dictation. The words of the diagnostic saying were:

1- BALL; 2- DOLL; 3- ROPE; 4- HOPS; 5 – SKATE.



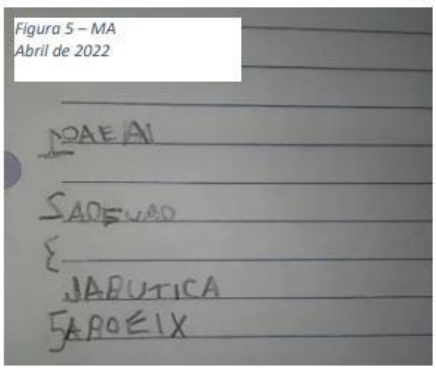


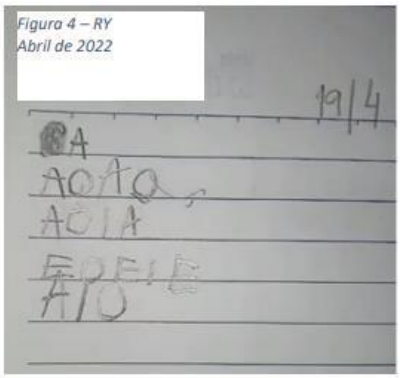
Figures 3, 4, 5 and 6 show the writings of children A2, A3, A4 and A5, respectively, both from the same class in which I carried out the research. These activities were carried out in April 2022. Each child has their own characteristic of understanding writing, in these writings I understand that all of them are experiencing the phase of the syllabic hypothesis, but in their own circumstances. A4 (figure 5) uses vowels when writing BALA, searches for consonants and vowels in the other words demonstrating sound perception, in this case I understand that the student is in the syllabic phase starting the sound value in vowels and consonants. In my understanding of the writing hypotheses, A3 (figure 4) shows that the syllabic phase with sound value in the vowels is initiated. A5 (figure 6) indicates in its writing that it is in the syllabic-alphabetic stage. And A2 (figure 3) appears again with the words of the dictation in April, she is using a larger number of letters to write the words.

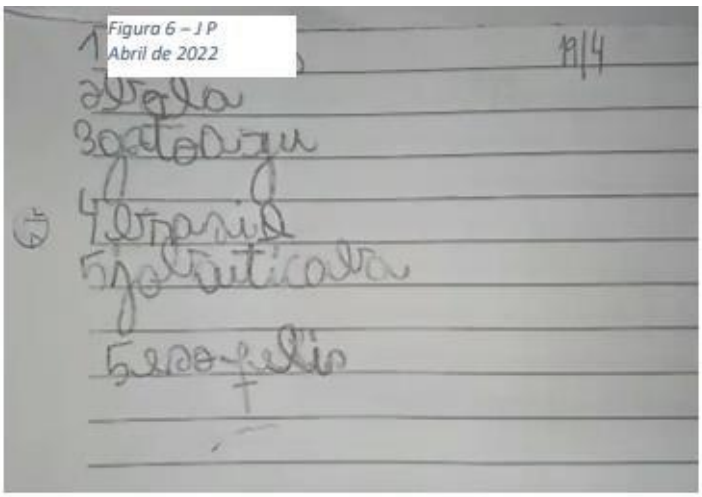
> It is interesting to note the cuts that the child makes in his writing and how he uses the knowledge he already has of the conventional to mark the flow of thought. The child does not merely "record" phonemes and graphemes, does not merely copy or repeat, but he processes, elaborates this knowledge dynamically, discursively. And this happens at every step, at every moment of writing: the child "writes" in different ways at different moments of the same text. (SMOLKA, 2003)

In this context, it was evident the children's effort to write the words, how the letters are available, sometimes in one way, sometimes in another, reinventing the writing code in a process that precedes the acquisition of mastery of the socially formalized alphabetic writing system. The words I used in the dictation came from stories told, and from the context lived in the classroom, the books worked on were "*ONCE UPON A TIME A CHESS CAT"* by Bia Villela and "*O TUPI QUE VOCÊ FALA"* by Claudio Fragata. The words of the saying in April were:

1-BULLET; 2-BLUE CAT; 3- BRAZIL; 4- JABUTICABA; 5- I AM HAPPY.



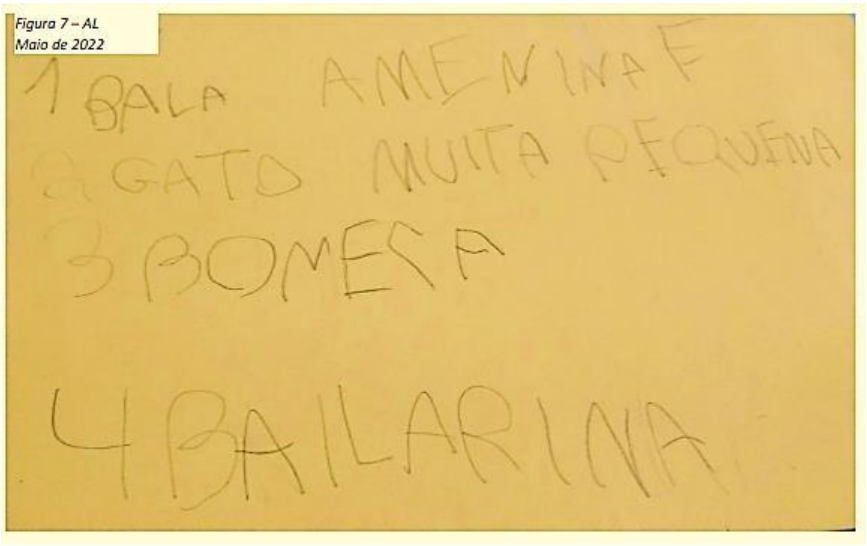


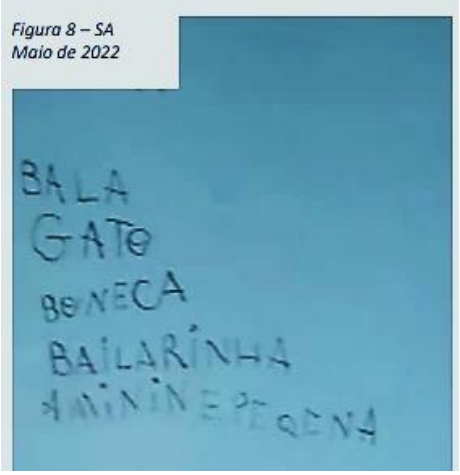


Alphabetical

I understand the alphabetic hypothesis stage as the phase in which the child begins to include vowels and consonants in his writings, linking letters and appropriate sounding, in which the child at the beginning of this phase will be able to use and exchange letters for similarities of sounds or tracing. These exchanges are variations that the child will be instigated to perceive by the pedagogical intervention in the classroom as they walk through the process of learning to read and write. In the following figures, I present two children from class 301 who I assess at this moment are experiencing the alphabetic phase due to their writings described in the activities in May 2022: A6 (figure 7) and A7 (figure 8). From the writing presented, A6 shows that it is orthographic alphabetic, with no spelling errors. A7 is writing as he speaks. I have the perception that A7 presents itself in a transition phase from syllabic-alphabetic to alphabetic. The words are in the context of the lessons held in the classroom. Among the tasks carried out, we studied the poem by Cecilia Meireles " *The Ballerina*". The words of the saying in May, were:

1-BULLET; 2- CAT; 3-DOLL; 4- BALLERINA; 5- THE GIRL IS SMALL.





In this item of the work I demonstrated some of the tasks that all literacy teachers have done in the classroom, searching for information, investigating their students, identifying their writings in order to create opportunities in which children can acquire and appropriate the socially conventionalized alphabetic writing system.

LITERACY AND LITERACY

Literacy comprises the practice of reading and writing, in these circumstances the literacy teacher provides opportunities for situations in which writing has meaning for the child. And reading needs to be practiced by the child, who needs access to different types of texts with varying textual genres. And in this regard, the practice of reading has relevance as it occurs in school and outside of it. For the child of a family who has the financial conditions and the awareness to allow literacy at home, the practices lived in this context must be a facilitator in the work of the literacy teacher in the classroom and at school. The social and economic issue evidences in the children's school life the possibility of a positive or non-positive contribution to the children's initial literacy process. Literacy

accompanies the literacy process at all times, and the social issue reflects from the first steps of our children's school life. In Magda Soares' work "*Literacy and Literacy" (2018),* the author recognizes the social difficulties that students experience and how these portray in their lives since literacy. It clarifies that literacy dedicates to accesses that are not always allowed to those included in low income, because they do not have the conditions, and it occurs that these groups maintain themselves in levels of literacy of inequality due to different social issues among children of literacy age.

> However, it can be inferred from all that has been said that the level of literacy of social groups is fundamentally related to their social, cultural and economic conditions. There must therefore be conditions for literacy.
> A first condition is that there is real and effective schooling of the population (...)."
> (SOARES, 2018)

However, in the (public) school, the literacy teacher in a public school will not wait for a fair and egalitarian society so that all children are in full socioeconomic conditions to practice literacy and literacy. The literacy teacher in the public school works for the student with what she has, and thus provides her students with activities that involve literacy with literacy through the possible and accessible collection. All children are capable of learning. Literacy will be achieved with the material we have, with accessible conditions through the search, to be presented and used in the public school classroom, in order to teach literacy with literacy. And literacy will be practiced with what we are able to seek and bring to class in public schools. This has been the case in public school classrooms in underserved communities.

> The fact that we have awakened to the phenomenon of literacy - that we are incorporating this word into our educational vocabulary - means that we already understand that our problem is not only to teach reading and writing, but also, and above all, to lead individuals – children and adults – to make use of reading and writing, to engage in social practices of reading and writing. (SOARES, 2003)

In the studies of the author SMOLKA (2003) in *"The child in the initial phase of writing: Literacy as a discursive process"* we find the work of literacy and literacy in which children's writing has been encouraged and used with relevance. The functionality of writing being used by the child in the classroom, at school, valuing the child's authorship at this moment when they are learning to read and write. The literacy teacher analyzes the child's writing for the purpose of current cognitive assessment of the child who is in the process of learning to master and acquire the social alphabetic writing system. In SMOLKA's work, the child is not being the recipient of school content in order to be literate at the time determined by an adult. The child is a being who thinks, who develops his ideas about the world and about writing, and the literacy teacher has the property of interceding, interfering in order to provide the opportunity for the child to walk the path of literacy and literacy in his school life during the present moment of the process of acquiring the social code of writing. While the child

is writing, inventing, asking, imitating, copying, combining, learning is built, and the child is appropriating the alphabetic system of social writing.

EXPERIENCE REPORTS

> The child learns to read and write by engaging in literacy activities, that is, reading and producing real texts and social practices of reading and writing. (SOARES, 2021)

My name is Auriceli, I have been a teacher for a few years, today I am 47 years old and I am teaching in a third year class of Elementary School I of Basic Education, class 301 at the Municipal School Professor Carmen Corrêa de Carvalho Reis Bráz which is located in the Santa Lúcia neighborhood, in Imbariê, third district of the city of Duque de Caxias, in the state of Rio de Janeiro. I am a teacher and I joined the municipal network of Duque de Caxias in 1998, I have been working at this school since 2019, but I met the school in 2014. I have been following the 301 class since the first year of schooling, they were my students in 2020, the year of the covid-19 pandemic, and during this period the service was entirely through facebook. In October 2020, we had an irreparable loss, one of our class students died in a train accident in Saracuruna, at the age of six he was one of the little ones. During the pandemic, very few students had access to the internet to follow up with their parents through the social network, so very few students were able to participate in classes. When we started distributing printed handouts with activities for everyone, the children were finally able to have access to the study material.

In 2021, the school returned to face-to-face activities, but teachers who still had a vulnerable health situation remained in remote work, and so I remained until September when I was able to take the third dose of vaccine against covid-19, due to the diabetes that has been accompanying me for a few years. By a misfortune or negligence of rulers, our school had an accident, the plaster of the ceiling and walls of the school began to fall and it was very scary, during the incident there was no one inside the school. Due to what happened in 2021, the school suspended classes for all students and began to attend remotely until the necessary works on the building were completed so that we could return to the building safely. When I returned in September, the school was still under construction and my class, which at the time was the second year of schooling, remained with remote classes. In February 2022, I was able to return to the classroom immunized and with the school renovated. All my students in class with face-to-face classes and being vaccinated against covid-19. I was starting the not easy task of teaching literacy to the class that had been without face-to-face activities for two years.

We have many difficulties, mishaps and confrontations that still need to be overcome. Class 301 has 22 students enrolled and attending assiduously, among these children we have a p.c.d. girl,

she is a wheelchair user with multiple physical and cognitive difficulties. My primary concern is to keep the focus on teaching literacy to the children of class 301, I have been looking for alternative texts that have affinity with the children's universe, stories that are from the children's world so that children are interested in reading and writing. During the month of February we did some work to socialize again in this return to face-to-face, and among the activities that I have presented I have included the first name where they cut letters and paste them assembling their name, the name of their colleague, to build the word, presenting the letters of the alphabet in their own name and in the name of their colleagues. The activity is interested in finding letter by letter of each word that is being written and transcribed by means of cut-out collage. In March and April 2022 I have been doing self-dictations with them where I present figures and images whose names are words of interest to them, to their children. The cut-and-paste tasks continued, in these proposals they need to find the letters they are looking for and associate them in the position they expect, a challenge for them.

In their writing activities I try to select some for diagnosis, I periodically perform the dictation diagnosis where I use some words that we are working on in class, I look for writings that have contextualization with the situations and stories that we are experiencing in the classroom. I always work on stories, I read children's storybooks to the class, we transcribe in notebooks excerpts from poems, passages from stories that belong to the children's world. I'm noticing that children are building their hypotheses, their ways of understanding and writing the word they're being provoked to write. We arrived in May 2022, today there are in the class of 22 children, 10 who are alphabetical and alphabetical syllakhs, 9 who are syllabic with sound value, of these most have sound value in vowels, 2 syllabic without sound value and 1 pre-syllabic. In this group of students we have reading children who are reading any text fluently, there are students that the family has put in an explainer and the child arrives in the classroom syllabaging the words without identifying and interpreting what the syllable. For these cases, I have been working literacy, constantly. One of the activities I do is to read the word together with the child, because reading is interpreting, reading is understanding the name of who and what is written. I always read with them, until I identify which word we are reading, and what reading actually is, because the word is something that exists, a word is the name of someone or something, a word is not "singing" a repetition of 'little pieces' (letters and syllables). These tasks carried out in the classroom have experienced positive results with the children.

METHODOLOGY

The methodology used is bibliographic research whose theoretical survey was based on books, scientific articles and materials available on the *internet*. This type of research provides the necessary support for any type of study.

According to Fonseca (2002, p. 32), the bibliographic research:

> It is based on the survey of theoretical references already analyzed, and published by written and electronic means, such as books, scientific articles, web site pages. Any scientific work begins with a bibliographic search, which allows the researcher to know what has already been studied on the subject. There are, however, scientific researches that are based solely on bibliographic research, looking for published theoretical references in order to collect information or prior knowledge about the problem to which the answer is sought.

Thus, the methodology used aims to collect relevant information that collaborates with reflections and discussions on "the literacy process of children in the early years of schooling". Along with the bibliographic research, a brief report of experiences was made to complement the studies carried out.

RESULTS AND DISCUSSION

The research carried out that I present in this document is interested in demonstrating the initial literacy of children in the first years of schooling, how the child understands writing, how he creates, invents and reinvents the structure of the alphabetic code while learning, demonstrating his writing hypotheses within the studies of the authors Emília Ferreiro, Ana Smolka and Magda Soares. In this process, the literacy teacher of the public school works with perception, observes, records, analyzes, evaluates, uses previous knowledge analyzing and evaluating the written material that is produced by the children, inserts with the intervention providing possible ways for children to become literate and have access to literacy. In the text, I argue that the child is the author of his learning, because he constantly resorts with his knowledge, which he is proceeding from knowledge that he builds in the investigation of thinking and creating the writing of the words that are provoked to write. The children's knowledge is being analyzed at every glance of the teacher. And in this context, the teacher plays a valuable role in evaluation and planning, verifying and looking for opportunities for growth and discoveries during this journey during the learning process in acquiring the apprehension of the mastery of the alphabetic code of writing historically conventionalized in society.

The authors I sought to substantiate the research, Ferreiro, Soares and Smolka, tell us how much the social and economic issue of the children's families are factors of inference and conditioning in the students' school life. And I also include public schools in this problem that involves socioeconomic issues. How to work and study in a school that for years still has problems with running water? When there is a lack of water, the circumstances are inappropriate. Either there is no class or the class is half the time without water. Imagine learning and teaching without water at school. Not having water for drinking, washing hands, or for sanitary use. The school has finally been renovated, but the works are not yet finished. The school court, which is the space loved by all the students of the school, still has no deadline for the works to be completed. A social aggravating factor

has been urban violence, episodes of gunfire in the vicinity of the school leave everyone at risk of death, they affect the people who live and those who work in the place to fall ill due to depression, panic and other diseases, and in the occurrences of shootings they promote the emptying of classrooms in the school until the conflicts are resolved. This description is a brief account of the consequences of a society belonging to such an unequal and contradictory socio-economic context.

Through this research in education, I want to affirm that literacy teachers in public schools can teach literacy and that children can learn, that children are capable of being literate and learning with literacy as long as they have access to reading materials that are broad and enriching, whether in the classroom, at school, or at home, with their families. Children are interested in novelties and in literacy we can instigate them through curiosity despite all the adversities we experience in today's society.

FINAL THOUGHTS

This research allowed us to report and better understand the process of child literacy in the first years of schooling in public schools. It offered the possibility of reflecting on the mediating role of the literacy teacher. And to confirm that teachers can indeed provide opportunities for literacy with literacy for public school children. The constructions of the writing hypotheses were approached with the demonstration of writing productions of children in the literacy phase. The approach was contextualized based on the studies of Emília Ferreiro, Ana Smolka and Magda Soares. The need to exercise literacy together with literacy was made explicit during all the reflections in this document. The social issues experienced in poor communities were highlighted, and lead us to reflect on the social inequalities of human life and their consequences in the early days of the population's schooling since childhood.

In conclusion, the task of teaching literacy in public schools is not easy, the mishaps and confrontations are extreme, and hinder the teaching-learning progress of the children, the school and the teacher in their pedagogical role. The pedagogical work of analyzing, evaluating and planning will be of importance in literacy, the literacy teacher will be in constant training, updating herself on the ways of studying how the child understands the writing of the socially and historically conventionalized alphabetic system. With these studies, the teacher will look for possibilities to offer paths of success to her literacy students.

In conclusion, every child is capable of being literate, every teacher is able to teach literacy in public schools. And society as a whole has the property of facilitating possible and accessible paths in favor of public education, guaranteeing literacy with literacy to every Brazilian child.

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Permanent health education: Potentials, challenges and trends for the work process

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ABSTRACT

The objective of this study is to describe how the process of reorganization of work and health planning permeates the results in the quality of health education and prevention. The study method of a theoretical, qualitative nature was sought, seeking a review of the literature, where the deepening of the knowledge related to the theme can be presented. The following inclusion criteria were considered: studies derived from research, original articles, and literature reviews that addressed the concept of EPS and its development in PHC in Brazil, in the Portuguese languages, from 2017 to 2023. The survey took place in November 2023 and December 2023. It is concluded that it is important for the EPS to develop strategies for dialogue with the population, in order to understand the desires, whether in the individual or in the collective, promoting education, guided by prevention and health promotion, a collaborative, problem-solving and effective work.

Keywords: Health, Quality of education, Health prevention.

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INTRODUCTION

According to history, in Brazil, the ordering of training and the development of human resources in the area of health was regulated by the Unified Health System (SUS) through the Organic Health Law. (Brazil, 1990) The National Policy for Permanent Education in Health (PNEPS) was formalized by the Ministry of Health through Ordinances No. 198, of February 13, 2004, and No. 1996, of August 20, 2007, and its implementation process depended on several actions, discussions, and strategies developed in Brazilian states and municipalities (Brasil, 2004; 2007).

The Unified Health System (SUS) requires health professionals to be committed to the doctrinal principles of universality, equity, and comprehensiveness. The strengthening of the SUS has been demonstrated by policies that reorient training and work, which historically seek to circumvent the obstacles that hinder the correct functioning of the system according to its principles (KODJAOGLANIAN VL and MAGALHÃES PM, 2019).

In view of the context studied, it is emphasized that Permanent Education in Health (PHE), inserted by the Ministry of Health as a health policy in Brazil through Ordinances No. 198/2004 and No. 1,996/2007, aims to guide the training and qualification of professionals inserted in public health services, with the purpose of transforming professional practices and the organization of work based on the needs and difficulties of the system (Ministry of Health and Education). of Health, 2009).

Permanent Health Education (PHE), inserted by the Ministry of Health as a health policy in Brazil through Ordinances No. 198/2004 and No. 1,996/2007, aims to guide the training and qualification of professionals inserted in public health services, with the purpose of transforming professional practices and the organization of work based on the needs and difficulties of the system (Ministry of Health, 2009).

It is noteworthy that the production of knowledge about EPS has been fundamental for the reorganization of work processes and health planning, among other factors, which characterize the relevance of this article. Still, in view of the scope of studies in a nationwide database on EPS and the implementation of the Permanent Education Policy in the Brazilian states and their municipalities, it is important to know their practices. In this way, it is possible to make a situational diagnosis regarding new trends and challenges of the EPS policy in Brazil.

METHODOLOGY

This is a theoretical, qualitative study, seeking a literature review, which aims to gather information pertinent to the researched object in order to contribute to the deepening of knowledge related to the theme.

For the selection of works, the following inclusion criteria were considered: works derived from research (monographs, dissertations, theses, original articles and literature reviews); works that

addressed the concept of EPS and its development in PHC in Brazil; studies whose objectives referred to EPS initiatives developed in PHC; and studies on perceptions regarding the change in professional practice based on these initiatives.

The survey included works published in the Portuguese languages, in the period from 2017 to 2023. The literature search and the selection of publications were carried out by four researchers independently, between November 2023 and December 2023.

Regarding the databases, the publications were collected from the Virtual Health Library (VHL), which brings together scientific journals and periodicals, and the following databases were also searched: SciELO (Scientific Electronic Library Online); electronic database of theses and dissertations of BDTD (Digital Library of Theses and Dissertations); Google Scholar; and Scopus (SciVerse Scopus).

THEORETICAL FRAMEWORK

POTENTIAL OF CONTINUING EDUCATION

Continuing health education emerges as a fundamental approach to improve the knowledge and skills of professionals, ensuring the provision of quality services in a scenario of constant transformations (Ministry of Health, 2006).

In view of the rapid technological evolution, the changes in health policies and the diversification of society's demands, it is essential to understand and analyze the potential of continuing education in health as an effective strategy to face contemporary challenges at work (Freire, 1996; Perrenoud, 2000)

According to Santos et al (2021), EPS is seen as an innovation in educational practice, enhancing teaching-learning in services, with the aim of making professionals reflective and active actors in the construction of knowledge, making learning meaningful according to the reality of each subject involved in the process, thus making their knowledge as prior to the performance of daily activities.

One of the potentialities of continuing education in health in the work process is the recognition of work as a source of knowledge, as a construction of the subjects' lives, in addition to providing an integration of and in work in an inter and multiprofessional way through educational activities in a dynamic and permanent way (Almeida, et al; 2016).

Thus, Permanent Education in health has great potential for effectiveness in the work process when it fails to follow ready-made scripts, without excluding the educational activities that bring their programs ready, as they also present their importance, but bring this EPS to the daily work process, according to the needs of those involved, launching its benefits to them, including the exchange of knowledge, greater problem-solving capacity of problems and situations, whether

individual or collective, in addition to better use of technologies for innovation in the work process and evaluation of this entire process (Silva, et al; 2016). In view of this sample, we understand that Permanent Education in Health (PHE) comes as a protagonist in the management of education and work.

CHALLENGES OF CONTINUING EDUCATION

According to Ferreira (2019) et. al. the insertion of the concept of Permanent Education in Health (PHE) occurred through the Human Resources Development Program of the Pan American Health Organization (PAHO) in 1980, focusing on the quality of the service through a pedagogical framework that involved the worker in the health processes. This practice was improved by SUS ordinances (No. 198/2004 and No. 1,996/2007).

Primary care, the initial space sought by health users in the country, is considered the first level of contact between people and the Unified Health System, was implemented in 1994 called the Family Health Program (PSF), then the Family Health Strategy and today the Basic Health Unit (UBS), renamed during the PAC (Growth Acceleration Program) in 2007. According to the Ministry of Health:

> The Basic Health Unit (BHU) is the establishment that provides services in Primary Health Care, where the Family Health teams work developing health actions at the individual and collective levels, which include health promotion and prevention, diagnosis, treatment and rehabilitation, with the objective of developing comprehensive care.

This ethical-political-pedagogical proposal, according to Ferreira (2019) et. al. aims to transform and qualify health care, training processes, health care practices, in addition to encouraging the organization of actions and services in an intersectoral perspective, strengthening primary health care, including management, educational institutions and the community.

The fundamental concept of Basic Health Units is the core of continuing education in health, considering that the units are at the center of the work with the population, a source of identification of demands and with all the potential for articulation between sectors.

Thus, the Ministry of Health (2004) proposes that the transformation of professional practices should be based on dialogue and critical reflection on the real practices of professionals working in the service network.

The National Policy for Continuing Education in Health establishes that municipalities meet the responsibility in relation to continuing education in health. As Peres, Silva and Barba (2016) cite:

> "Based on this reality, it is essential to investigate the processes related to the management of EPS, in addition to problematizing the weaknesses and potentialities evidenced in the policy through the literature, in order to contribute to the more efficient functioning of the Unified Health System (SUS) and the consequent improvement in the provision of services to health users."

Franco (2007) mentions that although investments in health education have increased, they have not been able to change the practice of health care and services.

For Peres, Silva and Barba (2016), health workers point out several factors that present themselves as obstacles to the development of EPS, among them the difficulty of using an active methodology that values the subject as the protagonist of their actions, develops their autonomy, and appreciates daily life as an instrument of learning.

The authors also point out that "this difficulty has led to the use of several ideologically traditional methodologies that are contrary to the recommended active methodologies.

> Even in the face of the difficulty of working with active methodologies in the process of implementing the EPS proposal, it is valid and current, as it seeks a new health paradigm that transforms the performance of health workers and managers, motivating them to change their praxis, in-service qualification and the consequent implementation of SUS principles. (PERES, SILVA, BARBA, 2016).

Therefore, understanding the conception of continuing education in health and inserting it in the day-to-day lives of workers and municipal managers may be the main key to the positivity of this field that is so important in health.

TRENDS IN CONTINUING EDUCATION IN HEALTH

Permanent Health Education recognizes everyday life as a place of inventions, acceptance of challenges and creative replacement of models by cooperative, collaborative, integrated and courageous practices in the art of listening to the diversity and plurality of the country.

The National Policy for Permanent Education in Health is a practice in experimentation and with a political requirement to offer proposals for the transformation of professional practices through the problematization of the work process. Proposal consistent with the challenges of training human resources for the SUS; to implement, in the country, a management of work and education with the vigor of a public policy committed to training and professional development; and to overcome the professional education policies aimed at work in the industry, historically implemented in Brazil. This triggers new profiles of workers and managers of health actions, services and systems (CECCIM et al, 2008).

The enactment of Ordinance No. 198/04, which institutes the National Policy for Permanent Education in Health, brings some innovations that represent ruptures in the way of conceiving the training of professionals to work in the SUS. Among these innovations, we have training perceived as a strategic policy of the federal government for the training and development of the group of health professionals, instead of just another one-off program of the Ministry of Health. Another innovation is the one that proposed PE as a pedagogical concept, in the health sector, to make organic relations between teaching and actions and services (training and sectoral management) and between teaching

and health care. health (institutional development and social control). Finally, the form of implementation of the policy, which should take place through the Permanent Education Centers in Health for the SUS (MANCIA, CABRAL and KOERICH, 2004).

Considering the normative framework with Ordinance No. 198/04, the training and development of professionals to work in the SUS began to be referenced in the principles of EPS, which proposed that training processes should have as their objective the transformation of professional practices and the organization of work itself, based on: the health needs of people and populations; sectoral management; social control in health and the renegotiation of training initiatives for a local regional conduction, thus creating conditions for an integrated National Policy for Permanent Education in Health (MACÊDO et al, 2014).

The perspective of EPS for the foundation of training processes is also mentioned in interministerial ordinances n. 2.101/05 (BRASIL, 2005) and 1.802/08 (BRASIL, 2008). The conceptual theoretical choice may need to follow the diversity of realities present in the Brazilian regions with different demands. However, if we consider professional training as essential for the consolidation of the national health system, we also need to strengthen the National Policy for Permanent Education in Health as a SUS strategy for the training and development of workers for the sector.

Among the advances pointed out, the planning of activities and the development of actions in Primary Care; the learning scenarios that involve the contents of teamwork; the knowledge of the principles and guidelines of the SUS and the Primary Care Information System stand out.

FINAL THOUGHTS

The implementation of strategies and actions focused on EPS is fundamental for the implementation of the PNEPS and has been developed in primary health care services. However, many of these initiatives developed for health workers are based on a conception of instrumental education with an emphasis on punctual, fragmented and decontextualized actions with the daily routine of the services, which are closer to the concept of CE.

It is noteworthy that the challenge is to break with the fragmentation of the health education process in search of the implementation of the PNEPS. It is suggested to fine-tune the conception of continuing education with workers and, mainly, health managers so that this process and the SUS are possible, since EPS is considered by the Ministry of Health as the driving force of the system.

In this way, it is necessary to rescue an EPS that actually articulates the "utopia" of "health as a right for all", as a possibility of quality of life, for users and workers, which in times of strengthening neoliberalism in the country is extremely necessary. The struggle must take place not

only in everyday life, but in political spaces, in collective articulations that strengthen the health reform movement and the implementation of the constitutional SUS.

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The influence of dance on the creativity of elementary school students I- A literature review

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ABSTRACT

The aim of this study was to analyze, through a bibliographical review, the importance of dance in the school context as an instrument to work creativity in the student's life. This article shows us that through dance, we have the opportunity to learn not only rhythmic models, but also to stimulate and enhance creativity, work on self-confidence, help in the development of critical thinking and in the elaboration of problem solving. It points out the need for the educator to be intentional, stimulating the student in their autonomy, their imagination, providing opportunities for the improvement and development of being creative. It is concluded that developing creative skills has been increasingly required in the current world we live in and dance within the school context, through a pedagogical and intentional look, is extremely important, bringing benefits in terms of enhancing and stimulating the creativity of students.

Keywords: Creativity, Dance, Elementary School.

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INTRODUCTION

Articles published in the journal Soviet Education by researchers such as Belyaev (1976), Danilov (1962), Kraevskii (1982), Lakovlev (1976), Skatkin (1982), Sukhomlinskii (1963) and Zhukovskaya (1962), show how the Soviet Union sees the need to develop students' creative skills, also pointing out that teachers should be attentive to each child, favoring the development of their talents. of their potential, to cultivate the imagination and creative activity of all in the school. In the USA, there is a need to open a greater space to develop creativity at school, we found debates and research on this topic, published in magazines such as Gifted, Creative; Talented, Journal of Creative, Behavior, and Gifted Child Quarterly. Currently, students need a better preparation to solve new problems in the uncertain and complex scenario of the twenty-first century, where creativity is associated with a set of personality attributes. Therefore, developing creative competence at school is one of the ways to prepare students for an uncertain future (Beghetto, 2010).

In Brazil, factors such as the lack of change in the classroom routine, emphasis on knowledge as reproduction, are factors in which the student's capacity for creation and expression are restricted. According to Wechsler (2002), the greatest challenge is to awaken teachers to develop strategies to work on creativity in the school context, this conclusion was reached after the analysis of Brazilian studies on the importance of creativity, because the stimulation and use of creative potential in education networks has been limited, although there is recognition of the relevance of promoting creativity. According to the author Torrance (1971), the possibilities of creative development diminish as the student advances in the grades and levels of education.

Formulating problems, transforming, expressing, producing, communicating ideas, are terms that associate creativity. To develop the creative potential is to see what no one else sees, to stimulate the flow of ideas, helping the child to discover new ways of seeking and awakening the creative world within him, making use of the use of strategies of knowing, seeing and doing, so that the student's thinking becomes visible. Regarding this, Physical Education, as Part of this pedagogical proposal brings components that are of fundamental importance for this stimulus in the student's life.

Paes (2008) argues that movement, feeling and thinking are the three aspects for the integral development of the individual, showing the importance of motor activities, which bring with them psychological, social and physical benefits in all age groups. Therefore, physical discipline in the school context brings corporality, and should go beyond the learning of specific skills, extrapolating the mechanics of body movements, contributing in different ways of experiencing the body, adding to the development of socio-affective, intellectual and motor skills. From the perspective of Daólio (2004), the individual expresses his ways of seeing and understanding the world, builds his motor skills through bodily practices.

For neuroscience, motor function is decisive in human behavior. The translation of thoughts

into concrete acts, it is our behaviors, it is a physical movement made through cognition. Intelligence, cognition, and creativity are physical products of the nervous system. For Mendes (2010), intelligence is an important component in the creative process.

The child's development is influenced by the experiences lived in his daily life, as well as by the quality of the activities he performs, Bee (1997). Development can be shaped by external stimuli, contrary to what was believed that this development occurred only in the maturation of the nervous system (Fonseca (1995), Tecklin (2002). As well as the environment, which can promote or inhibit the student's creative potential (Fleith & Alencar, 2005). Even if an individual has internal resources to reason creatively, the environment that can repress this creativity (Sternberg, 2006). Thus, dance brings, through its elements, necessary stimuli to work on creativity in the lives of students, also providing a favorable environment for it.

Among the various types of motor activities is dance, as a cultural phenomenon it has to contribute to the pedagogical practice and construction of knowledge in the area of Physical Education. Through dance we have the opportunity to: be creative, learn rhythmic models, work on self-confidence, combine movement activities with science, art, Music and Mathematics, Carbonera (2008). As well as working on laterality, notions of space and knowledge of one's own body. According to Castro (2006), for Vigo- tski, creative activity is the entire creation of the new, whether this creation is technical, scientific or artistic. For him, everything is a product of man's imagination, so we know that dance allows us to treat creativity as a possibility to be built within this motor activity.

Thus, the study in question deals with the urgent importance of developing children's creative competence in the face of the challenges we face in the complex scenario of the twenty-first century. It is also based on the observation that dance enables us to build a creativity that is already latent in the human being. Justifying, therefore, the realization of this theoretical review.

OBJECTIVES

GENERAL OBJECTIVE

The objective of this study is to analyze, through a literature review, the importance of dance in the school context as an instrument to work on creativity in the student's life. To bring reflection on the important role of the professional who is in the classroom, being the link between the creative being and the stimulation of this potentiality.

THEORETICAL REVIEW

The changes have been significant in our globalized world, the worker needs to be prepared to adapt quickly to the changes of this new society, so this citizen must be creative, thinking and

critical. Creativity and willingness to train will be increasingly valued and required. For Florida (2011), the use of creativity as an essential resource for value generation is where the strategic areas of companies have turned their eyes, configuring a new economy, the creative economy.

To put it simply, the meaning of creativity is "to do something that did not exist before", Bono (1994). For Bailin (1994) it is closely related to originality. Or Creative thinking is described by your imagination, spontaneous generation of ideas, questioning of judgments. Therefore, creativity must open up possibilities for the reception of the world in a multiple and comprehensive way.

Gardner (1987) states that the school is a privileged place of learning, it should guarantee the motivation of the students to know the new exercise with a lot of inventive intelligence, assuming the use of other intelligences. In the school environment, it is important to promote an attitude of questioning and curiosity, promoting many questions and few answers, so that the student becomes reflective and independent thinkers. Questions foster meaningful connections, encourage student participation, and encourage interest and curiosity. As Paulo Freire (1996, p.32) said, "There would be no creativity without the curiosity that moves us and makes us patiently impatient in the face of the world we have not made, adding to it something that we do." It is also important to teach them to learn from their own mistakes, as the fear of mistakes is a great blocker to creativity. Based on the statements of this scenario of the twenty-first century, it is extremely important for teachers to consider as key in this process the development of students' creative potential, preparing them for the changes that have occurred in this time.

When faced with creative students, teachers tend to present difficulties, preventing the expression of creativity in their work. The responsibility for this current situation is given in the process of teacher training, which prepares them to deal only with the "obedient student", the "standard student" and the "passive student". According to Fleith and Alencar (1992), a little more than a decade ago, Brazil began to worry about the importance of preparing teachers by equipping them, so that they become more effective for creativity in the classroom. It is important to motivate the teacher to use creative pedagogical practices, so these will stimulate students to develop their creative potential, since creative skills need to be stimulated from early childhood education to university, the teacher's awareness to enhance the creativity of their students is necessary, including this objective in their planning. This awareness of the teacher has been a great challenge for the school, in addition to the failure in the teacher's training, as already mentioned above, the existence of internal personal barriers is also a limiting agent, preventing the professional from daring and using innovative strategies in their practice. Olive Tree and Alencar (2007) conducted a study with teachers, in this research the barriers most cited by them on the creativity aspect were the traditional and content-based teaching, the excessively theoretical teaching that the professionals received and the lack of knowledge of the theme creativity.

In view of all this, it is notorious the need to invest in professional training that includes pedagogical practices related to creativity, bringing reflective processes. Teacher training should take into account some agents that are inhibitors of the creative perspective, among the highlights are: Organizational structure of the school, indiscipline in the classroom, work overload, lack of support for professional improvement.

Among the solutions for teaching a pedagogy that enhances and instigates creativity, we find school dance. The teacher, in addition to being an educator, is an intermediary of the art/dance process, where the interaction between body and mind is pleasurable through movement. The student who practices it must feel at ease, instigated to create, taking ownership of the process. The improvisation that this activity brings generates a creative development, allowing a more accurate perception of the subject who does it, in relation to his surroundings. Dance enables the individual to express himself creatively, an opportunity that contributes the student to a personal discovery of his abilities, leading him to develop his creative capacity, forming critical citizens, aware of his acts, aiming at a social transformation.

Vigostski apud Bock (1995), states that we all possess creative energy, which is not a biological determination, and it is materialized through our interactions with the socio-cultural environment, thus allowing the possibility of creativity to be built through dance classes. Thus, dance becomes important in the educational context without losing its artistic sense as well, bringing relationships that go beyond the classroom, expanding the perception and sensitivity of the world, integrating the development of physical skills, providing students with the opportunity to show their bodily and creative skills, as well as difficulties and their overcoming.

Awareness and mastery of bodily possibilities are important, through which the creative potential for movement is fully manifested. Our creativity is also shaped by the relationship we establish with the world and our experiences, teaching-learning processes that we go through throughout life. Laban (1990), stated that dance in education brings an integration between the student's creative abilities and their intellectual knowledge. In the process of learning body language, they also exercise their creative potential, experimenting and improvising their body language, leaving the reproductions of models, and discovering new possibilities when communicating with the body.

This improvisation, which involves dance, develops divergent thinking, contributing to a wide range of responses to the problems of creation. Aranha and Martins (1986, p. 376) associate divergent thinking with exploratory behavior. Within the subject of creativity, convergent thinking is presented when it converges to the correct solution of the problem, while divergent thinking is the raising of ideas and possibilities, in order to seek a solution to the problem. The path of divergent thinking as responsible for creative thinking shows us that creative thought is found in the mental

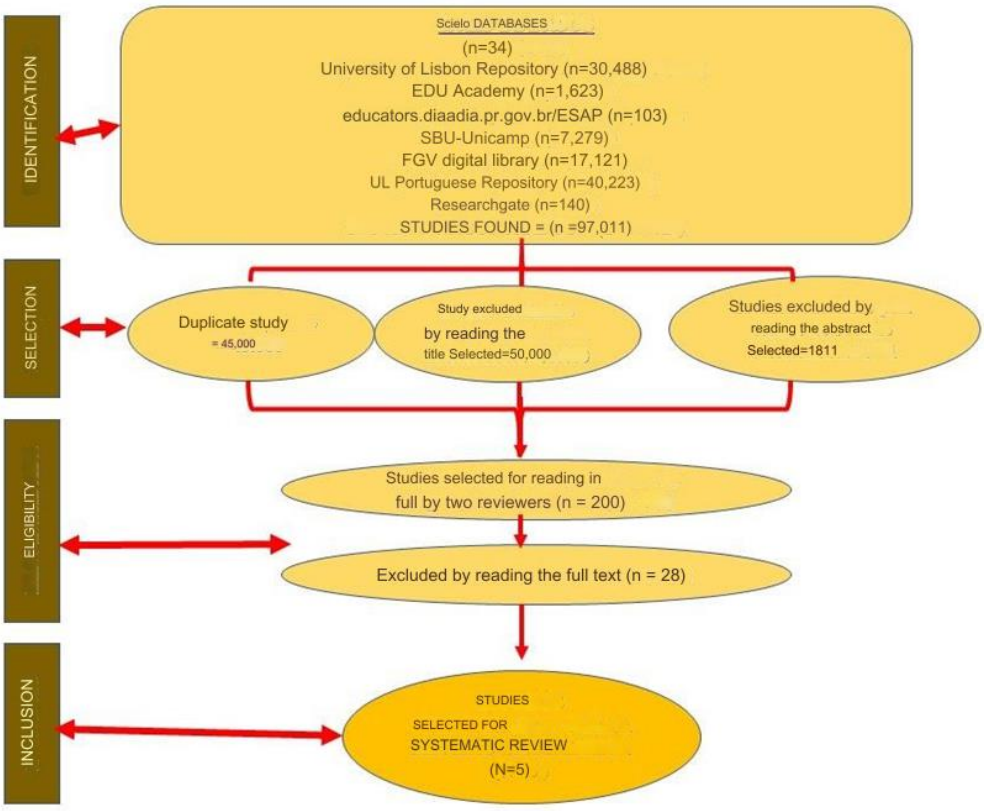
processes related to the new, discovery. It is in this place that dance education acts, building divergent thinking and enhancing the student's creativity.

METHODOLOGY

The following descriptors were analyzed, "dance and creativity", "dance and elementary school", "creative dance", "dance at school", the search was carried out in the following journals: Scielo, Repository of the University of Lisbon, Academia EDU, Educadores.diaadia.pre.gov.br, SBU – Unicamp, FGV Digital Library, UL Portugal Repository and Researchgate. Where 97,011 studies were found. Of these, the following were excluded: 45,000 studies for being duplicated, 50,000 for reading the title and 1,811 for reading the abstract. A total of 200 studies were selected to be read in full, of which 28 were excluded. At the end of the analysis, 5 studies were selected for the systematic review, as shown in figure 1.

The PRISMA, Galvão, Pansani and Harrad (2015) protocol was used, as shown in figure 1.

Figure 1: Prisma Review Flowchart



RESULTS AND DISCUSSION

5 articles were selected, which analyzed their objectives, number of participants, intervention and results of each selected article, as well as in the table below:

TABELA1: Characterization of dance in the school context as an instrument to work on creativity in different studies

AUTHOR	OBJECTIVE	SAMPLE	DURATION / INTERVENTION	RESULT
Souza, Pinho e Morais - 2020	Reflect on the importance of art for teaching and human formation, especially in the education of the child. Discussing the concept of creativity and creative potential in the teaching of art in school.	Bibliographic review, referring to the Network's database International Creative Schools – Riec in Tocantins	The study measured the importance of art within the school context and its contribution in the student's human development.	The study showed that art is of primary importance for the formation and evolution of the human being, and that the school can contribute significantly to this process.
Simões - 2020	Analyze how individual characteristics and socio-emotional skills influence creativity, and what is the role of psychomotricity in promoting creative potential.	38 children aged between 8 and 9 years, who attend the 3rd grade. By children of both genders, most of whom are male. The study also included a student with mild Autism Spectrum Disorder, 7 years old, attending the 2nd year of schooling and following the usual school curriculum.	TCT-DP test: to identify individuals who have a high creative potential, as well as individuals who have limitations in creative capacities. Gough Test (1979): Creative personality scale to measure students' creativity. Test: "For me it's a scale easy" instrument for assessing social and emotional competences.	1 – The 3rd grade class is in the 80th percentile (above average) and the 3rd B in the 50th percentile (average). Boys like girls are in the 70th percentile (average). 2 – No significant differences between boys and girls in creativity. Significant differences between the two classes in creativity. 66.5% of the students in the 3rd grade class are in the average, most of the students in the 3rd grade are above average (40%) or well above average (35%). 3 - There are no differences between genders, in the evaluation of teachers, there are significant differences between boys and girls. For parents it didn't reveal either differences between boys and girls.
Souza e Mendonça - 2019	To enable the experience of dance-education as a development of culture and styles, articulating the personal and collective creation of movements. Seeking to stimulate through dance movements the basic technical movements, creativity, choreographic construction.	10 participants, 3 males and 7 females, from elementary school. School A 6 males and 10 females. School B	Collection of informative data and theoretical-practical knowledge about dance through a questionnaire. Developmental evaluation happened through filming, photos and observation reports.	It was possible to expand the knowledge about dance, its history, rhythms of varied cultures, technical movements of styles, body expression through the release of feelings and creativity and the creation of choreographies. Dance at school as an important factor for individual and group development, creativity and expanding body perception of participants in addition to sports.
Alho - 2019	To enable a comprehensive study in order to assist in the construction of knowledge through	13 children from a class of 32 students from the 4th grade of elementary school, who are around 9 and 10 years old.	The instruments used in data collection were: • Conversation Circles • Choreographic Diary • Audiovisual Records •	It is concluded that the practice of interdisciplinarity combined with dance enables a study that uses movement as a

	processes of creation in dance using contents transmitted in other subjects of elementary school.		Content Analysis Practical activities were recorded in photographs and videos, and also generated products Artistic.	way to transmit certain content, because the body is the mediator between the child and the world, and according to Fazenda (2011 p. 78).
Araujo - 2019	Investigate and propose creative processes in performing arts (dance) and technologies in the discipline of Art.	Students from the fifth year of elementary school participated.	Practices were recorded in photographs and videos, and generated artistic products. It happened: conversation circles with the participants about the creative processes, stored in audio; activities of drawings and production of written texts on the themes of the creative processes. The activities were carried out at the times and spaces of the art classes.	The creative processes were taking place with the effective participation of the different languages that. They formed a dance video. The students were very deeply involved with every step of the process. They moved between the roles of dancer, cameraman, director, composer of the score and editor flowed with tranquility due to the recognition that each area was as important as the other.

According to studies by Souza et al (2020) demonstrated that art is of paramount importance for the formation and evolution of the human being, this can be justified by the findings of the study by Souza (2020) who says that art is art and the creative potential of the child, with art being of paramount importance in teaching and for the formation and creative performance of the child.

The articles by Alho (2019) and Araújo (2019) demonstrated that dance helps in the creative process of students, being beneficial in movement as a way to transmit certain content, as the body is the mediator between the child and the world, these findings are justified in the studies by Bueno et al (2020), in which improvisation in dance can contribute to the imagination, creativity and expression, seeking a broad knowledge of the possibilities of movement, space and body awareness of the child.

For Souza and Mendonça (2019), dance-education not only helps in creativity, but also, according to Nanni (1998), it works on the creative being through body expression, when appropriate in a pedagogical way, it is fundamental in building confidence, interaction, self-esteem, activating a critical awareness in the student. This report is justified in the studies of Caldas, Holzer and Popi (2017) who point out that art has an important role in the expressive and critical formation of the student, as it promotes these aspects in the life of the human being through activities that bring the expression of the individual's ideas, understanding of knowledge in a reflective way.

In the studies by Souza, Pinho, Morais (2020) and Rebocho (2020), they report the importance of stimulating creative potential in children, so that there is actually the development of creativity, the educator needs to be intentional, stimulating the student in their self-confidence, autonomy, in their imagination, providing opportunities for the improvement and development of their creativity. In the article by Oliveira and Alencar (2012) he justifies this point, as he describes

how important it is for the creative development of students to have teachers motivated to use creative pedagogical practices, so that the necessary stimulus is carried out through them.

Also for Rebocho (2020), his studies show us that one of the educational means to promote psychomotor development is art, through which it is feasible to express feelings, ideas and creativity (Freitas and Israel, 2008). Creative dance allows you to stimulate reasoning and problem-solving, stimulating executive functions such as creativity. According to Batista (2006), children must experience various bodily practices, allowing them to develop their spontaneity and creative beings.

CONCLUSION

It is concluded that dance within the school context, where the teacher in a pedagogical view, is not only a mediator, but also a stimulator of the student's creative potential, with gains beyond the classroom, where his self-confidence and autonomy are worked, boosting the student as an individual, developing the creative being and his critical thinking. stimuli that will help in solving problems in an increasingly organic way. As a consequence, helping in a potential that has been increasingly demanded in the world we live in today, which is creativity.

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Neuropsychology in literacy action proposed by the Paulo Freire method

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ABSTRACT

The present article was proposed with the objective of evaluating, through neuropsychological constructs, cognitive processes and strategies that corroborate the effectiveness of the Paulo Freire method, and there is a concern about the number of students enrolled in the educational program who have given up on their schooling process, since Paulo Feure's method is available to intervene and reduce the rates of the illiterate contingent. The method was designed to teach literacy and/or facilitate reading and writing in young people and adults. The methodology consists of the correlation between neuropsychological concepts with the Paulo Freire method to verify the reason for its effectiveness through a literature review of authors such as: Abramovay (2015), Catânia (1999), Eysenck (2017), Mendonça (2007), Paulo Freire (1967), going through the practice of the authors of this work, with the objective of understanding and elucidating the cognitive processes and strategies that favored the success of Paulo's method in the literacy action of adults, with the intention of contributing to the composition of training materials for literacy teachers of Youth and Adult Education (EJA). Therefore, the following were described: Paulo Freire's sociolinguistic method, the neuropsychological explanation of the learning contained in the method and the importance of these contributions to the continuing education of EJA literacy teachers. Paulo Freire's method privileges the mnemonic system so that students can be taught to read and write more quickly and fluidly and has in its essence to make the learner an active and participatory being in the construction of his own knowledge, integrating "learning how to do something" with which he "already knows how to do it". It promotes knowledge "about what it already knows how to do" by composing a knowledge continuum in new information, both in terms of "what to do" and "doing", thus weaving a network of practical meanings for knowledge. Many learners know how to "do something" but need to "learn about something they do." The search for PG, already known in sound and its meaning, leaves the iconic and echoic memory free of competing stimuli, contributed to the decoding present in the method, together brings the phonological and orthographic neighborhood, which also privilege memorization; Consequently, it facilitates reading and graphic mastery of the writing of the mother tongue without overloading the attentional system, thus expanding the student's learning capacity. The task of finding PG in newspapers, magazines, song lyrics, labels and poems by the learners, makes it promote an exploratory process that activates the structure of the visuospatial sketch, both in the Visual Cache and in the Inner Scribe. In this way, the mnemonic capacity is enhanced in an interaction with the associative capacity produced by the central executive. The high level of immediate recall of sentences is substantially beyond the capacity of the phonological loop, however, it can be explained by the proposed capacity of four chunks of the episodic buffer that is activated when the method presents in sentence form within the context in sentences, providing an increase in the mnemonic capacity of the learner, going from 4 to 16 recalled units. which favors learning.

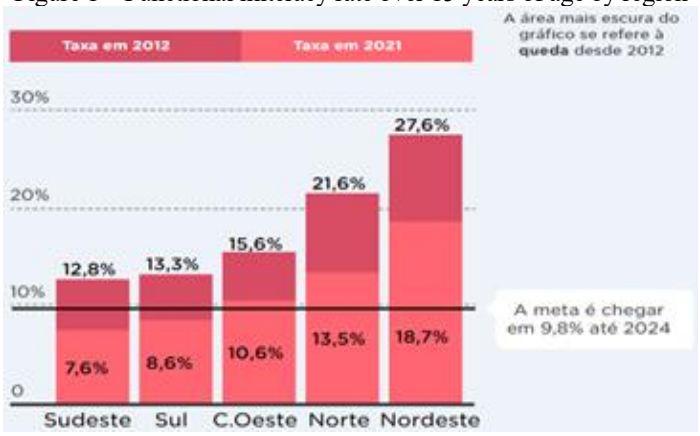
Keywords: Method, Paulo Freire, Neuropsychology, Memory, Learning.

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INTRODUCTION

Brazil is currently experiencing an educational crisis, with an illiteracy rate of 5.6% in 2022, which corresponds to 9.6 million people who cannot read and write, according to IBGE[6]. Another concern is functional illiteracy, which the NEXO – [7]Public Policies website (2023) presents an important comparative table for understanding this indicator divided by states. The Northeast is the largest region of functional illiteracy, reaching 27.6% of students who do not know how to read and write in an expected way for school level and age, see Figure 1:

Figure 1 – Functional illiteracy rate over 15 years of age by region



Source: Taken from the NEXO website https://pp.nexojornal.com.br/Dados/2023/05/19/A-alfabetiza%C3%A7%C3%A3o-e-o-illiteracy-functional-in-Brazil.

In view of the above-mentioned scenario, it is necessary to plan strategically in an emergency manner in order to change this condition. In an attempt to monitor educational development, an important tool was created to measure Brazilian educational development, the Basic Education Development Index (Ideb), created in 2007 by the National Institute of Educational Studies and Research Anísio Teixeira (Inep), formulated to measure the quality of national learning and assist educational professionals in setting goals for the improvement of teaching from 2012 onwards. In addition to this action, QEdu was born[8], a website that provides educational data with information on Brazilian Basic Education to monitor the development and improvement of indicators, for which it establishes challenges to be achieved in the country, in the states, in the municipalities and by school.

The IDEB challenge at the Brazilian level for 2021 was 4.9, where it reached 3.9. This indicator shows that the educational intervention projects have not been successful in advancing the educational development of Brazilian students.

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[6] IBGE, 2022 (ibge.gov.br). Available https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/37089-em-2022-analfabetismo-cai-mas-continua-mais-alto-entre-idosos-pretos-e-pardos-e-no-nordeste#:~:text=A%20taxa%20de%20analfabetismo%20das,da%20s%C3%A9rie%2C%20iniciada%20em%202016.tag . Accessed November 05, 2023.

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[8] QEdu, 2023. Available <https://qedu.org.br/brasil. Accessed on 11/05/23

QEdu also brings a comparison with international assessments made in a sample format with students aged 15 and over, coordinated by the Organization for Economic Co-operation and Development in 2018 (OECD). Compares adequate learning in science, math, and Portuguese, as shown in Figure 2:

Figure 2 - International Evaluations



Source: taken from the QEdu website

There is concern about the number of students enrolled in the educational program who have given up on their schooling process, since Paulo Feure's method is available to intervene and reduce the rates of the illiterate contingent.

Nowadays Paulo Freire's works are widely disseminated, but do the teachers of Youth and Adult Education (EJA) master Paulo Freire's literacy method? Is your method being applied today to reduce the number of illiterate people? How does neuropsychology analyze the method and its effectiveness? These are unsettling questions, but they need to be answered.

The objective of this work was to understand through the neuropsychological constructs that consisted of a literature review of authors such as: Abramovay (2015), Catânia (1999), Eysenck (2017), Mendonça (2007), Paulo Freire (1967), going through the practice of the authors of this work, with the objective of understanding and elucidating the cognitive processes and strategies that favored the success of Paulo's method in the literacy action of adults and how the strategies applied facilitated reading and writing, with the intention of contributing to the composition of training materials for literacy teachers of Youth and Adult Education (EJA). Therefore, Paulo Freire's sociolinguistic method, the neuropsychological explanation of the learning contained in the method and the importance of these contributions to the continuing education of EJA literacy teachers were described.

We will now make a recapitulation of the method so that the reader can understand how Paulo Freire's method is in practice and what are the important points of the method explained by neuropsychology and the contributions.

PAULO FREIRE'S SOCIOLINGUISTIC METHOD

Beck (2016) brings in his article the work of Paulo Freire and describes his method in a succinct and easy-to-understand way. It states that the Patron of Brazilian Education developed a method of literacy based on the life experiences of people who were in the process of literacy. He came to break traditional methodological actions such as booklets and proposed a more active and participatory way of teaching.

The booklets taught, for example, "the ox drools" and "grandma saw the grape" without contextualizing these words with the world of the learner. Paulo Freire taught with the so-called "generative words (PG)". These words were taken from the reality of the learner who created a state of co-participation during the school education process. This condition gave the students a critical sense, appreciation and autonomy, a scarce state at the time of the illiterate Brazilian citizen.

Paulo Freire's Method consists of a literacy proposal for adults developed while he was director of the Department of Cultural Extensions at the University of Recife, in the state of Pernambuco. He organized and guided a group of students to test the method in the city of Angicos, in the state of Rio Grande do Norte. The program managed to get 300 people to read and write in 40 hours of applying the method. When thinking about this feat, it is important to highlight the relevant effectiveness of the method, the feasible relationship with neuropsychology. It was possible to re-read the method, explaining the reasons for its success. Let's see in practice how the method works and its peculiarities.

Steps, steps, and definitions

Paulo Freire's sociolinguistic method (Freire, 1967, p. 111) is divided into three phases: investigation, thematization and problematization. Mendonça, (2007, p. 105) corroborates and describes the method based on 5 stages: encoding, decoding, analysis and synthesis, in the fixation of reading and writing. Together with its corresponding activities at the following levels: pre-syllabic, syllabic and alphabetic

In the investigation stage, the student and teacher do not subject themselves, but in sharing, they seek in the vocabulary universe of the learner and the society where he lives, the central words and themes of his biography. It consists of exploring all the non-formal knowledge of the learner, acquired through the practice of their mother tongue and the relationship with the experiences lived.

In the research phase, a survey of 500 words from the learner's universe is carried out and the identification of the generative words (PG) of high vocabulary frequency, under the following criteria: a) phonetic richness; b) phonetic difficulties, in a gradual sequence from minor to major difficulties; c) pragmatic content of the word, i.e., in the plurality of the word's engagement in a given social, cultural, and political reality, which may be: "packaging", "brick", "cement" or "ladder".

The PG describes and searches together with the students for the importance of this word in the social, family and economic context.

The codification is made from the representation of the aspect of reality brought by orality, drawing, music, mime, dramatization. Permeated by geographical, historical and social variations. The exercise in this step is to find the described whole word (PG) and its initial letter.

In the decoding, the reality that gives shape and originates the thematization will be reread. Initially, it brings to the student "how that word", so often used in its context, is implied in the socio-political meaning. This action aims to produce relevant topics of interest to students. Thus, weaving social meaning, awareness, and the ability to question the world and circumstances around you.

During the process, didactic activities will be used at the pre-syllabic level, having the generative word (PG) such as "LADDER", which must be identified in its sound and spelling. To do this, it will be offered as an exercise to find the whole word and the initial letter of the PG within the aforementioned context, using song lyrics, poetry, labels, pamphlets, newspaper, magazines and book pages.

The analysis and synthesis phase consists of the presentation of the syllable families of PG, by means of a new word discovery form. The student is asked to identify the syllables of the PG among other syllables, both in uppercase letters and cursive letters (Figure 3). Subsequently, new words will be identified (Figure 4).

Figure 3 – Analysis of the Generating Word (PG)

ES-CA-DA

SA – LO – OS – VA – **ES**	*es - is - os - us - as*
CA – EM – **CA** – CO – QUE	*ca - ce - cu - co - ci*
DA – LA – DO – VE – CA	*de - do - da - di - du*
A I O U E	*a o u i e*

Source: extracted from the book Literacy: sociolinguistic method

In this phase of analysis and synthesis, the student who is already able to identify letters and syllables of the PG on the discovery form, moves on to the synthesis phase. Thus, it will be possible to make compositions of new words, with the exploration of the initial (ES), medial (CA) and final (DA) syllables, with the objective of forming words. Syllabic dominoes are suggested as a good option (Figure 5).

After the student identifies the letters and syllables of the PG on the discovery sheet, they can go to the synthesis phase. In this phase, the learner will compose new words, such as putting syllables together and composing words on the blackboard. You can also read them later, with the

student asking you to copy each one of them in the notebook. The compositions from the discovery sheet will be described in figure 4, see how it works:

Figure 4: New Word Discovery Sheet
HORSE CALLUS COW MOON HOUSE DICE
CABBAGE HURTS BAG GOES TO SCHOOL FALLS
Source: extracted from the book Literacy: sociolinguistic and adapted method

In this phase of analysis and synthesis in the discovery stage, the exploration of initial, medial and final syllables for the composition of words through the use of syllabic dominoes continues (Figure 5). After the learner masters this step, he will go to the composition of new words, consequently he will be ready for the didactic activities of the syllabic level.

Figure 5: Syllabic dominoes



In the stage of reading and writing, the student will be asked to read and write the compound words in the synthesis of syllables, in the activities of dictation of words and sentences, word search exercise, crossword, oral and written transcription of the student's dialect to the standard dialect and in the interpretation, production of sentences and texts with meaning.

At the end, comes the problematization stage, which consists of questioning between the student and the teacher the "why" of each situation. This is how the questioning behavior originates, capable of overcoming the learner's magical vision, replacing it with a critical vision of the world. This movement aims to encourage the learner to seek transformative answers from the context experienced, create conditions for overcoming obstacles and promote autonomy.

In short, the Paulo Freire method stimulates students' literacy through mediation that provides discussion about their own life experiences and the words present in the realities lived. From there, the generating word is identified, decoded for the acquisition of comprehension of letters, syllables and the word in an integral way. Subsequently, with the understanding of the written word, the decoding phase brings the immersion of the word within the context for the understanding of the

world and its systems. Thus, it develops the critical sense that helps in the acquisition of autonomy of the citizen learner.

REREADING OF THE PAULO FREIRE METHOD BY NEUROPSYCHOLOGY

Learning and memory

Learning involves the integration of cognitive, metacognitive, affective, motivational, and behavioral factors into the action of learning. From the point of view of self-regulated learning, it defines the student as the protagonist of their own learning, strengthening their ability to learn and control their psychological processes in the school stages (BORUCHOVITCH AND GOMES, 2019) that must be cultivated within schools.

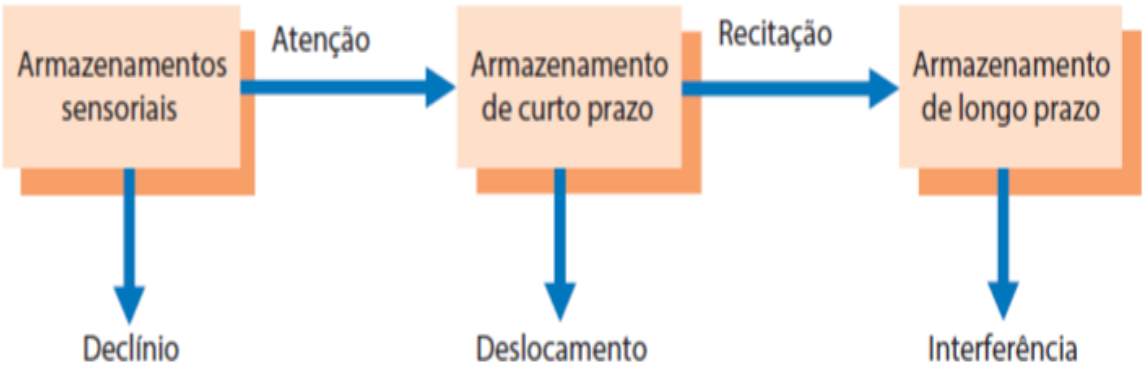
At the same time, memory is substantially important for learning in daily human activities. Without it, it would not be possible to follow conversations, remember phone numbers, write essays on exams, recognize people's faces, or understand what we read in books or in any other means of communication.

Eysenck (2017, p. 209) argues that learning and memory involve a series of stages. In the first stage there are processes that occur during the presentation of the learning material, such as: encoding, storage and recall. Encoding involves the perception of stimuli received by the sense organs that transform them into information. The ability to extract the stored information from the mnemonic system is retrieval. As a result of encoding, the information is stored within the mnemonic system for the retrieval of this data.

Memory and its subtypes

Eysenck (2017, p. 210) classifies memory into sensory, short-term and long-term, in terms of its capacity and duration. To explain the types and their mechanisms, he uses the multi-storage model Atkinson and Shiffrin (1968), where he describes the basic architecture of the memory system (see Fig. 6):

Figure 6 - Multi-storage memory model proposed by Atkinson and Shiffrin



Source: Memory multistorage model, as proposed by Atkinson and Shiffrin (1968).

According to the multi-storage model, environmental stimulation is initially processed by sensory storages. These stores are specific to each modality (e.g., vision, hearing). The information is kept for a short time in the sensory storages and some of it, when given attention, is thus processed within the short-term storage system. Some information processed in short-term storage is transferred to long-term storage when revisiting occurs. There is a direct relationship between the amount of recitation in short-term storage and the potency of the memory trace stored in long-term memory. (EYSENCK, 2017, p. 210)

Sensory Storages

Sensory stores are short-lived mnemic reserves, and the most studied, most prominently, are the iconic and echoic memory.

Visual storage (iconic memory) contains visual information for a short time of 500 ms or for a slightly longer period of time. It is useful and contains mechanisms responsible for visual perception with operation on the icon, concomitantly leaving visual information available for a longer time, such as at the time of reading.

The author brings an important piece of research data for the understanding of learning in the literacy process and iconic memory. It states that visual or iconic memory is considerably disturbed when the participant engages in tasks that require attention concomitantly (PERSUH et al., 2012). This data contributes to the understanding of the mnemonic facilitation of Angicos students during the literacy process made by Paulo Freire by sparing divided attention during the process. The words presented were already known, in terms of sound and their meaning, thus leaving the memory free of stimuli with concomitant or divided attention demand.

Auditory or echoic memory retains information for a few seconds, approximately 2 seconds. At the time of exposing this verbal information to the learner, attention is necessary so that this information stays for a few seconds, concomitantly so that they can give meaning to what they are

hearing. Possibly the same phenomenon happens with echoic memory (auditory information) when reading aloud. While the student listens to himself, the memory will search for information already processed and stored to assist in understanding and facilitating learning.

Short-term memory

Eysenck (2017, p. 210) says that short-term memory has very limited capacity and says that the maximum number of items evoked is approximately seven (Miller, 1956). However, the author points to the increase in this memory capacity when using "*chunks*", which are stored units formed by the integration of smaller fragments of information. For example, in the memorization of the CPF number, there is facilitation when memorization is done in three numbers, and this memorization space is called "*span"* or "*chuncks*".

Corrêa, 2010, p. 217, provides important information to clarify issues involving short-term memory:

> He observed that the memory capacity of young adults was around seven units, called "chunks," regardless of whether the units were numbers, letters, words, or other units. Further research revealed that the capacity depends on the category of the chunks: about seven units for digits, six for letters, and five for words, depending even on the characteristic of the chunks within a category. For example, the capacity is lower for long words than for short words. The memory capacity for verbal contexts (digits, letters, words, etc.) depends heavily on the time it takes to speak the contents aloud and on the lexical function (i.e., whether the contents are words known to the person or not) (Miller, 1956). An easy-to-understand example of chunks is the ability to recall long sequences of binary numbers, as they can be encoded in decimal form. For example, the sequence 0010 1000 1001 1100 1101 1010 could be more easily remembered as 2 8 9 C D A. In general, this only works for someone who can convert binary numbers to hexadecimal numbers (chunks are then said to be "meaningful"). (CORRÊA, 2010, p. 217)

Several other factors also affect the measurement of a person's memory capacity. Because of this, it is difficult to establish short-term memory capacity (MCP) by a number of chunks. Cowan (2001) proposed that memory activity has a capacity of four *"chunks*" in young adults, and is smaller in children and older adults (this statement became known as the "golden number four").

Short-term memory has been replaced by working memory or working memory, and has been highlighted in this study.

WORKING MEMORY

Short-term memory (PCM) is useful in everyday life because it enables mnemonic actions, such as remembering a phone number for the seconds after dialing it. Eysenck (2017) cites:

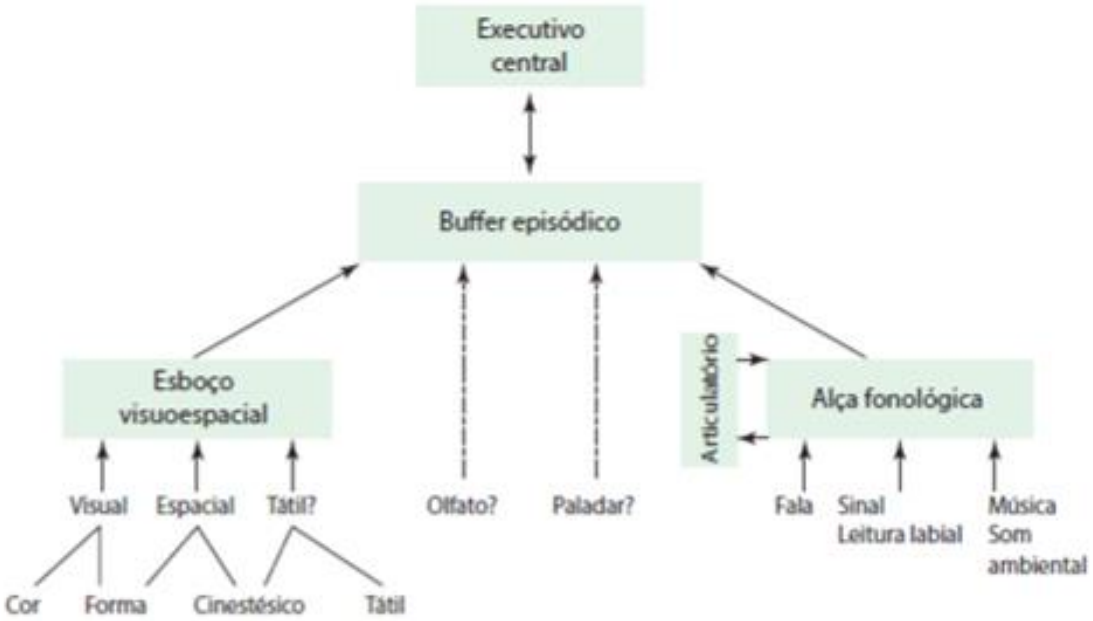
> Alan Baddeley and Graham Hitch (1974) (...) they argued that, in general, we use short-term memory when performing complex tasks. With such tasks, we run various processes. However, you also have to briefly store information about the outcome of initial processes in short-term memory as you move on to later processes. For example, this happens very often in mental arithmetic. One of Baddeley and Hitch's central insights was that short-term

> memory is essential in the performance of numerous tasks that are not explicitly memory tasks. (EYSENCK, 2017, p. 215)

The MCP is inserted inside the Working Memory (MT) or Working Memory. This line of thought promotes the replacement of the concept of short-term storage, short-term memory, by the concept of working or working memory. Memory, then, is not a single skill or function, but a "complex combination of mnemonic subsystems" (BADDELEY, 1992, p. 5).

Baddeley, (2012, p. 22) brings the working memory composed of central executive, phonological loop, visuospatial sketch and episodic buffer. The phonological loop is the structure that processes and stores auditory information briefly in phonological form. The specialized visuospatial sketch for the processing of spatial and visual information for temporary storage. In the episodic buffer, it expresses the temporary storage of the integrated information from the visuospatial sketch and the phonological loop. Here are Baddeley's models:

Figure 7 - Baddeley's working memory model showing the flow of information from perception to working memory



Source: Baddeley (2012). ©Annual Reviews 2012. With permission from Annual Reviews.

Eysenck (2017, p. 220) argues that the central executive is an important component for the proper functioning of working memory. The structure has a limited capacity, resembles that of attention, and copes with any task with cognitive demands.

The phonological loop and visuospatial sketch are subordinate systems used by the central executive for specific purposes. The phonological handle preserves the order in which words are presented, while visuospatial sketching stores and manipulates spatial and visual information.

The previous three components have limited capacity and can function relatively independently of each other. Two essential assumptions: the first, if the two tasks use the same

component, they cannot be successfully performed simultaneously; the other, if the two tasks use different components, it should be possible to perform them both at the same time and separately.

Phonological loop

Eysenck (2017, p. 216) describes that the phonological loop is composed of two systems: passive phonological storage, directly related to speech perception; and an articulatory process, linked to speech production (i.e., recitation) that gives access to phonological storage. See this description in figure 8:

Figure 8 - Phonological loop system as imagined by Baddeley (1990).



Source: Baddeley (2012). ©Annual Reviews 2012. With permission from Annual Reviews.

Research reveals that there are complex underlying processes of the phonological loop that need clarification for an understanding of their action relationships involving memory. The following quote clarifies these processes:

> Acheson et al. (2010) identified that the effect does not only involve the phonological loop – semantic processes also play a role. Schweppe et al. (2011) pointed out that the working memory model is underspecified. The emphasis of research has been on similarity at the phonemic level (phonemes are the basic units of sound). However, it is not clear whether the effect of phonological similarity depends more on acoustic similarity (similar sounds) or on an articulatory similarity (similar articulatory movements). (EYSENCK, 2017, p. 215)

The author states that in the tasks of remembering words, the number of words immediately recalled in the correct order is greater with short words than with long words (Baddeley, 2012). This phenomenon is by virtue of the neighborhood effect and not by the length of the word. Jalbert et al. (2011) argues that the orthographic neighborhood of a word consists of words of the same length that differ by only one letter. When an experiment was carried out addressing the orthographic neighborhood, the difference in word length disappeared in the effect of positive responses, i.e., the increase in the ability to memorize words lies in the similarities between them and not in their size.

This point is important for the clarification of the mnemonic facilitation of Paulo Freire's method, which searches for words common to the student, and does not overload the attentional system. The way in which the decoding is done brings the orthographic neighborhood, thus privileging the ability to memorize, consequently promoting the facilitation of the literacy process.

Eysenck (2017) describes the importance of the phonological loop for everyday life and that the act of remembering words is useful to us in language learning, both for passive phonological storage, directly related to speech perception, and for the articulatory process linked to speech production (i.e., recitation), which is responsible for giving access to phonological storage.

The tasks with Generative Word (PG) proposed by Paulo Freire are known in the articulatory process, that is, the learner already knows how the word is pronounced, thus enhancing the memory of the spelling of the dictated word by not having to divide attention, consequently relieves the nervous system for new learning.

Visuospatial sketching

The visuospatial sketch is a cognitive structure responsible for temporary storage with the manipulation of visual patterns and spatial movement. That is, visual processing involves remembering "what" and spatial processing involves remembering "where." The visuospatial sketch is the structure that assists us in orientation during locomotion when it involves the search for places, objects, words, and other actions.

Eysenck (2017, p. 219) cites Logie (1995), where he describes the visuospatial sketch as having two components: the *Visual Cache* (store of information about visual form and color) and the *Inner Scribe* (processor of spatial information and movement). These two structures are involved with the repetition of information in the *visual cache* and the transfer of information from the *visual cache* to the central executive. This structure directly assists in the recognition of letters, syllables, words, sentences, and the manipulation of information.

In the exploratory process of the Paulo Freire method, the selected PG is identified by the learner in newspapers, magazines, song lyrics, labels and poems. This action will use the structure of the visuospatial sketch in both the Visual *Cache* and the *Inner Scribe*. The action of identifying letters, syllables, and words in the identification process involves interaction with the structure of the central executive.

Central executive

The central executive is another fundamental component present in the most diverse complex cognitive activities, such as solving problems, performing two tasks at the same time, and processing decision-making. This structure does not store information, but manipulates it. It has an action that

involves four processes: the focusing of attention or concentration, the division of attention between two streams of stimuli, the shift in attention between tasks, and the articulation with long-term memory.

Eysenck (2017, p. 220) states that the brain location of the Central Executive is in the prefrontal cortex and actively participates in central executive functions. However, executive processes do not depend solely on the prefrontal cortex, but on several other brain structures.

Episodic buffer

As pointed out by Baddeley (2012), the function of the episodic buffer or episodic retainer is responsible for the integration of information about episodes or events of the multidimensional code, combined with visual, auditory and other variables. The system interconnects the components of the working memory system, and links working memory to perception and long-term memory. This action suggests that the capacity of this system is approximately four *chunks* (integrated units of information) and that it stores verbal information from the phonological loop and the visual/spatial information from the visuospatial outline.

An important piece of research mentioned by the author is that, in immediate recall, the average recall of "unrelated" words is about five words. When it is presented in "sentence form", that is, in sentence form, this capacity increases, reaching an average of 16 words or more (Baddeley et al., 1987). This high level of immediate sentence recall is substantially beyond the capacity of the phonological loop. However, it can be explained by the proposed capacity of the four *chunks* of the episodic buffer. This corroborates to explain the potential of Paulo Freire's method. If the word is presented in a single and isolated way, the mnemonic system has a capacity of 4 items. If it is presented in the form of a sentence, that is, within the context in the form of sentences, this capacity goes from 4 to 16 recalled units, consequently the mnemonic amplification occurs, which possibly facilitates the process of written mastery of the mother tongue by the method.

The explanation for the ability to produce immediate recall of sentences up to 16 words in length comes from the capacity of the episodic buffer, and from the central executive functioning efficiently to integrate or order *(chunks*) information from the sentences. In essence, information is integrated within the episodic buffer with the assistance of the central executive (baddeley and wilson, 2002).

When thinking about the content of continuing education for teachers, I see the importance of knowing how brain processing is done and how this knowledge can help in the creation of strategies that stimulate the nervous system for learning in a faster, more efficient and motivating way.

Neuropsychology has a lot to contribute, as it can bring the brain functioning of a person absent of neurological difficulties, as well as abnormalities that constitute disorders that involve the

learning process. By knowing important predictors during the students' schooling process, it is possible to identify them in order to stimulate and create new brain pathways through sensory strategies that facilitate memory and learning, just as Freire's method did.

RESULTS AND DISCUSSION

Paulo Freire's method has in its essence to make the learner an active and participatory being in the construction of his own knowledge, integrating "learning how to do something" with which he "already knows how to do it". It promotes knowledge "about what it already knows how to do" by composing a *knowledge continuum* in new information, both in terms of "what to do" and "doing", thus weaving a network of practical meanings for knowledge. Many learners know how to "do something" but need to "learn about something they do."

The search for PG, already known in sound and its meaning, leaves the iconic and echoic memory free of competing stimuli, contributed to the decoding present in the method, together brings the phonological and orthographic neighborhood, which also privilege memorization; Consequently, it facilitates reading and graphic mastery of the writing of the mother tongue without overloading the attentional system, thus expanding the student's learning capacity.

The task of finding PG in newspapers, magazines, song lyrics, labels and poems by the learners, makes it promote an exploratory process that activates the structure of the visuospatial sketch, both in the *Visual Cache* and in *the Inner Scribe*. In this way, the mnemonic capacity is enhanced in an interaction with the associative capacity produced by the central executive.

The high level of immediate sentence recall is substantially beyond the capacity of the phonological loop, however, it can be explained by the proposed capacity of four *chunks* of the episodic buffer that is activated when the method presents in sentence form within the context in sentences, providing an increase in the learner's mnemonic capacity, from 4 to 16 recalled units.

FINAL THOUGHTS

Finally, with the data obtained through neuropsychological explanations, it was possible to better understand Paulo Freire's method and how he privileges the mnemonic system so that students can be taught to read and write more quickly and fluidly.

It is extremely important that teachers can go through a training process to know the details of the method based on neuropsychological clarifications, and be stimulated again to apply it in schools that offer, not only Youth and Adult Education, but also all school follow-up, in order to reduce the rates of the contingent of students who have not yet been literate.

The question arises, does the teacher who applies and creates methods to assist students in school learning know "how the learner's brain learns" in its multiple facets, and how to find a path that is more appropriate for students who cannot keep up with the content of the school year?

In an attempt to help answer the aforementioned question, we add that there is a need to bring neuroscience and education closer together. Currently, there are important neuropsychological findings involving memory, information processing, attention, executive function and learning that can be incorporated into the teachers' training curriculum to contribute to the good educational development of Brazil.

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