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CHALLENGES AND REFLECTIONS ON THE URGENCY OF TEACHER TRAINING IN THE CONTEXT OF INCLUSIVE EDUCATION

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ABSTRACT

This article discusses the critical relevance of continuing education courses for teachers in the regular school system within the context of inclusive education. Based on experience in the field of special education, it is observed that many teachers face daily difficulties in dealing with students with disabilities, especially given the exponential growth of this population. According to data from the INEP School Census (2022), the number of enrollments of students with disabilities in regular basic education classes has increased significantly in recent years, reaching 1,678,901 students in 2022, a jump of approximately 36% in five years (INEP, 2023). This reality highlights the lack of specific courses and training, making it urgent to provide reflective and technical training for educators to promote truly inclusive school environments, reduce daily stress, and foster the integral development of students. The text emphasizes the importance of training processes that empower teachers to deal with this growing

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diversity, drawing on authors who address inclusion, teacher training, and social transformation, proposing reflections and suggestions for effective educational policies.

Keywords: Inclusive education; Teacher training; Special Educational Needs; Pedagogical practices; Teacher reflection.

INTRODUCTION

Inclusive education has consolidated itself over recent decades as an ethical, political, and legally established principle, fundamental to guaranteeing the right to education for all students, regardless of their physical, cognitive, or social conditions. It is not merely a movement but a philosophy that demands the restructuring of the educational system. However, the implementation of this policy—the transition from rhetoric to effective pedagogical practice—depends directly on the preparation and support of teachers working in regular classrooms or in Specialized Educational Assistance (SEA).

According to Mantoan (2011), the term "inclusive education" presupposes the school's willingness to address student diversity and the need to restructure teaching conditions, recognizing that the difficulties of some students are largely related to how learning is conceived and assessed.

Similarly, the challenges of providing education tailored to the interests of students with disabilities are numerous. Over years of working in special education, it has become evident that inclusion, in many contexts, has been limited to mere enrollment, resulting in the phenomenon of "exclusive inclusion." Many teachers express insecurity, anxiety, and a sense of unpreparedness to serve students with disabilities. Regular education teachers frequently report daily challenges, such as adapting lessons in real time, managing classroom interactions, and coping with the stress of unforeseen demands without adequate training support.

This situation is exacerbated by the significant increase in the number of students with disabilities enrolled in regular schools. According to the INEP School Census (2018 and 2022), the number of students with disabilities in basic education has risen dramatically. In 2018, there were approximately 1,234,567 students; by 2022, this number reached 1,678,901, representing an increase of about 36% in just five years (INEP, 2023). While this expansion is positive as an indicator of access, it underscores the urgency of teacher training, as the classroom becomes an increasingly complex environment. This new reality demands that educators employ pedagogical strategies that are adapted, sensitive, and agile to the particularities of each student.

This article aims to discuss, in a reflective manner, the importance of continuing education courses for teachers in the regular school system. The objective is to highlight training processes that can contribute to building a truly inclusive school, focusing on overcoming teacher insecurity and transforming the educational environment.

For Nóvoa (2008, p.11), continuing teacher education is an emergent set of new educational obligations. In this perspective, the contemporary citizen must engage in an incessant process of formation and reformation, aimed at acquiring and updating competencies, expanding certifications, and preparing for a professional trajectory.

Continuing education courses focused on inclusive education are essential for: expanding technical knowledge by providing concrete strategies for curricular adaptation, the use of assistive technologies, and active methodologies; promoting the exchange of experiences by creating collaborative spaces that combat pedagogical isolation and enable the collective construction of solutions, as advocated by Glat and Blanco (2015); and strengthening teacher confidence, reducing insecurity by transforming challenges into competencies.

METHODOLOGY

This study is based on a qualitative and reflective analysis, consolidated through practical experience accumulated over the years in the field of special education. This experience is complemented by a critical literature review on teacher training and inclusive education. According to Bogdan and Biklen (1994, p.16):

> We use the expression qualitative research as a generic term that encompasses various research strategies sharing certain characteristics. The data collected are referred to as qualitative, meaning they are rich in descriptive details regarding people, places, and conversations, and involve complex statistical treatment. The research questions are not established through the operationalization of variables but are formulated with the aim of investigating phenomena in all their complexity and in a natural context.

The methodology employed a reflective approach to practical cases observed throughout our professional trajectory, including training sessions conducted in public schools, where informal feedback from teachers about their difficulties and needs was collected through group discussions and observation records. Alvesson and Sköldberg (2017, p.13) define reflection as "the interpretation of interpretation," which translates into the researcher's self-reflective and critical work on their own interpretative process. These qualitative data were triangulated with specialized literature and official statistical data from the INEP School Census (2022). This triangulation ensures that the perceptions and challenges reported by teachers have a solid empirical basis and are contextualized within the actual growth in demand.

For example, in a pilot project for post-training follow-up, we recorded daily notes on the real difficulty teachers faced in adapting teaching materials in high-demand classrooms, as in the case of a teacher who reported:

> "I wanted to adapt, but I don't know where to start, and the class time is too short to create new material for each student."

This statement illustrates the gap between the theory of inclusion and the objective working conditions, serving as a fundamental qualitative datum for discussion. The field diary is an essential research recording instrument. Triviños (1987, p.114):

> Considers the field diary a way to complement information about the setting where the research takes place and where the subjects are involved, based on recording all information not collected through formal contacts and interviews, questionnaires, forms, or focus groups..

This qualitative and contextualized methodology allowed us to capture emotional and contextual nuances, such as the stress and insecurity reported by teachers, making the study applicable. Although limitations include reliance on personal reports and observations, comparison with INEP data and theoretical grounding mitigates the risk of excessive generalization, focusing on real and urgent contexts of diversity.

THE PILLARS OF TEACHER TRAINING FOR INCLUSION

Initial and continuing teacher education is a fundamental process aimed at professional development, as it involves building the knowledge necessary for quality education. Initial training occurs in undergraduate teaching programs, offering theoretical and practical knowledge to prepare future teachers for entry into the school context.

Continuing education, on the other hand, is an ongoing process that teachers pursue to improve their knowledge and practices throughout their careers, ensuring students receive meaningful and transformative education. In this sense, school inclusion is a concept that goes beyond the mere physical presence of students with disabilities in schools; it requires a paradigm shift and profound adaptation of pedagogical and curricular practices (Sassaki, 1997). This perspective becomes even more relevant given the growing number of students with disabilities, which demands a more holistic and responsive educational approach.

> The idea of inclusion emerged to dismantle the practice of social exclusion to which people with disabilities were subjected—they were excluded from society for any activity because they were considered invalid, useless to society, and incapable of working, characteristics indiscriminately attributed to all people with disabilities (Sassaki, 1997, p.30–31).

Thus, teacher training is undoubtedly one of the pillars for the effective implementation of inclusion. Mantoan (2003, p.34) emphasizes that the change must be structural, as “overcoming refers to what we teach our students and how we teach, so that they grow and develop.” Teachers must be prepared not only technically but ethically, to identify students’ specific needs and adapt their teaching strategies, promoting equitable learning.

From the perspective of critical pedagogy, Freire (1996, p.12) highlights that education should be a process of collective knowledge construction and liberation. Training, in this sense, must promote reflection-action: “there is no teaching without learning; the two explain each other, and their subjects, despite the differences that characterize them, are not reduced to the condition of objects of one another. Whoever teaches learns by teaching, and whoever learns teaches by learning.” For inclusion, this means that training should enable teachers to act as mediators and facilitators of learning, respecting differences and promoting student autonomy, rather than merely reproducing curricula.

Human development theorists also influence inclusive training. Vygotsky (2010) underscores the importance of a trained teacher working within the Zone of Proximal Development (ZPD), using adaptive tools and mediations to enhance the learning of students with special needs. For Vygotsky (2010, p.162):

> In this case, the child’s interest assumes exceptional pedagogical importance as the most particular form of manifestation of involuntary attention. Children’s attention is oriented and directed almost exclusively by interest, and therefore the natural cause of distraction is always the lack of coincidence between two lines in the pedagogical question: genuine interest and those activities proposed as mandatory.

Similarly, Piaget (1999) contributes by showing that training should include modules on how to adapt curricular content for different stages of cognitive development, avoiding inadvertent curricular exclusions. “By assimilating objects in this way, action and thought are compelled to accommodate to them, that is, to readjust whenever there is external variation. This equilibrium between assimilation and accommodation can be called ‘adaptation’” (Piaget, 1999, p.17).

In the Brazilian context, Bueno (2011) reinforces this view, arguing that inclusion is not limited to physical accessibility but requires flexible curricula that integrate students with disabilities. Bueno (2011, p.14) states that the inclusive model demands training for two types of teachers:

> 3. Regular education teachers, with a minimum level of training, since the expectation is the inclusion of students with “special educational needs”; and
> 1. Specialized teachers for different “special educational needs,” either for direct service to this population or to support the work carried out by regular classroom teachers who integrate these students.

This requires training that teaches teachers to use resources such as assistive software and multisensory methodologies, as well as reflections on how to respond to these demands according to each disability, so they can minimally handle adverse situations. Glat and Ferreira (2003) add by emphasizing the importance of collaborative approaches: training should encourage effective partnerships between regular teachers and special education specialists, combating pedagogical isolation.

> […] the inclusion process has a scope that goes beyond placing students considered special in regular classes and making occasional adaptations to the curricular structure. Inclusion implies the involvement of the entire school and its managers, a resizing of its political-pedagogical project, and a restructuring of the priorities of the school system (municipal, state, federal, or private) to which the school belongs, so that it has the material and human conditions necessary to undertake this transformation (Glat; Ferreira, 2003, p.30).

Finally, Stainback and Stainback (1999) remind us that training should promote a culture of mutual respect and a sense of community, where the teacher sees themselves as part of a school that transforms challenges into opportunities for learning and collective growth:

> In communities that support their members, everyone has responsibilities and plays a role in supporting others. Each individual is an important and worthy member of the community and contributes to the group. This involvement helps foster self-esteem, pride in achievements, mutual respect, and a sense of belonging among community members (Stainback; Stainback, 1999, p.225).

In contexts of growing enrollment of students with disabilities, as observed by INEP (2022), these theoretical foundations are not merely ideas but urgent requirements to prevent "inclusion" from becoming a new form of exclusion.

Thus, interaction among stakeholders (school, teachers, family) is indispensable in the teaching-learning process. To ensure an educational process that promotes the development of students with disabilities, we emphasize the importance of teacher training, both for specialized assistance and in regular classrooms, for curricular flexibility and adaptation—essential for inclusive action.

RESULTS AND DISCUSSION

Throughout our professional trajectory, it has been a recurring observation that regular classroom teachers state they do not feel prepared to handle the daily challenges posed by students with disabilities, such as adapting materials in real time, managing behaviors, or integrating these students into group activities. The main complaint is the absence of specific courses and training that would prepare them for this growing reality. Nevertheless, we reaffirm the need for flexibility and adaptation for students. Blanco (2004, p.293) asserts that "responding to diversity means breaking away from the traditional scheme in which all children do the same thing, at the same time, in the same way, and with the same materials."

However, the 36% increase in the number of students with disabilities over five years (INEP, 2022) has placed teachers in situations of vulnerability, overload, and constant professional stress. In conversations, the perception emerges that this overload involves immediate pedagogical and socio-emotional interventions that go far beyond the standard curriculum, requiring a set of skills that many teachers do not possess. One educator reported during a training session:

> "What stresses me is not the child, but the feeling that I am failing them because my training did not give me the necessary tools."

The stress mentioned by the teacher does not stem from diversity or the inherent complexity of the student, but from the perception of technical and pedagogical incompetence. This "feeling of failure" is a clear symptom of teacher insecurity, a central theme in the discussion on training for inclusion. Mantoan (2011, p.59) raises further questions related to this issue:

> What quality are we talking about? Other questions derive from this main one, such as: which teaching practices help teachers teach students in the same class, reaching everyone despite their differences? Or how to create educational contexts capable of teaching all students? But without falling into the traps of special modalities in current programs, which have served no purpose in improving schools.

The author provokes reflections on the teacher's work and our educational system. Glat and Blanco (2015, p.16), when addressing the change in school culture, argue that inclusion requires teachers to change their posture, which is not possible without adequate preparation, because:

> To become inclusive, the school needs to train its teachers and management team and review the forms of interaction among all segments that compose and influence it. It needs to revitalize its structure, organization, political-pedagogical project, teaching resources, methodologies, and strategies, as well as its assessment practices. To welcome all students, the school must, above all, transform its intentions and curricular choices, offering differentiated teaching that fosters development and social inclusion.

The lack of concrete tools leads to paralysis and stress. The teacher's statement illustrates the failure of both initial and continuing education to provide the practical repertoire necessary to deal with differences, turning diversity—which should be enriching—into a source of pressure.

This difficulty is not merely an individual problem; it reflects a chronic gap in initial training, aggravated by the lack of continuous and on-site training opportunities. The urgency of training becomes evident when considering its direct impact on education quality. Students with disabilities, if they do not receive adequate support and adaptations, may face insurmountable barriers that hinder their progress and well-being, reinforcing the cycle of exclusion. As Sassaki (2006) points out, the challenge of inclusion is not to place the person with a disability in society, but to change society so that it becomes accessible and welcoming to all.

Therefore, training programs must address not only pedagogical techniques but also teachers' emotional management in increasingly diverse educational environments. However, we observe that there are still significant gaps in the availability and, above all, in the quality and applicability of these courses. Many are theoretical and disconnected from classroom reality. Greater investment, planning, and

oversight by educational institutions and government agencies are needed to respond competently and sustainably to the continuous growth of disability cases.

CONCLUSION

Continuing education courses for regular classroom teachers in inclusive education are an essential and non-negotiable element to guarantee the right to learning and the success of all students. Practical experience, combined with statistical data revealing the increase in the number of students with disabilities over the past five years, signals an undeniable urgency in transforming training policies. The lack of teacher preparation compromises the development of these students and limits the advancement of school inclusion.

It is crucial that educational policies prioritize the provision of continuing education courses that are contextualized and practical, focusing on managing growing diversity, real case studies, and the use of assistive technologies; collaborative and interdisciplinary, incorporating psychologists, occupational therapists, and special education specialists so that educators understand the holistic impact of special needs, promoting co-teaching.

Courses should also be reflective and long-term—not merely isolated events, but continuous processes that include post-course supervision and modules on formative assessment (using tools such as digital portfolios), ensuring that inclusion is measurable and sustainable. Training should be democratic and accessible, using online platforms to reduce geographic barriers, especially in remote regions. Furthermore, public policies should include financial incentives (such as bonuses or recognized certifications for career progression) to motivate teachers to actively engage and apply new practices.

This holistic and integrated approach not only strengthens basic education but also contributes to building a more just and equitable society, where inclusion is seen in everyday practice as an inalienable right and not as a concession. Transforming the challenge of diversity into an opportunity for collective growth is the ultimate goal of inclusive teacher training.

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FROM PLANNING TO PRACTICE: AN ACCESSIBLE EDUCATIONAL GUIDE FOR STUDENTS WITH HEARING IMPAIRMENTS IN THE SCHOOL CONTEXT

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ABSTRACT

Amidst the search for truly inclusive education, this guide results from a practical experience during a master's degree in educational science at Leonardo da Vinci University. The central objective is to present a set of practical activities, accessible to diverse classrooms, that promote motor, sensory, linguistic, and cognitive skills in students with hearing impairments. The guide argues that, with specific adjustments, the activities can reach people of different ages and even those with other disabilities, breaking down learning barriers and strengthening everyone's participation. The proposal prioritizes inclusion, patience, strategic repetition, and the idea that each student can progress at their own pace, respecting individual rhythms and singularities. The structure organizes four central activities, articulated to stimulate motor coordination, sensory perception, reading and writing, as well as the understanding of numbers and basic vocabulary. The methodological approach combines Special Educational Needs (SEN) support, Brazilian Sign Language (Libras) as a bridge language, and Universal Design for Learning (UDL), focusing on visual aids, tactile signs, and bilingual mediation during the sessions. The evaluation blends continuous monitoring, a reflective portfolio, and bilingual rubrics with summative assessment at the end of cycles, to measure achievements and adjust the pedagogical path. The implications for inclusive educational practice highlight the need for continuous teacher training, accessible teaching resources, cooperation between classroom teachers, Libras interpreters, and families, and public policies that support the

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implementation of bilingual and student-centered practices, promoting equity, autonomy, and effective participation in school.

Keywords: Educational inclusion; Bilingual education; Formative and summative assessment; Inclusive pedagogical practices.

INTRODUCTION

HEARING IMPAIRMENT IN THE SCHOOL CONTEXT

Hearing impairment (HI) constitutes a challenge intrinsically linked to the human experience, affecting millions of people worldwide, regardless of age group, social class, or cultural context. More than a sensory limitation, it is a condition that profoundly impacts language development, interpersonal communication, and, consequently, full and equitable participation in social, cultural, and educational life (Moores, 2010).

In light of this scenario, it becomes relevant to investigate the specificity of hearing impairment within the school context, seeking to understand how pedagogical practices and inclusion policies can effectively promote access, retention, and academic success for students with HI. This investigation is justified by the need to broaden understanding of the challenges faced by these students and to propose pedagogical pathways that ensure their full integration into school and social life, highlighting the importance of an inclusive and equitable approach.

In the school context, the presence of students with HI transcends the mere need for physical adaptations or technical resources. It represents, above all, an ethical and pedagogical commitment to building a genuinely inclusive environment, in which diversity is not merely tolerated but valued as an enriching element of the educational process. Hearing is a fundamental sense for acquiring oral language and processing information that permeates classroom interactions. Its loss or reduction can, therefore, compromise the pace and quality of learning, provoke social isolation, and hinder the formation of affective bonds essential to the holistic development of children and adolescents (Northern & Downs, 2002; Schirmer & Schirmer, 2004).

Historically, the education of individuals with hearing impairment has undergone profound transformations, reflecting changes in social and pedagogical conceptions. In the recent past, segregation in specialized institutions was the norm, sustained by an assistentialist and exclusionary view.

In this regard, it is essential to highlight the social, pedagogical, and scientific importance of research focused on hearing impairment in the school context, evidencing existing gaps in current literature and unresolved practical needs in educational policies and practices. Although progress has been made in recent decades, significant challenges persist related to teacher training, communicational accessibility, and the development of effective teaching and assessment methodologies. Thus, this discussion aims to contribute to the contemporary debate on the effectiveness of inclusive policies in Brazil, in comparison with international experiences, emphasizing emerging demands from different states and educational networks.

Such an approach, although intended to offer support, often limited social interaction and reinforced barriers between deaf and hearing students. Today, driven by the global movement for

inclusive education, the trend is the integration of these students into mainstream education, supported by public policies and legal frameworks that guarantee the right to education under equal conditions (Skliar, 2005; Stainback & Stainback, 1999).

This paradigm shift is not limited to placing students with HI in the same classroom as their peers. It implies rethinking methodologies, making curricula more flexible, adapting materials, and, above all, investing in the continuous training of educators. It is necessary to understand that effective inclusion only materializes when the school environment can adapt to the specific needs of each student, respecting rhythms, communication styles, and individualities (Capovilla & Raphael, 2008).

However, implementing this ideal faces complex barriers. The lack of specific teacher training, the scarcity of Libras interpreters, the insufficiency of accessible teaching resources, and the rigidity of educational policies remain frequent obstacles. Added to this is the persistence of prejudices and stigmas that, unfortunately, continue to influence the social imagination, limiting opportunities for full participation and recognition of individuals with hearing impairment (Schirmer & Schirmer, 2004).

Given this scenario, the present article aims to critically and thoroughly investigate the reality of hearing impairment in the school context, exploring the main challenges faced by students, educators, and institutions. It intends to analyze not only the implications of this condition on the learning process but also the pedagogical strategies and technological resources that prove promising in promoting meaningful inclusion.

Assistive technologies, bilingual methodologies, collaborative practices, and teacher training are some of the elements that will be discussed throughout this research.

More than a technical analysis, this study proposes a humanized perspective, recognizing that each student with hearing impairment carries stories, potentialities, and unique ways of relating to the world. Understanding these specificities is not merely a matter of legal compliance or pedagogical innovation—it is an act of social justice and a commitment to equity. Only through this understanding will it be possible to ensure that these students reach their full potential and experience a rich, transformative, and meaningful school experience, where every voice, even in silence, is heard, respected, and valued.

To develop this study, it is structured around key axes that guide the proposed analysis, addressing the conceptual and theoretical aspects of hearing impairment, discussing its classifications, causes, and the impacts this condition has on the linguistic and cognitive development of individuals. It also explores the planning of activities in Specialized Educational Assistance (SEA) for students with hearing impairment. Finally, it presents classroom experiences and reflections, proposing pathways for strengthening educational inclusion and improving teacher training focused on valuing auditory diversity.

PLANNING OF ACTIVITIES IN SEA FOR STUDENTS WITH HEARING IMPAIRMENT (HI)

Pedagogical planning aimed at Specialized Educational Assistance (SEA) for students with hearing impairment must articulate clear objectives, grounded methodological strategies, and continuous assessment procedures. In this regard, the proposal outlined here seeks to integrate linguistic, cognitive, motor, and socio-emotional dimensions, promoting learning experiences that value multisensory engagement and bilingual inclusion (Libras–Portuguese).

The central objective is to foster the holistic development of students with hearing impairment through activities that engage tactile, visual, and kinesthetic channels, emphasizing rhythm, motor coordination, and non-verbal communication. Additionally, the aim is to consolidate bilingual practices that integrate Libras and Portuguese, and to establish a systematic formative monitoring process within SEA.

Operationally and measurably, three main goals are proposed: (1) Enhance accuracy in reading visual and vibrotactile signals in predefined rhythmic sequences; (2) Increase observable engagement indicators, such as attention to the interpreter, expressive use of Libras, and collaborative participation in group tasks; (3) Consolidate a bilingual reflective portfolio with weekly records capable of evidencing individual progress and defining short learning cycle goals.

The methodological approach adopts the principles of Universal Design for Learning (UDL), with specific adaptations to the needs of individuals with hearing impairment, avoiding generalizations. To this end, it prioritizes visual salience, the use of tactile signals, and the reduction of distracting elements, always integrated with mediation in Libras.

The linguistic-interactional axis promotes bilingualism through joint planning between the SEA teacher and the Libras interpreter, including interaction scripts, socialization circles, and sign games, all supported by high-contrast visual materials and digital Libras glossaries. Finally, the reflective portfolio axis encourages student autonomy by proposing weekly records in various formats (videos in Libras, annotated photographs, goal maps), valuing the student's voice and achievements in the educational process.

Assessment assumes a procedural and formative character. Initially, a baseline is established through the application of the BBS and engagement checklists, from which short- and medium-term goals are defined. Continuous monitoring is conducted through systematic observations of response frequency and duration, momentary time sampling, and adapted instruments for assessing visual and linguistic performance. These data are organized into weekly charts, enabling adjustments to the pedagogical path.

Summative assessment occurs at the end of each six- and twelve-week cycle, with reapplication of the BBS and analysis of the reflective portfolio, with results discussed with the student and, whenever possible, with the family. This process is complemented by bilingual rubrics that encompass aspects of

non-verbal communication, group collaboration, and autonomy. Finally, the safe progression of activities is ensured through gradual motor adaptations to safeguard the student's emotional well-being.

Linguistic Interface

The linguistic interface involves the prioritized use of Brazilian Sign Language (Libras) as the primary means of communication and learning for the deaf student. This interface ensures that information is conveyed clearly and accessibly, respecting the student's natural language. To achieve this, support is provided by the Libras interpreter, the Libras instructor, and the Specialized Educational Assistance (SEA) teacher, who facilitate communication with the student. Additionally, teaching materials are adapted with visual and signed elements, making the content more comprehensible and allowing the student to actively participate in class.

Pedagogical Interface

The pedagogical interface refers to the planning and implementation of specific strategies that consider the needs of the deaf student within the context of Specialized Educational Assistance (SEA). In this interface, the curriculum is adapted to promote the student's linguistic, cognitive, and social development. The activities are designed to be inclusive and dynamic, using a variety of resources that encourage participation and effective learning. Assessment is also flexible, aiming to identify the student's progress and adjust instruction to overcome potential difficulties, thereby ensuring a more effective and personalized educational process.

CURRICULUM SKILLS

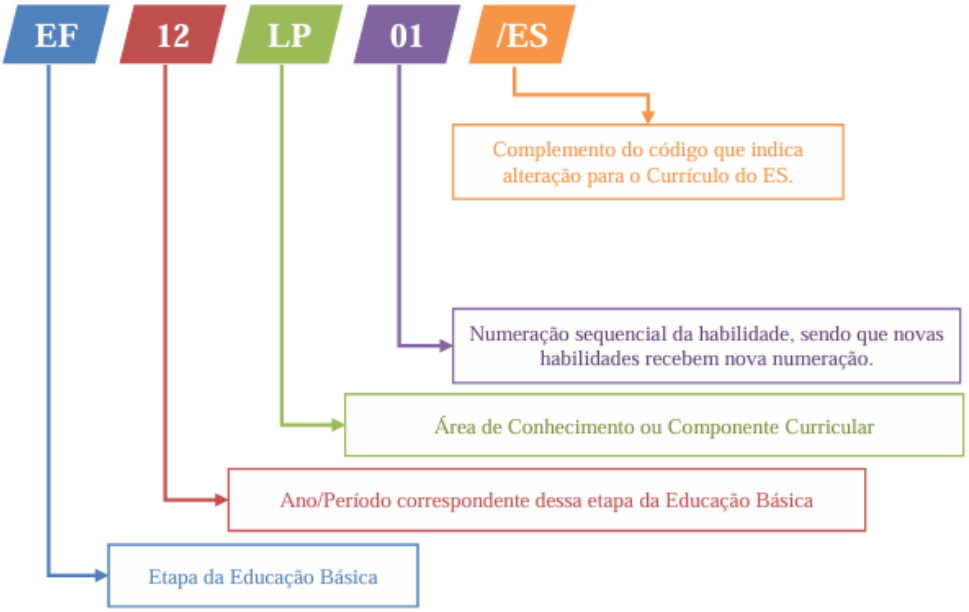
The Brazilian educational system adopts the Base Nacional Comum Curricular (BNCC)—National Common Curricular Base—as a mandatory reference for organizing the curricula of Basic Education. It guides the essential learning outcomes that must be guaranteed to students across all stages and modalities of education. As stated on the BNCC website:

> The Base establishes the knowledge, competencies, and skills that are expected to be developed by all students throughout basic schooling. Guided by the ethical, political, and aesthetic principles outlined in the National Curricular Guidelines for Basic Education, the Base aligns with the goals that direct Brazilian education toward comprehensive human development and the construction of a just, democratic, and inclusive society (BRASIL, 2018).

Each skill is assigned a code that follows a standardized structure and indicates the educational stage or curricular component (EI – Early Childhood Education, EF – Elementary Education, EM – High School, EJA – Youth and Adult Education), the year or age group (corresponding to the stage of basic

education), the acronym of the knowledge area (separated by area of knowledge), the sequential number of the skill, and the identification of the state and/or specific modality (such as EJA), as illustrated in Figure 1.

Figure 01: Composition of the skill code in the Curriculum of Espírito Santo (ES). Original diagram in Portuguese (pt-BR)



Source: ES 2020 Currículo, Volume 09, Ensino Fundamental – Anos Finais [Curriculum, Volume 09, Elementary School – Final Years], pag. 82.

Schema of the curriculum skill identification code. The composite code EF-12-LP-01/ES is disaggregated into five segments, each with a specific semantic role: EF = Stage of Basic Education; 12 = Year/Period for that stage; LP = Knowledge Area or Curriculum Component; 01 = sequential skill number; /ES = suffix indicating an adaptation to the ES Curriculum. Colored connectors map each segment to its corresponding definition, illustrating how the coding system encodes educational stage, temporal placement, disciplinary area, skill sequence, and local curriculum adjustments.

The selection of skills to be worked on with the student was defined based on diagnostic assessment and focused on the literacy process, aiming to build bridges between the concrete and the abstract and to foster meaningful learning.

SKILLS	LEARNING EXPECTATIONS
EI03EF05 Experiment with different possibilities of stroke and pressure using graphic instruments (pencil, brush, chalk, etc.), controlling the stroke with greater precision.	Demonstrate greater control in the use of graphic instruments when performing varied strokes, adjusting the force and direction of the stroke, exploring different surfaces and materials as part of the process of developing fine motor coordination and preparation for writing.
EF01MA01/ES Use the meaning of natural numbers as an indicator of quantity.	Understand the concept of quantity.
EI03EF09: Recognize and name letters of the alphabet, especially those in one's own name.	Stimulate recognition and familiarity with the letters that make up the student's name.
EF01LP04/ES: Distinguish letters of the alphabet from other graphic signs in meaningful texts from regional oral translation.	Recognize the letters of the alphabet and identify the letters in one's own name. Develop awareness that letters form words, distinguishing them from numbers, symbols, punctuation, or drawings.
EF01LP08- Relate sound elements (syllables, phonemes, parts of words) to their written representation.	Promote recognition of the letters in one's own name. Recognize and appropriate words, understanding that each word has meaning and contributes to the construction of meaning.
EF15LP03 Locate explicit and implicit information in texts.	Comprehend the message. Develop reading skills.
EI03ET04- Establish cause-and-effect relationships in everyday situations.	Formulate simple hypotheses about what might happen next in an observed situation
EF03ET06- Relate, based on personal criteria, objects, people, and situations, identifying similarities and differences.	Recognize similarities and differences in social and material relationships, developing perception, logical reasoning, and respect for diversity.
EFCICLO1MA07/ES/EJA Construct sequences of natural numbers in ascending or descending order from any given number, using an established regularity and common attributes.	Organize and order familiar objects or representations by figures, using attributes such as color, shape, and size, promoting work with patterns in grouping, classification, and ordering.

The activities were planned based on these skills with the aim of promoting the student's protagonism and autonomy, respecting her developmental pace and valuing her individual experiences. This provides a solid foundation for the development of reading, writing, and logical thinking—fundamental skills for the subsequent stages of school life.

The proposals also sought to promote inclusion and the student's active participation in the educational process, with emphasis on the development of concepts of quantity and logical reasoning through practical, visual, and contextualized activities.

STUDENT PROFILE AND METHODOLOGY SELECTION

The student who participated in the activities was 56 years old, profoundly deaf, and not fully oralized, as she communicated through isolated words without forming complete sentences. She partially understood oral communication, especially when supported by visual resources, gestures, and repetition. She did not use Brazilian Sign Language (Libras), which posed a significant challenge in the pedagogical mediation process, as it limited her understanding of more abstract instructions. Her first contact with Libras was taking place at that time, at school, with the support of a Libras instructor during the after-school period. She also received Specialized Educational Assistance from a teacher specialized in hearing impairment, focusing on the acquisition of Portuguese as a second language.

At that time, she was enrolled in the 6th Stage of Youth and Adult Education (EJA) at the "Pedro de Alcântara Galvêas" State School of Elementary and Secondary Education, located in Dores do Rio Preto, Espírito Santo. Her entry into the school context occurred in adulthood, without having had access to structured educational experiences during childhood, which resulted in significant academic and conceptual gaps.

The skills selected for work with the student were defined based on the results of the diagnostic assessment and initial observations, taking into account her current stage of learning. Consequently, it was necessary to propose concrete, visual, and tactile activities that respected her pace and were connected to her daily life, facilitating the gradual construction of new knowledge.

The pedagogical proposals were intentionally planned to promote progress in the literacy process and in the student's cognitive, linguistic, motor, and socio-emotional development. The aim was to integrate conceptual development with the expansion of sensory and meaningful experiences, focusing on the appropriation of the writing system and the construction of meaning, thereby strengthening her autonomy and active participation in the educational process.

The activities were carried out between April and July 2025, in the Resource Room, allowing for continuous monitoring of the student and the collection of evidence regarding her learning process.

Working with the student required constant attention, sensitive listening, and great pedagogical flexibility to ensure that interventions were aligned with her specific needs and individual potential. Her learning process was gradual and required intentional repetition, as the skills being developed were not yet consolidated.

Therefore, it was necessary to continually revisit the same content, using varied methodologies, diverse resources, and more accessible strategies that encouraged new possibilities for understanding and appropriation. In such cases, the progress observed—even if subtle—should be valued as significant milestones of achievement in her educational journey.

DEVELOPMENT OF ACTIVITIES IN THE RESOURCE ROOM

In order to facilitate a better understanding of the pedagogical process, the skills were organized by lesson in chronological order, considering that these activities were carried out between the months of April and July 2025, during the first semester of the Youth and Adult Education (EJA) program.

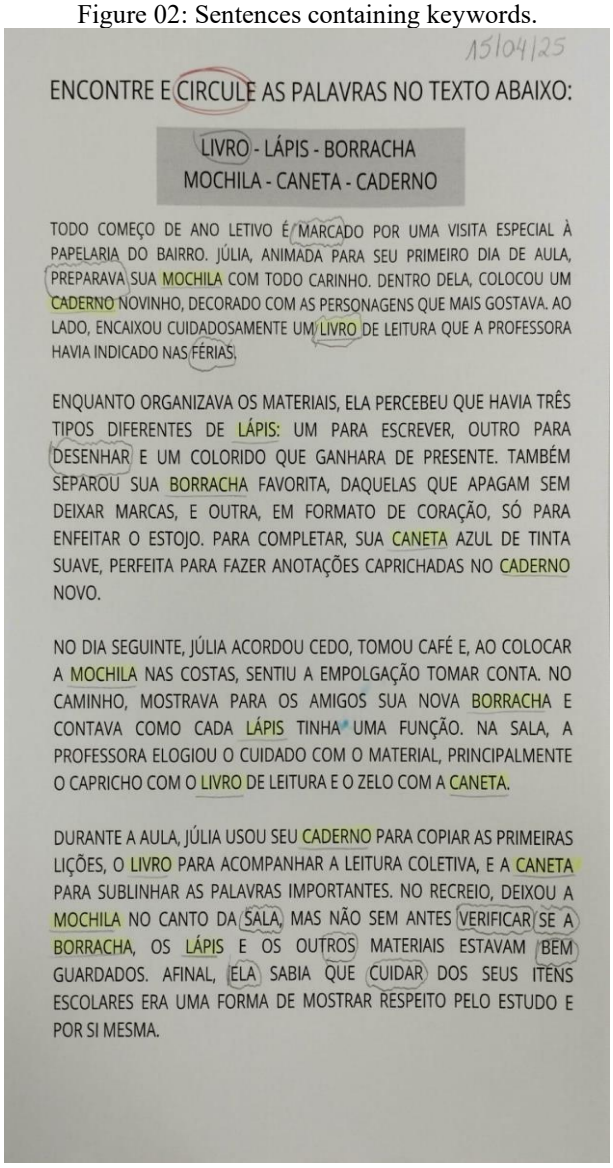
This structure allows for a more comprehensive record of the student's development throughout the activities, complemented by photographic documentation that illustrates her participation and progress.

SKILLS EF15LP03 AND EI03EF05

As part of the diagnostic assessment activities, sentences containing key words from the school context were used, embedded in short texts (Figure 02), with the aim of verifying the student's familiarity with the vocabulary of the environment in which she is situated. This also enabled observation of her ability to recognize words, understand their meaning, and associate them with her daily school experiences.

The same words were also worked on through image association; however, the student was unable to establish this connection, indicating the need for targeted interventions focused on developing this skill.

Figure 02: Sentences containing keywords.



15/04/25

ENCONTRE E CIRCULE AS PALAVRAS NO TEXTO ABAIXO:

LIVRO - LÁPIS - BORRACHA
MOCHILA - CANETA - CADERNO

TODO COMEÇO DE ANO LETIVO É MARCADO POR UMA VISITA ESPECIAL À PAPELARIA DO BAIRRO. JÚLIA, ANIMADA PARA SEU PRIMEIRO DIA DE AULA, PREPARAVA SUA MOCHILA COM TODO CARINHO. DENTRO DELA, COLOCOU UM CADERNO NOVINHO, DECORADO COM AS PERSONAGENS QUE MAIS GOSTAVA. AO LADO, ENCAIXOU CUIDADOSAMENTE UM LIVRO DE LEITURA QUE A PROFESSORA HAVIA INDICADO NAS FÉRIAS.

ENQUANTO ORGANIZAVA OS MATERIAIS, ELA PERCEBEU QUE HAVIA TRÊS TIPOS DIFERENTES DE LÁPIS: UM PARA ESCREVER, OUTRO PARA DESENHAR E UM COLORIDO QUE GANHARA DE PRESENTE. TAMBÉM SEPAROU SUA BORRACHA FAVORITA, DAQUELAS QUE APAGAM SEM DEIXAR MARCAS, E OUTRA, EM FORMATO DE CORAÇÃO, SÓ PARA ENFEITAR O ESTOJO. PARA COMPLETAR, SUA CANETA AZUL DE TINTA SUAVE, PERFEITA PARA FAZER ANOTAÇÕES CAPRICHADAS NO CADERNO NOVO.

NO DIA SEGUINTE, JÚLIA ACORDOU CEDO, TOMOU CAFÉ E, AO COLOCAR A MOCHILA NAS COSTAS, SENTIU A EMPOLGAÇÃO TOMAR CONTA. NO CAMINHO, MOSTRAVA PARA OS AMIGOS SUA NOVA BORRACHA E CONTAVA COMO CADA LÁPIS TINHA UMA FUNÇÃO. NA SALA, A PROFESSORA ELOGIOU O CUIDADO COM O MATERIAL, PRINCIPALMENTE O CAPRICHO COM O LIVRO DE LEITURA E O ZELO COM A CANETA.

DURANTE A AULA, JÚLIA USOU SEU CADERNO PARA COPIAR AS PRIMEIRAS LIÇÕES, O LIVRO PARA ACOMPANHAR A LEITURA COLETIVA, E A CANETA PARA SUBLINHAR AS PALAVRAS IMPORTANTES. NO RECREIO, DEIXOU A MOCHILA NO CANTO DA SALA, MAS NÃO SEM ANTES VERIFICAR SE A BORRACHA, OS LÁPIS E OS OUTROS MATERIAIS ESTAVAM BEM GUARDADOS. AFINAL, ELA SABIA QUE CUIDAR DOS SEUS ITENS ESCOLARES ERA UMA FORMA DE MOSTRAR RESPEITO PELO ESTUDO E POR SI MESMA.

Source: Authors.

Transcription (English):
FIND AND CIRCLE THE WORDS IN THE TEXT BELOW:
BOOK – PENCIL – ERASER
BACKPACK – PEN – NOTEBOOK

The whole school year *is marked* by a special visit to the neighborhood stationery store. Júlia, excited for her first day of class, prepared her **backpack** with great care. Inside it, she placed her brand-new **notebook**, decorated with her favorite characters. Next to it, she carefully tucked in a **book** that the teacher had recommended during the vacation.

While organizing her materials, she noticed that there were three different types of **pencil**: one for writing, another for drawing, and a colored one she had received as a gift. She also separated her **eraser**, distinguishing the ones that erase without leaving marks from the others, shaped like a heart, meant to decorate her pencil case. To complete her set, the blue **pen** with smooth ink was perfect for making neat notes in the new **notebook**.

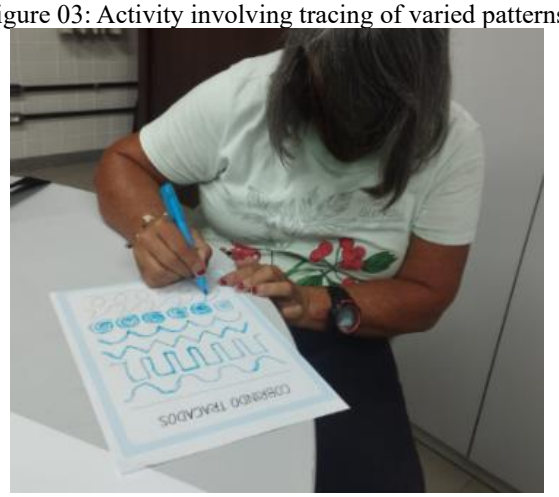
The next day, Júlia woke up early, had her coffee, and, after putting on her **backpack**, felt the excitement of returning to school. On the way, she showed her friends her new **eraser** and told them how each **pencil** had a specific purpose. In the classroom, the teacher praised the care she had taken with her materials, especially her neatness with the reading **book** and her dedication when using the **pen**.

During class, Júlia used her **notebook** to copy the first lessons, the **book** to follow the group reading, and the **pen** to underline important information. During recess, she left her **backpack** in the classroom but first checked if the **eraser**, the **pencils**, and the other materials were well stored. After all, she knew that taking good care of her belongings was a way of showing respect for her studies and for herself.

In the following activity, the student was asked to practice writing her name using dotted-letter exercises, promoting appropriation of her own name and the development of fine motor coordination. The activity aimed to observe the student's level of autonomy in tracing the letters and memorizing the correct sequence that forms her name—fundamental aspects of the literacy process.

Additionally, an activity involving tracing various patterns (Figure 03) was applied, using dotted lines in different shapes (curves, spirals, zigzags, etc.). Using a felt-tip pen, the goal was to observe stroke control, motor precision, and visual perception—skills that directly contribute to preparing the student for writing.

Figure 03: Activity involving tracing of varied patterns.



Source: Authors.

However, it was observed that the student was unable to perform the activities independently, requiring constant support to recognize the letters and carry out the proposed tasks. This highlights the importance of using differentiated strategies and individualized support.

SKILL EFCICLO1MA07/ES/EJA

The student was presented with an activity using various materials such as buttons, bottle caps, blocks, geometric shapes, and jar lids (Figure 04), with the objective of stimulating logical reasoning, visual perception, and fine motor coordination. The task consisted of organizing the presented objects according to different criteria: color, shape, and size.

Figure 04: Activity involving classification and ordering of objects.

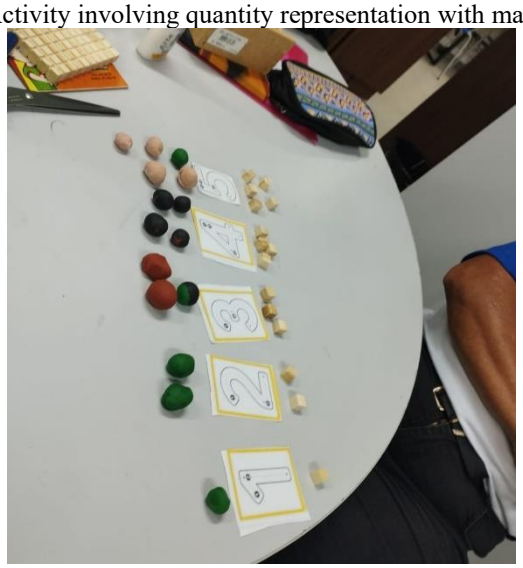
Source: Authors.

During the activity, the student was encouraged to carefully observe the materials and group the elements according to each characteristic, practicing classification and sequencing—skills fundamental to the development of mathematical thinking.

SKILL EF01MA01/ES

Initially, the student was encouraged to model small balls of playdough, with each group corresponding to the quantity indicated by printed numbers from 1 to 5. Next, using base-ten blocks (golden material), she was asked to organize small cubes (units) corresponding to the numerals presented (Figure 05).

Figure 05: Activity involving quantity representation with manipulatives.



Source: Authors.

In the next stage, printed materials, gouache paint, and brushes were used (Figure 06) with the objective of promoting the writing of numerals. This activity aimed to support both the association

between number and quantity and the development of fine motor coordination and tactile perception. It also sought to stimulate logical reasoning and spatial perception through the graphic reproduction of numerical symbols.

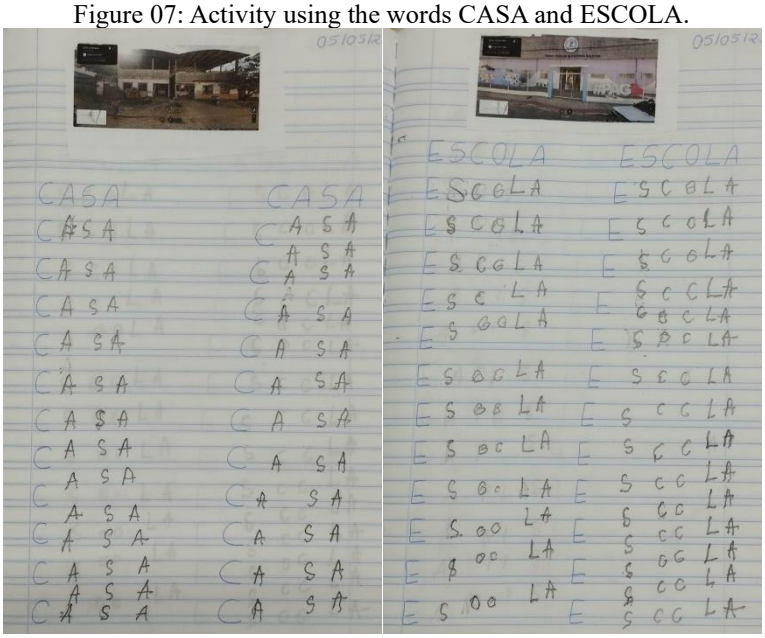
Figure 06: Activity using printed materials, gouache paint, and brush.

Source: Authors.

SKILLS EI03EF05 AND EI03EF09

During the diagnostic assessment period, an informal conversation with the student about her daily routine allowed for the exploration of meaningful aspects of her everyday life. Using the Google Maps tool, real images of her home and school were located (Figure 07), which provided a rich moment of interaction and contextualization. From this experience, the words CASA (home) and ESCOLA (school) were intentionally introduced, promoting the writing of these words based on concrete images. The images were printed and used as visual support, enabling the student to associate the vocabulary being taught with her reality, fostering comprehension of meaning and expanding her linguistic repertoire.

Figure 07: Activity using the words CASA and ESCOLA.



Source: Authors.

Next, the student was invited to paint the dotted letters of her name (Figure 08) using a cotton swab and paint. This strategy aimed to develop fine motor coordination and familiarity with the strokes of the letters in her own name. Subsequently, movable letters were provided so that the student could cut out, manipulate, and arrange the letters of her name, both with and without visual support.

This practice seeks to promote memorization of the correct sequence of letters while simultaneously encouraging autonomy in constructing written language and recognizing personal identity through her own name.

Figure 08: Activity using cotton swab and paint.

Source: Authors.

SKILL EF01MA01/ES

The student was presented with an activity using various visual and concrete resources: a numerical die, base-ten blocks (golden material), and sheets with numerals from 1 to 5, each containing circles corresponding to its quantity.

During the activity, the student was guided to roll the die, identify the number rolled, and then place the correct number of small cubes (units from the golden material) into the printed circles on the corresponding sheet (Figure 09). This process involves multiple skills, such as oral and visual counting, one-to-one correspondence, and fine motor coordination, while also stimulating concentration and autonomy in task execution.

Figure 09: Activity using various visual and concrete resources

Source: Authors.

The activity was designed to be playful and interactive, respecting the student's pace and promoting the construction of the concept of quantity in a concrete and meaningful way. The use of the die also introduced an element of surprise and engagement, encouraging her active participation.

SKILLS EI03EF09 AND EF01LP04/ES

With the support of plastic letters, activities were proposed to recognize and arrange the letters that make up the student's name, fostering the development of phonological and visual awareness. As a complementary resource, a personalized puzzle featuring the student's photo and name was used, which helped strengthen the emotional connection to the activity and stimulated personal identification—an essential aspect of the literacy process.

The activity also involved associating the letters in the student's name (**A, L, Z, I, E, and N**) with illustrative images and support words as reinforcement tools. Initially, plastic letters were used for

recognition and manipulation. In a subsequent activity, the student was invited to cut and paste these letters, concluding with the writing of her own name to reinforce learning and promote familiarity with its spelling.

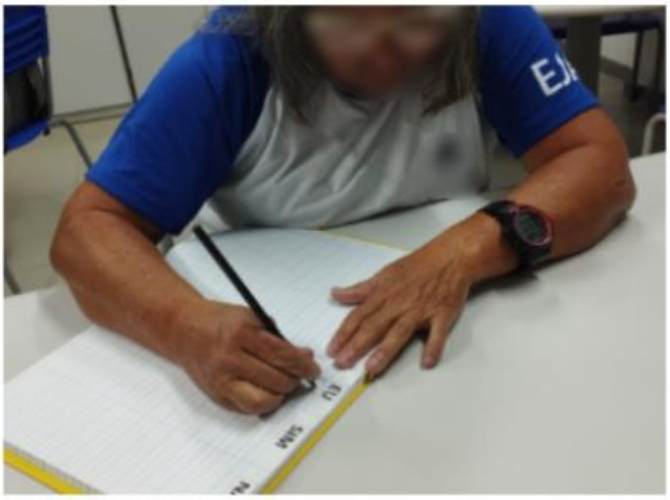
Additionally, numbers were incorporated into the context of the activities to observe whether the student could distinguish between letters and numbers, contributing to her understanding of the different symbols within the writing system. This differentiation is essential for the development of reading and writing, as well as for recognizing the graphic conventions that structure texts and everyday situations.

SKILLS EI03EF09 AND EF01LP08

An activity was carried out using printed materials, glue, and string, in which the student had the opportunity to compose her own name. This promoted visual recognition of letters, strengthened her identity, and supported the development of fine motor coordination. Manipulating the materials provided a meaningful sensory experience, encouraging autonomy and engagement in the learning process.

Additionally, the functional words “eu” (I), “sim” (yes), and “não” (no) were introduced (Figure 10) with the goal of expanding the student’s vocabulary and fostering recognition and appropriation of these frequently used words.

Figure 10: Activity using functional words “eu,” “sim,” and “não.”



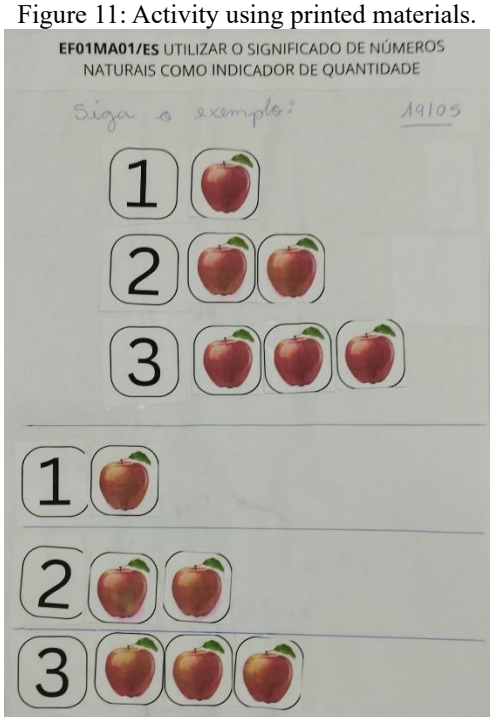
Source: Authors.

SKILL EF01MA01/ES

With the aim of assisting the student in assimilating the initial numerals, an activity was proposed using printed materials containing the numbers from 1 to 3, accompanied by concrete images of apples (Figure 11). The purpose of this activity was to strengthen the number/quantity association through a visual and hands-on approach. During the activity, the student was encouraged to cut out squares with illustrations of apples and paste them into the spaces corresponding to the presented numerals. This task

engaged multiple skills, such as counting, fine motor coordination (through cutting and pasting), number recognition, and understanding the relationship between numerical symbols and actual quantities.

Figure 11: Activity using printed materials.

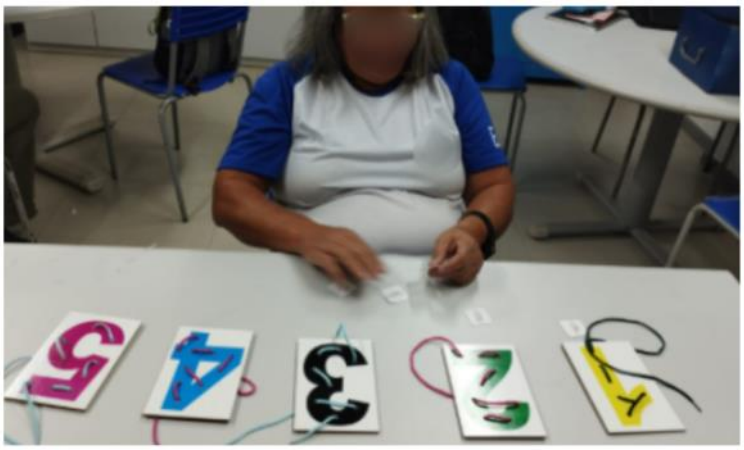


Source: Authors

Following that, the game “Numeral Lacing from 0 to 5” was introduced (Figure 12) with the aim of expanding number recognition and further stimulating motor coordination. The activity consisted of lacing, using string or shoelaces, the outlines of numerals displayed on perforated boards, allowing the student to manipulate the numbers in a concrete and sensory manner.

This proposal reinforced contact with numerals while simultaneously developing attention, patience, and fine motor skills—fundamental elements in the writing process and mathematical learning.

Figure 12: Activity – “Numeral Lacing from 0 to 5” game.

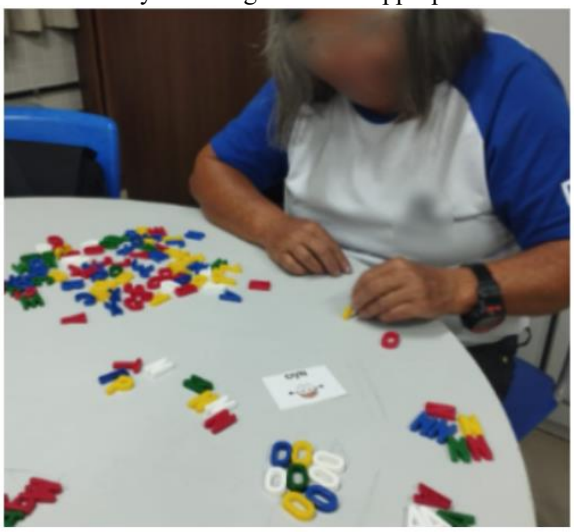


Source: Authors.

SKILL EF01LP08

Activities were developed focusing on the recognition and appropriation of frequently used words, using guided handwriting and pictograms as strategies. The words worked on—I, yes, no, eat, and sleep—were presented in a visual and contextualized manner, promoting the association between image, word, and meaning, with the goal of facilitating comprehension and use of these expressions. Additionally, plastic letters were used alongside printed pictograms (Figure 13), encouraging the student to identify and arrange the letters that make up each of the words.

Figure 13: Activity for recognition and appropriation of words



Source: Authors.

SKILL EF01MA01/ES

To reinforce the association between number and quantity, as well as to stimulate organization, visual perception, and motor coordination, the student was presented with a playful activity titled "Number Box" (Figure 14), using numerals from 0 to 5.

Figure 14: Activity for associating number and quantity.

Source: Authors.

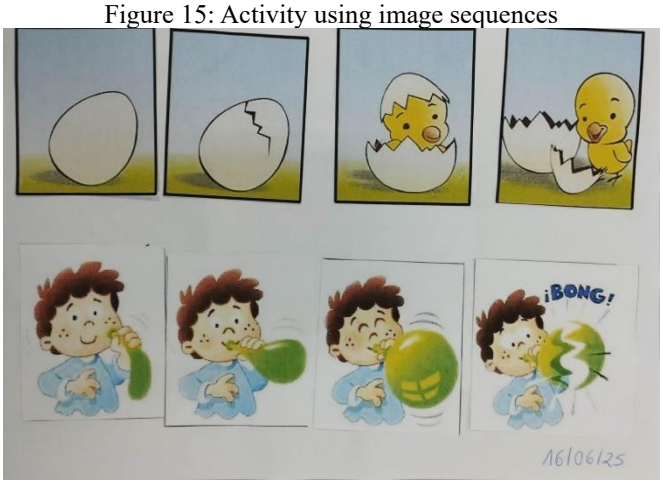
The activity began with the presentation of the box to the student, which contained various objects: a whistle, assorted geometric shapes, and wooden sticks. After the initial exploration, the student was asked to remove the items from the box, classify the objects according to their characteristics, and then place them in the spaces corresponding to each number.

The main objective of this activity was to promote the relationship between numerals and actual quantities in a concrete way, as well as to encourage the perception of categories and the recognition of differences among objects. The proposal also contributed to the development of fine motor coordination, attention, and autonomy in following instructions.

SKILLS EI03ET04 e EF01LP08

Activities were developed using image sequences (Figure 15) with the aim of encouraging the student to anticipate consequences and propose possible solutions to various presented situations. This practice contributed to the development of logical reasoning, oral language, and the ability to organize ideas, while also fostering meaning-making through image reading.

Figure 15: Activity using image sequences



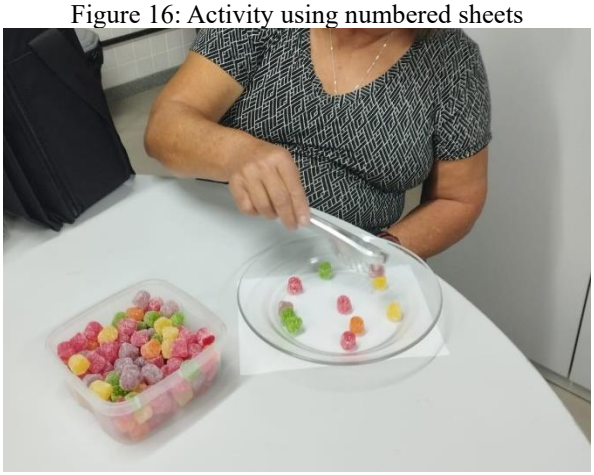
Source: Authors.

Illustrated cards containing simple words such as I, my, home, yes, and no were also used to promote the association between image and written word, encouraging vocabulary comprehension and its contextualized expansion. The proposal aimed to reinforce the relationship between orality, image, and writing, facilitating word recognition and encouraging the student's active participation in reading activities.

SKILL EF01MA01/ES

To develop and stimulate the student's understanding of the concept of number and quantity, an activity was proposed using numbered sheets from 1 to 5 and small concrete objects (gumdrops) (Figure 16).

Figure 16: Activity using numbered sheets



Source: Authors.

The activity consisted of relating each numeral, fixed below a transparent plate, to the corresponding quantity of gumdrops, promoting the number-quantity association in a playful, concrete,

and meaningful way. The activity sparked the student's interest and provided an enjoyable learning moment, reinforcing skills such as counting, spatial organization, and fine motor coordination.

Complementing this proposal, additional activities were developed involving collage and painting using string (Figure 17). Based on the numerical sequence from 1 to 5, the student was guided to represent the quantity of each presented number by gluing pieces of string and painting the corresponding spaces. This approach aimed to enhance visual perception, stimulate tactile exploration, and strengthen the connection between numerical symbols and associated quantities, exploring multiple languages and forms of expression.

Figure 17: Activity using numbered sheets

Source: Authors.

SKILLS EI03ET06 e EF01LP08

The student was introduced to the game "Which One Doesn't Belong?", using cards with nine images, one of which did not belong to the same category. Each card was explored individually, stimulating observation, visual attention, and logical reasoning. The student was invited to identify which image differed from the others, promoting object classification by criteria and contributing to the development of critical thinking and oral language.

Following this, plastic movable letters and printed pictograms were used (Figure 18) to encourage recognition of the relationship between image and written word. Pictograms corresponding to the words I, yes, no, eat, and sleep were presented, and the student was invited to identify each image and use the movable letters to form the words that name them.

This activity supported the development of phonological awareness, early reading skills, and the association between visual and linguistic representations, promoting meaningful learning through concrete and visual resources.

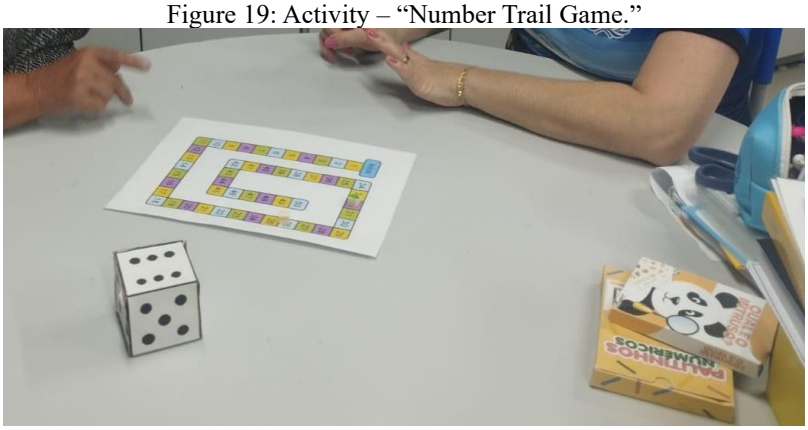
Figure 18: Activity using plastic movable letters

Source: Authors.

SKILL EF01MA01/ES

To stimulate counting, logical-mathematical reasoning, and numeral recognition, the student was invited to participate in the "Number Trail Game" (Figure 19), which featured a numbered trail from 1 to 50. The activity's dynamic consisted of rolling a die and moving a marker along the trail according to the number rolled.

Figure 19: Activity – "Number Trail Game."



Source: Authors.

During the game, the student was encouraged to identify numerals, count aloud the spaces moved, and anticipate movements, which contributed to strengthening sequential counting and numerical perception in a playful and interactive context.

To complement this proposal, number cards from 0 to 5 were used, accompanied by illustrated sets of various objects such as fruits, stars, and animals. The student was guided to match each presented number to the card containing the corresponding quantity of elements. This activity focused on promoting

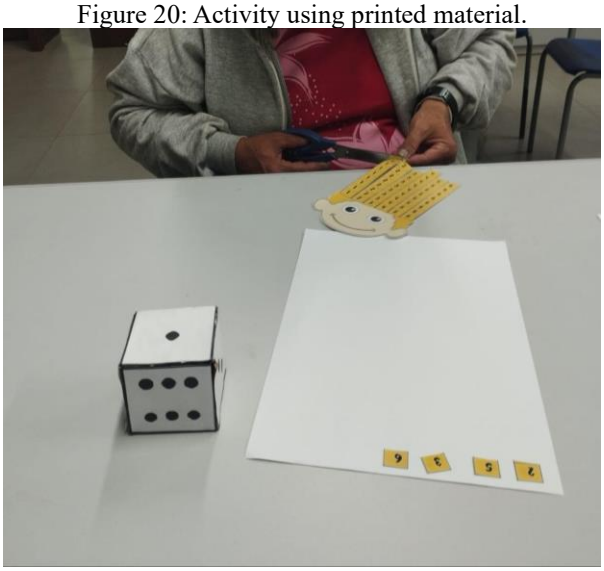
the association between numerical symbols and actual quantities, while also supporting the development of visual perception, attention, and logical reasoning.

SKILLS EI03EF09 AND EF01MA01/ES

An activity was carried out using the student's full name, written in block letters, along with plastic movable letters, with the goal of promoting recognition of the letters that make up her name. The student was guided to locate, among the available letters, those corresponding to the presented model and to arrange them in the correct sequence.

Following this, the student was presented with an activity using printed material featuring the numerical sequence from 1 to 6 (Figure 20), aimed at stimulating number recognition, sequential ordering, and fine motor coordination. The dynamic consisted of rolling a die, identifying the number rolled, cutting out the corresponding number from the printed sheet, and pasting it in sequential order on a blank sheet of paper.

Figure 20: Activity using printed material.



Source: Authors.

SKILLS EI03EF09 AND EF01MA01/ES

To stimulate identification and recognition of numerical representation, the student was presented with an activity using printed numbers from 1 to 5 (Figure 21). Each numeral was filled with random repetitions of numbers from 1 to 5, with the goal of visually challenging the student and promoting recognition of numerical symbols in different contexts and formats.

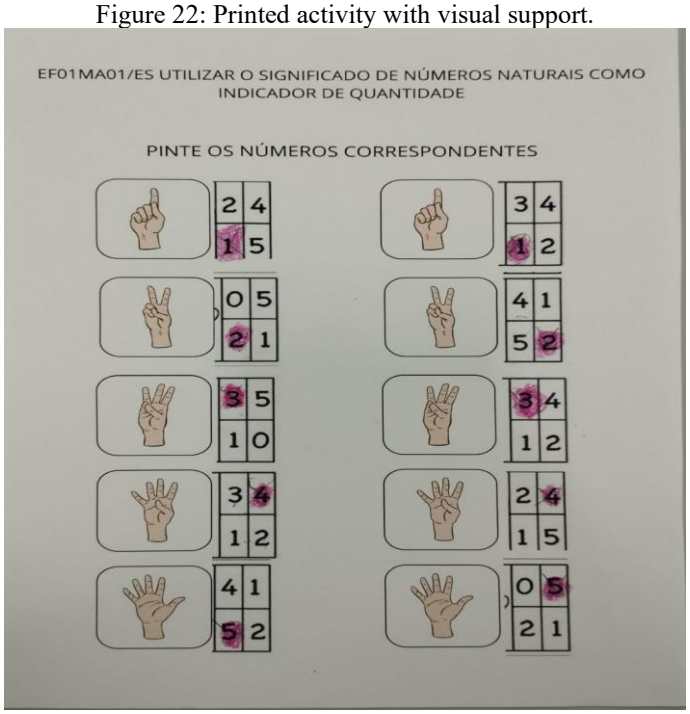
During the activity, the student was encouraged to carefully observe the internal numerals and identify which numbers were represented within each larger outline.

Figure 21: Activity using printed numbers from 1 to 5.

Source: Authors.

Following this, a printed activity with visual support was applied, in which the numbers from 1 to 5 were represented by images of hands with raised fingers (Figure 22), corresponding to each quantity. The student was guided to relate the symbolic number to the quantity visually expressed by the hands, thereby strengthening the number-quantity association and providing an accessible and concrete resource for consolidating learning.

Figure 22: Printed activity with visual support.



Source: Authors.

Portfolio: Concept, Objective, and Importance

The portfolio is a pedagogical tool that gathers various records and documents produced throughout the educational process, also promoting critical reflection on pedagogical practices and the teaching-learning process itself. It functions as an essential instrument for monitoring student development, enabling analysis of progress, difficulties, and achievements throughout their educational journey.

In the educational context, it serves as a record of the student's activities and experiences, allowing them to reflect on their own learning (Rodrigues, 2009). It is a personal construction in which the student consciously selects which productions to include, organizing them in a meaningful way. Furthermore, the portfolio is recognized as a formative assessment resource that not only documents the student's progress but also encourages critical reflection on their development and strengthens the learning process.

When used in pedagogical practices within Specialized Educational Assistance (SEA), the portfolio plays a fundamental role in tracking learning development, especially for students with specific needs. In this case, it accompanies the inclusion process of a deaf student enrolled in Youth and Adult Education (EJA). Its objective is to demonstrate how the pedagogical planning developed for SEA materializes into concrete actions, fostering the student's linguistic, cognitive, and social development.

The reflective portfolio is a pedagogical resource that allows the student to record their learning experiences in a personal way, considering their characteristics and particularities (Cesário et al., 2016). It includes descriptions of activities, problem situations, and practices carried out, enabling the student to organize their ideas creatively. According to Martin et al. (2010), this tool also supports the development of important competencies such as autonomy, responsibility, creativity, and critical thinking, while encouraging the student's protagonism in the educational process. By creating the portfolio, the student is able to analyze their own journey and better understand the meaning of the experiences they have lived. Thus, the reflective portfolio not only records learning but also serves as an alternative form of assessment, promoting an individualized view of the student's development.

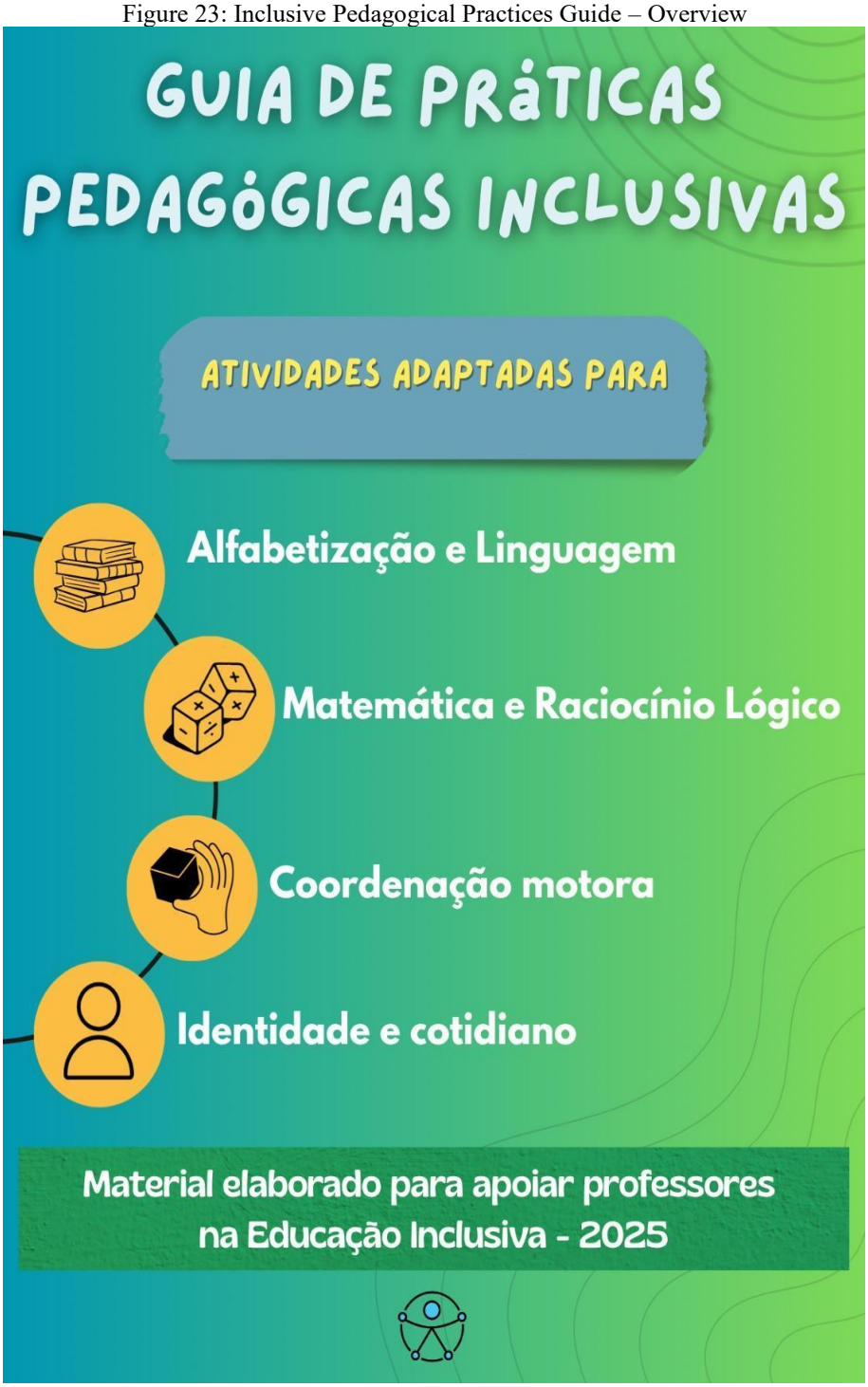
In inclusive education, deaf or hard-of-hearing students require pedagogical strategies that prioritize Brazilian Sign Language (Libras) and visual resources, which are essential for accessing knowledge. In this context, SEA organizes activities that strengthen these skills, creating opportunities for the student to expand their linguistic competence, develop logical reasoning, and engage in meaningful social interactions.

The SEA teacher specialized in hearing impairment plays a central role as a mediator between the student, school, and family, identifying barriers that hinder learning and proposing curricular adaptations. This professional works in partnership with classroom teachers, Libras instructors, and Libras

interpreters. Such collaborative action ensures continuous and effective inclusion, enhancing the student's holistic development and encouraging their active participation in school life.

This portfolio highlights the importance of the pedagogical work carried out in the Specialized Educational Assistance (SEA) room, which serves the student with equity and respect for her specific needs. More than a simple academic record, the portfolio represents a genuine commitment to promoting fair educational opportunities, ensuring that the student progresses according to her individual characteristics and potential.

Figure 23: Inclusive Pedagogical Practices Guide – Overview

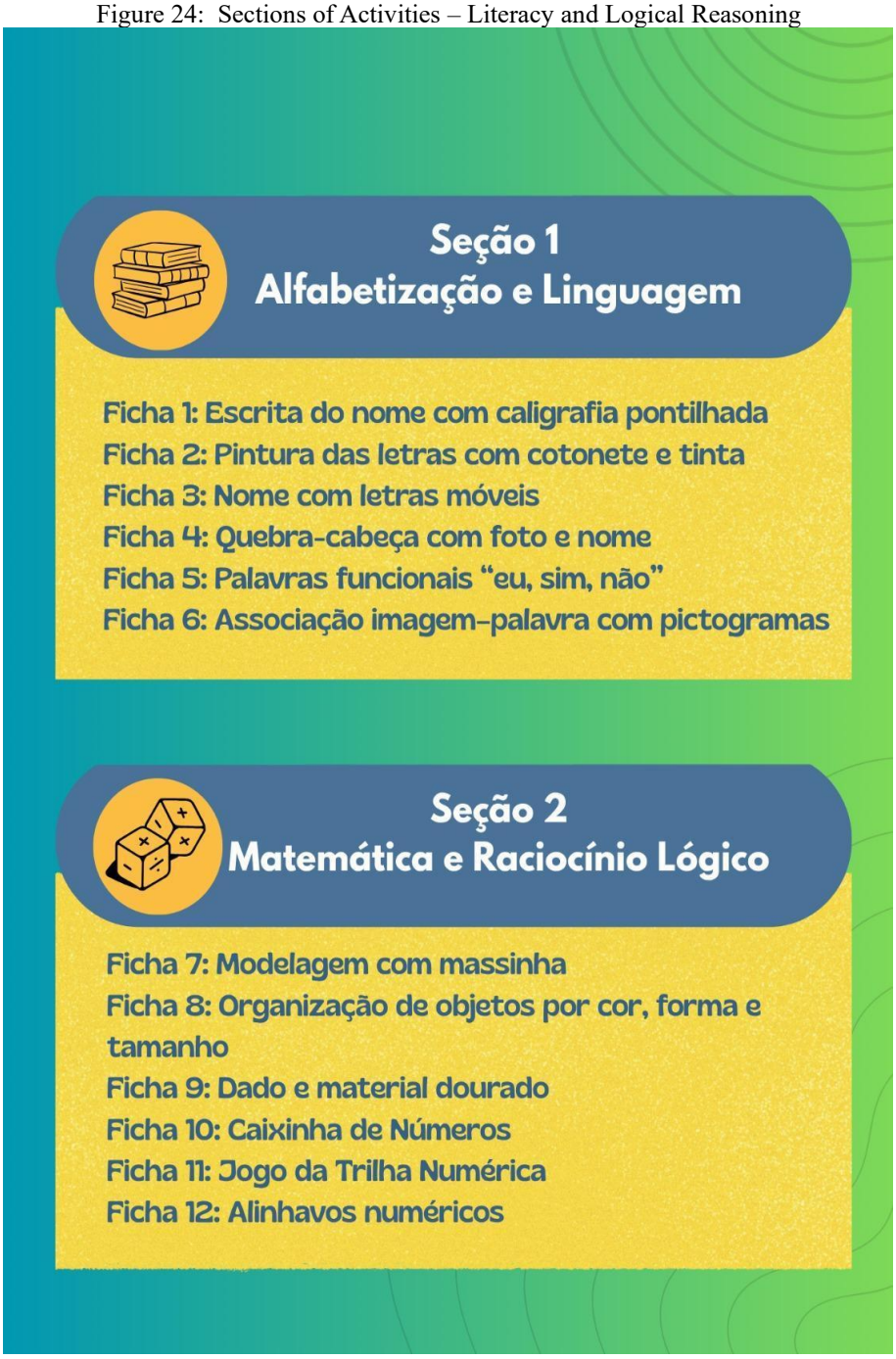


Transcription (English):
Inclusive Pedagogical Practices Guide
Adapted Activities For

- Literacy and Language
- Mathematics and Logical Reasoning
- Motor Coordination
- Identity and Daily Life

Material developed to support teachers
in Inclusive Education – 2025

Figure 24: Sections of Activities – Literacy and Logical Reasoning



Transcription (English):

Section 1 – Literacy and Language

- Worksheet 1: Writing the name with dotted calligraphy
- Worksheet 2: Painting letters using cotton swabs and paint
- Worksheet 3: Name with movable letters
- Worksheet 4: Puzzle with photo and name
- Worksheet 5: Functional words "I, yes, no"
- Worksheet 6: Image–word association with pictograms

Section 2 – Mathematics and Logical Reasoning

- Worksheet 7: Modeling with playdough
- Worksheet 8: Sorting objects by color, shape, and size
- Worksheet 9: Dice and golden material
- Worksheet 10: Number Box
- Worksheet 11: Number Trail Game
- Worksheet 12: Numerical lacing activities

Figure 25: Sections of Activities – Motor Coordination and Identity

Transcription (English):
Section 3 – Motor Coordination

- Worksheet 13: Tracing different lines (zigzag, curves, etc.)
- Worksheet 14: Gluing with string (quantities)
- Worksheet 15: Painting letters and numbers with tempera paint
- Worksheet 16: Image sequencing for cause and effect

Section 4 – Identity and Daily Life

- Worksheet 17: Association of real images
- Worksheet 18: Numerical sequencing with jellybeans
- Worksheet 19: Activity "Which one is the intruder?"
- Worksheet 20: Construction of the complete name

Figure 26: Writing the Name Using Dotted Calligraphy

Transcription (English):
Worksheet 1 – Writing the Name with Dotted Calligraphy
BNCC Skill

- EI03 EF05: Experiment with different tracing possibilities and pressure when using graphic instruments.
- EI03 EF09: Recognize and identify letters of the alphabet, especially those in the child's own name.

Activity Objective

- Develop fine motor coordination.
- Encourage familiarity with tracing the letters of the child's own name.
- Promote personal identity recognition.

Materials Needed

- Sheet with the student's name in dotted letters.
- Pencil or felt-tip pen.

Step-by-Step

1. Give the student the sheet with their name in dotted letters.
2. Guide the student to trace each letter, reinforcing the tracing.
3. Repeat the activity at different moments to strengthen memorization of the letter sequence.

Possible Adaptations

- Use thick crayons for students with less motor firmness.
- Provide visual support (poster or card) with the child's name as a reference.

Teacher's Tip

- Value every improvement in tracing, even the small ones, as they mark the process of learning and ownership of writing.

Inclusive Pedagogical Practices Guide – Section 1: Literacy and Language – Worksheet 1/20

Figure 27: Painting Letters with Cotton Swabs and Paint

Transcription (English):
Worksheet 2 – Painting Letters with Cotton Swabs and Paint
BNCC Skill

- EI03 EF05: Experiment with different tracing possibilities and pressure when using graphic instruments.

Activity Objective

- Develop fine motor coordination through precise movements.
- Encourage recognition of the child's own name.

Materials Needed

- Sheet with the child's name in dotted letters.
- Cotton swabs and tempera paint.

Step-by-Step

1. Present the student with the sheet containing the letters of their name.
2. Guide the student to paint the dots using a cotton swab and paint.
3. Encourage the student to follow the correct order of the letters.

Possible Adaptations

- Adapt the activity using sponge stamps or a small roller if the student has motor difficulties.
- Use non-toxic gel paint or colored sand to vary sensory stimulation.

Teacher's Tip

- Activities involving paint provide emotional and playful engagement, strengthening the bond with writing.

Inclusive Pedagogical Practices Guide – Section 1: Literacy and Language – Worksheet 2/20

Figure 28: Constructing the Name with Movable Letters

Transcription (English):
Worksheet 3 – Recognizing the Name with Movable Letters
BNCC Skill

- EI03 EF09: Recognize and identify letters of the alphabet, especially those in the child's own name.
- EF01LP04/ES: Distinguish alphabet letters from other graphic symbols.

Activity Objective

- Stimulate recognition of the letters that make up the student's name.
- Develop phonological and visual awareness.
- Strengthen personal identity and appropriation of the writing system.

Materials Needed

- Movable letters (plastic, EVA, or printed on paper).
- Cardstock or A4 sheet with the student's name written in block letters.
- Scissors and glue (optional).

Step-by-Step

1. Show the student the written model of their name.
2. Hand them the movable letters and ask them to find the matching ones.
3. Guide the student to organize the movable letters in the correct sequence.
4. Encourage repeating the activity several times, with or without visual support.

Possible Adaptations

- Use Velcro letters for panel fixation, helpful for students with lower motor coordination.
- To extend the activity: include names of family members or classmates.

Teacher's Tip

- The child's own name is always the best starting point for literacy, as it holds emotional meaning.

Inclusive Pedagogical Practices Guide – Section 1: Literacy and Language – Worksheet 3/20

Figure 29: Personalized Puzzle with Photo and Name

Transcription (English):
Worksheet 4 – Puzzle with Photo and Name
BNCC Skill

- EI03 EF09: Recognize letters of the alphabet, especially those in the child's own name.

Activity Objective

- Associate the child's personal image with their written name.
- Develop global recognition of the name.

Materials Needed

- Printed photo of the student.
- Student's name written below the photo.
- Cardstock or thick paper.
- Scissors.

Step-by-Step

1. Create a puzzle using the student's photo and their written name.
2. Cut it into simple pieces (4 to 6 parts).
3. Ask the student to reconstruct it, identifying their photo and name.

Possible Adaptations

- Increase the number of pieces according to the student's progress.
- Create puzzles with names of classmates or family members to expand recognition.

Teacher's Tip

- Activities using the child's own image strengthen identity and increase motivation to learn.

Inclusive Pedagogical Practices Guide – Section 1: Literacy and Language – Worksheet 4/20

Figure 30: Functional Words Activity

Transcription (English):
Worksheet 5 – Functional Words "I, Yes, No"
BNCC Skill

- EF01LP08: Relate sound elements with their written representation.

Activity Objective

- Expand frequently used functional vocabulary.
- Encourage global reading of simple words.

Materials Needed

- Cards with the words (I, yes, no).
- Corresponding pictograms.

Step-by-Step

1. Show the student the cards with the words.
2. Present the corresponding images and make the association.
3. Ask the student to reconstruct the pairs, identifying both pictograms and words.

Possible Adaptations

- Include alternative communication symbols (PCS, ARASAAC).
- Use cards with different textures for each word.

Teacher's Tip

- Encourage the student to use the words in short sentences ("I want," "I can't").
  This gives the activity practical meaning in daily life.

Inclusive Pedagogical Practices Guide – Section 1: Literacy and Language – Worksheet 5/20

Figure 31: Image-Word Association with Pictograms

Transcription (English):
Worksheet 6 – Image–Word Association with Pictograms
BNCC Skill

- EF01LP08: Relate sound elements with their written representation.

Activity Objective

- Stimulate early reading with visual support.
- Promote the association between image, word, and meaning.

Materials Needed

- Printed pictograms with everyday words.
- Cards with corresponding words.
- Movable letters.

Step-by-Step

1. Present simple pictograms to the student along with everyday words.
2. Show the corresponding written words, encouraging the association between image and word.
3. Ask the student to build the words using movable letters.

Possible Adaptations

- Replace pictograms with real photos if the student has difficulty with abstraction.
- Use colored clothespins for matching activities during gluing tasks.

Teacher's Tip

- Use real-life situations in class: show the "drink" pictogram and ask the student to dramatize the action. This strengthens the connection between image, word, and meaning.

Inclusive Pedagogical Practices Guide – Section 1: Literacy and Language – Worksheet 6/20

Figure 32: Modeling with Playdough

Transcription (English):
Worksheet 7 – Modeling with Playdough
BNCC Skill

- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Associate numbers with their corresponding quantities.
- Develop fine motor coordination through modeling.
- Stimulate early logical reasoning.

Materials Needed

- Playdough.
- Printed cards with numbers from 1 to 5.

Step-by-Step

1. Show the student the number and its corresponding quantity on a card.
2. Ask the student to model small balls matching the correct quantity.
3. Reinforce oral counting and the correspondence between number and quantity.

Possible Adaptations

- Begin with numbers 1 to 5, gradually increasing the sequence according to the student's understanding and skill level.

Teacher's Tip

- Playdough turns abstract concepts into concrete experiences, making mathematics more meaningful.

Inclusive Pedagogical Practices Guide – Section 2: Mathematics and Logical Reasoning – Worksheet 7/20

Figure 33: Organizing Objects by Color, Shape, and Size

Transcription (English):
Worksheet 8 – Sorting Objects by Color, Shape, and Size
BNCC Skill

- EFCICLO1MA07/ES/EJA: Build sequences of natural numbers in ascending or descending order starting from any given number, using an established regularity.

Activity Objective

- Stimulate object classification and sequencing.
- Develop visual perception and logical reasoning.

Materials Needed

- Buttons, bottle caps, blocks, and geometric shapes.

Step-by-Step

1. Present the student with various objects.
2. Guide the student to group them first by color, then by shape, and finally by size.
3. Encourage the student to replicate the ordered sequences.

Possible Adaptations

- Use picture cards when concrete objects are not available.
- Expand to more complex sequences (combining colors and sizes).

Teacher's Tip

- Vary the classification criteria (color, shape, size, thickness) to stimulate different cognitive skills.

Inclusive Pedagogical Practices Guide – Section 2: Mathematics and Logical Reasoning – Worksheet 8/20

Figure 34: Dice and Base-Ten Blocks Activity

Transcription (English):
Worksheet 9 – Dice and Base Ten Blocks
BNCC Skill

- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Relate numbers to their corresponding quantities.
- Stimulate oral and visual counting.
- Develop autonomy through play-based learning.

Materials Needed

- Number dice.
- Base ten blocks (units/cubes).
- Sheets with numerals and corresponding circles.

Step-by-Step

1. Guide the student to roll the dice and identify the number drawn.
2. Ask the student to place the corresponding number of cubes inside the circles on the sheet.
3. Reinforce oral counting and the correspondence between number and quantity.

Possible Adaptations

- Provide illustrated cards to enhance the association between number and object quantity.

Teacher's Tip

- Ask the student to record the rolled number on a sheet, linking written numbers, quantity, and counting.

Inclusive Pedagogical Practices Guide – Section 2: Mathematics and Logical Reasoning – Worksheet 9/20

Figure 34: “Number Box” Activity

Transcription (English):
Worksheet 10 – Number Box
BNCC Skill

- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Stimulate the relationship between numerals and real quantities.
- Develop organization, attention, and fine motor coordination.

Materials Needed

- Small numbered box.
- Various objects (whistle, sticks, geometric shapes).

Step-by-Step

1. Present the box with the objects to the student.
2. Have the student remove the items and classify them.
3. Link each group of objects to the corresponding number.

Possible Adaptations

- Use illustrated cards (e.g., images of 2 balls, 3 apples, etc.) along with the objects to help connect number–image–quantity.
- Attach different textures to the numbers on the box (felt, EVA foam, cotton) for students with visual impairments or those needing tactile stimulation.

Teacher’s Tip

- Use everyday items: bottle caps, clothespins, or small toys the student is familiar with. This makes the activity more meaningful and connected to real life.

Inclusive Pedagogical Practices Guide – Section 2: Mathematics and Logical Reasoning – Worksheet 10/20

Figure 35: Number Trail Game

Transcription (English):
Worksheet 11 – Number Trail Game
BNCC Skill

- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Stimulate sequential counting.
- Develop recognition of numerals up to 50.
- Promote logical reasoning through gameplay.

Materials Needed

- Game board with a numbered trail from 1 to 50.
- Dice and colored markers.

Step-by-Step

1. Roll the dice – the student rolls and observes the number of points.
2. Count the points aloud to reinforce counting.
3. Move along the trail – the student advances their marker according to the number rolled.

Possible Adaptations

- Work in pairs or trios to encourage cooperation and oral language.
- Reduce the trail (up to number 20) for beginners or students at an early counting stage.

Teacher's Tip

- Value playful learning: encourage students to count aloud, clap, or make gestures to represent the number rolled. This makes the activity more dynamic, strengthens memorization, and supports different learning styles.

Inclusive Pedagogical Practices Guide – Section 2: Mathematics and Logical Reasoning – Worksheet 11/20

Figure 36: Numerical Lacing Activity

Transcription (English):
Worksheet 12 – Number Lacing
BNCC Skill

- *EF01MA01/ES:* Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Reinforce recognition of numbers from 0 to 5.
- Develop fine motor coordination.
- Stimulate concentration and patience.

Materials Needed

- EVA sheets or cardboard with perforated numbers (0 to 5).
- Yarn or shoelaces.

Step-by-Step

1. Present the perforated numbers to the student.
2. Guide the student to pass the yarn through the holes while tracing each numeral.
3. Reinforce number identification throughout the activity.

Possible Adaptations

- Use thicker yarn or colored laces to make handling easier.
- As the student progresses, gradually introduce additional numbers.

Teacher's Tip

- Value the process, not just the result: encourage patience, motor coordination, and verbalization of numbers as the student laces them. This makes the activity more meaningful and enjoyable.

Inclusive Pedagogical Practices Guide – Section 2: Mathematics and Logical Reasoning – Worksheet 12/20

Figure 37: Tracing Varied Patterns

Transcription (English):
Worksheet 13 – Tracing Different Lines
BNCC Skill

- EI03EF05: Experiment with different tracing possibilities and pressure levels when using graphic instruments.

Activity Objective

- Develop fine motor coordination and control of tracing.
- Stimulate visual perception in different movement directions.

Materials Needed

- Sheets with dotted lines in various formats (curves, spirals, zigzag).
- Felt-tip pens, colored pencils, crayons, or paint with brushes.

Step-by-Step

1. Give the student sheets containing different line patterns.
2. Guide the student to trace over the dotted lines according to each format.
3. Repeat the activity using different colors and graphic tools.

Possible Adaptations

- Use enlarged sheets with thicker lines for beginners.
- Introduce more complex tracing patterns as the student progresses.

Teacher's Tip

- Encourage the student to vary speed and pressure while tracing, and discuss the differences.
  This supports motor awareness and prepares the student for structured writing.

Inclusive Pedagogical Practices Guide – Section 3: Motor Coordination – Worksheet 13/20

Figure 38: Collage with String for Quantities

Transcription (English):
Worksheet 14 – Gluing with Yarn
BNCC Skill

- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Associate numerals with quantities.
- Develop visual perception and fine motor coordination.

Materials Needed

- Sheets with numbers from 1 to 5.
- Yarn cut into pieces.
- Glue and brush.

Step-by-Step

1. Present the numbered sheets to the student.
2. Guide the student to glue yarn pieces representing each quantity.
3. Encourage the student to paint or fill the corresponding spaces after gluing.

Possible Adaptations

- Use yarn or wool with different textures and colors (rough, soft, fluffy) to reinforce tactile perception and differentiation.

Teacher's Tip

- Tactile activities enhance sensory perception and facilitate learning.

Inclusive Pedagogical Practices Guide – Section 3: Motor Coordination – Worksheet 14/20

Figure 39: Painting Letters and Numbers with Gouache

Transcription (English):
Worksheet 15 – Painting Letters and Numbers with Tempera Paint
BNCC Skill

- EI03EF05: Experiment with different tracing possibilities and pressure levels when using graphic instruments.
- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Develop fine motor coordination.
- Stimulate tactile and visual perception.
- Reinforce number/quantity association and letter tracing.

Materials Needed

- Printed sheets with letters and numbers.
- Tempera paint and brushes.

Step-by-Step

1. Present the student with the sheets containing letters and numbers.
2. Guide the student to paint the outlines with tempera paint.
3. Encourage counting and identification during the painting activity.

Possible Adaptations

- Use cotton swabs instead of brushes for more precise movements.
- Provide adapted brushes with thicker handles.
- Use stencils to help delimit painting spaces.

Teacher's Tip

- Encourage the student to choose meaningful letters/numbers (initial of their name, age, etc.). This creates an emotional bond with writing.

Inclusive Pedagogical Practices Guide – Section 3: Motor Coordination – Worksheet 15/20

Figure 40: Image Sequences for Cause and Effect

Transcription (English):
Worksheet 16 – Image Sequencing for Cause and Effect
BNCC Skill

- EI03ET04: Establish cause-and-effect relationships in everyday situations.

Activity Objective

- Develop logical reasoning and anticipation of consequences.
- Stimulate oral language and organization of ideas.

Materials Needed

- Simple image sequences (e.g., watering the plant → plant growing).
- Laminated cards or printed sheets.

Step-by-Step

1. Present the sequence in a random order.
2. Ask the student to identify and anticipate the correct sequence.
3. Complete the sequence together and discuss the result.

Possible Adaptations

- Create images with the student based on daily actions, such as filling a cup with water or planting a bean and recording each stage of growth.

Teacher's Tip

- Encourage the student to narrate what they see in the images and predict what will happen next. Ask, "What happens after this?" to stimulate oral language and logical reasoning.

Inclusive Pedagogical Practices Guide – Section 3: Motor Coordination – Worksheet 16/20

Figure 41: Association of Real Images

Transcription (English):
Worksheet 17 – Association with Real Images
BNCC Skill

- EI03EF09: Recognize letters of the alphabet, especially those in the child's own name.
- EF15LP03: Locate explicit information in texts and images.

Activity Objective

- Relate words to everyday images.
- Expand linguistic repertoire based on real-life experiences.

Materials Needed

- Real images of the student's home and school (Google Maps, printed photos).
- Cards with corresponding words ("house," "school").

Step-by-Step

1. Search with the student to locate images of their home and school.
2. For each image, present the corresponding word cards.
3. Guide the student to associate the image with the word, reinforcing reading and writing.

Possible Adaptations

- Include images of other places that are meaningful to the student, such as church, market, square, or bakery.

Teacher's Tip

- Make use of meaningful real-life images to reinforce comprehension and vocabulary development.
  Encourage the student to verbalize the words during the activity to strengthen language learning.

Inclusive Pedagogical Practices Guide – Section 4: Identity and Daily Life – Worksheet 17/20

Figure 42: Numerical Sequence with Gumdrops

Transcription (English):
Worksheet 18 – Numerical Sequencing with Jellybeans
BNCC Skill

- EF01MA01/ES: Use the meaning of natural numbers as an indicator of quantity.

Activity Objective

- Associate numbers with quantities in a concrete and playful way.
- Develop spatial organization and fine motor coordination.

Materials Needed

- Transparent plates.
- Cards with numbers from 1 to 5.
- Jellybeans.

Step-by-Step

1. Present the numbers from 1 to 5.
2. Encourage the association between numbers and quantities.
3. Ask the student to place the correct number of jellybeans on the plate/card.

Possible Adaptations

- Use deep or divided plates to help organize quantities.
- Offer large tweezers or tongs to promote coordination.
- Use different colors for each quantity (e.g., 1 red, 2 blue, 3 green).

Teacher's Tip

- Stimulate anticipation: ask, "How many do you think you'll need here?" — the student then tries to predict the quantity, strengthening logical reasoning.

Inclusive Pedagogical Practices Guide – Section 4: Identity and Daily Life – Worksheet 18/20

Figure 43: “Which One Doesn’t Belong?” Activity

Transcription (English):
Worksheet 19 – Game “Which One Is the Intruder?”
BNCC Skill

- EI03ET06: Relate objects, people, and situations by identifying similarities and differences.
- EF01LP08: Relate sound and visual elements with their written representation.

Activity Objective

- Develop logical reasoning and visual attention.
- Stimulate comparison and classification of objects.

Materials Needed

- Image cards in which one item does not belong to the group.

Step-by-Step

1. Present the image card to the student.
2. Encourage the student to identify which image does not match the others.
3. Ask the student to explain their choice.

Possible Adaptations

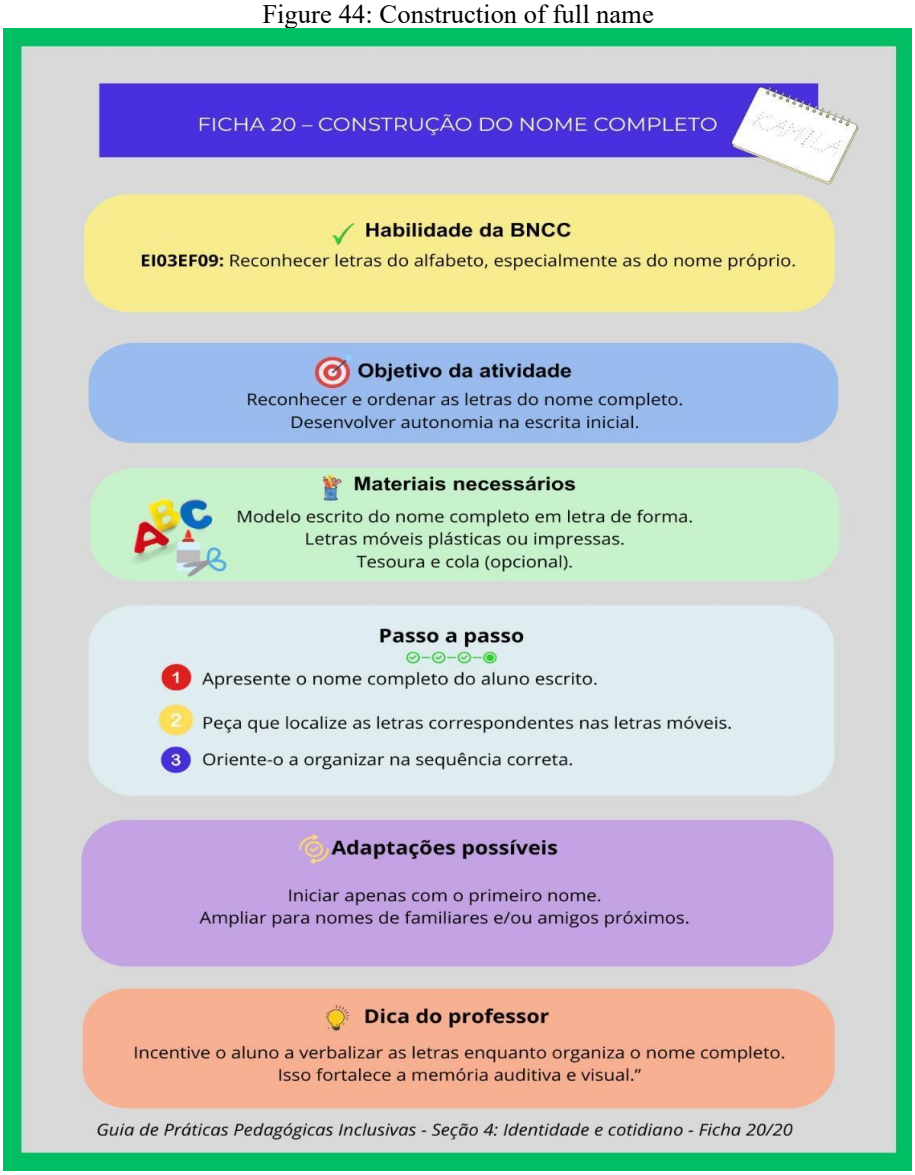
- Use fewer images (3 or 4) for beginners.
- Expand to more complex categories (animals, fruits, school objects).

Teacher’s Tip

- Explore the student’s reasoning. Ask them to explain why they chose a certain image as the intruder. This stimulates language, logical thinking, and the ability to justify choices.

Inclusive Pedagogical Practices Guide – Section 4: Identity and Daily Life – Worksheet 19/20

Figure 44: Construction of full name



Transcription (English):
Worksheet 20 – Building the Complete Name
BNCC Skill

- EI03EF09: Recognize letters of the alphabet, especially those in the child's own name.

Activity Objective

- Recognize and sequence the letters of the complete name.
- Develop autonomy in early writing.

Materials Needed

- Written model of the student's complete name in block letters.
- Movable letters (plastic or printed).
- Scissors and glue (optional).

Step-by-Step

1. Present the written model of the student's complete name.
2. Ask the student to find the matching movable letters.
3. Guide the student to organize the letters in the correct sequence.

Possible Adaptations

- Begin using only the first name.
- Expand to include names of family members or close friends.

Teacher's Tip

- Encourage the student to say the letters out loud while assembling the complete name. This strengthens auditory and visual memory.

Inclusive Pedagogical Practices Guide – Section 4: Identity and Daily Life – Worksheet 20/20

RESULTS AND DISCUSSION

The results achieved through the pedagogical practice carried out in the Resource Room of the Specialized Educational Assistance (SEA) with the deaf student demonstrated notable improvements in motor, cognitive, and language areas. The activities were structured progressively and intentionally, allowing for the observation of advances in fine motor coordination, recognition of letters and numbers, and the connection between images, words, and meanings. These findings reinforce that when teaching is designed based on the Universal Design for Learning (UDL), access to knowledge becomes more equitable and relevant, respecting each student's individual pace and characteristics.

Throughout the implementation of the activities, continuous progress was observed in visual attention and the ability to recognize symbols and patterns. The inclusion of tangible resources such as movable letters, pictograms, and sensory materials contributed to engagement and content assimilation. According to Capovilla and Raphael (2008), visual stimulation is one of the foundations of learning for deaf students, as visual perception and memory often compensate for the absence of the auditory channel. In this context, the adoption of adapted materials and bilingual mediation proved essential for enhancing the student's linguistic and cognitive skills.

The analysis of the activities indicated that the use of playful and sensory approaches fostered the student's autonomy and self-confidence. Active engagement in activities such as cutting, painting, games, and writing helped consolidate her identity and value her achievements, even if small. This path of meaning-making, mediated by tangible and affective experiences, strengthens the conceptions of Stainback and Stainback (1999) regarding the importance of inclusion as an educational practice that recognizes diversity as an opportunity for learning.

Finally, this collaborative experience throughout the master's program revealed to us that pedagogical planning—comprehensive, continuous, and participatory, as guided by Freire (1996) in his pedagogy of the oppressed and of autonomy—demonstrates that sensitivity and access to Specialized Educational Assistance (SEA) are decisive for the educational success of students with hearing impairments.

Thus, our case study at Leonardo da Vinci University provided evidence to our group that school inclusion goes far beyond the physical presence of the student: it is realized in daily pedagogical practice, in active listening and observation of students, and in the analysis and investigation of the recognition of each individual's uniqueness.

CONCLUSION

The practical experience reported in this study makes it clear that educating students with hearing impairments requires more than simply adapting activities or providing specialized resources. Effective

inclusion is a true challenge—constructing a teaching process in which the agent (student) is heard, respected, and, above all, recognized demands an ethical commitment from education professionals to support the student's holistic development. The practical guide presented proved to be an effective tool in promoting meaningful learning, fostering cognitive, linguistic, and socio-emotional development, while respecting each student's pace and specificities. The experiences analyzed demonstrate that when pedagogical practice is thoughtfully designed, it is possible for the student to overcome barriers and advance in their learning process. In this way, the student not only progresses in literacy but also builds knowledge autonomously, at their own rhythm.

The results observed reinforce the relevance of the work and show that collaboration among teachers, Libras interpreters, and family members is fundamental to the student's learning process. This collaboration forms a vital support network for creating a school environment where the student feels seen, safe, and capable of evolving and achieving success. Small advances gain significance when repeated through different approaches and combined with concrete and playful resources. Maintaining this engagement depends on intentional practice that values each achievement—no matter how small—and on strategies that help the student assume greater autonomy.

On the other hand, it is important to emphasize that this work is not limited to the classroom. The pedagogical guide proposed here can be expanded to other educational contexts, reaching schools in different municipalities and states, and serving as reference material for continuing education programs, outreach projects, and public inclusion policies.

From an academic perspective, the pedagogical guide can be further explored in master's and doctoral research, becoming a theoretical-practical reference for teacher training and for the enhancement of bilingual practices in Libras and Portuguese. Its applicability goes beyond a specific case, adapting to other demands of special education in diverse realities.

In summary, from a broader social perspective, this work can contribute to the deconstruction of stigmas and prejudices that still surround the inclusion of people with disabilities. By demonstrating that everyone can learn when given appropriate conditions and accessible methodologies, new paths open to infinite possibilities. When public policies go beyond concerns with physical infrastructure and begin to recognize the human value of education professionals, the school environment reorganizes and transforms in meaningful ways. The school must transcend toward teaching practices grounded in flexibility, creativity, and sensitivity, so that educators can effectively respond to the real needs of each student. The testimonies of active participants in the practical guide showed that inclusion manifests within school practices, in daily pedagogical choices, and in the recognition that each student carries the potential for transformative experiences. These breakthroughs require the working group to revisit school practices,

engage in ongoing teacher training, and, above all, foster cultural change—one that recognizes "differences" as potential, not as limitations.

Ultimately, this experience reinforces that inclusion is realized in the everyday life of the school, in small pedagogical decisions, and in the human relationships established around learning and teaching. Educating within diversity is, above all, a political act and an act of hope. Overcoming the intrinsic harms of prejudice and creating alternative paths is not an act of kindness, but rather a fulfillment of duties and rights, promoting a more humane, plural, and socially equitable school. In this way, the proposed guide not only contributes to the advancement of learning for students with hearing impairments but also establishes itself as a tool for social transformation, capable of inspiring fairer, more creative, and more equitable practices throughout the national territory. By humanizing relationships, the school reinvents itself and strengthens its role as a welcoming space for coexistence and citizenship.

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THE POSITIVE IMPACT OF AMBASSADORS IN AN ENGLISH SCHOOL IN AMERICAN TERRITORY

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ABSTRACT
This study addressed the positive impact of educational ambassadors in an English language school located in the United States, taking as reference the institution Approach International Student Center, situated in Boston, Massachusetts. The research aimed to understand how the role of these ambassadors contributed to the teaching-learning process of the English language and to the cultural integration of foreign students, highlighting their role as social and cultural mediators in an international educational environment. The study adopted a qualitative and bibliographic approach, grounded in authors who discuss language teaching, communicative approaches, and interculturality, such as Krashen, Brown, Larsen-Freeman, Richards, Rodgers, and Celce-Murcia, as well as scholars of the internationalization of education, including Knight, De Wit, and Byram. The theoretical review revealed that learning a foreign language is directly related to cultural immersion and social interaction, and that ambassadors exert significant influence on student reception, motivation, and active participation. It was found that the educational model adopted by Approach, based on communicative and intercultural practices, fostered both linguistic and personal development, transforming the learning process into a more humanized and meaningful experience.The theoretical analysis also showed that the presence of ambassadors strengthened the sense of belonging and multicultural coexistence, promoting values of empathy, respect, and cooperation. It was concluded that the ambassadors' role contributed to strengthening the academic community and enhancing the educational experience at the studied school, demonstrating that the integration of language, culture, and social interaction is essential for the success of international education programs.

Keywords: Educational ambassadors; Language teaching; Interculturality; Internationalization; Approach.

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LATTES: http://lattes.cnpq.br/8413778291707095

INTRODUCTION

Language teaching in an international context has gained increasing relevance in the globalized educational scenario, as learning a new language represents not only mastering linguistic structures but also immersing oneself in different cultures, values, and ways of thinking. Within this panorama, English has consolidated itself as the main language of international communication, playing a central role in processes of academic, professional, and cultural integration.

In this context, institutions specializing in teaching English to foreigners, such as Approach International Student Center, located in Boston (Massachusetts, USA), perform a strategic function in shaping global citizens and promoting intercultural dialogue.

The choice of Approach as the object of study is justified by the relevance of its pedagogical proposal, which combines academic excellence, cultural diversity, and human-centered support. Among its innovative practices, the educational ambassador program stands out as a fundamental initiative to strengthen community spirit, facilitate the adaptation of international students, and enrich the learning experience. These ambassadors act as cultural and social mediators, fostering an environment of cooperation, empathy, and knowledge exchange—elements that directly contribute to the success of the educational process.

The general objective of this study is to analyze the positive impact of ambassadors on the pedagogical and social dynamics of Approach, observing how their role influences student engagement, cultural integration, and language learning. Specifically, it seeks to: understand the relevance of communicative and intercultural approaches in teaching English to foreigners; identify the role of ambassadors as agents of integration and cultural mediation; and discuss the internationalization model adopted by the institution.

The hypothesis is that the ambassadors' role at Approach significantly contributes to creating a more welcoming, participatory, and humanized educational environment, favoring not only English language learning but also the development of social and intercultural competencies. This experience, by integrating teaching, coexistence, and diversity, reflects a pedagogical model aligned with the demands of contemporary education.

The work is structured into four main parts. After this introduction, the methodology is presented, describing the research path and theoretical foundation. Next, the development is divided into three sections: the first addresses language teaching in an international context and the main communicative and intercultural approaches; the second analyzes the role and functions of educational ambassadors; and the third describes the Approach school and its internationalization model. Finally, the conclusion presents final considerations on the theoretical results and reflections obtained throughout the study, highlighting the relevance of ambassadors as agents of educational and social transformation.

METHODOLOGY

This study is characterized as qualitative research with a bibliographic nature, developed through the analysis of books, scientific articles, and academic publications related to language teaching in an international context, focusing on teaching English to foreigners in the United States. The objective was to understand, through a literature review, the main communicative and intercultural approaches that guide pedagogical practices in this scenario.

According to Gil (2019), bibliographic research consists of collecting, reading, and interpreting previously elaborated materials, such as books, articles, and theses, with the purpose of deepening knowledge on a given topic. Thus, theoretical sources from recognized authors in applied linguistics and language teaching methodology were selected, including Krashen (1982), Larsen-Freeman (2000), Brown (2007), Richards and Rodgers (2014), and Celce-Murcia (2008), in addition to studies addressing interculturality in the teaching-learning process.

The analysis was conducted descriptively and interpretatively, seeking to identify convergences and relevant contributions to understanding the impact of communicative and intercultural approaches on English learning by foreign students, especially in the context of language schools located in the United States, such as Approach School in Boston (MA).

DEVELOPMENT

LANGUAGE TEACHING IN AN INTERNATIONAL CONTEXT

Language teaching in an international context has become one of the pillars of contemporary globalization, reflecting not only the need for communication among different peoples but also the pursuit of cultural, academic, and professional integration. In the United States, English language teaching for foreigners (English as a Second Language – ESL or English as a Foreign Language – EFL) occupies a prominent position, as the country is one of the main destinations for international students seeking to improve their linguistic and cultural competencies.Specialized schools, such as Approach, located in Boston (Massachusetts), play an essential role in this process, offering multicultural environments and methodologies that go beyond grammar, promoting true linguistic and social immersion.

Teaching English to foreigners in the United States is not limited to formal language instruction but involves integrating the student into a real communicative ecosystem, where everyday interaction serves as the primary learning tool. According to Brown (2007), second language acquisition is a dynamic process that depends on active student engagement, intrinsic motivation, and continuous exposure to the language in authentic contexts. In this sense, the American environment offers unique

opportunities, allowing students to experience real communication situations, from interacting with native speakers to participating in academic, cultural, and professional activities.

Krashen's (1982) Comprehensible Input theory is one of the most influential conceptual foundations in this field. The author argues that language learning occurs most effectively when students are exposed to linguistic content slightly above their current proficiency level (i+1), enabling comprehension to occur naturally and contextually. At schools like Approach, this theory is applied through methodologies that prioritize language use in real communicative situations, encouraging students to understand and produce meaning rather than memorize isolated rules. This perspective aligns with the immersion model, in which language is both the means and the end of learning.

Complementarily, communicative and intercultural approaches have transformed language teaching in recent decades, shifting the focus from the teacher as a transmitter of knowledge to the student as the protagonist of the learning process. Larsen-Freeman (2011) emphasizes that the communicative approach aims to develop communicative competence—that is, the learner's ability to use the language appropriately in diverse social contexts. This competence goes beyond verbal fluency, encompassing pragmatic, sociocultural, and strategic aspects. Thus, English teaching incorporates authentic interaction situations, simulations of everyday communication, and discussions that promote functional language use.

Richards and Rodgers (2014) also highlight that the communicative approach is based on principles such as the centrality of meaning, learning through interaction, and the integration of the four language skills (listening, speaking, reading, and writing). Unlike traditional methods focused on repetition and translation, communicative methodologies propose task-based activities (Task-Based Learning), in which students are encouraged to solve problems, negotiate meaning, and collaborate with peers, developing both linguistic skills and social competencies. This practice is particularly effective in multicultural environments, such as Approach in Boston, where students from different nationalities share experiences and perspectives, enriching mutual learning.

In addition to the communicative component, the intercultural dimension has become indispensable in language teaching in an international context. As Celce-Murcia (2007) observes, language cannot be dissociated from the culture that sustains it, as learning a language also means learning new ways of thinking, acting, and understanding the world. In this sense, English teaching should include the development of intercultural competence—the ability to understand, respect, and engage in dialogue with other cultures empathetically and consciously. This competence is essential in institutions that host students from multiple backgrounds, allowing the learning process to go beyond linguistic acquisition and promoting values of diversity, tolerance, and global citizenship.

At Approach, intercultural contact is experienced daily, both inside and outside the classroom. Students interact with peers from different countries, participate in multicultural events, and engage in activities led by student ambassadors, who act as cultural and linguistic mediators. This coexistence fosters communicative fluency and strengthens self-confidence while expanding participants' cultural repertoire. As Brown (2007) emphasizes, meaningful learning occurs when students are emotionally and socially engaged, making English teaching in an international context a profoundly human and transformative process.

Thus, it can be affirmed that teaching English to foreigners in the United States—especially in schools with an educational philosophy oriented toward interculturality, such as Approach—represents much more than the mere acquisition of a foreign language. It is an integral formative experience that unites communication, culture, and identity. Communicative and intercultural approaches, supported by authors such as Krashen (1982), Larsen-Freeman (2011), Brown (2007), Richards and Rodgers (2014), and Celce-Murcia (2007), have consolidated themselves as indispensable foundations for promoting authentic, meaningful, and globalized learning, preparing students to act competently and sensitively in an increasingly interconnected world.

THE ROLE OF EDUCATIONAL AMBASSADORS

In the context of language teaching and the internationalization of education, the figure of educational ambassadors—or student ambassadors—has gained prominence as an essential link between the institution, students, and the school community. These ambassadors play a strategic role in cultural mediation, welcoming new students, and promoting a collaborative and inclusive environment. In English schools for foreigners, such as Approach, located in Boston (Massachusetts, USA), the work of ambassadors becomes even more significant, as it directly contributes to the linguistic, social, and emotional integration of international students.

The concept of student ambassador is closely related to the idea of academic and social engagement. Astin (1984), in his student involvement theory, emphasizes that the greater the students' involvement in academic and extracurricular activities, the greater their cognitive, affective, and social development. By acting as bridges between the school and the student body, ambassadors encourage active student participation, fostering a sense of belonging that positively impacts learning. In multicultural institutions, this role is even more crucial, as foreign students often face linguistic and cultural adaptation challenges that can affect their confidence and academic performance.

The work of ambassadors at Approach reflects precisely this function of human and cultural mediation. They assist in welcoming new students, clarify doubts about academic and cultural procedures, encourage English communicative practice, and facilitate integration among students of

different nationalities. According to Kuh (2008), peer interaction is one of the most influential factors in the educational experience, as learning occurs not only inside the classroom but also through interpersonal exchanges and shared experiences. Thus, ambassadors contribute to creating a learning community where cooperation and empathy become fundamental pillars of linguistic and social development.

In addition to promoting social integration, educational ambassadors act as models of leadership and intercultural communication. Tinto (1993) argues that student persistence and success in educational contexts largely depend on the quality of interactions established within the institution. In this sense, ambassadors exert a positive influence on new students, offering emotional and practical support, sharing experiences, and providing reassurance during the adaptation process. This supportive relationship creates an environment of trust and belonging that encourages active participation and reduces linguistic and cultural barriers.

From the perspective of educational psychology, the ambassadors' role can also be understood through Bandura's (1977) social learning theory, which posits that human behavior is shaped by observation and imitation of models. Ambassadors, through their example, inspire peers to adopt positive attitudes toward learning, coexistence, and overcoming challenges. This observational and motivational dimension is particularly relevant in language teaching contexts, where self-confidence and communicative exposure are determining factors for linguistic progress. By observing ambassadors communicating with fluency and empathy, other students feel encouraged to participate more actively and apply what they learn.

Another fundamental aspect of the ambassadors' role relates to intercultural competence, a concept widely discussed by Byram (1997), who defines it as the ability to interact effectively and appropriately with people from other cultures. By mediating interactions among students of diverse nationalities, ambassadors develop and foster skills such as tolerance, respect for differences, and openness to dialogue. In schools like Approach, where students from Latin America, Europe, Asia, and Africa coexist, these competencies become indispensable for building a harmonious and truly international educational environment.

From an institutional perspective, ambassador programs also strengthen the school's identity and reputation. Chickering and Reisser (1993) affirm that learning and student development are deeply linked to creating communities that encourage personal and collective growth. Ambassadors, by representing the institution's philosophy and promoting its values, become agents of cultural and institutional dissemination, contributing to strengthening the school's image within the academic community and to the external public. In the case of Approach, the work of these students reflects the

school's commitment to pedagogical excellence and to welcoming different cultures in a space of learning and mutual respect.

The practice of ambassadors, therefore, goes beyond administrative functions and reaches pedagogical and human dimensions. They symbolize the ideal of cooperative learning and transformative education, as their presence fosters empathy, solidarity, and appreciation of diversity. Coexistence with peers from different countries and personal backgrounds expands students' sociocultural repertoire, making English learning a process that goes far beyond grammar and vocabulary—it becomes an experience of personal growth and cultural exchange.

In summary, educational ambassadors exert a profound positive impact on language teaching institutions, especially in international contexts such as Approach. By combining leadership, empathy, and intercultural communication, they contribute to students' holistic development and to the consolidation of a global school community. Their role reflects a humanized pedagogy, centered on relationships and dialogue, in line with the principles of meaningful learning and education as a practice of coexistence and transformation.

APPROACH SCHOOL IN BOSTON AND ITS INTERNATIONALIZATION MODEL

The Approach International Student Center, located in Boston, Massachusetts (USA), is one of the English language teaching institutions that best represent the contemporary model of educational internationalization. Founded with the mission of providing quality education to students from diverse backgrounds, the school has established itself as a space for intercultural coexistence and meaningful learning. Its pedagogical model combines linguistic excellence, human-centered support, and opportunities for personal development, reflecting the principles of communicative and intercultural approaches in language teaching.

Boston, considered one of the world's leading educational hubs, hosts renowned universities such as Harvard and MIT and attracts thousands of international students annually. In this context, Approach emerges as an institution that responds to the demands of a globalized society, offering intensive English programs, courses aimed at academic and professional purposes, and a set of cultural and social activities that extend learning beyond the classroom. As Knight (2004) observes, internationalization of education goes far beyond student mobility; it involves integrating intercultural and global dimensions into the purpose, function, and delivery of education. Approach materializes this vision by integrating culture, language, and social interaction as inseparable parts of its educational process.

The teaching model adopted by the school reflects the understanding that learning a language is also living a cultural experience. Inspired by theories such as Krashen (1982) and Brown (2007), the

institution promotes methodologies based on communication and linguistic immersion, offering students real opportunities for interaction. Classes are conducted by qualified teachers who act as knowledge mediators, encouraging the use of English in everyday and academic contexts. This pedagogical perspective aligns with the communicative approach proposed by Larsen-Freeman (2011) and Richards & Rodgers (2014), which emphasize learning through the exchange of meanings and collaborative knowledge construction.

In addition to academic excellence, Approach stands out for its commitment to welcoming and including international students. The school's multicultural environment is carefully designed to provide comfort, belonging, and respect for linguistic, cultural, and religious diversity. According to De Wit (2011), internationalization should be understood as an intentional process of integrating intercultural and global dimensions into education, aiming to improve quality and contribute to society. Approach applies this principle in practice, promoting a space where learning English also becomes an exercise in coexistence, empathy, and dialogue among different worldviews.

One of the most distinctive features of the school's internationalization model is the student ambassador program, which reinforces the connection between teaching and intercultural experience. These ambassadors act as mediators between new students and the institution, assisting with adaptation, encouraging English use in daily life, and promoting multicultural integration events. This initiative exemplifies Kuh's (2008) view that active student involvement in academic and social experiences is essential for holistic development and educational success. Thus, the ambassador figure is not merely symbolic but pedagogical, representing the incorporation of leadership, solidarity, and intercultural communication values into school life.

The success of the model adopted by Approach is also linked to its student-centered institutional philosophy. The school understands that each learner has a unique trajectory, with individual rhythms, motivations, and challenges. Therefore, its methodologies are personalized, promoting a balance between formal instruction and practical experiences. This perspective aligns with Brown's (2007) view that learner-centered education is fundamental for second language acquisition. By valuing autonomy and student protagonism, Approach fosters meaningful learning, in which the student is not merely a knowledge recipient but an active agent of their own formation.

Another relevant aspect of Approach's internationalization model is the encouragement of social and cultural immersion. The school organizes extracurricular activities, cultural outings, and volunteer programs that allow students to apply English in real contexts, expanding their communicative and intercultural competencies. This practice resonates with Dewey's (1938) idea of learning by doing, which conceives education as a living, dynamic, and transformative experience. In this context, learning

transcends classroom boundaries and connects to everyday life, becoming a continuous process of discovery and belonging.

The cultural diversity present in Approach's environment is another key element for consolidating its international identity. Students from Latin America, Europe, Asia, and Africa coexist daily in the same learning space, exchanging experiences and building relationships that transcend linguistic boundaries. This coexistence reflects what Byram (1997) calls intercultural communicative competence, that is, the ability to understand and respect different cultures, engaging in dialogue empathetically and consciously. By fostering this type of interaction, the school contributes not only to English language mastery but also to the formation of global citizens capable of acting critically and responsibly in an interdependent world.

Finally, the Approach International Student Center can be understood as a practical example of what is now conceived as humanized international education—a model that combines academic rigor with hospitality, diversity, and cultural sensitivity. Its commitment to students' holistic development, the promotion of cultural exchange, and the strengthening of human bonds makes it a reference institution in English language teaching in the United States. More than teaching a language, Approach teaches a way of seeing the world: with openness, respect, and empathy.

CONCLUSION

This study provided a broad and in-depth understanding of the positive impact of educational ambassadors in the context of teaching English as a foreign language, taking as reference the pedagogical and institutional model of Approach International Student Center, located in Boston, Massachusetts (USA). The analysis revealed that the role of these ambassadors goes far beyond a representative or administrative function; it constitutes an essential role in cultural mediation, promoting social integration, and strengthening learning in multicultural environments. In a globalized scenario, where English has consolidated itself as a tool for communication and mobility, initiatives such as the ambassador program become fundamental to humanizing and enriching the educational process.

The research, of bibliographic and qualitative nature, was based on authors such as Krashen (1982), Brown (2007), Larsen-Freeman (2011), Richards and Rodgers (2014), and Celce-Murcia (2008), whose theoretical contributions elucidate the importance of communicative and intercultural approaches in language teaching. Based on this literature, it was possible to identify that meaningful learning occurs when students are exposed to real communication situations and are encouraged to actively participate in constructing their own knowledge. Constant interaction, social engagement, and welcoming practices are elements that enhance learning and human development, which were widely reinforced by the practices observed in the studied institution.

The theoretical results indicated that the model adopted by Approach favors students' holistic development, combining linguistic learning with intercultural experience. The presence of ambassadors, in this context, represents a pedagogical differential, as they act as bridges between different cultures, assisting new students in adapting to school routines and life in the United States. Their role promotes engagement and cooperation, encourages the use of English in authentic contexts, and contributes to building a supportive and plural educational community. This dynamic reflects an educational model that transcends the classroom, expanding the teaching-learning process to spheres of coexistence, respect, and empathy.

It was also found that Approach International Student Center is an institution that incorporates into its practice the principles of internationalization of education, as discussed by authors such as Knight (2004) and De Wit (2011). The school integrates cultural and global dimensions into its methodology, enabling students to learn English not only as a communication tool but as an instrument of interaction and intercultural understanding. By promoting immersion activities, volunteer programs, and multicultural events, the institution reinforces the idea that learning a language is, above all, learning to coexist and dialogue with others.

Thus, the research confirmed the hypothesis that educational ambassadors play a decisive role in consolidating a more inclusive, participatory, and humanized school environment. They contribute not only to students' academic development but also to their personal and social formation, strengthening the sense of belonging and intercultural awareness. The experience described demonstrates that the presence of ambassadors can transform the school into a living space of symbolic exchanges, where learning occurs collaboratively and affectively.

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ACTIVE METHODOLOGIES AND GAMIFICATION AS A LEARNING ENGAGEMENT STRATEGY: AN EXPERIENCE REPORT USING KAHOOT IN THE CLASSROOM

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ABSTRACT

This article was written by students on the Master's course in Education at the Leonardo da Vinci University, on the subject of "Active methodologies and gamification" and presents a reflection on the role of active methodologies in the educational process, highlighting gamification as a resource capable of promoting greater student motivation, participation and autonomy in an inclusive manner. The experience reported consisted of using the Kahoot application in the classroom to assess content and stimulate interaction between students. The study shows that by transforming assessment into a playful activity, the digital resource contributed to engagement, collaboration and the retention of content in a dynamic way. The research proved to be important as a didactic tool for students with Autism Spectrum Disorder because the teacher's mediation as a guide to the process favors a more meaningful and inclusive learning environment. Thus, the practice revealed that gamification can be an effective strategy for boosting results in the contemporary educational context.

Keywords: Gamification; Inclusion; Learning.

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INTRODUCTION

The use of active methodologies combined with gamification proves to be an effective strategy for engaging autistic students, as it promotes active participation, motivation, and knowledge construction in a playful and meaningful way. Tools such as Kahoot enable interactive activities mediated by technology, transforming learning into a more dynamic and accessible experience (Schneider et al., 2024). For autistic students, gamification contributes to organizing thought, developing attention, and fostering socialization, while respecting different learning paces.

The combination of challenges, rewards, and immediate feedback stimulates autonomy and reduces the anxiety often present in traditional assessment processes. In this context, the teacher's role is fundamental as a mediator, ensuring necessary adaptations and encouraging cooperation among peers. Thus, gamification, when integrated with active methodologies, can become an inclusive resource, promoting learning and social interaction among students in the school environment.

The contemporary educational scenario has undergone significant transformations, driven by constant technological evolution and new social and cognitive demands from students. In this context, Alves (2018) asserts that it is essential to rethink traditional teaching methods, seeking alternatives that foster greater interaction, motivation, and active participation in the learning process. Active methodologies emerge as pedagogical approaches that place the student at the center of knowledge construction, encouraging critical thinking, autonomy, and collaborative problem-solving.

Among the various strategies linked to active methodologies, gamification stands out as an innovative resource capable of enhancing engagement and making learning more dynamic and meaningful. By incorporating typical game elements—such as challenges, rewards, immediate feedback, and level progression—gamification fosters the creation of motivating environments, stimulating curiosity and student persistence in proposed activities.

This article, produced by students in the Master's program in Education at Leonardo da Vinci University, aims to analyze the applicability of active methodologies, focusing on gamification as a pedagogical strategy aimed at increasing engagement and improving teaching-learning processes. It seeks to understand how the integration of these approaches can contribute to building more attractive, interactive, and effective educational experiences, considering the challenges and possibilities of current teaching practices. Thus, it intends to offer theoretical and reflective contributions that support the adoption of innovative methodologies aligned with the needs of 21st-century learners.

The article will be structured as follows: Chapter 2 will briefly discuss the importance of active methodologies in the school context, presenting them as useful tools for student learning. Subsection 2.1 will address Project-Based Learning and exemplify the development of a recyclable waste collection app. Subsection 2.2 will describe the flipped classroom methodology, which consists of reversing actions that

occur inside and outside the classroom. Subsection 2.3 will conceptualize gamification in pedagogical practice to develop socio-emotional skills and new learning for students with ASD. Chapter 3 and its subsections will report the conception, implementation, and analysis of an educational product based on the use of the Kahoot platform. Chapter 4 will describe the methodology adopted in the research, which was designed as descriptive, qualitative, and bibliographic, with its analysis in field research. Chapter 5 will present the analyses and discussions of the research addressed in this article, emphasizing that active methodology strategies aim to reorganize traditional teaching. Finally, conclusions and theoretical references will be provided.

METHODOLOGY

The research is characterized as bibliographic, as it is based on the analysis of previously published works, such as books, scientific articles, dissertations, theses, and official documents related to the topic under study. According to Gil (2008), bibliographic research is developed from materials prepared earlier, allowing the researcher access to a broad theoretical framework capable of supporting the proposed reflection. In this sense, a careful selection of current and recognized academic sources was carried out, with the aim of gathering different theoretical perspectives and identifying relevant contributions to understanding the phenomenon investigated.

This is a qualitative research approach, as it does not seek to quantify data but rather to understand, interpret, and discuss the meanings attributed to the object under analysis. According to Minayo (2001), qualitative research works with a universe of meanings, values, and attitudes, enabling an in-depth reading of the reality studied. Thus, the methodology adopted allows for understanding the complexity of the phenomenon investigated, highlighting its subjective and interpretative aspects, in order to build a critical and well-founded analysis based on the theoretical framework consulted.

Regarding the procedures, the research involved several stages and specific techniques. It is characterized as bibliographic, based on books, scientific articles, theses, and dissertations that discuss active methodologies, gamification, and inclusive pedagogical practices. According to Gil (2008), bibliographic research, developed from previously prepared materials, allows for gathering a broad theoretical framework, contributing to the construction of critical analyses of the object investigated. In this sense, a careful selection of current and recognized academic sources was carried out, with the aim of gathering different theoretical perspectives and identifying relevant contributions to understanding the phenomenon investigated.

Next, a case study was applied, which describes and analyzes the practical application of the Kahoot tool in the classroom, with direct observations, interaction records, and collection of qualitative and quantitative data through questionnaires, engagement records, and informal interviews with students

and teachers, allowing the identification of potentialities, limitations, and pedagogical implications of the resource in the learning context. This combination of sources and techniques enabled data triangulation and a robust analysis of the engagement dynamics promoted by Kahoot.

As for the methodological approach, this is a qualitative investigation, as it does not aim to quantify data but to understand and interpret educational phenomena in their context. According to Minayo (2001), qualitative research works with meanings, values, and attitudes, which aligns with the purpose of this study, centered on analyzing perceptions and the impacts of using Kahoot as a pedagogical resource. This choice allows capturing nuances related to engagement, motivation, and student inclusion—aspects that would hardly be revealed by quantitative methods alone.

In terms of nature, the research is classified as applied, as it seeks to produce knowledge aimed at solving specific problems in the educational field, especially regarding the use of gamification and active methodologies as teaching and inclusion strategies. Unlike basic research, which focuses on expanding theories without immediate commitment to practice, applied research concentrates on concrete and usable results in everyday pedagogy.

Thus, the methodology adopted can be summarized as applied research, with a qualitative approach, bibliographic foundation, and experience report, suitable for understanding and discussing the role of gamification in the teaching-learning process, especially concerning the inclusion of students with Autism Spectrum Disorder. This combination not only allowed the study to be grounded in solid references but also enabled the analysis, in a real context, of the potentialities and challenges of using Kahoot as a pedagogical resource. By articulating theory and practice, the investigation contributed to understanding innovative teaching strategies and reaffirmed the importance of active methodologies and gamification as pathways for building an inclusive, dynamic, and meaningful education. This classification highlights the relevance of the investigation both theoretically and practically, reaffirming the research's commitment to innovative and inclusive education.

ACTIVE METHODOLOGIES: A BRIEF HISTORICAL OVERVIEW

Active learning methodologies are pedagogical approaches that place the student at the center of the teaching-learning process, encouraging active participation, collaboration, and autonomy in knowledge construction. They emerged as an alternative to traditional teaching, where the teacher was the holder of knowledge and the student a passive recipient (Bacich; Moran, 2018).

Instead of focusing on the transmission of information by the teacher, active methodologies seek to engage students in practical activities, such as problem-solving, projects, debates, and case studies, where they are encouraged to question, research, experiment, and build their own knowledge (Martins; Silva; Almeida, 2021). With encouragement from the teacher, students begin constructing knowledge

based on a presented problem, an exposed concept, or even a current situation introduced and studied by them.

The word "methodology" derives from "method," originating from the Latin methodus, which means "path or way to accomplish something." The method, in turn, is the process used to achieve a specific goal or acquire knowledge. According to Nascimento and Feitosa (2020), in the educational context, teaching methodology refers to the application of different methods to conduct the teaching-learning process.

They arose from a reflective need, which marked a stimulus to critical thinking, whether personal or social, where the search for something new clarified a doubt or question. In other words, they did not emerge at a single moment or from a single author, but rather as an evolutionary movement over time, influenced by various theorists and educators.

Although many believe that the so-called "active methodology" is a recent concept, its essence is ancient. Aristotle already referred to it, as did the Chinese thinker Confucius, who, around 500 B.C., wrote: "What I hear, I forget; what I see, I remember; what I do, I understand."

The proposal for an education that actively involves and stimulates learners has existed for centuries, although the term itself is modern. Thinkers such as Paulo Freire, John Dewey, Malcolm Knowles, Carl Rogers, and Lev Vygotsky did not use the expression "active learning," but advocated practices aligned with these principles. Going even further back in history, Socratic philosophy in the 5th century B.C. sought to provoke listeners through the interrogative method. If we were to look for an "originator" of this approach, we would need to go back millennia in the history of education (Nascimento; Feitosa, 2020).

The term "active learning" was introduced only in the 1930s by the English professor R. W. Revans (1907–2003). In general terms, active learning encompasses any activity that goes beyond simple listening, involving reading, writing, discussion, or problem-solving. It is considered active because, unlike the traditional lecture, it does not limit itself to passive listening, which requires little mental effort from students and does not always guarantee full attention to the transmitted content.

At the beginning of the 20th century, thinkers such as John Dewey developed psycho-pedagogical works, such as the theory of knowledge, where he defended the importance of experience and active participation of the student in the learning process. This idea is seen in the 1960s, when Problem-Based Learning (PBL), developed by Dewey, emerged in the health field, focusing on problem-solving as a form of learning.

In the 1990s, Professor Eric Mazur developed "Peer Instruction" (PI), based on acquiring knowledge and skills through cooperation among students of different statuses and abilities, organization and engagement, cognitive conflict, error management, communication, and empathy. These processes

help both the helper and the helped to learn during a PI or mentoring session. This method fosters collaborative learning between tutor and tutee, providing substantial gains in deepening certain areas and/or knowledge (Azevedo et al., 2022).

From 2000 onwards, active methodologies gained space in formal and informal education, with the spread of new technologies and the search for more engaging and effective approaches. We see progress among students who are encouraged to be more active and responsible for their own learning, especially post-pandemic, through involvement in practical activities, debates, and projects that stimulate skill development, taking them beyond technical knowledge and aiming at developing critical thinking, problem-solving, collaboration, and communication.

In this context, the teacher acts as a facilitator of the learning process, guiding and encouraging students. Thus, active methodologies seek to connect learning with the student's reality, making it more relevant and meaningful as an integral element in the social evolutionary process (Ferreira et al., 2024).

Although the principles underlying active methodologies have ancient origins, their modern formulation is anchored in 20th-century pedagogical theories, such as those proposed by Dewey, Piaget, and Vygotsky, which provided more consistent systematizations about the student's role as a protagonist in the learning process. This historical trajectory shows that, over time, there has been a movement to overcome traditional teacher-centered teaching, giving way to practices that stimulate autonomy, collaboration, and critical and meaningful knowledge construction. Understanding this evolution allows us to relate past and present, highlighting how these methodologies have become increasingly relevant to address contemporary educational challenges.

However, the application of active methodologies still faces significant obstacles today. Among them are the resistance of some school sectors to abandon traditional teaching models, insufficient teacher training to deal with innovative practices, and infrastructure limitations that hinder the implementation of technological resources and participatory dynamics.

PROJECT-BASED LEARNING: DEVELOPMENT OF A RECYCLABLE WASTE COLLECTION APP

Project-Based Learning (PBL) is an active methodology that seeks to bring students closer to real-world contexts, promoting knowledge construction through the resolution of concrete problems. John Dewey (1916) already advocated that education should be experiential, guided by practice and by the critical engagement of students. Later, William Kilpatrick (1918) consolidated the so-called Project Method, considered the embryo of PBL.

According to Moran (2018), active methodologies aim to develop student autonomy, granting them a central role in the learning process. In this context, PBL presents itself as a pathway to integrate theory and practice, stimulating creativity, innovation, and collaboration. This article presents a practical

example of PBL through the development of an application for selective collection of recyclable waste in residential condominiums, in which users accumulate points that can be exchanged for goods or monetary values.

PBL finds its roots in Dewey's (1916) thought, which defended the importance of experience for critical formation. For him, "education is not preparation for life; education is life itself." In the same vein, Paulo Freire (1996) highlighted the relevance of a liberating education, in which the student assumes an active role in the construction of knowledge.

Kilpatrick (1918) complemented this by proposing that real projects be used as strategies to connect school knowledge with practical life. Papert (1980), with his constructionism, reinforced the idea that learning occurs more effectively when the individual builds something meaningful for themselves and for the community.

PBL directly dialogues with cooperative learning as proposed by Johnson and Johnson (1999), in which group work enhances the development of socio-emotional skills. Internationally, Larmer and Mergendoller (2010), linked to the Buck Institute for Education (BIE), presented practical guides that structure PBL as an essential methodology for the 21st century.

In Brazil, José Moran (2018) emphasizes the importance of pedagogical innovation and the integration between digital technologies and active methodologies. Lilian Bacich and Moran (2018) point out that PBL stimulates protagonism, critical thinking, and the resolution of real problems. Pedro Demo (2015) argues that learning through research is central to developing autonomy and critical reflection—fundamental aspects of PBL.

Celso Vasconcellos (2015) and Cipriano Luckesi (2018) contribute to this reflection by discussing innovation, critical practices, and formative assessment as part of integral education. Vasconcellos (2015) reinforces that active methodologies aim not only at cognitive mastery but also at ethical, socio-emotional, and civic development, connecting to the need to prepare critical and autonomous individuals for the challenges of the contemporary world. For Luckesi (2018), understanding the historical evolution and theoretical foundations of these practices allows us to recognize their relevance as a pathway to a more inclusive and transformative education.

Among active methodologies, Project-Based Learning stands out as a practice capable of integrating knowledge, stimulating teamwork, and fostering the resolution of real problems. However, its implementation faces limitations such as lack of resources, the need for continuous teacher training, insufficient time for proper project development, and the diversity present in classrooms. Doug Lemov (2011), widely cited in teacher training and educational exams in Paraná, points out classroom strategies that help overcome some of these barriers, favoring more engaging and organized teaching. Recognizing these difficulties, while valuing the potential of PBL, is essential to sustain a critical and realistic view of

active methodologies, reaffirming their role as an instrument of innovation and strengthening the student's integral formation (Lemov, 2011).

Project methodology: Recyclable waste collection App

The project developed by Professor Rubens Palhares (author) aimed to create an application focused on managing selective waste collection in residential condominiums. The methodology followed the stages of Project-Based Learning (PBL):

Problem Identification – The problem of improper disposal of solid waste in urban areas was identified, directly impacting the environment.

Planning – Students, guided by the teacher, mapped the needs of condominium residents and defined how the application could contribute to sustainable collection.

Research and Construction – Students investigated existing solutions and developed digital prototypes, applying programming and design concepts.

Collaboration – In groups, students tested functionalities such as the points system and user interface, collectively discussing improvements.

Delivery and Socialization – The application was presented as the final product, with the possibility of real implementation in condominiums.

Reflection – Students evaluated the process, identified learning outcomes, and proposed future improvements.

This process illustrates what Moran (2018) emphasizes: PBL enhances meaningful learning when it connects students to real-world problems.

Project stages according to PBL

In addition to the general methodology, the project was organized into specific stages inspired by the logic of Project-Based Learning. These phases were systematically followed by the students:

Planning: Definition of functionalities, detailed scope, requirements, and division of responsibilities.

Design: Screen definition, wireframe creation, screen development, and evaluation with corrections.

Development: Database construction, API implementation, back-end integration, and server configuration.

Testing: Verification of proper functioning and usability analysis of the system.

Presentation: Preparation of slides and pitch training for project communication.

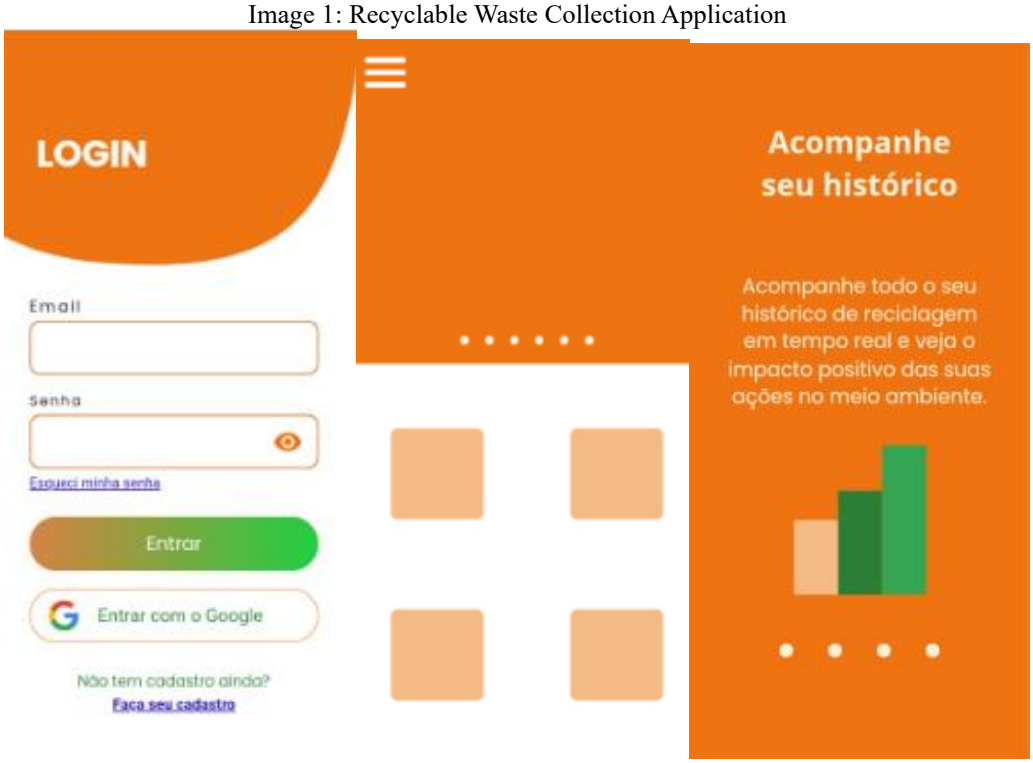
These stages fostered collective work organization and ensured greater clarity in the learning process, directly reflecting the principles of PBL: protagonism, collaboration, critical reflection, and practical application.

The development of the recyclable waste collection app demonstrated how Project-Based Learning can transform the classroom into a space for innovation and social impact. The methodology enabled students to learn actively, collaboratively, and meaningfully, developing technical and socio-emotional skills continuously and integratively, aiming to prepare them to face academic, professional, and personal challenges, promoting autonomy, critical thinking, collaboration, and adaptability in the contemporary world (authors' emphasis).

According to Dewey (1916), education must be linked to experience; Freire (1996) reinforces the importance of critical participation; Moran (2018) and Bacich (2018) point to pedagogical innovation; and Demo (2015) reminds us that research is the foundation of active learning. Thus, PBL is confirmed as an essential tool for preparing students for the challenges of the 21st century.

Below are images of the application that is under construction:

Image 1: Recyclable Waste Collection Application



Source: Prepared by the academic (2025).

The first screen shows the Login page, with fields labeled Email and Password, an option to Forgot my password, and buttons for Enter and Sign in with Google, followed by a link to Create your account. The second screen displays the main navigation layout with an orange header and four square

icons representing different functional categories. The third screen presents an informational section titled Track your history, with text encouraging users to monitor their recycling history in real time and observe the positive environmental impact of their actions.

Image 2: Application under development for Recyclable Waste Collection

Source: Prepared by the academic (2025).

The first screen shows the section Exchange your points for coupons, explaining that users can redeem accumulated points for discount coupons and exclusive rewards at partner stores. The second screen presents the section Recycle ➔ Points, indicating that each recycled material earns points based on its weight, and the more you recycle, the more points you accumulate. The third image displays the application logo, LiShop, featuring a recycling bin icon in two color variations (orange and green) on contrasting backgrounds.

FLIPPED CLASSROOM

The flipped classroom model emerged as a response to the limitations of traditional teaching, marked by the centrality of the teacher and the passivity of the student. This historical and educational context was driven by the need to overcome practices focused solely on content transmission and to expand student participation in the learning process. With the advancement of digital technologies and increased access to information, it became possible to shift content delivery to moments prior to class, freeing up in-person time for activities such as analysis, debate, and problem-solving—making learning more active and meaningful (Moran, 2018).

This shift profoundly transformed the role of the student, who ceases to be merely a recipient of information and assumes greater autonomy and protagonism in their educational journey. By accessing content beforehand and arriving in class prepared to discuss and collectively construct knowledge, the

student develops competencies such as responsibility, collaboration, and critical thinking. In this way, the flipped classroom promotes a more holistic education, integrating cognitive, social, and attitudinal dimensions, in line with the perspective of innovative and democratic education (Vasconcellos, 2015; Luckesi, 2018).

As described by Martins, Silva, and Almeida (2021), this methodology consists of inverting the actions that occur inside and outside the classroom. It considers discussions, assimilation, and understanding of content (practical activities, simulations, tests, and others) as central objectives led by the student in the classroom, in the presence of the teacher, who acts as a mediator in the learning process. Meanwhile, the transmission of knowledge (theory) preferably takes place outside the classroom. In this case, study materials must be made available in advance so that students can access, read, and begin to understand the proposed content.

The teacher assumes the role of mediator, guiding discussions and facilitating the execution of activities to be carried out in the classroom, based on the knowledge and content previously accessed by the student—that is, outside the classroom environment (Martins; Silva; Almeida, 2021). The teacher can then dedicate classroom time, in the presence of students, to consolidating knowledge, clarifying doubts, and supporting the development of their learning.

This strategy proposes changes to certain elements of in-person teaching, offering an alternative to the traditional logic. In this regard, several professors from Harvard, Olin College, MIT, University of Québec / Montréal, Universidad de Chile, among others, discuss this approach as a prerequisite for implementing active learning methodologies and for enhancing the value of in-person classroom spaces.

In this approach, both the teacher and the student must adopt new roles. The student ceases to be a spectator and begins to act actively, becoming the protagonist of their own learning. The teacher steps off the stage, no longer acting as a lecturer, and positions themselves closer to the student, assisting in the learning process and assuming the role of guide, tutor, or mentor.

GAMIFICATION IN PEDAGOGICAL PRACTICE TO DEVELOP SOCIO-EMOTIONAL SKILLS AND NEW LEARNING IN STUDENTS WITH ASD

Originating from the English word Gamification, which combines game design with the idea of applying principles used in games to create engagement in various contexts, students set goals, follow a specific set of rules, and receive feedback on their learning performance. Moreover, game components stimulate healthy competition while promoting teamwork, emotional regulation, and empathy (Alves, 2018).

The word Gamificação (from the English Gamification) is a neologism derived from the word game, which in Portuguese means jogo (Caffe, 2019). Digital Game-Based Learning refers to the

integration of games into learning experiences to increase engagement and motivation. Gamification involves the use of a pedagogical system developed within game design but implemented in a non-game context—and the game itself, which may be digital or not (Amriani et al., 2013).

Autism Spectrum Disorder (ASD) is characterized by differences in the development of communication, social interaction, and behavioral patterns, which may include restricted interests and difficulties with cognitive flexibility (Silva, 2012). However, many autistic students show strong affinity for technological resources and structured activities—features that closely align with the logic of games. Therefore, when applied in a planned and sensitive manner to individual needs, gamification can be an effective tool to foster meaningful learning and promote school inclusion.

According to Feitosa (2021), gamification in the classroom does not simply mean playing for the sake of playing, but rather using game mechanics (such as scoring, missions, rankings, rewards, levels, and challenges) within the pedagogical process. These elements create a more dynamic and motivating environment, capable of transforming curricular content into enjoyable and interactive experiences. For students with ASD, this approach offers specific benefits, such as greater predictability in tasks, stimulation of focused attention, and the possibility to learn at their own pace.

One of the main benefits of gamification for autistic students is intrinsic motivation. Many face emotional barriers with traditional teaching methods, which can lead to anxiety or lack of interest (Silva, 2012; Teixeira, 2018). By transforming activities into game-like stages, with clear rewards and immediate feedback, students feel more engaged and secure in their learning journey. According to Kapp (2012), the visual and concrete nature of games facilitates the understanding of rules and objectives—an essential aspect for students who struggle with abstraction.

Beyond fostering motivation and engagement, gamification has proven to be an effective pedagogical strategy for developing social and communicative skills. For students with Autism Spectrum Disorder (ASD), digital games and gamified activities can support the acquisition of verbal language and oral expression, especially when students still face expressive difficulties, by promoting mediated interactions and functional language use situations.

When games are developed in other languages, they can enhance foreign language learning, expanding opportunities for communication and social interaction. In this sense, gamification contributes not only to academic learning but also to holistic development, supporting autonomy, collaboration, and inclusion (Moran, 2018; Bicudo; Cruz, 2020).

According to Bicudo and Cruz (2020), games and gamified activities can be structured collaboratively, encouraging peer interaction and teamwork. By completing group challenges, autistic students have the opportunity to experience cooperation, negotiation, and respect for social rules in a

controlled and motivating environment. This practice helps reduce social isolation and fosters a sense of belonging and inclusion.

Gamification supports pedagogical differentiation, as it allows for the adaptation of difficulty levels, types of rewards, and modes of participation according to individual needs (UNESCO, 2021). For some students, rewards may be linked to point accumulation; for others, to unlocking content or earning digital badges. What matters is that the progression system is clear, fair, and tailored to the student's profile. This flexibility aligns with the principle of inclusive education, which seeks to respect the uniqueness of each learner.

Technology has been a major ally in applying gamification for autistic students. Digital platforms such as Kahoot, Classcraft, Duolingo, and Minecraft Education Edition offer adaptable resources that can be used across different subject areas. The use of these tools stimulates attention, supports memory, and allows teachers to monitor student progress in real time. For autistic students, who often show greater interest in digital activities, these resources represent a concrete opportunity for engagement and meaningful learning.

However, it is important to emphasize that gamification must be used in a planned and intentional manner. It is not about replacing the curriculum with games, but rather enriching pedagogical practices with strategies that spark interest and respect the specificities of each student. The teacher must select resources according to learning objectives and continuously monitor outcomes, assessing whether the strategy truly promotes progress in cognitive, social, and emotional development. It is essential that the student's family and the multidisciplinary team accompanying them are involved in this process, ensuring an integrated and coherent approach.

The implementation of gamification must also take into account potential challenges. Some autistic students may show resistance to change or difficulty in dealing with new rules. Others may become frustrated with competition or pressure for quick results. Therefore, it is up to the teacher to create a safe environment in which mistakes are understood as a natural part of the process and rewards are linked to effort and individual progress, not just final performance. This perspective strengthens the student's self-esteem and prevents feelings of exclusion.

In summary, gamification in the classroom for autistic students presents itself as an innovative and promising strategy, capable of uniting playfulness with pedagogy in favor of inclusion and learning (Vianna, 2013). By transforming the school space into an environment of challenges, rewards, and discoveries, gamification creates opportunities for cognitive, social, and emotional development for students on the spectrum. More than a methodology, it is a pedagogical stance committed to recognizing differences, valuing each student's potential, and building a truly inclusive school (Amriani et al., 2013).

Therefore, by incorporating game elements into teaching, the educator not only expands their repertoire of didactic strategies but also reaffirms their role as a mediator of knowledge and agent of social transformation. For autistic students, this approach can mean not only learning curricular content but also strengthening essential life skills such as communication, autonomy, and cooperation. In this way, gamification establishes itself as a fertile path for promoting inclusive education in the 21st century.

Socio-emotional learning is a set of teachable competencies or skills considered fundamental for success in school and life. It is a process through which children acquire and apply knowledge, skills, and attitudes to develop healthy identities, manage emotions, achieve personal and collective goals, feel and show empathy for others, establish and maintain supportive relationships, and make responsible and careful decisions (Teixeira, 2018).

A game can be described as a structured form of play. According to extensive studies, play is one of the most effective and powerful catalysts for learning (Mardegan, 2014). Play has been shown to increase overall well-being and creativity in both children and adults. Thus, the artificial boundaries that once existed between serious learning and fun play are now collapsing. The technological revolution of the 21st century has also combined technology with learning and fun, resulting in a boom in the educational games industry (Amriani et al., 2013).

According to Amriani et al. (2013):

> "At its core, every game is a learning game. They provide rich content, engagement, and motivation, leveraging subject knowledge and a variety of skills in players. However, a learning game is best defined as one designed with the primary goal of conveying the learning material specifically embedded in the game. Digital learning games combine current technology, allowing for an entirely new level of interaction, collaboration, and a unique learning experience."

Digital learning games, in particular, trigger high levels of engagement and motivation. They often induce a state of flow through immersion, clear goals, immediate feedback, and a balance between skill and challenge. Therefore, digital learning games can, in many ways, be considered an ideal platform for learning.

We can affirm that gamification in the classroom can help teachers create experiences that fully engage their students. Gamification captures their attention and motivates them, as they strive to achieve a goal. When students feel positive about their learning process and know they will be rewarded in some way for their efforts, they stop being passive observers and become active participants (Alves, 2018). In doing so, they are able to effectively absorb information and store it in long-term memory, as the knowledge itself is linked to the favorable experience provided by the educator through gamification (Amriani et al., 2013).

Gamification makes learning fun and interactive.

Although the teacher may have a variety of learning goals and objectives to achieve throughout the lessons, none of these outcomes can be effectively reached if students are not genuinely excited about what they are learning. Gamification makes learning not only informative but also fun and exciting. It also adds an interactive element to lessons. This creates a sense of immersion, offering students the opportunity to feel like an integral part of the overall learning process (Alves, 2018).

Gamification in lessons allows students to see real-world applications and benefits of the subject matter. They can see firsthand how their choices within the game result in consequences or rewards. If they do not perform well, they are not rewarded for their actions or cannot progress to the next level. Essentially, the teacher gives them the chance to explore a topic in depth and understand how they can apply this information outside the virtual classroom, all within a fun and risk-free environment. Then, when they venture into the world, they will be empowered to put that knowledge to good use in professional or personal settings, learning to manage their emotions (Alves, 2018).

Social and emotional learning is about helping students develop the ability to manage their emotions and build positive behavior throughout their developmental process. Gamification is important because it enables students to learn how to make responsible decisions for academic success, resolve conflicts to build healthy relationships, manage their emotions to avoid negative behaviors, and make ethical decisions regarding others.

Gamification can be used to motivate and increase engagement in social-emotional learning. The use of gamification as an educational tool can help students solve new problems they face daily. According to Dicheva et al. (2015):

> "The use of educational games as learning tools is a promising approach due to the ability of games to teach and the fact that they reinforce not only knowledge but also important skills such as problem-solving, collaboration, and communication." (DICHEVA et al., 2015, p. 6)

One strategy for using gamification to learn emotional regulation is for teachers to create Choice Boards for students, labeled and color-coded according to a Mood Meter. Once students become "emotion scientists," they can increase their self-awareness by having agency to select differentiated activities aligned with their moods. For example, students in the yellow zone can be guided toward creative problem-solving activities. They might use Google Jamboard (an interactive whiteboard where teachers and students can write, draw, add notes, research results, or open presentations) or create in Minecraft. Children in the red zone can channel their mood into competitive activities, such as classroom debates. They may also be guided to develop argumentation skills through competitive video games. Children in the blue zone may be more inclined toward inquiry-based lessons or empathy-based activities.

Creating choice boards aligned with the mood meter is, in fact, an easy step toward gamifying emotional learning. It can promote a sense of autonomy, competence, and relatedness—the three components of self-determination theory, innate human needs that can lead to human flourishing. Good games do this, as players feel agency over experiences that seem within reach. By planning lessons that incorporate self-determination theory, a sense of well-being can be fostered, creating happier classrooms for everyone (UNESCO, 2021).

Games can allow children to practice emotions in consequence-free environments. With careful guidance, games can help children manage emotions, gain perspective, demonstrate empathetic concern, and exhibit prosocial behaviors.

Gamification consists of using game elements, dynamics, and mechanics in non-game contexts, with the goal of engaging, motivating, and enhancing learning. It differs from educational games, which are created specifically to teach certain content, and from game-based learning, which uses the game itself as the central teaching resource. Gamification, therefore, does not necessarily require a complete game, but rather the incorporation of features such as points, missions, rankings, and rewards into the teaching-learning process, stimulating student protagonism and motivation (Moran, 2018; Fardin; Leite, 2020).

In the case of students with Autism Spectrum Disorder (ASD), whose main characteristics include difficulties in verbal and non-verbal communication, limitations in social interaction, and the presence of repetitive and restrictive behavior patterns, gamification presents itself as a relevant pedagogical opportunity. Games, by offering task predictability, visual stimulation, and structured interaction possibilities, can support both concentration and socialization. Games allow students to learn at their own pace, respecting their specificities, through an interactive environment that reduces anxiety and creates opportunities for engagement (Bicudo; Cruz, 2020; Schmidt; Bosa, 2017).

Among the benefits of gamification are the stimulation of attention, development of concentration, adaptability of difficulty levels and rewards, and the creation of different forms of participation according to the individual needs and profiles of students. These characteristics make this methodology consistent with the principles of inclusive education, as they promote equity of opportunity and respect for differences. However, it is essential that gamification be applied intentionally, aligned with clear learning objectives, to avoid becoming merely a playful resource disconnected from the formative process (Moran, 2018; Fardin; Leite, 2020).

PROPOSAL OF EDUCATIONAL PRODUCT AND EXPERIENCE REPORT WITH THE USE OF KAHOOT IN THE CLASSROOM

This proposal presents the design, implementation, and analysis of an educational product based on the use of the Kahoot platform as a gamification strategy in teaching. The proposal seeks to integrate

interactive technological resources into active methodology practices, aiming to foster student engagement, active participation, and the consolidation of meaningful learning, in alignment with contemporary educational demands.

THEORETICAL FOUNDATION AND OBJECTIVES OF THE EDUCATIONAL PRODUCT

Kahoot! is a free-access digital platform designed for creating and administering real-time interactive quizzes. Developed in 2013 by Norwegian educators in partnership with the Norwegian University of Science and Technology, the tool stands out for incorporating elements characteristic of digital games—such as scoring, time limits, rankings, and immediate feedback—into the pedagogical context (Callegari, 2021). These features configure what Dicheva et al. (2015) define as a Game-Based Student Response System (GSRS), promoting intrinsic motivation and active learning.

The design of the educational product was based on theoretical assumptions linked to gamification and active learning methodologies. Gamification is defined as "the use of game-based mechanics, where its aesthetics and logic are used to engage people, motivate actions, promote learning, and solve problems." Vianna et al. (2013) add that it involves "the use of game mechanisms to solve a problem or simply to engage an audience in an activity." In the educational field, Bacich and Moran (2018) emphasize that active methodologies place the student at the center of the process, encouraging them to act and reflect on their own learning.

In this sense, Kahoot has the potential to stimulate student participation and motivation through dynamic challenges, provide formative assessment with immediate feedback, promote interaction and peer collaboration, and accommodate different learning styles in an accessible and responsive environment (Castro; Mangueira, 2018).

PLANNING AND DEVELOPMENT OF THE PROPOSAL

The development of the educational product was structured in stages inspired by Didactic Engineering (Artigue, 1996), a methodology that, according to Chizzotti (1991, p. 26), allows "facts and events to be apprehended within a context of constant norms and [...] systematically observed, deliberately organized, and subject to planned intervention."

Content Selection – The topic was defined based on a diagnosis of the class's main difficulties. As Freire (1996) argues, it is essential that teaching be connected to students' realities and needs.

Development of Assessment Items – Questions were constructed with clarity and objectivity, prioritizing alignment with learning objectives and emphasizing the importance of tailoring question formulation to the participants' level of knowledge.

Platform Configuration – The quiz mode was chosen, with response times varying from 20 to 60 seconds depending on question complexity, following guidelines found in application manuals.

Infrastructure – The activity required a computer connected to a multimedia projector for displaying questions, as well as students' personal mobile devices to access the platform via kahoot.it using a PIN code.

DESCRIPTION OF THE APPLICATION

The implementation took place in a high school/technical education class, during a session previously scheduled in the course syllabus. The application procedure included presenting the activity's dynamics, during which the teacher explained the objectives and rules, guided students in accessing the platform, and instructed them to enter the PIN code to ensure a smooth start to the activity. During the interactive session, the questions were projected in real time, and responses were recorded individually. Points were awarded based on the accuracy and speed of responses, with the ranking updated after each item, which contributed to increasing student engagement. At the end of each round, the teacher discussed the correct answer, encouraging reflection on mistakes and correct responses, thereby reinforcing the formative nature of the activity. Finally, the system displayed a podium with the top three scorers and generated detailed reports, which were later used to inform instructional planning.

RESULTS AND OBSERVATIONS

The observed results demonstrate that using Kahoot in educational contexts provides a high level of student engagement, stimulating active participation from all students, including those who typically show less involvement in classroom activities (Schneider, 2024). This motivation is driven by the combination of playfulness, which makes the learning process more enjoyable, and healthy competition, which encourages a desire for improvement and interest in answering correctly. Licorish (2018) affirms that students' attention is sustained throughout the activity, supported by the time constraints for responses and the fast-paced nature of the game—elements that significantly contribute to concentration and focus during the educational process.

Regarding interaction and collaboration, a notable increase in communication between students and the teacher was observed, especially during the discussion of answers. This collaborative environment strengthens collective learning, allowing students to share doubts, debate concepts, and construct knowledge together, moving beyond the traditional passive approach. This active interaction also fosters the development of socio-emotional skills, such as teamwork and respect for differing opinions.

Another relevant aspect is the learning monitoring enabled by the platform. The reports generated by Kahoot allow the teacher to closely track both individual and group performance, identifying strengths, specific difficulties, and topics that require further attention and review. This ongoing formative assessment provides valuable input for pedagogical adjustments, enabling targeted interventions that can enhance teaching effectiveness and promote more meaningful and lasting learning.

However, some challenges must be considered for the effective implementation of this tool. The requirement for a stable internet connection is a limiting factor, especially in contexts where technological infrastructure is still lacking. Inequality in access to technological devices such as smartphones, tablets, or computers can lead to digital exclusion and hinder full student participation. Another important point is the need to balance the number of questions and the time allocated for responses, avoiding cognitive overload and mental fatigue, which can compromise learning quality. Therefore, careful planning of the activity, along with the adaptation to available technological resources, is essential to ensure that the use of Kahoot maximizes its pedagogical benefits and effectively contributes to the teaching-learning process.

RESULTS AND DISCUSSION

Contemporary education has been constantly seeking innovative strategies to meet the demands of a transforming society, marked by the presence of technology and the diversity of students in educational institutions. In this context, the inclusion of autistic students presents one of the major pedagogical challenges, as it requires practices that go beyond traditional teaching and learning models, valuing interactive, creative, and adaptable resources (Teixeira, 2018). One such practice that has gained significant traction is gamification—that is, the application of game elements in educational contexts to stimulate student participation, motivation, and engagement (Amriani et al., 2013).

Gamification in education is a strategy to increase engagement by incorporating game elements into a learning environment. The goal is to generate levels of involvement similar to those typically produced by games. The main objectives of gamification are to enhance certain skills—including emotional ones—introduce goals that give purpose to learning, engage students, optimize learning, support behavioral change, and foster socialization (Fardo, 2014).

According to Nascimento and Feitosa (2020), student autonomy is a central principle of active methodologies, as it places the learner as the protagonist of their own learning. In this context, research plays an essential role, acting as a catalyst for knowledge and stimulating curiosity. Through investigation, the student develops intellectual autonomy, seeking answers, analyzing information, and constructing conclusions independently. This process contributes to the development of critical awareness, enabling the student to question, reflect, and evaluate different perspectives.

Unlike the traditional model, in which knowledge is passively transmitted by the teacher, active methodology encourages students to participate actively. Thus, they do not merely receive information but construct it through their own discoveries and interpretations. This approach prepares them to deal with real-world problems, make informed decisions, and engage in lifelong learning. Autonomy, therefore, strengthens self-confidence and responsibility in the learning process. Active methodologies foster the development of socio-emotional competencies such as organization, discipline, and resilience. By becoming agents of their own education, students expand their capacity for adaptation and innovation. In this way, learning becomes more meaningful, personalized, and transformative (Bacich; Moran, 2018).

According to Martins, Silva, and Almeida (2021), the flipped classroom is an active methodology strategy that reorganizes the traditional teaching format. In this model, students engage with content before the in-person session, usually through videos, texts, podcasts, or other digital resources provided by the teacher. Classroom time, which was previously dedicated to theoretical exposition, is now used for practical activities, discussions, problem-solving, and application of learned concepts.

This inversion places the student as the protagonist of the process, requiring them to prepare in advance and actively participate in classroom interactions. The teacher, in turn, assumes the role of mediator, guiding, clarifying doubts, and encouraging collaboration among peers. In addition to promoting autonomy, the flipped classroom increases engagement, develops critical thinking skills, and strengthens collaborative learning. Thus, content is not merely memorized but understood and applied in various contexts, making learning more meaningful and lasting.

The experience demonstrates that Kahoot, when incorporated in a planned manner, can serve as an effective tool for formative assessment and a stimulus for active student participation, significantly contributing to the promotion of more meaningful and lasting learning (Dellos, 2015). The platform offers high adaptability, allowing its use across different subject areas and educational levels, thereby expanding its reach and pedagogical potential.

To maximize this potential, it is recommended that Kahoot be integrated into broader instructional sequences, ensuring its use is aligned with clear learning objectives and articulated with other methodological strategies, avoiding its isolated use as a mere playful resource. It is equally essential to ensure technological accessibility for all students, guaranteeing adequate availability of devices and quality internet connection to prevent digital exclusion and promote equity in access to educational activities (Castro; Mangueira, 2018).

Furthermore, it is crucial that the data generated by the platform be analyzed systematically and critically, serving as a basis for targeted pedagogical interventions, content reviews, and adjustments in instructional planning. In this way, Kahoot can be enhanced not only as an entertainment tool but also as a

robust resource for formative assessment and support for teacher decision-making, increasing the effectiveness of the teaching-learning process.

The use of Kahoot in different educational contexts requires recommendations that value both accessibility and intentional pedagogical planning. It is essential that the teacher adapt quizzes according to the specificities of the class, ensuring accessible resources for students with different needs, such as subtitles, images, appropriate response time, and clear language. Kahoot should be aligned with previously defined learning objectives, avoiding its use solely as a playful tool. When properly planned, it can enhance student participation, foster inclusion, and make the assessment process more interactive and formative, establishing itself as an innovative tool aligned with the practices of democratic and inclusive education (Moran, 2018; Vasconcellos, 2015).

CONCLUSION

This research has shown that the use of Kahoot as an educational product, grounded in the principles of active methodologies and gamification, constitutes an effective and relevant pedagogical strategy for contemporary teaching. It responds appropriately to the demands of an increasingly connected student body—digitally active and accustomed to interactive environments.

The experience presented demonstrates that the use of Kahoot in the classroom, when pedagogically planned, can be a highly valuable resource in the teaching and learning process, especially in the context of including students with Autism Spectrum Disorder (ASD). Gamification, combined with active methodologies, proved capable of increasing engagement, stimulating participation, and promoting interaction—transforming assessment moments into meaningful and less exclusionary experiences. For autistic students in particular, the playfulness, predictability of game stages, and immediate feedback offered by the platform support concentration, motivation, and socialization, helping to reduce learning barriers.

Finally, Kahoot's adaptability allows for the accommodation of different learning styles and paces, reinforcing its applicability across various educational levels and subject areas. However, its use must be integrated into broader instructional sequences aligned with clear objectives, to avoid it being used merely as a recreational tool. It is equally essential to ensure technological and structural accessibility, guaranteeing equitable participation for all. It is concluded that gamification, when applied inclusively, can be an effective strategy to enhance more meaningful and lasting learning, promoting not only knowledge but also inclusion and the holistic development of autistic students.

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AN INTERDISCIPLINARY PERSPECTIVE ON THE CHALLENGES AND POTENTIALS OF CURRICULAR IMPLEMENTATION IN BASIC EDUCATION

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ABSTRACT

This article brings together three reflections on cross-cutting themes in Brazilian education, based on the BNCC (National Common Core Curriculum) and state curriculum documents. The first text discusses how citizenship, ethics, and culture are addressed in the subjects of Sociology and Religious Education, highlighting the role of schools in critical thinking and respect for diversity. The second text analyzes the teaching of Natural Sciences with a focus on sustainability and environmental education, highlighting the convergence between federal and state guidelines and proposing active methodologies to promote student engagement. The third text deals with Food and Nutrition Education (FNE) as an essential pedagogical practice, articulated by programs such as PNAE and PSE, and emphasizes the importance of teacher training and interdisciplinarity to consolidate healthy habits. Together, the texts reinforce the need for a comprehensive, critical education that is connected to contemporary challenges.

Keywords: Comprehensive education; Interdisciplinarity; Cross-cutting themes.

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INTRODUCTION

The National Common Core Curriculum (BNCC) constitutes a fundamental regulatory framework for Brazilian education, establishing the essential learning outcomes that students must develop throughout Basic Education. Normative in nature, the BNCC guides curriculum development with the aim of promoting comprehensive human education and contributing to the construction of a just, democratic, and inclusive society. In this context, curricular implementation faces the challenge of integrating contemporary cross-cutting themes—such as citizenship, ethics, culture, sustainability, and nutrition—in a way that transcends mere content transmission and permeates the entire educational process. This article, which brings together three reflections on these cross-cutting themes, reinforces the need for an education that is critical and connected to contemporary challenges.

The cross-cutting nature of these themes demands an approach that articulates different areas of knowledge, fostering interdisciplinarity. However, this integration is not without obstacles, including the need for ongoing teacher training and the alignment between federal guidelines and regional realities. Given this complex scenario, the following research question arises: How are critical cross-cutting themes—specifically citizenship, ethics, and culture (in the areas of Sociology and Religious Education), sustainability and environmental education (in Natural Sciences), and Food and Nutrition Education (FNE)—articulated and implemented in Basic Education, and what are the main challenges and potentials observed from an inter- and transdisciplinary perspective?

Thus, the General Objective of this study is to analyze, from an inter- and transdisciplinary perspective, the challenges and potentials of curricular implementation of cross-cutting themes in Basic Education, as advocated by the BNCC and related documents. To achieve this purpose, the following Specific Objectives were outlined: 1) To analyze the manifestation of the themes of citizenship, ethics, and culture in the disciplines of Sociology and Religious Education, examining the general competencies of the BNCC and curricular guidelines; 2) To establish a parallel between national guidelines, such as the SAEB Matrix and federal documents, and the Curriculum of the State of Espírito Santo (ES) in addressing sustainability and environmental education in the teaching of Natural Sciences; 3) To discuss the role of Food and Nutrition Education (FNE) as an essential pedagogical and cross-cutting practice, and the implications of teacher training in this context.

The justification for this study lies in the urgency of understanding the realization of the pillars of comprehensive education and active citizenship within the school environment. A detailed analysis of the conceptual and thematic convergences between the BNCC and state curricula (such as that of Espírito Santo, in the case of sustainability), as well as the investigation into the need for a multiprofessional and contextualized approach in critical areas such as FNE, provide relevant support for the qualification of pedagogical practices and for overcoming structural and training limitations that permeate curricular

implementation. The integration of these themes is crucial for forming individuals capable of understanding and transforming reality, promoting social justice and well-being.

In a Brief Theoretical Review, it is emphasized that the BNCC establishes ten General Competencies that serve as the foundation for comprehensive education, where elements such as citizenship, ethics, and culture are intrinsic and cross-cutting. Interdisciplinarity is seen as a key factor, with Religious Education, for example, offering an opportune space for its exercise, and FNE requiring a transdisciplinary and multiprofessional character to encourage healthy habits. The BNCC conceives citizenship, ethics, and culture not as isolated themes, but as dimensions that prepare students to act consciously in society. Additionally, the legal framework for Food and Nutrition Education (Law No. 13.666/2018) consolidates FNE as an indispensable cross-cutting theme, reinforced by programs such as PNAE and PSE, requiring nutrition to be incorporated into various subjects for contextualized learning. Finally, sustainability and environmental education are recognized as structuring axes, whose cross-cutting nature is advocated by both federal and state documents.

METHODOLOGY

This study is characterized as a theoretical research of bibliographic and documentary nature, with a qualitative approach, essential for academic articles. Its objective was to analyze the curricular implementation of contemporary cross-cutting themes in Basic Education, as advocated by the National Common Core Curriculum (BNCC) and related documents.

The methodology was structured into three independent yet convergent analytical axes, reflecting the reflections gathered in the article:

1. Documentary Analysis on Citizenship, Ethics, and Culture.

- This axis focused on analyzing the General Competencies of Basic Education present in the BNCC, aiming to identify intrinsic elements of citizenship, ethics, and culture.
- It specifically examined the guidelines of the Human and Social Sciences area (Sociology) and the specificities of the Religious Education curricular component in Elementary Education, using the BNCC document (2017/2018) as the primary source to identify convergences in the promotion of these values and knowledge.

2. Comparative Study on Sustainability and Environmental Education.

- This stage consisted of a comparative and parallel study between federal guidelines and the Curriculum of the State of Espírito Santo (ES) for High School.
- Federal documentary sources included the “Environment” material from the Ministry of Education and the SAEB Reference Matrix for Natural Sciences.

- The analysis aimed to identify points of convergence, shared values, thematic structure, competencies and skills, and regional emphases in the treatment of sustainability and environmental education within the scope of Natural Sciences.

3. Investigation of the Cross-Cutting Nature of Food and Nutrition Education (FNE).

- The third axis addressed Food and Nutrition Education (FNE) as an essential pedagogical practice and cross-cutting theme, characterized as a set of continuous, permanent actions of a transdisciplinary and multiprofessional nature.
- The legal framework of FNE (including Law No. 13.666/2018), the National Curriculum Parameters (PCNs), and relevant public policy documents such as the National School Feeding Program (PNAE), the Health in Schools Program (PSE), and the FNE Reference Framework for Public Policies were reviewed.
- The research also drew on studies (Moura et al., 2020; Boff et al., 2021; Araújo and França, 2024) to discuss challenges related to initial teacher training and the approach to FNE in pedagogical materials, such as textbooks.

Overall, the adopted methodology enabled the articulation and discussion of the interdisciplinarity required by the BNCC for comprehensive education, based on national and regional documentary evidence and guidelines.

THE BNCC AND THE APPROACH TO CITIZENSHIP, ETHICS, AND CULTURE: A LOOK AT SOCIOLOGY AND RELIGIOUS EDUCATION

The National Common Core Curriculum (BNCC) represents a fundamental regulatory framework for Brazilian education, establishing the essential learning outcomes that all students must develop throughout Basic Education. This normative document guides the formulation of curricula and pedagogical proposals nationwide, aiming at comprehensive human education and the construction of a just, democratic, and inclusive society. In this context, the approach to themes such as citizenship, ethics, and culture assumes central relevance, as they are pillars for the development of conscious, critical, and socially engaged individuals.

This section aims to analyze how the BNCC addresses the themes of citizenship, ethics, and culture, with a specific focus on their manifestation and development in the disciplines of Sociology and Religious Education. To this end, the General Competencies of Basic Education, the guidelines for the area of Human and Social Sciences (with emphasis on Sociology), and the specificities of the Religious Education curricular component will be examined, seeking to identify convergences and particularities in the promotion of these values and knowledge.

The BNCC establishes ten General Competencies of Basic Education that must be developed in an integrated manner throughout the entire school trajectory. These competencies serve as the foundation for students' comprehensive education, permeating all areas of knowledge and curricular components. Citizenship, ethics, and culture are intrinsic elements of several of these competencies, reflecting the document's commitment to an education that transcends mere content transmission.

Dimensions and Development of General Competencies of the BNCC, p. 2 Original document Portuguese (pt-BR)

Diagram presenting the ten general competencies established by the Brazilian National Common Curricular Base (BNCC). Each competency is represented in a color-coded radial layout around the central term "Competências Gerais," including areas such as Knowledge, Scientific and Creative Thinking, Cultural Repertoire, Communication, Digital Culture, Work and Life Project, Argumentation, Self-Knowledge and Self-Care, Empathy and Cooperation, and Responsibility and Citizenship. The diagram briefly defines what each competency entails and its intended purpose.

As the above picture shows, the ten General Competencies of Basic Education and the competencies that most explicitly address the themes discussed in this work include:

Competency 1: Knowledge – To value and utilize the knowledge historically constructed about the physical, social, cultural, and digital world to understand and explain reality, continue learning, and collaborate in building a just, democratic, and inclusive society. This competency highlights the

importance of cultural and social knowledge as a foundation for civic participation and the construction of a more equitable society.

Competency 3: Cultural Repertoire – To value and enjoy the various artistic and cultural manifestations, from local to global, and also participate in diverse practices of artistic-cultural production. This competency directly promotes the appreciation of culture in its multiple forms, encouraging respect and active participation in cultural life.

Competency 5: Digital Culture – To understand, use, and create digital information and communication technologies in a critical, meaningful, reflective, and ethical manner in various social practices (including school-related ones) to communicate, access and disseminate information, produce knowledge, solve problems, and exercise protagonism and authorship in personal and collective life. The ethical dimension and the exercise of citizenship in the digital environment are emphasized here.

Competency 6: Work and Life Project – To value the diversity of knowledge and cultural experiences and appropriate knowledge and experiences that enable understanding of the relationships inherent to the world of work and making choices aligned with the exercise of citizenship and one's life project, with freedom, autonomy, critical awareness, and responsibility. The appreciation of cultural diversity and the exercise of citizenship are connected to the construction of the student's life project.

Competency 7: Argumentation – To argue based on facts, data, and reliable information, to formulate, negotiate, and defend ideas, points of view, and common decisions that respect and promote human rights, socio-environmental awareness, and responsible consumption at local, regional, and global levels, with ethical positioning regarding care for oneself, others, and the planet. This competency is a pillar for ethical and civic formation, as it promotes dialogue, respect for human rights, and socio-environmental responsibility.

Competency 9: Empathy and Cooperation – To exercise empathy, dialogue, conflict resolution, and cooperation, asserting oneself and promoting respect for others and human rights, with acceptance and appreciation of the diversity of individuals and social groups, their knowledge, identities, cultures, and potentialities, without prejudice of any kind. This competency is crucial for building a culture of peace and respect for cultural and identity diversity—essential elements of citizenship and ethics.

Competency 10: Responsibility and Citizenship – To act personally and collectively with autonomy, responsibility, flexibility, resilience, and determination, making decisions based on ethical, democratic, inclusive, sustainable, and solidarity principles. This competency synthesizes the formation for active citizenship, guided by ethical and democratic principles.

These competencies demonstrate that the BNCC conceives citizenship, ethics, and culture not as isolated themes, but as cross-cutting dimensions that must permeate the entire educational process, preparing students to act consciously and responsibly in society. The interrelationship among them is

fundamental for the formation of individuals capable of understanding and transforming reality, respecting diversity, and promoting social justice.

Sociology, as a curricular component of High School, is part of the Human and Social Sciences area, which, according to the BNCC, aims to deepen the essential learning developed in Elementary Education, always guided by an "ethical formation." This area is designed to promote "justice, solidarity, autonomy, freedom of thought and choice, recognition of differences, respect for human rights and interculturality, and the fight against all forms of prejudice." (MEC, 2018)

Sociology, by analyzing social structures and dynamics, offers fertile ground for the development of citizenship and ethics. The BNCC proposes that students develop the ability to "establish dialogues—between individuals, social groups, and citizens of different nationalities, knowledge, and distinct cultures—an essential element for the acceptance of otherness and the adoption of ethical conduct in society." (MEC, 2018) This implies:

Critical Analysis of Social Relations: The discipline enables students to investigate and question social norms, values, and institutions, understanding how they influence individual and collective life. This critical analysis is fundamental for the exercise of active and conscious citizenship, which seeks social transformation and the promotion of justice.

Promotion of Human Rights: Sociology addresses social inequalities, conflicts, and forms of exclusion, encouraging reflection on the importance of human rights as the foundation for a fairer and more equitable society. The study of social movements and struggles for rights contributes to the formation of citizens engaged in defending these principles.

Social Responsibility and Protagonism: The BNCC emphasizes the need for students to "mobilize different languages... and engage in cooperative practices to formulate and solve problems." Sociology, by exploring themes such as political participation, social movements, and community organization, stimulates youth protagonism and collective responsibility in constructing solutions to social challenges.

Culture is a central concept in Sociology, and the BNCC recognizes its importance by including the category "Individual, Nature, Society, Culture, and Ethics" as one of the thematic axes of the Human and Social Sciences area. The discipline allows for:

Understanding Cultural Diversity: Sociology explores the plurality of cultural manifestations, beliefs, values, and ways of life present in Brazilian and global society. By studying the "reasons and motives (material and immaterial) responsible for the formation of a society, its language, customs," and the "logic that produces diversity," students develop a broader and more respectful view of different cultures.

Combating Prejudice and Intolerance: The sociological analysis of identities and otherness, as well as the processes of social construction of prejudice and discrimination, is crucial for developing a

culture of respect and inclusion. The discipline contributes to deconstructing stereotypes and promoting the appreciation of diversity in all its dimensions.

Interculturality: The BNCC promotes the ability to "establish dialogues... between different knowledge and cultures," and Sociology, by studying interactions among different cultural groups, fosters interculturality as a principle for peaceful coexistence and mutual enrichment.

In summary, Sociology, within the scope of Human and Social Sciences, plays a crucial role in the formation of critical, ethical, and culturally sensitive citizens, capable of understanding the complexity of the social world and acting to build a more just and inclusive society.

Religious Education, as a knowledge area in Elementary Education, has a specific educational function: "to ensure respect for cultural religious diversity, without proselytism," and is an integral part of the citizen's basic education. The BNCC establishes clear objectives for this discipline, which align directly with the promotion of citizenship, ethics, and culture. This approach is reinforced by the understanding that Religious Education, by working transversally with the contemporary themes proposed by the BNCC itself, contributes to the integral and civic formation of the human being, as established by Souza et al.

Religious Education, by addressing contemporary themes in a transversal manner, supports the integral formation of the human being. Furthermore, Religious Education presents itself as an opportune space within the educational process to exercise and experience interdisciplinarity in the school context. (SOUZA, SCHMITT, & KLEMZ, 2023).

The objectives of Religious Education in the BNCC demonstrate a strong commitment to the ethical and civic formation of students:

Promotion of Human Rights and Freedom of Conscience: One of the objectives is "to provide knowledge about the right to freedom of conscience and belief, with the constant aim of promoting human rights." This is fundamental for building citizenship that respects individual and collective freedoms, especially regarding the religious dimension.

Dialogue and Pluralism of Ideas: The discipline seeks to "develop competencies and skills that contribute to dialogue between religious and secular life perspectives, exercising respect for freedom of beliefs and the pluralism of ideas, in accordance with the Federal Constitution." This aspect is crucial for forming citizens capable of living in a pluralistic society, respecting different worldviews.

Construction of Personal Meaning and Ethical Principles: Religious Education should "contribute to students constructing their personal life meanings based on values, ethical principles, and citizenship." This highlights the concern with forming individuals who base their actions on solid ethical values, essential for the exercise of responsible citizenship.

Combating Intolerance and Discrimination: The discipline adopts research and dialogue to "problematize prejudiced social representations of others, with the aim of combating intolerance, discrimination, and exclusion." Specific Competency 6 of Religious Education reinforces the need to "debate, problematize, and take a stand against religious intolerance, discrimination, and violence, in order to ensure human rights in the constant exercise of citizenship and a culture of peace." (MEC, 2018)

The cultural and diversity approach is intrinsic to Religious Education, which proposes to study religious phenomena as part of the "cultural substrate of humanity."

Knowledge and Appreciation of Religious Manifestations: Religious Education aims to "promote the learning of religious, cultural, and aesthetic knowledge based on religious manifestations observed in students' realities." This includes the study of "worldviews, languages, knowledge, beliefs, mythologies, narratives, texts, symbols, rites, doctrines, traditions, movements, practices, and ethical and moral principles."

Interculturality and Ethics of Otherness: The BNCC emphasizes that "interculturality and the ethics of otherness constitute theoretical and pedagogical foundations of Religious Education, as they foster recognition and respect for the histories, memories, beliefs, convictions, and values of different cultures, religious traditions, and life philosophies." The discipline seeks "the welcoming of cultural identities, whether religious or not, from the perspective of interculturality, human rights, and a culture of peace."

Recognition and Respect for Otherness: The thematic units of Religious Education, such as "Identities and Otherness," aim for students to "recognize, value, and embrace the singular and diverse nature of the human being, through identifying and respecting similarities and differences between the self (subjectivity) and others (otherness)." Specific Competency 4 emphasizes "living with the diversity of beliefs, thoughts, convictions, ways of being and living.".

In summary, Religious Education, as defined by the BNCC, transcends a confessional approach to become a space for dialogue, respect for cultural and religious diversity, and ethical and civic formation, contributing to students' understanding of the complexity of religious phenomena and their influence on the construction of societies and cultures.

The analysis of the National Common Core Curriculum (BNCC) reveals an explicit and comprehensive commitment to the promotion of citizenship, ethics, and culture at all stages of Basic Education. These themes are not treated as curricular appendices but as structuring axes that permeate the General Competencies and unfold across different areas of knowledge and curricular components.

The General Competencies of Basic Education establish a fundamental framework, encouraging the development of critical thinking, respect for diversity, empathy, dialogue, socio-environmental responsibility, and autonomous and solidarity-based action. The appreciation of historically constructed

knowledge, cultural manifestations, and the ethical use of digital technologies are elements that, together, aim to form engaged citizens who are aware of their role in building a more just and inclusive society.

Regarding specific disciplines, Sociology, within the Human and Social Sciences area of High School, plays a crucial role. It offers conceptual and methodological tools for students to critically analyze social structures, understand power dynamics, inequalities, and diverse cultural manifestations. The discipline fosters dialogue, respect for human rights, and the fight against prejudice, enabling students to exercise active citizenship and adopt ethical conduct in their social interactions. Sociology, therefore, is a privileged space for deepening the understanding of cultural complexity and the importance of otherness.

Religious Education, in turn, in Elementary Education, transcends a confessional perspective to establish itself as a curricular component that promotes respect for cultural religious diversity and freedom of conscience. Its objectives and specific competencies emphasize dialogue between different life perspectives, the construction of ethical values, and the promotion of human rights. By studying religious phenomena as an integral part of humanity's cultural heritage, the discipline contributes to combating intolerance, discrimination, and exclusion, cultivating interculturality and the ethics of otherness as pillars for democratic coexistence and a culture of peace.

By integrating citizenship, ethics, and culture both transversally and specifically in the disciplines of Sociology and Religious Education, the BNCC seeks to form individuals capable of understanding and acting in a complex and plural world. The interconnection of these themes in these disciplines is essential for developing critical awareness, respect for differences, and engagement in practices aimed at the common good, consolidating the principles of a truly comprehensive and transformative education.

SCIENCE AND ENVIRONMENT, SUSTAINABILITY AND NATURAL SCIENCES: WHERE THE FEDERAL AND STATE CURRICULA OF ESPÍRITO SANTO MEET

The promotion of sustainability and environmental education currently appears as one of the structuring axes of Brazilian education. Both federal documents and state curricula recognize the relevance of preparing students to understand, analyze, and critically intervene in socio-environmental issues.

This study establishes a parallel between national guidelines, present in documents such as the "Environment" material from the Ministry of Education and the SAEB Reference Matrix for Natural Sciences, and the Curriculum of the State of Espírito Santo for High School. The aim is to identify points of convergence, regional emphases, and implications for pedagogical practice within the scope of Natural Sciences.

Both federal documents and the state curriculum recognize environmental education as a constitutional obligation and an educational priority, linked to the formation of critical citizens. The national document highlights the importance of the 1988 Federal Constitution and the Rio-92 Conference, while the Espírito Santo Curriculum reinforces the integration of the BNCC and presents specific competencies focused on sustainability.

The axes of the SAEB Matrix, organized into "Matter and Energy," "Life and Evolution," and "Earth and Universe," find correspondence in the Espírito Santo Curriculum. This alignment ensures conceptual coherence and facilitates articulation between national assessments and local practices.

Both documents value the overcoming of mere memorization, emphasizing critical analysis, ethical judgment, and the proposition of solutions. The SAEB Matrix describes cognitive levels of increasing complexity. The Espírito Santo curriculum, through codified competencies (CE01 to CE03), expands this logic and incorporates the analysis of local and global environmental issues.

The "Environment" document advocates for the cross-cutting nature of environmental themes and the adoption of participatory methodologies. The state curriculum also guides learning through investigation, projects, and the use of digital technologies. This convergence strengthens the integration of theory and practice and the connection between school and regional reality.

While federal texts present general guidelines, the Espírito Santo curriculum translates global concerns into regional priorities, such as the analysis of energy matrices, the impacts of monocultures, and problems arising from local productive arrangements. These specificities reinforce the connection between teaching and the socioeconomic reality of Espírito Santo.

The SAEB Matrix guides evaluative processes graduated into three cognitive levels, from recognition to the proposition of solutions. The Espírito Santo curriculum, by organizing codified skills and competencies, dialogues with this typology, favoring evaluative practices that value the application of knowledge in real situations.

Practical recommendations for teachers

- Use local environmental problems as a starting point for interdisciplinary projects.
- Integrate competencies from the Espírito Santo curriculum with the axes of the SAEB Matrix.
- Prioritize assessments that require data interpretation, hypothesis development, and solution proposals.
- Relate school content to local public policies, strengthening active citizenship.

LIMITATIONS AND CHALLENGES

The documents offer consistent theoretical and operational foundations, but challenges include ongoing teacher training, resource availability, and intersectoral coordination. It is recommended that

schools in Espírito Santo use the codified skills of the state curriculum as a guide for local projects, articulating them with the principles of the BNCC and the SAEB Matrix.

The analysis shows that there is broad convergence between national guidelines and the Espírito Santo Curriculum in addressing environmental education and sustainability in the teaching of Natural Sciences. The state curriculum, however, adds regional emphases that bring global guidelines closer to the local reality of Espírito Santo.

This integration strengthens the formation of students capable of understanding natural and social phenomena, assessing risks, and proposing contextualized solutions. The consolidation of this process depends on the effective implementation of innovative pedagogical practices and support for schools and teachers.

SCHOOL FOOD AND NUTRITION EDUCATION: NUTRITION AS A CROSS-CUTTING THEME IN THE CURRICULUM

Food is a fundamental aspect of human physical, cognitive, and emotional development. To establish healthy eating habits, it is essential that proper nutrition be practiced from early childhood. For this reason, the school plays a prominent role in implementing Food and Nutrition Education (FNE).

FNE is defined as a set of continuous and permanent actions, with a transdisciplinary and multiprofessional character, aimed at encouraging healthy and appropriate eating practices within the school environment (BRASIL, 2020). Its inclusion as a cross-cutting theme in Basic Education was consolidated by Law No. 13.666/2018, which amended the National Education Guidelines and Framework Law, highlighting the importance of integrating the theme into student education from the early grades (BRASIL, 2018).

When incorporated into the school environment, FNE can improve the quality of life of a community by promoting the formation of healthy eating habits, encouraging conscious choices, and fostering care for health. In this context, nutrition should not be understood merely as an isolated topic within biological sciences or physical education, but as a cross-cutting theme to be integrated across various school subjects. Transversality allows for a broad and integrated approach, essential for forming conscious, critical, and healthy citizens.

With the publication of the National Curriculum Parameters (PCNs), themes such as health, environment, cultural plurality, and ethics came to be considered **cross-cutting themes** and, therefore, should be addressed in all areas of knowledge, as they pertain to students' social lives and civic formation (BRASIL, 1998). Once integrated into traditional subjects, food—initially approached from a health perspective—began to be recognized as a multidimensional theme, encompassing nutritional, cultural, and socioeconomic aspects.

Among the strategies aimed at ensuring the human right to adequate food and promoting food and nutritional security for the population are the National School Feeding Program (PNAE), the Health in Schools Program (PSE), and important publications such as Interministerial Ordinance No. 1.010 of May 8, 2006, Law No. 11.947/2009/FNDE, and more recently, Resolution No. 26/2013/FNDE and Law No. 13.666/2018.

PNAE is one of Brazil's main strategies for promoting healthy eating, through the use of varied, safe, and culturally appropriate foods that foster healthy habits, contributing to students' growth, development, and academic performance—all associated with the implementation of FNE activities in daily school life (BRASIL, 2009).

According to FNDE Resolution No. 6/2020, which regulates school meal provision to Basic Education students under PNAE, school meals must also have a pedagogical character, encouraging the integration of FNE into the curriculum in a transversal manner (BRASIL, 2020).

Decree No. 6.286/2007, which established the Health in Schools Program (PSE), aims to promote the health and comprehensive education of public school students through coordination between the health and education sectors (BRASIL, 2007). By integrating actions focused on prevention, promotion, and health care, the program contributes to improving students' quality of life. Moreover, PSE fosters continuous and collaborative work between these sectors, expanding the possibilities for FNE implementation.

A significant advancement for FNE actions was the creation of the FNE Reference Framework for Public Policies, developed in 2012. This framework establishes principles to guide the implementation of educational practices across various sectors, requiring professionals to connect theory with reality in order to enhance FNE training processes.

To reinforce this approach, the publication of the National Common Core Curriculum (BNCC) in 2017 consolidated FNE as a cross-cutting theme in the Brazilian curriculum by including competencies that emphasize health promotion, conscious consumption, and sustainability. It encourages teachers to develop interdisciplinary projects that incorporate FNE.

The PCNs introduced the approach of interdisciplinary themes that link various areas of knowledge, aiming to form citizens who are aware of health, social, environmental, and ethical issues. The transversal nature of nutrition seeks not only to transmit scientific knowledge about food but also to foster the construction of healthy habits.

By integrating nutrition and food content into different subjects, contextualized and meaningful learning is promoted. For example: In Science classes, students study the digestive system, nutrients, metabolism, and food-related diseases. In Mathematics, they work on reading and interpreting nutritional labels, calculating portions, and analyzing statistical data on eating habits. In Portuguese, students

produce texts about food and critically read advertisements for ultra-processed foods. In History and Geography, they investigate the evolution of eating habits, food culture, and the socio-environmental impacts of food production. In Physical Education, the relationship between nutrition, physical performance, and well-being is explored. In Arts, students create visual campaigns and projects that encourage healthy eating practices.

It is essential that teacher education includes content that enables educators to address this theme confidently. However, studies indicate that initial teacher training still lacks structured content on FNE. Moura et al. (2020) found that undergraduate Pedagogy programs rarely systematically address this topic, hindering its effective inclusion in the school curriculum. Boff et al. (2021) observed that in elementary school textbooks, FNE is addressed in a limited way and often focuses solely on biomedical aspects, neglecting the cultural and social dimensions of food.

According to Araújo and França (2024), topics related to Food and Nutrition have only recently begun to be included in the school context. Many teachers reported having had no contact with these subjects during their academic training, resulting in limited and superficial knowledge about healthy eating.

The Food Guide for the Brazilian Population is an essential tool for FNE actions, as it provides clear, updated, and culturally appropriate guidelines on healthy eating. Aimed at the general population, it can be used by teachers to promote healthy eating habits. According to Araújo and França (2024), the Guide is an effective pedagogical and political instrument for FNE actions, especially when combined with active methodologies, enhancing teachers' confidence in addressing the topic in an interdisciplinary and participatory manner.

The inclusion of Food and Nutrition Education (FNE) in educational institutions encourages student protagonism in building a more balanced food culture and reinforces the school's role in promoting health and preventing diseases associated with poor nutrition (SANTOS and COUTINHO, 2025).

FNE, as a cross-cutting theme, enhances health promotion and meaningful student learning. Its effectiveness depends on robust public policies, qualified teacher training, and contextualized pedagogical materials. The integration between the health and education sectors, combined with the use of participatory methodologies, constitutes a fundamental strategy for transforming the school environment into a space for promoting healthy eating habits.

CONCLUSION

The analysis of the curricular implementation of cross-cutting themes demonstrated the explicit commitment of the National Common Core Curriculum (BNCC) to comprehensive human education.

This article, by bringing together three independent yet convergent reflections, reinforces the need for a critical education that is connected to contemporary challenges. It was found that themes such as citizenship, ethics, culture, sustainability, and nutrition are not curricular appendices, but rather dimensions that must permeate the entire educational process, requiring both interdisciplinary and transdisciplinary approaches that go beyond mere content transmission. This interconnection is crucial for forming individuals capable of understanding and transforming reality, promoting social justice and collective well-being.

Specifically, the disciplines of Sociology and Religious Education prove to be privileged spaces for deepening citizenship, ethics, and culture. Sociology, situated within the Human and Social Sciences area, equips students to critically analyze social structures and to promote human rights, fostering dialogue and combating prejudice. Religious Education, as a curricular component in Elementary Education, is established as an essential subject for ensuring respect for cultural religious diversity and freedom of conscience, promoting the ethics of otherness and dialogue among different perspectives. In both cases, the focus is on forming critical, ethical, and culturally sensitive individuals, capable of acting consciously in society.

Regarding sustainability and environmental education, the research established broad convergence between federal guidelines (such as the SAEB Matrix and documents from the Ministry of Education) and the Curriculum of the State of Espírito Santo. This methodological and conceptual convergence emphasizes the overcoming of memorization in favor of critical analysis, ethical judgment, and the proposition of contextualized solutions, although the Espírito Santo curriculum adds regional emphases. In parallel, Food and Nutrition Education (FNE) has been consolidated as an essential pedagogical practice and cross-cutting theme through the legal framework (Law No. 13.666/2018) and programs such as PNAE and PSE. FNE requires a transdisciplinary and multiprofessional character, integrating various areas of knowledge to promote health and the development of healthy and conscious eating habits.

Despite the consistency of the theoretical and documentary foundations of the BNCC and state curricula, the implementation of these cross-cutting themes faces significant challenges. The most pressing obstacle is the need for ongoing and qualified teacher training, as studies point to deficiencies in initial teacher education, hindering the effective and contextualized inclusion of themes such as FNE. Therefore, the consolidation of a truly transformative and comprehensive education requires not only robust public policies and coordination between sectors (health and education), but also continuous investment in educators and the adoption of active and participatory methodologies, ensuring that global guidelines are realized in the local reality of schools.

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ASSISTIVE TECHNOLOGIES AND ADAPTIVE DIGITAL GAMES IN TEACHING CHILDREN WITH ASD

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ABSTRACT

The use of assistive technologies and adaptive digital games has proven to be an innovative and effective strategy in the teaching and learning process of children with Autism Spectrum Disorder (ASD). These tools allow for the personalization of educational activities, considering individual needs, rhythms, and learning styles. Assistive technologies—such as interactive software, alternative communication devices, and visual resources—promote autonomy, attention, and student engagement. Adaptive digital games provide playful and motivating experiences, adjusting difficulty levels and feedback according to user performance, which stimulates cognitive, social, and emotional development. Furthermore, they foster school inclusion by enabling greater participation and interaction within the educational environment. Integrating these technologies into the curriculum requires teacher training and pedagogical planning to ensure they are used as mediating instruments rather than mere entertainment. It is concluded that the articulated use of assistive technologies and adaptive games represents a significant advancement in inclusive education, contributing to more accessible, equitable practices centered on the potential of each child with ASD.

Keywords: Autism Spectrum Disorder; Personalized learning; Assistive technologies.

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INTRODUCTION

In recent years, inclusive education has gained prominence, driven by advances in public policies and new pedagogical approaches. What once seemed to be a highly individualized process has now evolved into a broad search for innovative strategies. With the growing diversity in classrooms, addressing the needs of each student—especially those with Autism Spectrum Disorder (ASD)—has become an increasingly significant responsibility for educators. To cope with the specific challenges faced by these students, such as difficulties in communication and social interaction, many teachers have turned to resources like adaptive digital games and assistive technologies, which make the teaching process more accessible, engaging, and effective.

Autism Spectrum Disorder (ASD) is a condition that interferes with a child's neurological development, affecting their way of communicating, socializing, and perceiving the surrounding world. According to the American Psychiatric Association (2014), individuals with ASD commonly exhibit difficulties in social interaction, language use, and repetitive behaviors, in addition to highly restricted and specific interests. ASD generally manifests in the early years of life and, in most cases, accompanies the individual throughout their lifetime. Identifying the signs early is essential to ensure that the child receives the necessary support from the outset. When the diagnosis is made at the appropriate time, it becomes possible to initiate interventions such as specialized therapies and monitoring that promote overall development. These early measures, when properly applied, help the child face everyday challenges and, over time, lead to significant achievements in different areas of life. Furthermore, they contribute to building stronger social relationships and advancing cognitive, emotional, and communication skills, both inside and outside the school environment (AMERICAN PSYCHIATRIC ASSOCIATION, 2013).

The World Health Organization (WHO) estimates that approximately 1% of the global population is on the autism spectrum, and about 75% of these individuals also present some degree of intellectual disability (WHO, 2023; FILIPEK et al., 2023). The term "spectrum" is used precisely because symptoms and levels of impairment vary greatly among cases. In general, ASD affects a child's ability to interact with others, communicate clearly, and cope with changes in routine or environmental stimuli.

The challenge of including students with ASD in schools is evident, as this condition is subject to divergent interpretations among health professionals and is widely debated by educators, leading to new methodologies and educational practices. Inclusion does not merely mean being physically present in the classroom; it requires equity with peers, creating a caring and attentive environment with deep, targeted knowledge that respects the unique characteristics of children with ASD (MANTOAN, 2003; MITTLER, 2003).

Within the school setting, educational games represent an important tool in the learning process of children with ASD. Embedded in the context of inclusive education, these games contribute to the development of motor and cognitive skills that often remain underexplored by the child. Additionally, they enhance language acquisition, stimulate autonomy, and strengthen social bonds—essential elements for holistic growth (KISHIMOTO, 2010).

According to Kishimoto (2010), "play is a fundamental activity for child development, as it is through play that the child experiments, interprets, and gives meaning to the surrounding world." This assertion underscores the importance of games in schools and becomes even more compelling when adapted for all students, particularly those with ASD, who frequently encounter barriers to participating in activities alongside peers.

Silva (2019) emphasizes that well-planned playful activities play a crucial role in fostering bonds, learning respect for rules, and valuing others as partners in coexistence. This perspective reinforces the potential of educational games to support the development of children with ASD, especially when tailored to their individual needs. Properly adapted resources assist not only in cognitive and emotional aspects but also in emotional regulation, reasoning construction, and, in many cases, help reduce episodes of hyperactivity and impulsivity present in some profiles within the spectrum.

The attentive gaze of teachers and inclusive education professionals is essential to identify both challenges and potentialities of each child. This care significantly influences the choice of games used in the classroom, allowing adjustments according to each student's characteristics and contributing effectively to their development. Vygotsky (1991) already noted that play, when mediated by imagination, enables the child to transcend habitual behavior and experiment with new ways of acting. This demonstrates that games go far beyond recreation: they can be powerful tools for comprehensive skill development, especially when employed with educational intent.

> "A school that aims to be inclusive must, above all, be willing to rethink its practices, spaces, schedules, and content. This means accepting that students differ from one another and that these differences are not problems to be solved but potentials to be embraced. Inclusion demands a pedagogical perspective committed to the development of all, not merely to fulfilling a standardized curriculum."
> (MACHADO, 2017, p. 42)

This article aims to analyze the contribution of assistive technologies, with an emphasis on adaptive digital games, in the teaching process of children with Autism Spectrum Disorder. Specifically, it seeks to: understand the theoretical foundations supporting the use of adaptive digital games in inclusive education; present examples of tools and platforms used with this population; discuss the pedagogical impacts of these games on cognitive, social, and communicational development; and

demonstrate how teacher mediation of assistive technologies can enhance social interactions among children with and without the condition.

ASSISTIVE TECHNOLOGIES AND ADAPTIVE DIGITAL GAMES IN SCHOOLS

In recent times, an important transformation has been observed in the way educational games are applied in schools, particularly within the context of inclusive education. Many of these games have incorporated technological resources, evolving into digital versions that offer greater reach and possibilities, especially when designed to meet the needs of students with Autism Spectrum Disorder (ASD). Focused on innovation, these digital games are developed to stimulate motor and sensory skills in an adapted manner, respecting the specificities of each child and their developmental level. This adaptability makes the school environment more accessible, welcoming, and aligned with the principles of inclusion.

A significant difference between traditional and digital games lies in how each child experiences these activities. While conventional games generally follow fixed rules and predictable formats, digital games are designed to adapt to the player's profile, offering a personalized experience based on the student's responses and interactions. This flexible nature is particularly advantageous for children with ASD, who often have distinct learning rhythms and specific needs. According to Figueiredo and Souza (2021), this type of personalization supports the child's development by respecting limitations without restricting potential, fostering progress in emotional, social, and cognitive domains.

Although significant advances have been achieved in inclusive education, many challenges remain for these practices to become fully consolidated in schools. Numerous teachers report difficulties in applying educational games in daily classroom routines, whether due to insufficient training, lack of adapted teaching resources, or limitations in school infrastructure. For inclusion to occur effectively, continuous investment in teacher training, supportive public policies, and conditions that ensure access to materials and practices addressing diverse student realities is essential.

In recent years, Brazil has increased incentives for technologies aimed at developing adaptive games for classroom use. The "Brincar e Aprender" ("Play and Learn") project, for example, linked to the Federal University of Ceará, develops digital platforms with adaptive games designed to stimulate social interaction and language skills in children with ASD, achieving positive results in over 70% of cases tested in classrooms (CARVALHO et al., 2022).

According to Miranda (2019), "digital games, when well-structured, function as windows into the inner world of the autistic child, revealing aspects that do not always manifest in traditional interaction." This statement highlights another relevant aspect: the potential for games to serve as direct assessment tools. In this regard, professionals such as psychologists and educators specializing in inclusive education

can use data obtained during playful activities to observe and analyze the behavior of students with ASD when faced with different challenges.

Despite the positive contributions of digital games to the teaching process, it is important to emphasize that these resources should not replace traditional teaching materials, particularly those designed for children with ASD. The most appropriate approach is to use both technological and conventional tools complementarily, creating a more balanced and enriching learning environment. This integration must be carefully planned and monitored by educators and specialists who understand the specific needs of each student. In this context, comprehensive and ongoing teacher training for those who adopt adaptive games as auxiliary pedagogical resources represents a significant advantage, promoting more inclusive practices tailored to each student's reality (SANTOS; FERREIRA, 2021).

> "Even with the progress achieved, it is necessary to recognize that challenges persist. Many teachers still do not feel prepared to use educational games effectively, whether due to a lack of continuous training, scarcity of adapted materials, or structural limitations in schools. Building an inclusive school, therefore, depends on continuous investment in public policies, teacher training, and equitable access to educational resources." (LOPES; FERREIRA, 2022, p. 191)

Another study conducted by Ferreira Filho et al. (2022) developed a board game specifically designed for children with ASD, supported by the toy library at Júlio Bandeira University Hospital. The game included 32 spaces, illustrated cards, and toy cars as playing pieces. The researchers emphasized that this game promoted autonomy and speech development among participating children with ASD.

> "The playful nature of board games has the potential to be used by children with autism to develop autonomy and social skills, improving the quality of life of these individuals and their interactions."
> (FERREIRA FILHO et al., 2022, p. 5)

A study carried out at the Federal University of Pará focused on another type of game: digital. This game was based on mathematics, presenting a didactic sequence involving calculation concepts and resulting in playful learning that reduced anxiety while facilitating the understanding of arithmetic concepts through interaction and visualization.

> "The use of games in mathematics teaching allowed students with ASD to assimilate content in a contextualized manner, transferring it to their daily lives." (UFPA, 2021, p. 32)

At the Federal University of Rio Grande do Norte (UFRN), researchers developed an exploratory study using adaptive digital games aimed at promoting social interaction among children with ASD. According to Yanaze et al. (2023, p. 178), "The context of the 'Digital Game for Awareness' project demonstrated that digital games favor sustained attention and willingness for social interactions among

children with ASD." Although still in its initial phase, the results of these studies showed increased attention and motivation among children with ASD.

A report by the Federal University of Uberlândia (UFU) presented experiences within a toy library, highlighting the importance of children with ASD playing together. According to the UFU report, "Then Rei smiled... called other children: 'I will hold another child's hand'... mediation enabled the child with ASD to connect with the group during a moment of collective play." (BRINCADILHAR: Vivências, 2021, p. 8).

TEACHER MEDIATION IN THE USE OF ASSISTIVE TECHNOLOGIES FOR STUDENTS WITH ASD

Traditional games such as cards, dominoes, puzzles, memory games, and building blocks like LEGO, among others, are still widely used in school contexts, mainly due to their financial accessibility, ease of application, and playful appeal. These games can be highly useful when working with children with Autism Spectrum Disorder (ASD), especially as an entry point for socialization with peers, since they present clear rules, predictable structures, and repetition—elements that can provide a sense of security during interaction (SOUZA; ROCHA, 2019).

To ensure these games truly meet the individual needs of each child with ASD, specific adaptations are often necessary. These modifications may include adjustments in color use—softer or more vibrant tones depending on the student's sensory sensitivity—the addition of tactile elements such as varied textures, or even rule reformulation to make challenges more accessible. As Oliveira (2016) emphasizes, adapting playful materials is essential to guarantee access to the curriculum while respecting each student's limitations and potential. Therefore, games must consider the unique characteristics of each child, valuing their forms of expression and participation in the learning process.

Digital games have increasingly gained space in school routines, especially in practices aimed at inclusion. This progress is closely linked to the growing use of technology and, more recently, to the resources offered by artificial intelligence. These tools have made it possible to create more personalized experiences that align with the specificities of each child. According to Freitas and Medeiros (2022), adapting digital games to the needs of students with autism can enhance concentration, spark interest in activities, and stimulate autonomy. When carefully planned with attention to each student's sensory responses, these games become powerful allies in making classrooms more welcoming and engaging.

As Mantoan (2003, p. 54) states:

> "Inclusion does not merely mean being physically present in the school space, but actively and meaningfully participating in the educational experiences it offers. For this to happen, pedagogical resources such as games must be adjusted to each student's possibilities."

Thus, the teacher's role is to plan the application of adaptive games throughout the school year alongside traditional teaching materials for students with ASD. These resources serve as powerful instruments in building a more inclusive education among peers, helping all students develop equitably.

One of the most effective strategies in inclusive pedagogical practices is curricular adaptation. This involves support teachers adjusting content according to the grade level in which the student with ASD is enrolled, while respecting their specific needs. In this way, the student can maintain interaction with neurotypical peers while engaging in personalized activities aimed at individual development. The professional responsible for this support must have autonomy to propose adapted activities, enabling the student to actively participate in school routines both inside and outside the classroom (DUARTE, 2023; SCHMIDT, 2016).

The effective use of educational games in inclusive education, combined with the training of professionals qualified to work in this area, constitutes one of the main pillars for promoting meaningful learning. Teacher mastery in the classroom is indispensable, as educators play a central role in the student's growth process—especially those working in early childhood education. Mantoan (2003) underscores the need for transformation within schools, advocating for more inclusive environments and granting teachers the freedom to make classrooms more empathetic.

According to Vygotsky (1991), students' social and cognitive development occurs largely through interactions established in daily classroom life. In this process, the teacher plays a fundamental role as a mediator, fostering collective and meaningful knowledge construction by facilitating dialogue, experience sharing, and cooperation among students. In other words, when educators mediate interactions, they guide and encourage children to fully participate in lessons—and games make this process more enjoyable and accessible.

For students with ASD, teacher-student interaction requires greater care to meet each child's needs, creating an interactive environment with communication and behavioral observation. When teachers are trained for this role, they can identify when games need adaptation, when intervention is necessary, and even when silence is important during activities. This creates a more disciplined and productive environment. These narratives align with Nogueira and Lopes (2021), who highlight how inclusive strategies become effective through attentive care and observation by educators.

> "The playful environment encourages children with autism to engage more in proposed activities, fostering the development of social and communication skills. Moreover, games offer opportunities for contextualized learning, where the student feels part of the group and capable of contributing with their own potential."
> (GOMES; LIMA; PEREIRA, 2019, p. 211)

For this reason, adequate teacher training focused on inclusive education is essential. It is necessary for the federal government, in partnership with education departments, to develop and implement strategies that promote continuous professional qualification. Silva and Almeida (2020) argue that when teachers are well-trained and schools are properly equipped for inclusive teaching, students respond positively, strengthening education in this field.

FINAL CONSIDERATIONS

This article is divided into three subsections, each structured to contribute to building a broad and critical understanding of pedagogical practices focused on adaptive games as instruments to complement teaching materials, supporting children with Autism Spectrum Disorder (ASD). Although ASD has been recognized for many years, it remains widely discussed among health professionals, as its prevalence has increased over time.

Despite all the challenges encountered in addressing this condition, it is essential that educators, health professionals, and families work together to ensure that the child receives comprehensive support to meet cognitive and intellectual needs. Appropriate care and treatment will provide improvements in social and personal life, as well as long-term benefits, enabling children with ASD to become adults capable of coping with everyday difficulties in professional, emotional, and social contexts.

Autism Spectrum Disorder (ASD) presents different forms of manifestation and varying levels of impairment, requiring teachers to exercise sensitivity in dealing with each student individually. Understanding the specific needs of each child is crucial to promoting fair and inclusive education. When adaptive games are integrated into pedagogical planning—especially when combined with appropriate teaching materials—they can significantly contribute to learning. Moreover, these games encourage interaction among students, strengthening social bonds and making the school a space more open to diversity.

School inclusion offers numerous benefits for autistic children, and it is the responsibility of parents and teachers to support this development by providing resources available to better serve them—from early diagnosis to ongoing activities and monitoring over the years. Pedagogical strategies are fundamental throughout this process, particularly with the involvement of specialized professionals.

Despite progress, many challenges remain. The lack of technological infrastructure in numerous public schools, the scarcity of specific teacher training, and the absence of structured public policies to support the implementation of inclusive technologies hinder the full realization of these practices. Furthermore, it is necessary to address the risk of replacing human connection with technology, recognizing that digital resources should serve as allies to teachers—and never substitutes for their listening, empathy, and presence.

It is concluded, therefore, that adaptive digital games, as part of assistive technologies, are highly valuable pedagogical resources for teaching children with ASD, provided they are used in a planned, mediated, and contextualized manner. They represent a bridge between playfulness and knowledge, between technology and pedagogical sensitivity, and between the right to education and the realization of inclusion.

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AFFECTIVITY AND EMOTIONAL RELATIONSHIPS IN LEARNING: PATHS TO AN INCLUSIVE AND HUMANIZED SCHOOL

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ABSTRACT

This article analyzes the importance of affectivity and emotional relationships in the teaching and learning process, highlighting their essential role in building an inclusive and humanized school. The research, with a qualitative and reflective approach, integrates a theoretical review and a teaching experience report developed in a public rural school with a student with special educational needs. Based on classical and contemporary authors such as Vygotsky, Wallon, Freire, Rogers, and Goleman, it discusses how empathy, bonding, and active listening can transform the school environment into a space of acceptance and respect for diversity. The results show that affectivity is a fundamental pedagogical tool for students' holistic development and for promoting inclusion and humanization in the educational context.

Keywords: Affectivity; Emotion; Learning; Inclusion; Humanization.

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INTRODUCTION

In recent decades, the educational field has undergone intense transformations driven by social, technological, and emotional changes that characterize the 21st century. The contemporary school, as a space for human formation, is called upon to re-signify its pedagogical practices, overcoming the traditional paradigm centered solely on content transmission and recognizing the essential role of affectivity and emotions in learning. The educational process, understood from a holistic perspective, involves cognitive, social, and affective dimensions that intertwine, making it impossible to dissociate knowing from feeling.

Affectivity, often relegated to a secondary role in pedagogical practices, constitutes an essential component of human development and knowledge construction. Henri Wallon (1942) was a pioneer in affirming that child development results from the interaction between emotion, movement, and cognition, arguing that affective experiences directly influence behavior and learning. Lev Vygotsky (1991), in turn, emphasized that teaching and learning occur within social interactions, where the bond between teacher and student assumes a mediating role. For him, emotions mobilize curiosity and motivation—indispensable elements for cognitive advancement.

In the context of contemporary education, especially after the COVID-19 pandemic, the emotional dimension of learning has gained even greater relevance. The difficulties imposed by social isolation and remote teaching highlighted the importance of care, empathy, and sensitive listening in the relationship between educators and students. The return to in-person classes revealed an urgent need to rebuild bonds, restore trust, and strengthen the human dimension of schooling. In this scenario, affectivity is not only a means of interaction, but also a tool for rehumanizing teaching, capable of restoring the sense of coexistence, solidarity, and belonging.

From Carl Rogers' (1983) humanistic perspective, meaningful learning occurs when the individual feels accepted and valued in their entirety. The teacher, by adopting an empathetic and authentic posture, creates conditions for the student's potential to flourish. Rogers argues that education should be person-centered, respecting emotions and subjectivity. This conception aligns with Paulo Freire's (1996) thought, which advocates "amorosidade" (lovingness) as a fundamental pedagogical principle: teaching requires ethical commitment, sensitivity, and openness to dialogue.

Thus, affectivity is not limited to expressions of kindness or affection but constitutes a pedagogical category endowed with intentionality and theoretical foundation. It permeates the organization of practices, activity planning, and the form of interaction among subjects within the school space. The presence of affection in the educational process enables the construction of an inclusive and humanized school, where students are recognized in their uniqueness and respected in their rhythms and ways of learning.

Beyond its pedagogical value, affectivity plays a crucial role in inclusive education. Teaching experience shows that students with specific educational needs respond better in environments where they feel welcomed and understood. Empathy and active listening are tools that foster the development of bonds and promote the effective participation of these students in school life. Inclusion, therefore, goes beyond legal and structural dimensions and materializes in the human relationships established in the classroom.

This study aims to analyze the role of affectivity and emotional relationships in the learning process, highlighting their contribution to building an inclusive and humanized school. The investigation starts from the understanding that affection is a structuring element of the educational process, determining academic and emotional success. Furthermore, it seeks to present an experience report that demonstrates how emotional relationships can transform school life and strengthen students' holistic development.

The scientific relevance of this work lies in its proposal to discuss affectivity from a critical and humanizing approach, articulating theory and practice. By reflecting on the role of emotions in learning, it intends to contribute to strengthening a pedagogy committed to equity, respect, and sensitivity, reaffirming the principle that educating is, above all, an act of love, dialogue, and hope.

METHODOLOGY

This research is qualitative, descriptive, and reflective, based on theoretical assumptions of the interpretative approach, which recognizes the subject as the center of the knowledge construction process and values concrete experiences lived in the educational context. According to Bogdan and Biklen (1994), qualitative research allows understanding educational phenomena from the participants' perspective, privileging meanings, perceptions, and feelings.

The study adopts the experience report method as its main investigative strategy. This type of methodology, according to Minayo (2001), enables the researcher to critically reflect on previously lived practices, analyzing their pedagogical, emotional, and social implications. When scientifically structured, the experience report goes beyond narrative and assumes the role of an instrument for reflection and systematization of teaching practice, allowing dialogue between theory and reality.

PROFESSIONAL EXPERIENCE CONTEXT

The experiences reported in this work were lived throughout the researcher's practice as a teacher in the early years of elementary education, in municipal public schools located in rural communities of Rio Grande do Norte, where pedagogical work is characterized by multi-grade classes and by a very close coexistence among members of the school community.

In this scenario, teaching practice is marked by the constant need for adaptation, sensitivity, and creativity. Each student brings with them unique stories, rhythms, and emotions, which require the teacher not only to master content but also to possess emotional and affective competence to mediate relationships and promote meaningful learning.

Among the experiences analyzed are actions developed in literacy and school inclusion projects, with emphasis on activities aimed at strengthening students' self-esteem and their sense of belonging to the school community. In all these moments, affectivity emerged as the central axis of the educational process, both in mediating learning and in building bonds among teachers, students, and families.

OBSERVATION AND REFLECTION PROCEDURES.

Observations were carried out during the development of pedagogical practices that integrated cognitive and emotional aspects. Particularly noteworthy are moments experienced in shared reading activities, collective text production, conversation circles, and coexistence workshops, in which students were encouraged to express feelings, personal experiences, and opinions.

Participant observation, combined with reflective recording in a field diary, made it possible to identify situations in which affectivity acted as a mediator of learning. Attentive observation and sensitive listening allowed us to understand that the student's emotional involvement with the activity directly influences their motivation and performance.

In one of the experiences, for example, it was observed that students with reading and writing difficulties showed greater commitment when activities were associated with meaningful themes from their reality and conducted in an affectionate manner. Verbal encouragement, sincere praise, and recognition of individual effort proved to be effective strategies for promoting progress in learning and strengthening students' confidence.

THE EXPERIENCE REPORT AS A PATH FOR TEACHER DEVELOPMENT.

By adopting the experience report as a method, this study also proposes a reflection on teaching practice. Each reported experience is understood as an opportunity for learning and reconstructing pedagogical practice. Affectivity, in this process, is analyzed not only as a feeling but as an epistemological and formative dimension of teaching, as it guides ethical posture, sensitive perspective, and commitment to the humanization of education.

The systematization of these experiences contributes to strengthening reflective teacher education, in which the teacher recognizes themselves as a researcher of their own practice. This conception aligns with Schön (1992), who advocates the figure of the "reflective professional," capable of learning from their actions, interpreting context, and reinventing methodologies.

Thus, the methodology adopted in this study articulates experience and reflection, theory and practice, in a continuous movement of constructing pedagogical knowledge. The analysis of experiences makes it possible to understand that affection, when intentionally incorporated into educational practice, transforms the school environment into a space of trust, dialogue, and belonging, promoting meaningful and truly humanized learning.

RESULTS AND DISCUSSION

The results presented in this study emerge from reflections on real pedagogical experiences within the classroom context, in which affectivity proved to be a determining element for the success of educational practices and for strengthening bonds between teacher and student. The analysis of these experiences reveals that the emotional dimension of learning not only favors cognitive development but also contributes to the ethical, social, and human formation of those involved in the educational process.

In general, it was observed that school environments marked by healthy and welcoming affective relationships tend to show greater student engagement in activities, as well as more significant levels of participation and cooperation. Pedagogical practices guided by empathy and active listening enhance students' sense of belonging and self-confidence, generating direct impacts on learning.

During observation and reflective analysis of teaching practices, it was found that simple gestures—such as dialogue, praise, recognition of effort, demonstration of patience, and the use of encouraging words—positively influence students' behavior and disposition. These emotional elements become mediators of the teaching process, promoting engagement and awakening interest in knowledge.

Teaching practice also revealed that, in situations of conflict, anxiety, or insecurity, the teacher's affective posture is essential to restore emotional balance and ensure the continuity of pedagogical work. The educator who listens, understands, and respects the student's limits fosters an environment of trust, where mistakes are perceived as a natural part of learning. This approach strengthens what Vygotsky (1991) defines as the zone of proximal development, as affective interaction creates the necessary conditions for the student to progress with the support of others.

Another important aspect highlighted in the analyzed experiences is that affectivity acts as an integrating element of differences, allowing each student to be recognized in their uniqueness. In heterogeneous classes—with different rhythms, backgrounds, and learning levels—the emotional bond established between teacher and student becomes a channel for accessing knowledge and an instrument of inclusion. When students feel welcomed, respected, and valued, they engage more actively in the educational process.

This finding aligns with Carl Rogers' (1983) reflections, affirming that genuine learning occurs when the environment is permeated by empathy, acceptance, and authenticity. Likewise, Paulo Freire

(1996) emphasizes that teaching requires lovingness, which implies seeing the student as a complete being, with emotions, dreams, and potentialities.

During the reported practices, situations were observed in which the simple act of listening to the student, understanding their difficulties, and encouraging their verbal and creative expression resulted in significant improvements in school performance. In this case, affectivity proved to be not only a strategy for rapprochement but a pedagogical resource for transformation, capable of promoting students' protagonism and autonomy.

Furthermore, the presence of affection contributed to strengthening the relationship between school and community. By involving families in school activities—through projects, presentations, and collective actions—emotional bonds extended beyond the classroom, creating a support network that enhances students' development and reinforces their sense of belonging to the school space.

These observations confirm that affectivity plays a structuring role in the educational process. A school that values dialogue, respect, and human care forms individuals who are more conscious and cooperative, prepared to live with differences and face the challenges of the contemporary world. According to Goleman (1995), the development of emotional intelligence is as important as that of reason, as it enables individuals to deal with their own emotions and understand those of others, making coexistence more ethical and balanced.

Therefore, the results obtained through the analyzed teaching experiences reinforce that the success of learning depends largely on the quality of relationships established in the school environment. The teacher, as a mediator of knowledge and emotions, plays a fundamental role in building a sensitive and inclusive education that integrates reason, affection, and action.

Thus, it can be affirmed that affection, when intentionally and consciously incorporated into pedagogical practices, transforms the classroom into a space of listening, trust, and hope, promoting not only students' intellectual development but also their holistic formation as human beings..

CONCLUSION

The analysis developed in this study reaffirmed that affectivity constitutes a central axis in the teaching and learning process, being an essential element for consolidating an inclusive, humanized, and transformative pedagogical practice. The teaching experiences reflected throughout the research demonstrate that the act of educating goes beyond the mere transmission of content and is grounded in relationships of trust, empathy, and sensitive listening, in which teacher and student jointly construct knowledge and a sense of belonging to the school.

The results showed that the affective bond sustains meaningful learning and the holistic development of the student. The presence of affection in the classroom acts as a mediator of social

interactions, facilitates overcoming emotional and cognitive barriers, and creates an environment conducive to curiosity and creativity. In contexts marked by diversity and the challenges of inclusion, affectivity assumes the role of an emancipatory pedagogical tool, capable of transforming school life into a space of care, respect, and equity.

From a theoretical perspective, authors such as Vygotsky, Wallon, Rogers, Freire, and Goleman support the understanding that human development is an integral process in which emotion and cognition continuously interrelate. Learning, from this viewpoint, is both an intellectual and emotional act. Thus, teaching requires not only planning and technical knowledge but also sensitivity, ethics, and lovingness—indispensable characteristics for contemporary teaching.

In professional practice, affective approaches proved decisive for building democratic learning environments where all students, regardless of their conditions and rhythms, find opportunities to express themselves, learn, and coexist. The teacher who adopts an affective posture becomes a mediator of emotions and human values, promoting dialogue and empathy as formative principles.

Therefore, this study reinforces the need to rethink teacher education, systematically including the development of socio-emotional competencies. It is essential that educators be prepared to recognize their own emotions and those of their students, understand the impact of interpersonal relationships on the learning environment, and act with balance and empathy when facing the daily challenges of the classroom.

Affectivity, therefore, is not an ornament of pedagogical practice but an epistemological and ethical dimension of education, as it enables the encounter between knowing and feeling, between knowledge and humanity. It is in this encounter that meaningful, living, and transformative learning is produced.

Moreover, a school that cultivates affectivity in its relationships becomes a space of hope and belonging. As Paulo Freire (1996) states, educating is an act of love, and loving, in the pedagogical context, means committing to the other, believing in their ability to learn, and providing conditions for them to flourish fully. This perspective reaffirms the importance of an education committed to human dignity and to building a more just and supportive society.

Finally, this study reinforces the conviction that the path to a truly inclusive school lies in valuing emotions, building bonds, and recognizing that affectivity is the heart of the educational process. Educating with affection is educating for life—it is forming human beings capable of thinking, feeling, acting, and coexisting in a world that urgently needs more empathy, sensitivity, and humanity.

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PERSONALIZED TEACHING MATERIALS AS A TEACHING–LEARNING STRATEGY IN CONTEXTS OF CULTURAL AND LINGUISTIC DIVERSITY

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ABSTRACT

This article analyzes the use of personalized teaching materials as a strategy to promote teaching and learning in contexts of cultural and linguistic diversity. The research explores how these materials meet the needs of students from different backgrounds, fostering inclusion and engagement. Through a literature review and analysis of case studies, effective practices, challenges, and benefits are highlighted. A concrete example is a study conducted in a public school in São Paulo, where teachers developed bilingual booklets featuring stories and everyday situations of immigrant students, facilitating content comprehension and promoting a sense of belonging among students of different nationalities. The results indicate that culturally contextualized materials strengthen meaningful learning and educational equity, providing greater participation and valuing students' identities. However, the implementation of these materials faces barriers such as limited financial resources for producing specific content and the lack of adequate teacher training. For instance, many teachers report difficulties adapting the curriculum due to insufficient training in inclusive pedagogical practices and restricted access to diversified teaching materials. The lack of teacher training not only hinders the creation of adapted materials but also limits their effective use in the classroom, directly impacting the potential for inclusion and student engagement.

Keywords: Teaching materials; Cultural diversity; Linguistic diversity; Teaching–learning; Inclusion.

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INTRODUCTION

The demographic and social configuration of contemporary educational institutions has been profoundly transformed by the intensification of migratory flows and the growing global interconnectedness. This phenomenon positions cultural and linguistic diversity not as an exception but as the central reality of countless classrooms worldwide, creating educational environments of remarkable richness and complexity (UNESCO, 2017). The presence of students with different cultural repertoires, worldviews, and mother tongues directly impacts pedagogical practice, challenging historically homogeneous and standardized teaching models. Educators face the daily task of mediating knowledge, building communication bridges, and ensuring that the teaching–learning process is relevant and accessible to all, regardless of their origins.

In this scenario, significant pedagogical challenges emerge. The application of a single curriculum and standardized teaching materials often results in a dissonance between school content and the reality experienced by students. This monocultural approach can generate comprehension barriers, disengagement, and a sense of non-belonging, undermining learning potential. The difficulty for minority students to see themselves represented in textbooks, examples, and proposed activities perpetuates a cycle of exclusion and reinforces structural inequalities. Educational systems that fail to recognize and value diversity risk systematically marginalizing students from cultural and linguistic minorities (Ladson-Billings, 1995). Therefore, the search for new educational strategies that overcome the logic of standardization and promote genuinely inclusive and equitable education becomes imperative.

The response to these challenges lies in adopting pedagogical approaches that are culturally sensitive and responsive. For education to be truly equitable, it is not enough to guarantee access to school; it is essential to ensure that all students have equal opportunities to participate, learn, and thrive academically (Banks, 2015). At this point, the investigation into personalized teaching materials becomes fundamental for improving educational processes in multicultural contexts. Personalizing pedagogical resources transcends mere translation of content or inclusion of folkloric elements. It is an intentional strategy to connect the curriculum to students' life experiences, prior knowledge, and cultural references, using them as a foundation for constructing new knowledge. By doing so, learning becomes contextualized and, consequently, more meaningful (Gay, 2010).

This article, therefore, aims to investigate the potential of personalized teaching materials as a strategic tool for strengthening the teaching–learning process in highly diverse environments. The central objective is to analyze how these materials can be conceived, developed, and implemented to meet students' cultural and linguistic specificities, fostering not only academic performance but also the appreciation of their identities and the development of intercultural competencies. Based on a methodology that combines systematic literature review and in-depth case study analysis, we seek to

identify effective practices, challenges inherent to their application, and observed impacts. The guiding question of this investigation is: How do personalized teaching materials contribute to achieving meaningful and equitable learning in culturally and linguistically diverse educational environments?

The relevance of this study is justified by the urgent need to build educational paradigms that respond to the demands of the 21st century, preparing citizens to coexist in plural societies. By offering theoretical and practical support to educators, managers, and policymakers, this research aims to contribute to overcoming barriers that have historically limited the school success of millions of students. To present the results clearly and systematically, this work is organized into five sections: the present introduction, which contextualizes the theme and problem; the theoretical framework, which deepens the concepts of multicultural education and culturally responsive pedagogy; the methodology, which details the research procedures; the results and discussion section, which presents and analyzes the collected data; and finally, the conclusion, which synthesizes the main findings and points out implications for future research and pedagogical practices.

THEORETICAL FRAMEWORK

Cultural diversity refers to the coexistence of different values, beliefs, social practices, and worldviews within the same context, representing the plurality of ways of life that shape contemporary societies (Banks, 2015). Linguistic diversity, in turn, involves the presence of multiple languages or dialects in a social or educational environment, constituting an essential part of the identity of groups and individuals. In this scenario, recognizing cultural and linguistic diversity in education is not merely an additional aspect of the teaching process but a structural element for pedagogical practices that aim to be inclusive and equitable. Echoing the writings of Vera Maria Candau (2008, 2012), the school can serve as a space for dialogue among different cultures rather than a place for imposing a hegemonic culture.

According to Ladson-Billings (1995), culturally relevant education is fundamental for valuing students' identities, enabling the learning process to become meaningful and connected to their realities. This implies adopting teaching practices that go beyond the transmission of universal content, promoting the incorporation of elements that respect and acknowledge students' sociocultural origins. In this sense, the personalization of teaching materials stands out as a pedagogical strategy. Such materials may take the form of bilingual texts, examples contextualized in local experiences, activities that engage with community traditions, or narratives representing diverse identities, thereby strengthening students' self-esteem and sense of belonging (Gay, 2010).

This perspective aligns with Ausubel's theory of meaningful learning (2000), which asserts that learning is more effective when new knowledge is related to students' prior experiences. When teaching materials incorporate familiar cultural and linguistic elements, they create cognitive bridges that facilitate

understanding and retention of content. Complementarily, Vygotsky (1978) emphasizes that cognitive development is profoundly influenced by social interactions and cultural context. Thus, materials reflecting students' realities not only enhance engagement but also stimulate collective knowledge construction, transforming the classroom into a more dynamic and inclusive space.

Personalized materials also connect with the concept of differentiated instruction, which seeks to address the needs of students in heterogeneous contexts (Tomlinson, 2017). In classrooms marked by cultural and linguistic plurality, differentiated resources allow each student to find meaning in the educational process. Examples include narratives featuring characters from diverse cultural backgrounds, math problems situated in local realities, or activities that encourage valuing students' mother tongues without disregarding the official language of instruction (Barbosa, 2019). When carefully planned and contextualized, these resources increase motivation, foster active participation, and improve content retention, promoting more meaningful and inclusive educational experiences.

Furthermore, educational literature highlights that personalized materials not only contribute to individual learning but also help reduce structural inequalities within schools. UNESCO (2017) underscores that creating pedagogical resources adapted to students' cultural and linguistic specificities is a strategic path toward greater educational equity. In this sense, personalization emerges as an instrument of social justice in schools, as it democratizes access to knowledge, recognizes diverse identities, and strengthens inclusion, whereas standardized materials often perpetuate stereotypes and power relations (Silva, 2000).

The Freirean framework also relates to this theoretical foundation, as the concept of "reading the world," which precedes "reading the word," is the very essence of personalized teaching materials. Freire (1996) advocates that education should begin with the student's concrete reality. Using personalized materials is a direct application of his pedagogy, which values learners' knowledge and experiences as the starting point for meaningful and critical learning.

This theoretical foundation is not only academically supported but also strongly endorsed by Brazilian educational legislation. The National Education Guidelines and Framework Law (LDB, Law No. 9.394/96), in Article 26-A, establishes the mandatory inclusion of Afro-Brazilian and Indigenous history and culture in basic education curricula, requiring materials that reflect this diversity. More specifically, the LDB guarantees Indigenous communities the right to bilingual and intercultural schooling, with their own learning processes (Art. 78). This perspective is reinforced by the National Common Curricular Base (BNCC), which, in its general competencies, advocates empathy, dialogue, and respect for diversity (Competency 9) and the appreciation of diverse cultural manifestations (Competency 3). These regulations legitimize and promote the creation and use of personalized teaching materials, transforming cultural adaptation from a pedagogical ideal into a legal obligation for fostering equity.

However, the mere existence of culturally appropriate materials and legal support does not guarantee effective application. The implementation of a pedagogy of diversity depends intrinsically on the educator's role, making continuous professional development an indispensable pillar. Teachers need support not only to develop technical skills for selecting, adapting, or creating these resources but also to cultivate attitudes sensitive to differences and attentive listening to students' realities. This preparation involves critical reflection on their own worldviews and the development of competencies to mediate conflicts and intercultural dialogues in the classroom. Without educators prepared for the cultural and didactic management of these materials, there is a risk of superficial or folkloric application that fails to achieve the goal of promoting truly transformative learning.

Therefore, by considering cultural and linguistic diversity as central axes of pedagogical practice, the personalization of teaching materials is not merely an alternative methodology but an ethical and educational imperative. This approach expands learning potential, respects identity plurality, and contributes to building a school environment that is fairer, more participatory, and more responsive to students' realities.

METHODOLOGY

This study adopts a qualitative approach, combining a literature review and case study analysis, as suggested by Yin (2016) for exploratory research. The literature review encompassed articles published between 2015 and 2025, retrieved from databases such as Scielo, ERIC, and Google Scholar, selected based on three criteria: (1) relevance to the topic, (2) methodological rigor, and (3) publication in peer-reviewed journals. A total of 18 articles addressing teaching practices in contexts of cultural and linguistic diversity were analyzed.

Three case studies were selected: (1) an Indigenous school in Brazil that uses bilingual materials; (2) a multicultural school in the United States focusing on immigrant narratives; and (3) an institution in Australia incorporating Aboriginal content. These cases were chosen because they represent contexts of high cultural and linguistic diversity. The analysis was structured into four categories: (1) characteristics of the materials, (2) implementation strategies, (3) impact on learning, and (4) challenges encountered. Data triangulation, as recommended by Creswell (2018), was employed to ensure the robustness of the conclusions.

Data were collected from institutional reports, academic articles, and pedagogical documents. The qualitative analysis involved thematic coding to identify patterns related to the use of personalized materials. The research adhered to the ethical guidelines of ABNT NBR 14724:2011 for academic work preparation, ensuring confidentiality and methodological rigor.

RESULTS AND DISCUSSION

The results of the analyzed studies indicate that personalized teaching materials are primarily characterized by three dimensions: flexibility, cultural contextualization, and linguistic accessibility. These elements enable content to engage with students' realities, promoting more meaningful and inclusive learning.

NATIONAL AND INTERNATIONAL EXPERIENCES

In national experiences, for example, an Indigenous school located in Mato Grosso do Sul implemented bilingual materials (Portuguese and Guarani) in science teaching, which resulted in greater student participation and strengthened interest in scientific subjects (Coelho, 2019). This initiative also fostered community integration, enhanced the appreciation of traditional knowledge, and contributed to more contextualized and meaningful pedagogical practices. This case demonstrates how including the mother tongue can affirm students' cultural identity while expanding their understanding of content.

Similarly, studies with the Xerente people show that producing bilingual teaching materials, developed with active participation from the school community, constitutes a powerful strategy for integrating Indigenous knowledge with contemporary knowledge, aligning with national and international experiences in intercultural education. The research process involved discussion circles and teacher validation sessions with continuous training, favoring memory preservation and identity strengthening, bridging territory and curriculum. The articulation between oral and written language prevents generic materials, requiring careful pedagogical planning (Souza; Andrade; Martins, 2024).

In the same direction, the collective and bilingual production of specific teaching materials has enabled the strengthening of mother tongues, cultural preservation, and improvement of pedagogical practices. Experiences developed by the "Projeto Ação Saberes Indígenas" reveal that research, documentation, and community authorship are as relevant as the final product, as they value traditional knowledge and bring it closer to the school. Such practices foster critical and transformative interculturality (Moreira; Zoia, 2021).

Among international examples, in the United States, a school in Los Angeles adopted literary texts portraying Mexican immigrant culture, which increased student motivation during literature classes (Rodrigues, 2019). This contextualized approach also strengthened cultural identification, expanded engagement in discussions, and contributed to a more inclusive and meaningful learning environment. Recognizing their own culture in study materials reinforced students' connection with school and reduced disengagement rates. Similarly, in Australia, introducing Aboriginal narratives into school materials was associated with improved self-esteem and greater student engagement (Sales, 2023). This pedagogical strategy also encouraged valuing local identities, increased participation in classroom activities, and

contributed to richer, culturally sensitive learning experiences. These results show that personalization can transcend the academic dimension, reaching holistic and psychological aspects essential for student development.

Recent literature highlights convergent criteria for teaching materials aimed at Portuguese as a second language in Indigenous schools. It is essential that these materials align textuality with sociocultural context, avoiding decontextualized lists and prescriptive practices. Analyses show progress when materials originate from the territory, as in the Xingu case, and setbacks when they prioritize oral repetition without real interaction. To ensure relevance, it is crucial to align curriculum, bilingualism, and interculturality with continuous teacher training and classroom use evaluation. These criteria guide the production and revision of more effective books for Indigenous literacy in Portuguese (Moscardini; Fargetti, 2024).

IMPLEMENTATION STRATEGIES

The most effective implementation strategies include direct collaboration with local communities in developing culturally relevant content and continuous teacher training. Community involvement ensures that teaching materials reflect students' realities, incorporating traditions, languages, and everyday experiences often absent from standardized curricula. Collective material development strengthens school-community ties and legitimizes local knowledge as an integral part of the educational process.

According to Tomlinson (2017), teacher training is a cornerstone of this approach, providing educators with methodological and conceptual tools to adapt pedagogical resources to students' specific needs. Well-prepared teachers can not only select appropriate content but also develop competencies to reinterpret the curriculum critically and contextually. This training fosters teacher autonomy and contributes to consolidating more creative and inclusive pedagogical practices.

However, recurring challenges emerged across all analyzed studies. Among them, the scarcity of financial resources stands out, limiting both the production of differentiated materials and the provision of continuous training. Added to this is resistance to change among some education professionals, often accustomed to traditional teaching methods and skeptical about the effectiveness of new pedagogical practices. Another significant obstacle is the time required to develop personalized materials, which becomes challenging given the multiple demands already placed on teachers (Banks, 2015).

These barriers reveal that, although personalization is a pedagogical strategy of proven effectiveness, its applicability depends on structural, political, and institutional conditions that support it. In other words, recognizing the importance of personalized materials is not enough; mechanisms of

support, incentives, and appreciation of teachers' work must be created for this practice to expand and consolidate as part of everyday school life.

PEDAGOGICAL AND PSYCHOLOGICAL IMPACT

The positive impacts of adopting personalized teaching materials were reported at different levels. Pedagogically, there was an increase in content retention and greater interest in subjects. Barbosa (2019) highlighted that Indigenous students showed significant improvement in interest in science after introducing materials contextualized to their cultural reality, strengthening their connection with studied content and promoting deeper, more relevant, and motivating learning.

By incorporating diverse narratives, symbols, and cultural references, learning becomes more meaningful and closer to students' daily lives. This perspective resonates with Paulo Freire, who argued that knowledge should start from students' concrete reality, valuing their life experiences and sociocultural contexts. For Freire, education is not a process of mere content transmission but a collective construction of knowledge, where dialogue between educator and learner ensures relevant, critical learning connected to students' experiences. Arroyo (2013) corroborates this view by asserting that recognizing popular cultures in schools strengthens students' dignity and sense of belonging, functioning as an emotional and social protective factor. This strengthening translates into a more inclusive and democratic environment, where students perceive themselves as rights-bearing subjects and protagonists of their own learning process.

Psychologically, studies such as Gay (2010) reinforce that cultural validation provided by these materials strengthens student identity, reducing feelings of exclusion and marginalization. This effect is particularly relevant in contexts of linguistic diversity, where bilingual or multilingual students often face communication barriers (Ladson-Billings, 1995). Additionally, Tomlinson (2017) argues that personalization can contribute to creating more inclusive learning communities, where students feel represented, recognized, and valued.

The strategy of personalizing teaching materials supports the development of students' self-esteem and self-concept. These psychological dimensions directly influence academic performance, as they shape students' understanding of themselves and their ability to learn. Brazilian studies show that students with higher self-esteem tend to perform better, show greater willingness to face challenges, and are less prone to feelings of failure. According to Coelho (2019), students with average or above-average academic performance tend to demonstrate higher self-esteem and a more developed social self-concept, positively contributing to their participation and interaction in the school environment. This demonstrates that pedagogical practices validating students' cultural and linguistic identity not only enhance cognitive understanding but also provide essential emotional support for their holistic development.

When students recognize themselves in teaching materials, they feel more connected and attribute greater meaning to learning, which reduces emotional barriers that hinder academic progress. Dionísio and Stribel (2020) analyzed Geography workbooks from the Nova EJA program, revealing stereotyping or absence of Black population representation in materials. The authors conclude that using pedagogical resources with little or no representativeness reinforces feelings of exclusion and invisibility among program students, most of whom belong to the Black population. This highlights the urgent need for teaching materials adapted to be representative, promoting inclusion and recognition of these students. When schools acknowledge and value students' sociocultural backgrounds, they act as spaces of care and belonging, preventing discomfort and strengthening positive bonds with the educational process.

A parallel can be drawn between personalized teaching materials and the concept of intrinsic motivation in Self-Determination Theory (Deci & Ryan, 2000). The authors define intrinsic motivation as performing tasks for personal satisfaction, based on genuine interest, without external rewards. By including elements that resonate with students' realities and interests, materials reinforce basic psychological needs for autonomy, competence, and belonging. This process directly impacts academic engagement, as students who feel recognized and respected tend to participate more actively, showing greater involvement and persistence in the face of difficulties.

THE ROLE OF TECHNOLOGY AND SCALABILITY CHALLENGES

Another relevant factor identified is the role of technology. Digital platforms, educational software, and multimedia tools not only enable greater agility in creating adapted content but also facilitate personalized teaching, individualized student monitoring, and the scalability of this approach across different educational contexts, significantly expanding its reach and impact (Rodrigues, 2019). However, reliance on technological resources can also exacerbate inequalities, especially in low-infrastructure contexts, as emphasized by Banks (2015). This contradiction highlights the need for policies that ensure not only access but also equity in the use of educational technologies.

In addition, IoT platforms play a fundamental role in managing sensors, processing and integrating data from different devices, and assigning added value to selected information. Examples of these platforms include FIWARE, Konker, and ThingsBoard, which can be applied in various sectors such as smart cities, healthcare, environmental monitoring, and industrial management, providing greater efficiency, automation, and data-driven decision-making (Sales, 2023). Likewise, cloud computing has proven highly useful in education by offering a wide range of learning tools, enabling access for both teachers and students regardless of location or time. Artificial Intelligence integration further enhances this process by analyzing user patterns to optimize these tools (Govea et al., 2023).

In this sense, the use of cloud computing has expanded significantly in recent years due to its flexibility and scalability in service delivery (França et al., 2023). Moreover, numerous devices connected to the internet generate vast amounts of data daily, which are utilized on a global scale (Sousa et al., 2018).

DEVELOPMENT OF SOCIOEMOTIONAL COMPETENCIES

The literature also indicates that the personalization of educational materials can go beyond cognitive learning, influencing aspects related to the student's holistic development. In this context, socioemotional competencies are particularly relevant, including empathy, cooperation, autonomy, resilience, and respect for diversity, which contribute to forming individuals who are more conscious, participative, and prepared for complex social interactions both in school and in everyday life (Barbosa, 2019). These competencies are essential in increasingly plural and interdependent societies, where coexistence with different cultures, languages, and worldviews demands skills in dialogue and mutual understanding.

Pedagogical activities based on cultural narratives, for example, not only foster intercultural dialogue but also stimulate students' critical reflection on their own identities and the relationships they establish with others. This process helps reduce prejudice, deconstruct stereotypes, and strengthen an ethical stance that values diversity. Furthermore, the personalization of materials can encourage group work and collaborative learning, promoting a more democratic, participatory, and inclusive classroom environment where everyone feels represented and respected.

EDUCATIONAL POLICIES AND SUSTAINABILITY OF THE PRACTICE

Finally, the analysis of the studies demonstrates that the successful implementation of personalized teaching materials depends on their articulation with solid educational policies. UNESCO (2017) emphasizes that such policies must treat diversity as a pedagogical asset, ensuring continuous investments in school infrastructure, teacher training, and the production of teaching resources. Without this support, these experiences tend to remain isolated cases, lacking lasting impact on the educational system as a whole.

Decree No. 4.281, dated June 25, 2002, under the National Education Guidelines and Framework Law (LDB), No. 9.795, highlights that environmental education has a political character, aiming to transform society toward a more sustainable future committed to environmental preservation. It seeks to form conscious citizens who understand their rights and social responsibilities and adopt a critical and participatory stance in collective decision-making.

The LDB, through the cited decree, establishes that environmental education is a fundamental and continuous component of education in Brazil, and must be present at all levels and modalities of teaching, both formal and non-formal, as described in Article 1 of Law No. 9.795.

Environmental education is understood as the processes through which individuals and communities build social values, knowledge, skills, attitudes, and competencies aimed at conserving the environment, as well as common-use resources essential to a healthy quality of life and sustainability (BRASIL, 1999).

The concept of sustainability reinforces the need for a closer and more conscious relationship between people and the environment, emphasizing care for oneself, others, life in society, and the planet. In this context, environmental education—according to Article 2 of the National Curriculum Guidelines—is understood as an intentional social practice that seeks to develop individuals with social awareness, in harmony with nature and with other human beings.

CONCLUSION

Personalized teaching materials represent a powerful strategy for promoting inclusion and meaningful learning in contexts marked by cultural and linguistic diversity. By respecting students' identities and adapting content to their sociocultural realities, these materials contribute not only to knowledge construction but also to the promotion of educational equity. Valuing individual and collective experiences strengthens the sense of belonging, increases classroom participation, and positively impacts students' self-esteem, as they recognize themselves as active subjects in the learning process.

Despite their transformative potential, the implementation of personalized teaching materials faces obstacles that cannot be ignored. Among these challenges are the limited financial resources available for producing adapted materials, the lack of time within teachers' routines for differentiated planning, and, most importantly, the need for continuous teacher training. Pedagogical preparation is essential, as teachers are the mediators between school content and students' realities. Without adequate institutional support, consistent public policies, and investments in teacher development, personalization tends to remain restricted to isolated initiatives, hindering its consolidation as a systematic pedagogical practice.

In this sense, the role of digital technologies emerges as a promising resource to overcome some of these challenges. Technological tools can facilitate the production, adaptation, and dissemination of personalized content, making them more accessible to teachers and students. Digital platforms, multimedia resources, and educational software can be leveraged to create learning environments that are more flexible, interactive, and sensitive to student diversity. Nevertheless, future research must deepen the debate on the impact of such resources, investigating how they contribute to long-term academic performance and the social inclusion of historically marginalized groups.

This scenario reinforces the importance of formulating educational policies that value cultural and linguistic diversity as a pedagogical resource rather than as an obstacle to teaching. When systematically incorporated, diversity becomes a tool for building more just, critical, and inclusive educational practices capable of responding to the demands of a plural society. Thus, the personalization of teaching materials should be understood not merely as an innovative methodology but as part of a broader project of democratizing knowledge, ensuring that all students have real opportunities to learn, develop, and actively participate in social and cultural life.

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FULL-TIME EDUCATION AS A STRATEGY TO REDUCE EDUCATIONAL INEQUALITIES: GLOBAL PERSPECTIVES ON EQUITY, INCLUSION, AND SOCIAL JUSTICE

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ABSTRACT

This chapter aims to analyze full-time education as a strategy to reduce educational inequalities, discussing its contribution to promoting equity, inclusion, and social justice in a global context. The methodology is based on a literature review of authors such as Libâneo (2013), Saviani (2019), and Arroyo (2018), as well as international reports from UNESCO and OECD addressing full-time school policies and their impact on educational indicators. The results indicate that extended school hours support the holistic development of students, particularly in vulnerable regions, by expanding learning opportunities and access to socio-educational services. Furthermore, international experiences demonstrate positive impacts on reducing inequality, provided they are accompanied by structural

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investment, proper teacher training, and social support policies. It is concluded that full-time education, when aligned with intersectoral actions, is a powerful tool to promote a more just and equal educational system.

Keywords: Educational policies; Equity; Full-time education; Inclusion; Social justice.

INTRODUCTION

In recent decades, the debate on extending school time has gained international relevance, especially in light of persistent educational inequalities affecting students in socioeconomically vulnerable contexts. Full-time education, by proposing an extended school day and diversified educational activities, emerges as a promising strategy to promote human development, reduce learning disparities, and contribute to equity, inclusion, and social justice within education. The central question guiding this study is: to what extent can full-time education contribute to reducing educational inequalities, fostering equity and social inclusion in different national contexts? Thus, the aim is to understand whether extending school hours, when articulated with intersectoral public policies, effectively impacts educational outcomes in a sustainable manner, particularly among students from historically marginalized groups.

The general objective of this chapter is to analyze full-time education as a strategy for promoting educational equity. Specifically, it seeks to: (a) discuss the concept of full-time education in light of contemporary theoretical frameworks; (b) present national and international experiences implementing this modality; and (c) identify potentialities and limitations of its application in reducing educational inequalities.

The justification for this study lies in the need to reflect on pedagogical practices and public policies capable of addressing structural challenges in education, considering that extending school time may represent expanded formative opportunities, especially for students in contexts of social exclusion. The theoretical review draws on authors such as Libâneo (2013), Saviani (2019), Arroyo (2018), and Cavaliere (2007), as well as UNESCO and OECD reports that address full-time education as a tool for social justice and meaningful learning.

These studies show that, although promising, full-time education requires minimum structural conditions, qualified teacher training, and alignment with intersectoral policies to generate effective results. Therefore, this chapter is structured around a critical analysis of the literature and a discussion of the potentialities and challenges of full-time education in building a more democratic and inclusive education system.

METHODOLOGY

This chapter was developed through qualitative research of an exploratory and descriptive nature, based on document analysis and literature review. The methodological structure is organized into numbered sections and subsections, as exemplified below.

TYPE OF RESEARCH

The research is characterized as qualitative, enabling an in-depth understanding of educational phenomena, and exploratory-descriptive, as it seeks to identify and analyze the contributions of full-time education to reducing educational inequalities. The qualitative approach allows for interpreting data grounded in social contexts, which is relevant to the theme of equity and school inclusion.

TECHNIQUES AND INSTRUMENTS

Data collection instruments included literature review and document analysis. The literature review encompassed theoretical works by authors such as Libâneo (2013), Saviani (2019), Arroyo (2018), and Cavaliere (2007), as well as reports from UNESCO, OECD, and official documents from Brazil's Ministry of Education related to full-time education policies. Document analysis covered legislation, curricular guidelines, and national and international educational indicators.

SAMPLE AND MATERIAL SELECTION

The sampling was non-probabilistic and intentional, comprising 25 academic publications and 5 institutional reports produced between 2010 and 2024. Selection criteria considered theoretical relevance, alignment with the theme, and impact on discussions of public educational policies aimed at social justice.

GROUNDED DISCUSSION

Data analysis was conducted using content analysis techniques, according to Bardin (2016), enabling categorization of information into three main axes: (a) conception and foundations of full-time education; (b) experiences implemented in national and international contexts; and (c) impacts on equity and reduction of educational inequalities. The discussion was grounded in critical pedagogy and social justice theory, aligning theoretical concepts with the evidence found. Thus, the adopted methodology allowed for building a consistent analysis of full-time education as a strategy for promoting equity and inclusion, enabling theoretical-practical reflections for improving public educational policies.

RESULTS AND DISCUSSION

The results indicate that implementing full-time education significantly contributes to reducing educational inequalities, especially among students in socially vulnerable situations. The analysis shows that extending school hours fosters the development of socio-emotional and cognitive skills, providing more time for learning, community integration, and participation in extracurricular activities, as noted by Cavaliere (2007) and reaffirmed in UNESCO reports (2022).

Schools adopting full-time education exhibit higher rates of retention and academic performance, particularly when combined with social support policies such as nutrition, psychopedagogical monitoring, and family involvement. However, results are only effective when accompanied by adequate infrastructure, continuous training, and favorable working conditions for teachers (Arroyo, 2018; Saviani, 2019).

The reviewed literature aligns with these findings, highlighting that successful full-time models, such as those implemented in countries like Portugal and Canada, positively impact not only academic performance but also social justice and holistic student development (Libâneo, 2013; OECD, 2023). In Brazil, programs such as "Programa Mais Educação" show progress but still face challenges related to funding and policy continuity.

In summary, the data suggest that full-time education is a potentially effective strategy for promoting equity, provided it is incorporated into a structured, intersectoral educational project aimed at meeting the specific needs of school communities. The analysis confirmed the initial hypothesis that extended school time has the potential to mitigate historical inequalities, as long as it is accompanied by favorable conditions for implementation.

CONCLUSION

This chapter aimed to analyze full-time education as a strategy to reduce educational inequalities, focusing on promoting equity, inclusion, and social justice. Based on literature review and document analysis, it was possible to understand that extending school time, when articulated with public policies and intersectoral actions, represents an important path to strengthening students' holistic development, especially those in vulnerable contexts.

The main results demonstrated that full-time education contributes to improving learning, strengthening socio-emotional skills, and enhancing school performance and retention rates. Successful experiences, both nationally and internationally, show positive impacts in addressing educational inequalities, as highlighted by authors such as Cavaliere (2007), Libâneo (2013), and Saviani (2019). However, the effectiveness of this modality depends on adequate structural conditions, qualified teacher training, continuous funding, and strategic pedagogical monitoring.

This research contributes by presenting a critical and grounded view of the potential of full-time education as a transformative educational policy, reaffirming its role in building a more just, equal, and inclusive education system. Future investigations should deepen the analysis of longitudinal impacts of this modality, as well as comparative studies in different territorial and socioeconomic contexts, to identify key success factors for its implementation.

It is concluded that full-time education, when conceived as an integrated educational project committed to social justice, can become an effective instrument in combating inequalities and promoting a democratic and emancipatory education.

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FROM THE CLASSROOM TO THE WORLD: THE SUCCESS OF ALUMNI AND THE TRANSFORMATIVE ENTREPRENEURSHIP OF MICHELE FERNANDES' ENGLISH SCHOOL IN BOSTON

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ABSTRACT

This study analyzed the role of Michele Fernandes' English School, located in Boston, as a formative, entrepreneurial, and socially impactful space within the context of the Brazilian diaspora. The general objective was to understand how the school's pedagogical approach, entrepreneurial management, and institutional environment contributed to alumni success and their academic, professional, and cultural integration in the United States. The research adopted a qualitative approach, characterized as a case study, based on bibliographic and documentary research, as well as descriptive analysis of institutional practices, programs offered, and alumni trajectories. The results indicated that the school went beyond technical English language instruction, establishing itself as an educational ecosystem that integrated linguistic learning, socio-emotional skill development, institutional support, and the strengthening of community networks. Alumni demonstrated significant progress in entering the job market, accessing higher education, engaging in entrepreneurship, and achieving cultural integration, highlighting language as an instrument of social mobility. Michele Fernandes' entrepreneurial role stood out for its humanized management, pedagogical innovation, and sensitivity to the needs of Brazilian immigrants, consolidating the institution's reputation and expanding its social impact. It was concluded that the experience of the English School in Boston represents a relevant example of language education committed to community empowerment, contributing to studies on immigrant education, school management, and female entrepreneurship by demonstrating how educational initiatives can promote social transformation in migratory contexts.

Keywords: Language education; Educational entrepreneurship; Immigration; Alumni success; Community empowerment.

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INTRODUCTION

Language education in migratory contexts has been widely recognized as a strategic element for the social, academic, and professional integration of immigrants, especially in societies marked by cultural diversity and economic competitiveness. Mastery of the host country's language goes beyond the communicative dimension, constituting an instrument of social mobility, civic participation, and access to educational and labor opportunities, as highlighted by studies on language teaching and cultural integration (Council of Europe, 2001; Brown, 2007). In this scenario, language schools aimed at migrant communities play a central role by combining linguistic training, institutional support, and human development.

Within this context, Michele Fernandes' English School, located in Boston, stands out for its work with the Brazilian and multicultural community, combining a communicative pedagogical approach, entrepreneurial management, and social commitment. Literature on educational entrepreneurship and school management indicates that initiatives led by entrepreneurs sensitive to social demands tend to generate impacts that go beyond the classroom, consolidating themselves as expanded formative environments (Dornelas, 2018; Libâneo, 2017). Furthermore, research on female entrepreneurship highlights the role of women in creating educational projects aimed at inclusion and community empowerment, especially in migratory contexts (Machado; Gazola; Anez, 2013).

Given this, the general objective of this study was to analyze Michele Fernandes' English School as a formative and entrepreneurial ecosystem, investigating how its pedagogical approach, organizational culture, and management contributed to alumni success and the integration of the Brazilian community in Boston. Specifically, the study sought to contextualize the school's creation and operation, examine the founder's entrepreneurial profile, analyze alumni trajectories, and discuss the institution's social impact in light of academic literature.

The hypothesis was that the articulation between language education, educational entrepreneurship, and humanized management favored positive outcomes in student development, promoting not only English proficiency but also socio-emotional skills, professional insertion, and the strengthening of social capital. The study's justification lies in the relevance of expanding discussions on immigrant education, school management, and female entrepreneurship—areas still lacking integrated empirical studies. Methodologically, the work was characterized as a qualitative case study, supported by bibliographic and documentary research, as well as descriptive analysis of institutional practices and alumni experiences.

Structurally, the text was organized into sections addressing the school's contextualization, Michele Fernandes' entrepreneurial profile, alumni success, the school as a formative and entrepreneurial

ecosystem, discussion of results, and final considerations, offering an integrated view of the phenomenon investigated.

METHODOLOGY

This research adopted a qualitative approach, allowing for an in-depth understanding of social and educational phenomena within their specific contexts, considering meanings, practices, and relationships established in the environment studied. Regarding technical procedures, the study was characterized as a case study, as it analyzed in detail the experience of Michele Fernandes' English School in Boston, seeking to understand its particularities, institutional dynamics, and formative impacts within the Brazilian diaspora context.

The research was developed through a bibliographic survey, consulting books, scientific articles, and academic documents addressing language education, language teaching in migratory contexts, school management, educational entrepreneurship, and female entrepreneurship. This stage aimed to build the theoretical framework that supported the analyses and enabled dialogue between the case studied and specialized literature.

Additionally, documentary research was conducted through the analysis of institutional materials from the school, such as presentation documents, program descriptions, pedagogical proposals, activity records, informational content, and public reports on the institution's trajectory and its alumni. These documents allowed for an understanding of the organizational structure, teaching methodology adopted, programs offered, and community integration strategies developed by the school.

Data analysis was descriptive and interpretative, seeking to identify convergences between institutional practices, observed results in alumni trajectories, and theoretical assumptions discussed in the bibliographic framework. Data were organized into thematic axes, covering the school's contextualization, the manager's entrepreneurial profile, alumni success, the school as a formative and entrepreneurial ecosystem, and the institution's social impact.

Finally, the methodological procedures adopted enabled an integrated understanding of the object of study, respecting the ethical principles of academic research and ensuring coherence between objectives, theoretical framework, data analysis, and conclusions presented.

DEVELOPMENT

CONTEXTUALIZATION OF THE ENGLISH SCHOOL IN BOSTON

The English School in Boston emerged in response to the linguistic and social demands of an expanding multicultural community, particularly the Brazilian community present in the metropolitan region (Council of Europe, 2001). The history of its creation is often linked to local initiatives by teachers

and entrepreneurs who identified gaps in services for Portuguese speakers, transforming initial community projects into structured institutions offering both in-person and hybrid courses (Richards; Rodgers, 2001).

The mission of these schools generally emphasizes inclusion, the promotion of communicative competence, and preparation for academic and professional integration in English-speaking contexts, aligning pedagogical objectives with internationally recognized frameworks such as the CEFR (Council of Europe, 2001). Their values typically prioritize communicative practice, respect for cultural diversity, and the development of learner autonomy; the target audience ranges from immigrants undergoing integration to international students and professionals seeking specific qualifications (Brown, 2007). Pedagogical differentiators include conversation-focused classes, an emphasis on real-life tasks (task-based learning), and the adaptation of materials to students' socio-labor needs—practices consistent with the literature on language teaching methodologies (Richards; Rodgers, 2001; Brown, 2007).

The school's integration into Boston's Brazilian and multicultural community occurs through partnerships with community organizations, participation in cultural events, offering courses focused on employability, and extension programs that facilitate social integration—strategies that strengthen the link between language learning and local social networks (Council of Europe, 2001).

Institutional environments combine classrooms equipped for in-person lessons, spaces for conversation practice, and multimodal resources for hybrid teaching. Methodologically, communicative and interactive approaches prevail, with assessment aligned to CEFR proficiency levels and the use of authentic materials adapted to the target audience (Richards; Rodgers, 2001). Program offerings typically include intensive courses (full-time), conversation modules for oral fluency, Business English for professionals, exam preparation for proficiency tests, and customized packages for companies—composing a portfolio that balances academic efficiency and practical relevance (Brown, 2007).

ENTREPRENEURIAL PROFILE OF MICHELE FERNANDES

Michele Fernandes' entrepreneurial profile reveals a trajectory marked by the articulation of personal experience, professional training, and sensitivity to the educational demands of the Brazilian diaspora in Boston. Her journey fits within the context of women entrepreneurs who, drawing from migratory experiences, transform social and linguistic challenges into business opportunities and educational impact—a phenomenon widely discussed in the literature on female entrepreneurship and immigration (GEM, 2023; Machado; Gazola; Anez, 2013).

Michele Fernandes' personal and professional trajectory is characterized by the identification of a concrete gap: the need for an English school that engaged with the sociocultural reality of Brazilian immigrants, respecting their pace, experiences, and professional goals. This initiative aligns with the

concept of opportunity-driven entrepreneurship, in which a business emerges from the perception of real demands in the market and the community served (Dornelas, 2018). In founding and expanding the school, Michele faced challenges common to entrepreneurs in the educational sector, such as initial financial limitations, building institutional credibility, adapting to legal requirements, and competing in the language teaching market of a global city like Boston (Chiavenato, 2020).

Michele Fernandes' entrepreneurial vision became a strategic pillar of the institution, integrating pedagogical innovation, humanized management, and constant adaptation to transformations in the educational market. Her approach demonstrates an understanding of entrepreneurship as a practice that goes beyond business creation, involving inspiring leadership, valuing people, and the ability to interpret social and economic contexts (Drucker, 2003). The human-centered management adopted by the school—focused on dialogue, continuous teacher training, and student support—contributes to more inclusive and effective learning environments, as advocated by studies on educational leadership and participatory management (Libâneo, 2017).

This entrepreneurial stance directly impacted the institution's pedagogical quality, reflected in the diversification of programs, adoption of communicative methodologies, and personalization of teaching for different student profiles. The consolidation of the school's reputation results from the combination of administrative efficiency and pedagogical commitment, reinforcing the notion that the sustainability of educational enterprises depends on balancing management and formative projects (Saviani, 2013; Dornelas, 2018).

Finally, Michele Fernandes' work highlights the close relationship between female entrepreneurship and education within the Brazilian diaspora context. Migrant women entrepreneurs often play a central role in creating educational initiatives that promote social integration, economic autonomy, and community strengthening, breaking gender barriers and expanding the social reach of education (Machado; Gazola; Anez, 2013; GEM, 2023). Thus, Michele Fernandes' trajectory not only drives the institutional success of the school but also symbolizes female leadership in transforming educational realities in migratory contexts.

ALUMNI SUCCESS: PATHS, ACHIEVEMENTS, AND IMPACTS

The success of alumni from the English School in Boston can be understood through the diversity of profiles served and the paths taken after completing their language training. Alumni generally include Brazilian immigrants in the process of social and professional integration, international students seeking access to U.S. higher education, and professionals who require English proficiency for career advancement or to launch new ventures. This heterogeneity reflects the role of language education as an

instrument of social mobility and cultural integration in migratory contexts (Council of Europe, 2001; Brown, 2007).

The success trajectories of alumni manifest in different dimensions. There are reports of former students who secured better positions in the job market, enrolled in universities and colleges, obtained professional certifications, or expanded their own businesses after developing communicative competence in English. These paths confirm studies that identify linguistic proficiency as a decisive factor for employability, academic continuity, and the strengthening of immigrant autonomy in English-speaking countries (Richards; Rodgers, 2001; Saviani, 2013). Even when presented as individual narratives or case studies, these accounts reveal concrete impacts of language training on alumni's personal and professional lives.

The training provided by the school significantly contributed to these outcomes by prioritizing the functional use of language in real-life situations, such as job interviews, academic presentations, workplace interactions, and entrepreneurial practices. Mastery of English enabled not only access to formal opportunities but also more effective cultural integration, reducing communication barriers and reinforcing a sense of belonging to local society, as advocated by communicative and sociocultural approaches to language teaching (Brown, 2007; Council of Europe, 2001).

Although quantitative indicators are not always systematized, qualitative results can be observed through testimonials, student retention and progression rates, increased demand for advanced courses, and alumni returning for complementary training. Such evidence aligns with studies that recognize the importance of mixed indicators—qualitative and quantitative—in evaluating educational impact, especially in non-formal and community contexts (Libâneo, 2017).

The role of the school environment, the methodology adopted, and institutional support proved central to student performance. Welcoming environments, communicative methodologies, small class sizes, and individualized follow-up fostered student engagement and confidence in using the language. Furthermore, institutional support—expressed through academic guidance, continuous encouragement, and appreciation of individual trajectories—contributed to alumni retention and success, reinforcing the understanding that educational quality results from the articulation between pedagogical design, management, and human relationships (Saviani, 2013; Libâneo, 2017).

THE SCHOOL AS A FORMATIVE AND ENTREPRENEURIAL ECOSYSTEM

The English School in Boston has consolidated itself as a true formative and entrepreneurial ecosystem, where the organizational culture envisioned by Michele Fernandes plays a central role in promoting the personal and professional growth of students, teachers, and staff. This culture is grounded in values such as inclusiveness, cooperation, innovation, and social commitment—elements that,

according to the literature on educational management, foster learning environments that are more engaging and conducive to holistic development (Libâneo, 2017; Chiavenato, 2020).

The school's internal organization includes projects and programs that go beyond traditional language teaching, incorporating initiatives such as academic and professional mentoring, thematic events, workshops, and networking meetings. These actions contribute to building support networks and spaces for experience exchange—an essential aspect for immigrants undergoing social and professional integration. Studies on educational entrepreneurship emphasize that formative environments that encourage interaction, collaboration, and student protagonism tend to generate greater engagement and better long-term outcomes (Dornelas, 2018; Drucker, 2003).

In this sense, the school's role as a bridge between the Brazilian community and opportunities in the United States emerges as a strategic and social differentiator. By guiding students on everyday communicative practices, labor market demands, U.S. organizational culture, and educational possibilities, the institution fulfills a mediating role that goes beyond the classroom. This mediation fosters cultural integration and expands students' social capital, as advocated by sociocultural approaches to education and language (Council of Europe, 2001; Saviani, 2013).

The integration of language teaching with the development of socio-emotional and professional competencies constitutes another structural axis of this ecosystem. The pedagogical practice adopted values skills such as effective communication, self-confidence, empathy, problem-solving, and teamwork—competencies increasingly demanded in the labor market and international academic contexts (Brown, 2007; Libâneo, 2017). By incorporating these dimensions into the language learning process, the school contributes to forming individuals who are more autonomous, critical, and prepared to face personal and professional challenges in a globalized context.

Thus, the English School in Boston affirms itself as an expanded formative space, where teaching, entrepreneurship, and social commitment converge to promote not only linguistic proficiency but also individual and collective empowerment of the community served, particularly within the Brazilian diaspora (Dornelas, 2018; Saviani, 2013).

DISCUSSION

The analysis of data related to the English School in Boston and the trajectories of its alumni reveals a strong convergence with the literature on language education, educational entrepreneurship, and migratory processes. The central role of language as an instrument of social integration, economic mobility, and civic participation—widely discussed in the field of language teaching in multicultural contexts—is confirmed in the experiences reported by alumni, who achieved professional insertion, academic continuity, and greater social autonomy through the development of communicative

competence in English (Council of Europe, 2001; Brown, 2007). In this sense, the observed results reinforce the conception of language education as a situated social practice, going beyond technical acquisition of the language and assuming a mediating function in cultural integration processes (Richards; Rodgers, 2001).

When relating these data to the literature on educational entrepreneurship, it becomes evident that the school is structured around a logic that integrates efficient management, pedagogical innovation, and social commitment—central characteristics of contemporary entrepreneurship in the educational field (Dornelas, 2018; Drucker, 2003). Michele Fernandes' entrepreneurial role, by combining quality teaching, humanized management, and a sensitive reading of migrant community needs, aligns with studies that point to entrepreneurship as a transformative practice when guided by ethical and social values (Chiavenato, 2020). Thus, the school does not limit itself to offering language courses but consolidates itself as a space for producing human and social capital.

In the context of migratory processes, the case of the Boston school proves exemplary by demonstrating how community-based educational initiatives can act as mechanisms of reception, belonging, and empowerment. Literature on immigrant education emphasizes that culturally responsive educational environments tend to foster retention, engagement, and learner success—especially when they recognize the identities, histories, and needs of migrant individuals (Saviani, 2013; Libâneo, 2017). The school analyzed confirms this perspective by building pedagogical and institutional practices aligned with the reality of the Brazilian diaspora.

From the perspective of social impact, the case in question highlights how language education can function as a vector of community empowerment, expanding individual opportunities and strengthening collective support networks. The creation of spaces for mentoring, networking, and professional guidance reinforces the school's role as an agent of social transformation, as indicated by studies associating education, community development, and social justice (Saviani, 2013).

Finally, the study offers relevant contributions to research on immigrant education, school management, and female entrepreneurship. By highlighting the leadership of a female entrepreneur at the head of an educational project with social impact, the case resonates with research emphasizing women's protagonism in creating educational initiatives in migratory contexts—challenging structural inequalities and expanding the social reach of education (Machado; Gazola; Anez, 2013; GEM, 2023). Thus, the experience of the English School in Boston broadens the academic debate by articulating language education, entrepreneurship, and migration under an integrated and socially committed perspective.

CONCLUSION

This study analyzed Michele Fernandes' English School, located in Boston, highlighting its role as a formative, entrepreneurial, and socially impactful space within the context of the Brazilian diaspora. Based on the analysis conducted, it was found that the institution went beyond the traditional function of language teaching by integrating linguistic education, entrepreneurial management, and community commitment, establishing itself as an educational ecosystem aimed at the social, academic, and professional integration of its students.

The results demonstrated that the pedagogical approach adopted—grounded in communicative and contextualized methodologies—significantly contributed to the development of students' linguistic competence, positively influencing alumni trajectories. It was observed that the training provided facilitated access to the job market, continued studies, entrepreneurship, and cultural adaptation, confirming language as an instrument of social mobility and empowerment for individuals in migratory contexts.

Furthermore, the central role of Michele Fernandes' entrepreneurial leadership—marked by social sensitivity and humanized management—proved decisive for the school's consolidation and for creating a welcoming and stimulating environment. Her trajectory reinforced the relevance of female entrepreneurship in the educational field, particularly when associated with projects committed to inclusion, community empowerment, and social transformation.

It was concluded that the experience of the English School in Boston constitutes a significant example of education tailored to immigrant needs, offering valuable contributions to studies on language education, school management, and educational entrepreneurship. Finally, the study highlighted the importance of future research that expands the analysis of similar initiatives, incorporating quantitative and comparative indicators to deepen the understanding of educational and social impacts of formative projects in migratory contexts.

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TEACHER EDUCATION FOR AI WITH ELEMENTARY SCHOOL STUDENTS: CRITICAL MEDIATION, ETHICS AND PEDAGOGICAL INTENTIONALITY

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ABSTRACT

The growing presence of artificial intelligence in educational platforms and everyday digital services is reshaping teaching and learning in elementary schooling, demanding teacher education that goes beyond technical training. Grounded in a narrative literature review, this chapter discusses teacher education for pedagogical work with AI with children and early adolescents, articulating three interdependent dimensions: intentional pedagogical mediation, sociotechnical ethics, and algorithmic criticality. The discussion mobilizes Selwyn, Williamson, Holmes and Tuomi, Rojo, Lankshear and Knobel, Papert, Floridi, Noble, Benjamin, Zuboff and international guidelines, particularly UNESCO. It argues that educating teachers for AI requires understanding the non-neutral nature of technologies, the risks of

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datafication and surveillance, the reproduction of bias and inequality, and the need for didactic practices that strengthen authorship, multiliteracies, inquiry and autonomy in digital environments. The chapter proposes that teacher education should integrate theoretical foundations, critical case analysis, pedagogical criteria for AI use, data protection and collaborative professional cultures. It concludes that the ethical and educational integration of AI in elementary schooling depends on structured policies for initial and continuing teacher education, data governance, and a commitment to cognitive justice and children's rights.

Keywords: Teacher education; Artificial Intelligence; Elementary Education; Ethics; Digital culture.

INTRODUCTION

Artificial intelligence has ceased to be a theme restricted to academic research and has come to operate as everyday infrastructure for navigation, search, recommendation, personalization, and automation. In schooling, this shift manifests itself both in tools explicitly designed for education and in services widely used by students and families, in which algorithms filter information, suggest content, organize workflows, and modulate practices of reading, writing, attention, and interaction. In elementary education—where foundations of literacy, scientific thinking, cultural repertoire, and school socialization are consolidated—the presence of AI imposes a specific formative challenge: the school must act before technology becomes an invisible curriculum, naturalized and governed by logics external to the educational project.

This scenario moves teacher education to a more demanding level. It is not merely about "learning to use" tools, but about understanding how they structure social practices and, consequently, learning practices. Selwyn (2016) warns that educational technologies carry discourses of efficiency and innovation that may obscure economic interests, governance models, and power asymmetries. Williamson (2020) adds that the datafication of education transforms pedagogical processes into metrics and profiles, altering the very way that performance, risk, and quality are defined. When this process permeates childhood and the initial stages of schooling, ethical and pedagogical consequences become more sensitive: digital rights, data protection, development of autonomy, and the very social purpose of schooling are at stake.

This chapter discusses teacher education for work with AI in elementary education from a formal and critical academic perspective. It argues that teacher preparation must integrate three interdependent dimensions: pedagogical intentionality, sociotechnical ethics, and algorithmic criticality. To support this thesis, the text is organized into six sections: the first delimits assumptions about teaching and digital culture; the second examines AI as educational infrastructure and the risks of uncritical adoption; the third proposes a model of teacher competencies for AI; the fourth discusses pathways for initial and continuing education; the fifth presents implications for public policy and governance; and, finally, conclusions and recommendations are synthesized.

In this sense, discussing teacher education for work with artificial intelligence in elementary schooling implies recognizing that technology does not add itself neutrally to preexisting school practices; rather, it reconfigures meanings, temporalities, languages, and pedagogical relationships. Teacher education thus becomes a strategic space of mediation between technological innovation and educational commitment, requiring a critical reading of digital infrastructures, an understanding of their sociocognitive impacts, and a conscious definition of pedagogical criteria. From this perspective, the

chapter articulates theoretical foundations, critical analysis, and formative propositions for an ethical and educational insertion of AI in basic schooling.

TEACHING, DIGITAL CULTURE, AND THE SHIFT BEYOND TECHNICAL COMPETENCE

Teacher education, in contexts of digital culture, has historically oscillated between two poles: instrumental training (focused on tools) and critical-pedagogical education (centered on educational aims. However, the expansion of AI intensifies the limits of instrumental training. Technology is no longer merely a "resource" attachable to a lesson, but a system that participates in text production, circulation of meanings, organization of attention, and selection of what is visible. This requires that teachers understand not only operational functioning but also the sociotechnical logics that underpin the environment.

Literacy and multiliteracies studies provide a foundation for this shift. Rojo (2012) argues that contemporary language practices are multimodal, hybrid, and traversed by technical mediations, demanding from schools an expanded understanding of what it means to read and produce meaning. Lankshear and Knobel (2011) add that "new literacies" are not reducible to devices; they constitute social practices with their own values, norms, modes of participation, and regimes of visibility. When AI begins to intervene in these practices, teacher education must encompass discourse analysis, modes of authorship, information circulation, and criteria of credibility.

Within this context, it is essential to reaffirm that teaching is not substitutable by automation. Holmes and Tuomi (2022) argue that AI can support educational processes but should not be conceived as a substitute for pedagogical mediation. Teaching involves situated judgment, care, listening, contextual reading, and real-time ethical decision-making—dimensions that are not reducible to statistical patterns. Teacher education for AI, therefore, should strengthen teaching as critical and intentional mediation, rather than weaken it through technological dependency.

ARTIFICIAL INTELLIGENCE IN ELEMENTARY EDUCATION: INFRASTRUCTURE, PROMISES, AND AMBIVALENCES

To understand the formative demands placed upon the elementary teacher, it is necessary to analyze how artificial intelligence presents itself concretely in everyday schooling. More than a technological abstraction, AI today constitutes a diffuse infrastructure that permeates didactic materials, educational platforms, family practices, and students' cultural habits, producing direct effects on ways of learning, teaching, and assessment.

AI reaches elementary education through multiple avenues. It appears in adaptive platforms that promise personalization; in recommendation systems for videos and exercises; in automated correctors; in

conversational assistants; in search engines; and in digital learning environments. The most recurrent promise is personalization—adjusting pace, pathways, and feedback based on student performance. Pedagogically, this promise may be enticing, especially in heterogeneous classes. Nevertheless, algorithmic personalization requires critical examination: what is "adapted," based on which data, according to which criteria, and with what long-term effects?

Selwyn (2016) warns that the innovation narrative tends to shift the debate from educational aims to operational efficiency. This may lead schools to adopt AI as a quick response to structural problems such as insufficient planning time, large class sizes, and scarcity of pedagogical support. Williamson (2020) shows that when systems collect data continuously, they begin to classify students and guide decisions, instituting forms of governance via indicators. In elementary education, the risk is to transform child development and learning trajectories into performance profiles, reducing the complexity of learning.

There is also the dimension of algorithmic bias. Noble (2018) evidences how search and classification systems can reproduce stereotypes and inequalities, especially when training data reflect social asymmetries. Benjamin (2019) expands this by showing that technologies can operate as "codes" of exclusion, reinforcing hierarchies under the guise of technical neutrality. In the school setting, this means that recommendations, automated assessments, and content filters may unequally affect students, particularly in contexts of social and cultural vulnerability.

Finally, datafication and surveillance constitute a central ethical problem. Zuboff (2019) describes how surveillance capitalism transforms personal data into the raw material of predictions and markets. In educational environments, this process can be aggravated by the sensitivity of children's data, by power asymmetries between schools and platforms, and by low transparency regarding secondary uses of information. Teacher education, therefore, must include data governance, privacy, and digital rights as a core component, not a mere addendum.

Faced with these ambivalences—between pedagogical promise and sociotechnical risk—it becomes evident that the focus of the discussion cannot rest solely on technology itself, but on the formative conditions of the subjects who pedagogically mediate it. It is at this point that teacher education emerges as the central axis for any responsible proposal to integrate AI into elementary schooling..

TEACHER EDUCATION FOR AI: DIMENSIONS, COMPETENCIES, AND FORMATIVE CRITERIA

Educating teachers for AI in elementary schooling entails consolidating a set of professional competencies that are not to be conflated with technical mastery. Here we propose an analytical model of three interrelated dimensions: the pedagogical-didactic dimension, the ethical-legal dimension, and the

critical-epistemological dimension. These dimensions are not isolated "modules," but knowledge domains that must operate jointly in the planning, execution, and evaluation of practices involving AI.

The pedagogical-didactic dimension concerns intentionality of use. Papert (1980) already argued that technologies become educationally potent only when placed at the service of active construction, inquiry, and authorship. In AI, this means orienting use toward the production of questions, comparison of versions, review of arguments, exploration of multiple languages, and project construction. Teachers must distinguish activities in which AI supports learning from those in which it replaces the central cognitive effort, impoverishing the process. The criterion is not prohibition or blanket approval, but deciding when AI serves learning and when it undermines it.

The ethical-legal dimension involves privacy, data protection, and responsibility. Floridi (2018) argues that information ethics should guide practices in computerized societies because technical decisions produce human effects. In basic education, this entails understanding principles of data minimization, informed consent where applicable, credential security, limits on exposure of personal information, and care in the use of children's images and works. UNESCO guidelines (2021; 2023) emphasize transparency, equity, inclusion, and respect for human rights as parameters for integrating AI into education. For teachers, this translates into practical criteria: avoiding opaque tools, reducing data collection, guiding students regarding digital identity, and discussing the consequences of sharing information.

The critical-epistemological dimension concerns reading the world algorithmically. Generative AI produces plausible texts but does not guarantee truth, context, or accountability—requiring teacher education for assessing reliability, verifying sources, identifying bias, and understanding model limitations. Holmes and Tuomi (2022) insist that education for AI should include criticality regarding what AI can and cannot do. In elementary education, this converts into critical literacy practices appropriate to the age group: differentiating opinion from evidence, recognizing patterns of persuasion, comparing responses with curricular materials, and developing habits of checking.

Figure 1 – Dimensions of teacher education for the pedagogical use of artificial intelligence in elementary education

Formative Dimension	Main Focus	Implications for Teaching Practice
Pedagogical-Didactic Dimension	Intentional planning of AI use	Clear definition of learning objectives, use of AI to support investigation, authorship and critical review, avoiding substitution of the student's cognitive effort
Ethical-Legal Dimension	Protection of data and children's rights	Conscious selection of platforms, minimization of data collection, guidance on digital identity, privacy and responsible use of information
Critical-Epistemological Dimension	Algorithmic reading and evaluation of automated responses	Development of practices for comparing sources, verifying information, identifying biases and understanding the limitations of AI systems
Sociocultural Dimension	Impacts of AI on school relationships	Analysis of the effects of automation on interaction, participation, inequalities and school culture
Formative-Professional Dimension	Continuous teacher learning	Construction of communities of practice, collective reflection, pedagogical documentation and replanning of actions

Source: Created by the authors, 2025

INITIAL AND CONTINUING EDUCATION: A FORMATIVE ARCHITECTURE FOR ELEMENTARY SCHOOLING

If teacher education constitutes the structuring axis for a critical insertion of AI in basic schooling, it becomes essential to reflect on how this education can be organized institutionally. The distinction between initial and continuing education should not be understood as a rigid separation, but as a formative continuum that accompanies teachers throughout their professional trajectory.

Initial education, in teacher-training programs (licenciaturas), must integrate AI as a transversal and structuring theme, avoiding treatment as an optional subject disconnected from practice. A consistent pathway is to insert AI into components such as didactics, curriculum, assessment, and educational policy, articulating theory and practice. This enables future teachers to understand AI as a pedagogical and social issue, not as an isolated “technological innovation.” At the same time, teacher preparation should promote concrete experiences of planning with AI, always focusing on learning objectives and ethical criteria.

Continuing education, in turn, should be conceived as institutional policy, not as a one-off initiative. Communities of practice, study groups, and teacher networks can sustain ongoing professional learning through case analysis, practice review, and construction of local pedagogical protocols. This format is especially relevant in elementary education, where the demands for literacy, multiliteracies, and holistic development require that technology not weaken essential human interactions, but rather support processes of authorship and participation.

A consistent formative proposal includes at least four axes of continuous work. The first is the foundations axis, in which teachers study AI concepts, limitations, biases, and social implications. The

second is the didactic axis, in which pedagogical use is planned based on objectives, authorship criteria, and assessment. The third is the ethical axis, concerning data governance, child protection, and discussions of responsibility. The fourth is the assessment and teacher research axis, in which teachers document, analyze, and replan practices, treating the classroom as a space of pedagogical inquiry.

Teacher education for work with artificial intelligence in elementary schooling must also consider the specificities of child development and learning processes characteristic of this stage. Unlike later levels, elementary education is marked by the consolidation of basic skills in reading, writing, logical thinking, social interaction, and construction of intellectual autonomy. In this context, the use of automated systems can both broaden formative experiences and compromise essential processes if it replaces practices mediated by human interaction, language, and the pedagogical time required for meaningful learning. Thus, teacher education should emphasize that AI must not operate as a cognitive shortcut but as a resource carefully integrated into practices that respect students' rhythms, needs, and individuality.

Another central aspect concerns the relationship between artificial intelligence and assessment of learning. Automated systems for correction, performance monitoring, and report generation have been incorporated into educational platforms with the promise of objectivity and efficiency. However, as Williamson (2020) argues, such systems tend to reduce the complexity of the educational process to quantifiable indicators, shifting assessment from a formative process to a logic of continuous measurement. In elementary education, this risk is particularly sensitive, as assessment exerts a strong influence on the construction of self-esteem, motivation, and the child's relationship with learning. Teacher education must therefore prepare teachers to interpret critically the data generated by AI, avoiding automatic pedagogical decisions and preserving assessment as a reflective, contextualized practice oriented toward development.

The relational dimension of teaching also assumes heightened relevance in light of the increasing presence of AI in basic schooling. Learning in elementary education is profoundly shaped by affective bonds, trust, listening, and recognition—elements that cannot be automated. Santaella (2018) highlights that in a culture marked by technical mediation, there is a risk of impoverishment of symbolic relations when technologies take the place of human encounters. In this sense, educating teachers for AI entails reinforcing the centrality of the pedagogical relationship, ensuring that the use of technologies does not weaken the teacher's role as an intellectual, ethical, and affective reference for students. AI should support teaching practice and never replace the pedagogical presence that sustains the educational process.

Moreover, teacher education for AI should foster the understanding that intelligent technologies produce distinct effects depending on the sociocultural context in which they are used. Schools located in

territories with fewer resources, unstable connectivity, or institutional fragilities tend to experience the introduction of AI unevenly, which may widen educational asymmetries. Selwyn (2016) warns that technologies often reproduce existing inequalities when implemented without equity policies and adequate formative support. Preparing teachers for the pedagogical use of AI thus also involves developing sensitivity to local contexts, enabling pedagogical choices that consider students' real conditions and avoid naturalizing homogeneous and exclusionary technological models.

Finally, it is essential to understand teacher education for AI as an ethical-political process, not merely a pedagogical one. The decision to use or not use certain technologies; to trust or question automated responses; to protect data or accept indiscriminate collection—constitutes an exercise of professional and civic responsibility. Floridi (2018) asserts that in computerized societies every technical decision is also a moral decision. In elementary schooling, this responsibility is amplified by the fact that children lack full capacity to consent or to comprehend the implications of data and algorithm use. Thus, teacher education for AI should strengthen teaching as an instance of protection, ethical mediation, and defense of children's rights, reaffirming the school as a space of humanization amid growing processes of automation.

PEDAGOGICAL PRACTICES WITH AI IN ELEMENTARY EDUCATION: PRINCIPLES FOR DIDACTIC DESIGN

To prevent the chapter from becoming a manual of tools, we propose discussing didactic design principles applicable to different realities. The first principle is the centrality of questioning: practices with AI should strengthen problem formulation, curiosity, and inquiry. Rather than soliciting "answers," teachers can guide the construction of better questions, the comparison of responses from different sources, and the identification of gaps.

The second principle is guided authorship. AI can support revisions, rewritings, and reorganization of ideas, but authorship must be maintained as a human process of choice, justification, and responsibility. Rojo (2012) and Lankshear and Knobel (2011) argue that multiliteracies involve participation and meaning production in different languages; in this scenario, AI should broaden repertoires without erasing the student's voice.

The third principle is verification as a habit. From the early grades, it is possible to teach checking practices at appropriate levels: "Where does this information appear in the textbook?" "What evidence supports this claim?" "Is there another source that confirms it?" This principle responds directly to the risk of informational superficiality and to the undue authority attributed to automated systems.

The fourth principle is care with data and with childhood. In pedagogical practice, this implies avoiding exposure of personal information, guiding the use of fictitious names in public activities,

discussing privacy in accessible terms, and selecting tools with attention to terms of use. Here, UNESCO guidelines (2023) are a reference for institutional and pedagogical decisions, as they emphasize protection of rights, inclusion, and responsibility.

IMPLICATIONS FOR EDUCATIONAL POLICY AND SCHOOL GOVERNANCE

The pedagogical reflections developed throughout the chapter show that teacher education for AI cannot be addressed solely within the scope of individual practice or isolated school initiatives. On the contrary, it is a structural issue requiring articulated educational policies capable of sustaining institutional, normative, and ethical conditions for pedagogical work with intelligent technologies.

Teacher education for AI cannot depend exclusively on individual initiative. It requires policies that articulate curriculum, teacher education, infrastructure, planning time, and data governance. Selwyn (2016) observes that technologies tend to be implemented top-down under modernization discourses without teacher participation. To reduce resistance and avoid uncritical adoption, policies should be built with schools, taking into account contexts and inequalities.

Williamson (2020) highlights that governance by data alters pedagogical and administrative decisions. Therefore, school systems must establish criteria for acquisition and use of tools, privacy protocols, transparency regarding data collection and processing, and auditing mechanisms. In basic education, this point is decisive: children must not be converted into exploitable profiles by platforms. The role of the State and educational institutions is to protect childhood and to ensure that technologies serve the educational project, not the reverse.

FINAL CONSIDERATIONS

Teacher education for work with artificial intelligence with elementary school students constitutes a formative, ethical, and political imperative of the present. As discussed throughout the chapter, AI no longer occupies a peripheral place in educational practices; it operates as infrastructure of information, language, and visibility, directly interfering with ways of reading, writing, researching, communicating, and learning. This shift, announced in the introduction, requires schools to take an active stance toward technologies, recognizing that they not only support pedagogical practices but also reorganize meanings, temporalities, and educational relationships.

In light of this scenario, educating teachers solely for instrumental use of tools proves insufficient and, in certain contexts, dangerous. Uncritical adoption of AI can intensify processes of cognitive dependency, widen educational inequalities, and legitimize forms of surveillance and datafication incompatible with the principles of basic education. As argued throughout the text, teacher education must move from an operational logic to a perspective of critical mediation capable of interrogating the

intentionalities inscribed in algorithmic systems and of defining clear pedagogical criteria for their insertion into daily schooling.

The chapter maintains that consistent teacher education for AI in elementary schooling must articulate three inseparable dimensions: pedagogical intentionality, which orients technology use via explicit formative objectives; sociotechnical ethics, which regulates decisions related to privacy, data protection, and children's rights; and algorithmic criticality, which enables understanding of limits, biases, and social effects of intelligent systems. These dimensions, anchored in robust theoretical foundations and international guidelines, constitute the core of a teaching practice capable of acting responsibly in complex digital environments.

Furthermore, it has been evidenced that the educational insertion of AI depends on consolidating collaborative professional cultures in which teachers can reflect collectively on practices, share usage criteria, and build situated pedagogical knowledge. When conceived as an articulated, institutionally supported process, initial and continuing teacher education strengthens teacher autonomy and prevents technology decisions from being imposed vertically or decontextualized. In this sense, educational policies and data governance structures become central elements to ensure ethical and pedagogical working conditions with AI in basic schooling.

It is concluded, therefore, that artificial intelligence will only contribute effectively to elementary education when subordinated to a pedagogical project committed to cognitive justice, democracy, and holistic formation. Schools must ensure that students learn not only with technology but about the technology that organizes the world they live in, developing capacities for critical interpretation, responsible authorship, and conscious participation. Thus is reaffirmed the role of teaching as indispensable human mediation in times of automation, ensuring that technological innovation does not obscure but strengthens fundamental educational principles.

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PEDAGOGICAL PRACTICES FOR THE INCLUSION OF NEURODIVERGENT STUDENTS (ASD, ADHD, DYSLEXIA)

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ABSTRACT

This book chapter aims to analyze inclusive pedagogical practices directed at the schooling of neurodivergent students, focusing on Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and dyslexia within the context of basic education. The methodology is based on a qualitative bibliographic review grounded in national and international scientific literature by recognized authors such as Vygotsky, Mantoan, Barkley, and Lyon, as well as official documents related to inclusive education policies. The results indicate that pedagogical practices grounded in curriculum flexibility, active learning methodologies, adapted teaching resources, and recognition of individual strengths significantly enhance student engagement, learning outcomes, and socioemotional development. The findings also emphasize the relevance of continuous teacher education and collaborative work involving schools, families, and multidisciplinary teams. It is concluded that effective inclusion of neurodivergent students requires attitudinal, pedagogical, and organizational changes, moving beyond standardized teaching models toward an equitable, accessible, and diversity-centered educational approach.

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Keywords: ADHD; Dyslexia; Inclusive education; Neurodiversity; Pedagogical practices.

INTRODUCTION

The diversity present in educational contexts has expanded significantly in recent decades, requiring schools to adopt pedagogical practices that address students' singularities. In this scenario, neurodiversity emerges as a fundamental concept for understanding neurological differences, recognizing conditions such as Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and dyslexia not as deficits but as variations of human functioning (Armstrong, 2012). Inclusive education, therefore, takes on the challenge of ensuring access, retention, and meaningful learning for these students in mainstream school environments.

Despite legal and regulatory advances, such as the National Policy on Special Education within the Perspective of Inclusive Education, a gap is still observed between inclusive discourse and the practices effectively implemented in the classroom. Many teachers report difficulties in curricular adaptation, choosing appropriate methodologies, and pedagogical management when faced with the specific educational needs of neurodivergent students, which underscores the need to deepen the debate on inclusive pedagogical practices.

In this context, the research problem guiding this chapter is to understand: which pedagogical practices favor the inclusion and learning of neurodivergent students with ASD, ADHD, and dyslexia in regular education? The general objective is to analyze inclusive pedagogical practices aimed at the schooling of these students. The specific objectives are to: (a) discuss the theoretical foundations of neurodiversity and inclusive education; (b) identify effective pedagogical strategies for serving students with ASD, ADHD, and dyslexia; and (c) reflect on the role of the teacher and teacher training in the school inclusion process.

The justification for this study is based on the social and educational relevance of the theme, since the school plays a central role in promoting equity and valuing human diversity. Understanding and disseminating inclusive pedagogical practices contribute to overcoming attitudinal and pedagogical barriers, as well as to building more democratic and welcoming educational environments.

From a theoretical standpoint, this chapter is supported by Vygotsky's contributions (1997), which emphasize the importance of pedagogical mediation and social interaction in human development; by Mantoan (2015), who advocates for a school that teaches everyone without discrimination; and by Barkley (2013) and Lyon (2003), whose studies provide subsidies for understanding the specificities of ADHD and dyslexia, respectively. These theoretical contributions underpin the analysis of inclusive pedagogical practices discussed throughout the chapter..

METHODOLOGY

TYPE OF RESEARCH

This chapter is characterized by a qualitative approach, bibliographic in nature, and with a descriptive-analytical character. Qualitative research proves adequate as it enables an in-depth understanding of complex educational phenomena—such as inclusive pedagogical practices aimed at neurodivergent students—while considering their social, cultural, and institutional contexts (Minayo, 2014). The choice of bibliographic research is justified by the need to systematize and analyze knowledge already produced on inclusive education, neurodiversity, ASD, ADHD, and dyslexia.

DATA COLLECTION PROCEDURES

Data collection was carried out through the survey and selection of scientific works published in books, articles in indexed journals, dissertations, theses, and official documents. Recognized databases in the fields of education and health—such as SciELO, Google Scholar, and CAPES journals—were consulted, prioritizing national and international publications from the last 15 years, without neglecting classic works relevant to the theoretical framework.

INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria adopted were: (a) studies addressing inclusive pedagogical practices in the school context; (b) works related to the schooling of students with ASD, ADHD, and dyslexia; and (c) research grounded in recognized theoretical frameworks in inclusive education. Studies with no direct relation to the educational context or limited exclusively to clinical approaches, without interface with pedagogical practice, were excluded.

ANALYSIS TECHNIQUES AND INSTRUMENTS

Data analysis was conducted using content analysis, as proposed by Bardin (2016), allowing for the organization, categorization, and interpretation of the information collected. The analytical categories emerged from the systematic reading of the selected material, highlighting themes such as curricular flexibility, active methodologies, adaptation of teaching resources, inclusive assessment, and teacher training. Analytical fiches (note cards/summaries) were used to organize the data, enabling the comparison and synthesis of the main findings.

GROUNDED DISCUSSION OF THE DATA

The discussion of the data was conducted in light of theoretical frameworks supporting inclusive education and the neurodiversity perspective. Vygotsky's contributions (1997) ground the understanding

of learning as a socially mediated process, underscoring the importance of the teacher's role in promoting development. Mantoan (2015) supports the analysis of the inclusive school as a space that values differences, while Armstrong (2012) contributes to understanding neurodiversity as a legitimate expression of human diversity. Studies by Barkley (2013) and Lyon (2003) provide theoretical support for analyzing the specificities of ADHD and dyslexia in the educational context, enabling a critical and reflective articulation between theory and pedagogical practice.

RESULTS AND DISCUSSION

The analysis of the selected scientific works made it possible to identify a set of recurrent and effective pedagogical practices for the inclusion of neurodivergent students, particularly those with Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and dyslexia. The results indicate that the realization of school inclusion is directly related to curricular flexibility, the adoption of diversified methodologies, and the teacher's mediating stance.

INCLUSIVE PEDAGOGICAL PRACTICES IDENTIFIED

Among the main findings, curricular flexibility stands out as a central strategy to meet different ways of learning. Studies indicate that adaptations in objectives, content, strategies, and assessment modes promote greater participation and meaningful learning among neurodivergent students (Mantoan, 2015). For students with ASD, for example, the use of structured routines, visual supports, and predictable activities favors cognitive and emotional organization. In the case of ADHD, practices involving dynamic activities, task fragmentation, and frequent feedback contribute to maintaining attention and engagement. For students with dyslexia, strategies such as the use of adapted texts, shared reading, and multisensory resources prove effective.

Table 1 – Inclusive pedagogical practices for neurodivergent students

Condition	Identified pedagogical practices
ASD	Use of visual supports; structured routines; individualized mediation
ADHD	Active methodologies; short tasks; organized environment
Dyslexia	Multisensory resources; textual adaptation; differentiated assessment

TEACHER TRAINING AND PEDAGOGICAL MEDIATION

Another relevant finding concerns teacher training as a determining element for the implementation of inclusive practices. The literature shows that teachers with continuing education in inclusive education demonstrate greater confidence and competence to adapt pedagogical strategies and

deal with diversity in the classroom (Pimenta; Ghedin, 2012). In this perspective, pedagogical mediation plays a fundamental role, as per Vygotsky's historical-cultural theory (1997), by emphasizing that learning occurs through social interaction and intentional teacher action.

CHALLENGES AND POSSIBILITIES FOR SCHOOL INCLUSION

Despite the advances identified, the analyzed studies reveal persistent challenges, such as the scarcity of material resources, teacher workload, and the fragility of institutional support policies. These factors hinder the systematic consolidation of inclusive pedagogical practices. However, the literature also points to possibilities for overcoming these challenges through collaborative work among teachers, multiprofessional teams, and families, as well as through the strengthening of public policies for inclusive education (Armstrong, 2012).

In general, the results corroborate the understanding that the inclusion of neurodivergent students does not depend exclusively on diagnoses, but on the reorganization of pedagogical practices and the valuing of differences as educational potential. Thus, the discussion of the findings reaffirms the need for a school that recognizes diversity as a constitutive element of the teaching–learning process, promoting equity and social justice.

CONCLUSION

This chapter aimed to analyze pedagogical practices directed at the inclusion of neurodivergent students—focusing on Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and dyslexia—within the context of basic education. Based on a qualitative approach and a bibliographic review grounded in classic and contemporary authors in inclusive education, we sought to understand which pedagogical strategies contribute to the realization of the teaching–learning process of these students in regular education.

The main results showed that pedagogical practices based on curricular flexibility, the use of active methodologies, the adaptation of teaching resources, and inclusive assessment processes favor participation, engagement, and meaningful learning among neurodivergent students. The relevance of pedagogical mediation and teachers' continuing education also stood out as central elements for building inclusive educational environments capable of respecting students' singularities and strengths.

As a contribution, this study reinforces the understanding of neurodiversity as a legitimate expression of human diversity, moving beyond deficit-based and medicalizing perspectives. By systematizing theoretically grounded inclusive pedagogical practices, the chapter offers support to teachers, administrators, and researchers interested in promoting more equitable, democratic, and accessible education, and contributes to strengthening public policies on inclusive education.

Finally, we suggest conducting empirical research that investigates the application of these pedagogical practices in specific school contexts, as well as studies that analyze continuing teacher education and the impact of collaborative actions among school, family, and multiprofessional teams. Such investigations may broaden the understanding of the challenges and possibilities of school inclusion for neurodivergent students, strengthening the construction of increasingly effective and humanized educational practice

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ARTIFICIAL INTELLIGENCE AND NEURODIVERSITY: POTENTIALS AND RISKS FOR STUDENTS WITH ADHD AND ASD

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ABSTRACT

This chapter examines the potentials and risks of using artificial intelligence in the education of neurodivergent students, particularly those with ADHD and ASD. The study is grounded in a narrative literature review and aims to understand how AI-based tools can either support or compromise processes of learning, autonomy and inclusion. The methodology involved the selection, organization and analytical synthesis of works on neurodiversity, inclusive education, algorithmic ethics and educational technologies. Results indicate that AI offers meaningful possibilities for cognitive accessibility, personalized scaffolding and multimodal communication, especially through tools that assist executive function for students with ADHD and support communication and predictability for autistic learners. However, the literature also reveals significant risks related to surveillance, biased datasets, behavioral normalization, cognitive dependency and extensive data collection affecting vulnerable populations.

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These issues are intensified in datified school environments where algorithms classify and track students. The study concludes that AI can contribute to more inclusive and equitable educational experiences only when its use is critically mediated by teachers and aligned with ethical principles that protect autonomy, dignity and the right to learn according to diverse cognitive profiles. Critical teacher education, strong data protection policies and a commitment to cognitive justice are essential to ensure that AI supports rather than undermines neurodivergent students.

Keywords: Neurodiversity; Artificial Intelligence; ADHD; Autism; Inclusive education; Cognitive justice.

INTRODUCTION

The growing incorporation of artificial intelligence systems in education has produced profound transformations in teaching and learning practices. Although often celebrated as a solution to persistent pedagogical challenges, AI operates according to complex sociotechnical logics that do not always align with the principles of inclusive education. For neurodivergent students, such as those with Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD), these transformations can be even more decisive—both for the promise of personalized resources and for structural risks associated with surveillance, datafication, and the reproduction of inequalities.

The contemporary notion of neurodiversity shifts the understanding of these students from a pathologizing perspective to the recognition of legitimate variations in human neurological functioning. Within this framework, AI can act as a mediator of cognitive accessibility, support communication, organize routines, and diversify modes of expression. However, as Selwyn (2016), O'Neil (2016), Benjamin (2019), and Williamson (2020) warn, intelligent technologies are not neutral: they carry power structures, historical-social biases, and intentionalities embedded in their operational models.

In this context, this chapter critically analyzes the interactions between AI and neurodiversity, examining how intelligent technologies can simultaneously expand access and produce new forms of vulnerability. To this end, it discusses recent literature on ADHD, ASD, algorithmic ethics, and inclusive education, articulating theoretical foundations, pedagogical implications, and ethical challenges. The chapter is structured into four axes: a review of neurodiversity concepts; analysis of AI's potentials for neurodivergent students; discussion of risks associated with datafication and algorithmic biases; and, finally, recommendations for educational practices and public policies that promote cognitive justice. This contribution is aimed at educators, researchers, and policymakers seeking to understand how AI can integrate into inclusive education critically, ethically, and emancipatorily.

METHODOLOGY

This study is characterized as a narrative literature review, an approach that proves methodologically consistent for emerging, multifaceted, and interdisciplinary themes, such as the interactions between artificial intelligence, neurodiversity, and inclusive education. Unlike systematic reviews, whose strength lies in rigid protocols and exhaustiveness, the narrative review allows for interpretative readings, the construction of dialogues between distinct theoretical fields, and the development of conceptual syntheses that illuminate complex phenomena. Its objective is not simply to gather references but to understand meanings, disputes, epistemological tensions, and possible formative pathways. It is, therefore, a method that supports in-depth analyses when the object of study is undergoing

accelerated technological transformation and demands transversal articulations among education, ethics, developmental psychology, and sociotechnical studies.

The starting point of this review was the recognition that research on AI applied to education often ignores the cognitive and sensory specificities of neurodivergent students, producing generalized discourses. For this reason, the construction of the theoretical corpus needed to simultaneously include works addressing ADHD and ASD from the perspective of neurodiversity (Armstrong, 2012; Kapp, 2020), studies on technologies and learning (Papert, 1980; Holmes & Tuomi, 2022), critical analyses of datafication and algorithms in education (Selwyn, 2016; Williamson, 2020), debates on sociotechnical ethics (Floridi, 2018), as well as works denouncing algorithmic biases and structural inequalities (Noble, 2018; Benjamin, 2019). International guidelines such as UNESCO (2023) and documents on Universal Design for Learning were also incorporated, given their relevance to inclusion.

The first methodological stage consisted of a broad survey of sources in academic databases, digital repositories, and institutional documents. Priority was given to literature with consolidated impact in the field and recent works that directly address the emergence of generative AI. This process was not limited to education but included cognitive sciences, social sciences, philosophy of technology, and critical studies on race and algorithms, recognizing that understanding AI and neurodiversity requires a plural and interdisciplinary approach.

The second stage involved exploratory reading, preparation of analytical summaries, and thematic categorization. In this process, central axes emerged, such as: AI-assisted personalization; mediation of executive function in ADHD; augmentative communication and predictability in ASD; pedagogical surveillance and childhood datafication; algorithmic biases and production of inequalities; risks of cognitive dependency; cognitive justice; multimodal accessibility; and ethical implications in basic education. This categorization was not reduced to mere listings but treated as a conceptual map, allowing the identification of relationships, tensions, and contradictions among authors.

The third methodological stage consisted of integrative synthesis, a process in which categories were cross-referenced to produce new interpretations of AI's role in neurodiverse contexts. The synthesis did not seek consensus but aimed to make visible conceptual fractures that enrich the analysis—for example, the tension between the discourse of algorithmic personalization, often celebrated by technology companies, and academic criticism of the production of cognitive dependency and behavioral surveillance. This interpretative movement enabled an understanding of how technology both expands access and reconfigures vulnerabilities. This stage also brought together fields that rarely interact—such as neurodiversity and algorithmic ethics—highlighting their convergence in defending student autonomy and dignity.

Another important methodological element was the critical analysis of silences in the literature, understood as significant absences for comprehending the theme. For instance, the scarcity of studies considering sensory specificities of autism in AI-based technologies; the lack of research on hyper-personalization risks for students with ADHD; and the almost non-existent Brazilian debate on protecting sensitive data of neurodivergent children in datafied school environments. Identifying such gaps is a constitutive part of the narrative review, as it reveals blind spots that need to be addressed by research and educational policies.

This is a theoretical study; the research did not involve human participants or empirical data collection. The methodological choice reinforces that analyses of AI and inclusion cannot dispense with conceptual depth, as educational technologies are products of historical, political, and economic processes that must be interpreted for their use to be ethically defensible.

Finally, the narrative review, far from being a mere preliminary stage, became the analytical foundation of the chapter, as it allowed the ambivalent nature of AI to be evidenced—capable of expanding access while simultaneously intensifying vulnerabilities. This methodological path reveals that understanding AI in neurodiverse contexts requires a careful, interdisciplinary, critical, and sensitive approach to singularities. The methodology employed, by valuing complexity and theoretical dialogue, ensures that the results presented do not oversimplify the phenomenon but offer rigorous contributions for educators, researchers, and policymakers seeking to build truly inclusive practices in the algorithmic era.

NEURODIVERSITY AS AN EDUCATIONAL PARADIGM

The notion of neurodiversity represents a significant epistemological shift in how education understands cognitive differences, moving away from a pathologizing logic toward a perspective that recognizes the plurality of modes of human neurological functioning. In contrast to the traditional model, which tends to frame students with ADHD and ASD in terms of deficits and deviations from the norm, neurodiversity proposes that such differences be understood as legitimate variations in cognition, attention, language, and sensory processing. Armstrong (2010) emphasizes that recognizing neurodiversity implies abandoning educational practices aimed at normalization and adopting approaches that value talents, specific interests, and unique cognitive styles.

Kapp (2020), in discussing the neurodiversity movement from the standpoint of autistic voices themselves, reinforces that inclusion is not limited to physical presence in school but involves belonging, recognition, and meaningful participation. From this perspective, the educational challenge is not to "correct" the neurodivergent student but to reorganize pedagogical practices, curricula, and assessments to encompass multiple ways of learning and expressing knowledge. This approach directly engages with

the notion of cognitive justice, understood as the right for different forms of thought to coexist and be legitimized within the school environment.

In the context of digital culture, neurodiversity becomes even more relevant, as technologies expand the possibilities for pedagogical mediation while simultaneously reinforcing normative performance standards. Thus, discussing neurodiversity as an educational paradigm entails questioning singular models of attention, productivity, and academic success, opening space for practices that are more flexible, sensitive, and ethically committed to human diversity.

ADHD AND ASD IN CONTEMPORARY SCHOOLING

In contemporary schools, students with ADHD and ASD face challenges beyond their individual cognitive profiles. Difficulties often attributed to these students largely stem from rigid school structures, inflexible curricula, and pedagogical practices centered on homogeneous learning models. For ADHD, variations in attention, impulsivity, and movement needs clash with environments privileging sustained attention and behavioral control. For ASD, differences in social communication, interpretation of implicit cues, and sensory processing can lead to misunderstandings and silent exclusions.

Traditional school practices often ignore cultural and communicational transformations brought by digital languages, affecting neurodivergent students even more intensely (Rojo, 2012; Lankshear & Knobel, 2011). These students frequently develop unique learning strategies in digital environments, where they find greater control over pace, repetition, visuality, and expression. However, schools rarely recognize these repertoires as legitimate, producing merely formal inclusion marked by enrollment and physical presence rather than effective participation.

This tension between formal and real inclusion underscores the need to rethink schooling in light of cognitive diversity. Simple activity adaptations or sporadic technology use do not guarantee inclusion without deeper changes in conceptions of learning, assessment, and success. Here, AI becomes relevant, as it can either expand mediation possibilities or reinforce exclusionary logics, depending on its pedagogical integration.

ARTIFICIAL INTELLIGENCE AND INCLUSIVE EDUCATION

Artificial intelligence has often been presented as a promise of personalized learning, capable of adapting content, pace, and learning pathways to the individual needs of students. In inclusive education contexts, this promise gains strength by suggesting solutions to historical challenges faced by neurodivergent students. AI-based tools can offer multimodal explanations, organize tasks, support executive functions, and expand communication resources, aligning with the principles of Universal Design for Learning and the specific demands of students with ADHD and ASD.

However, critical authors warn that algorithmic personalization is neither neutral nor automatically inclusive. Selwyn (2016) argues that educational technologies frequently carry discourses of efficiency and innovation that conceal power relations, commercial interests, and control processes. Williamson (2020) expands this critique by demonstrating that AI systems applied to education operate through datafication, transforming students into analyzable and predictable profiles, which can reduce the complexity of subjects to performance and behavioral indicators.

Noble (2018) contributes to this debate by showing that algorithms tend to reproduce structural biases, reinforcing existing stigmas and inequalities. In inclusive education contexts, this means that neurodivergent students risk being classified, monitored, and labeled even more intensely—now under the guise of technological neutrality. The promise of personalization can thus turn into pedagogical impoverishment when the system begins to offer reduced challenges or limited learning pathways based on initial algorithmic interpretations.

Therefore, the literature indicates that the relationship between AI and inclusive education is profoundly ambivalent. Technology can expand access and foster learning, but it can also intensify surveillance, cognitive dependency, and symbolic exclusion. Teacher mediation, pedagogical intentionality, and ethical reflection thus become indispensable conditions for artificial intelligence to effectively contribute to educational practices committed to neurodiversity and cognitive justice.

RESULTS AND DISCUSSION

The body of analyzed works reveals that AI holds significant potential to support students with ADHD and ASD, yet these potentials are inseparable from ethical, pedagogical, and sociopolitical risks.

For students with ADHD, AI tools that assist in organizing routines, segmenting tasks, and regulating time can contribute to the development of executive function. Multimodal and synthesized explanations facilitate the understanding of complex concepts when sustained attention becomes challenging. However, the literature points to the danger of cognitive dependency: when algorithms assume functions that should be progressively developed by the student, autonomy may be compromised. Selwyn (2016) argues that educational technologies often create the illusion of autonomy while reducing agency—a critical aspect for this population.

Regarding ASD, AI can support alternative and augmentative communication, visual organization of routines, and the creation of social narratives that help in understanding everyday interactions. Such resources enhance linguistic accessibility and predictability, elements fundamental for many autistic students. However, technologies for behavioral monitoring or emotional recognition are widely criticized by researchers. Benjamin (2019) shows that these systems tend to interpret neurodivergent expressions as

anomalies, reinforcing pathologization. O'Neil (2016) demonstrates that algorithms trained on biased data reproduce historical injustices—a risk amplified when dealing with vulnerable groups.

School datafication constitutes an additional risk. Williamson (2020) demonstrates that schools increasingly operate as predictive systems, classifying students based on data. For neurodivergent individuals, this can lead to the crystallization of labels and inadequate interventions. Zuboff (2019) warns that extensive data collection transforms subjectivities into commercial raw material, jeopardizing the privacy and dignity of children with ADHD and ASD.

At the same time, the literature emphasizes that, when used with critical mediation, AI can expand educational repertoires and promote cognitive justice. Intelligent tools that enable multiple forms of expression, representation, and engagement align with Universal Design for Learning principles and support broader recognition of cognitive singularities. The condition, however, is always the presence of a teacher capable of interpreting the uses, limits, and intentionalities of technology.

The relationship between AI and neurodiversity must be understood within a broader sociotechnical ecology, in which devices, people, and institutions interact continuously. Authors such as Floridi (2018) and Benjamin (2019) highlight that intelligent technologies do not merely respond to commands but structure environments, shape behaviors, and influence decisions. For students with ADHD and ASD—whose ways of perceiving and organizing the world already differ from neurotypical norms—these mediations can expand access or create additional barriers. Thus, the debate cannot be restricted to technical evaluations of tools but must consider ethical, political, and relational dimensions that permeate their use.

Another fundamental aspect concerns how digital platforms and AI systems produce forms of attention regulation. For students with ADHD, whose executive functions are often strained by multiple stimuli, digital environments can alternate between support and overload. Williamson (2020) and Santaella (2018) observe that digital interfaces are designed to maximize engagement, which can intensify distraction, impulsivity, or hyperfocus. Conversely, AI tools that organize routines, filter distractions, or transform complex information into visualizations can function as mediators of autonomy and self-management.

Among students with ASD, AI can act as a communicative and socio-affective mediation technology, especially when used in formats that respect predictability, controlled repetition, and low ambiguity—essential elements for many learners on the spectrum. Systems based on natural language processing can foster written expression, support social routines, and enhance inferential comprehension. However, as Kapp (2020) emphasizes, such technologies should not replace human relationships but expand spaces for participation and belonging.

Algorithmic personalization constitutes an equally ambivalent dimension. Adaptive systems can adjust the pace, format, and complexity of activities, reducing frustration and increasing engagement. However, Selwyn (2016) and O'Neil (2016) warn that algorithms tend to reinforce pre-existing patterns, potentially crystallizing deficit-based expectations about neurodivergent students. A student who shows initial difficulty may be systematically exposed to simpler challenges, impoverishing their educational trajectory. Thus, personalization must be constantly monitored by educators to ensure it expands rather than restricts learning horizons.

Finally, the issue of school datafication deserves special attention. The massive collection of behavioral data can produce learning profiles useful for pedagogical planning but can also reduce the complexity of the student to predictive indicators. Zuboff (2019) and Noble (2018) warn that when data replace human narratives, pedagogical decisions may be based on incomplete or biased statistical models. For neurodivergent students, this means a risk of digital pathologization or reinforcement of stigmas.

Table 1 – Potentials and Risks of Artificial Intelligence for Students with ADHD and ASD

AI POTENTIALS	AI RISKS AND LIMITATIONS
Personalization of task pace and complexity, respecting different learning times.	Reduction of pedagogical complexity when excessive adaptation limits cognitive challenges.
Tools supporting executive functions, such as routine organization, reminders, and activity sequencing.	Cognitive dependency on intelligent assistants for planning, decision-making, and problem-solving.
Augmentative and alternative communication resources expanding expression for ASD students.	Reinforcement of algorithmic biases associated with neurodivergent profiles.
Visualization of complex information in accessible formats, such as diagrams, maps, and visual syntheses.	Risk of excessive datafication and continuous behavioral surveillance.
Reduction of sensory overload through interfaces adjusted to student profiles.	Algorithmic stigmatization, with systems classifying students as less capable.
Attention regulation support via filters, timers, and guided focus.	Highly stimulating digital environments intensifying impulsivity and distraction.

Expansion of communicative, textual, and visual autonomy.	Improper substitution of essential human interactions for social development.

CONCLUSION

Artificial intelligence holds significant potential to transform educational practices for neurodivergent students, particularly by enhancing cognitive accessibility, diversifying modes of expression, and offering communicative mediations that foster engagement and participation. Resources such as multimodal explanations, intelligent organization of routines, support for augmentative communication, and the generation of visual representations can reduce historical barriers that hinder the learning of students with ADHD and ASD. Pedagogical personalization, when carefully planned, allows different rhythms, interests, and attention profiles to be recognized as legitimate elements of the educational experience, contributing to a school environment that is more equitable and sensitive to singularities.

However, these benefits cannot be analyzed without a critical understanding of the risks that AI also introduces. Behavioral surveillance, the collection of sensitive data, the use of predictive models, and the intensification of school datafication produce effects that may amplify inequalities, reinforce stigmas, and compromise student autonomy. For neurodivergent individuals—whose educational history is often marked by excessive evaluations and attempts at normalization—the introduction of algorithmic systems may represent a new layer of control, transforming singular behaviors into statistical anomalies. Algorithmic biases, as evidenced by O'Neil (2016), Noble (2018), and Benjamin (2019), tend to reproduce historical inequalities and may disproportionately impact those who already face social, cognitive, and institutional barriers.

In this scenario, pedagogical mediation becomes even more central. The teacher assumes the role of critical interpreter of technologies, assessing their relevance, limitations, and ethical consequences. It is the teacher's responsibility to protect data, contextualize tools, guide processes of self-regulation, promote reflection on AI usage, and ensure that the focus remains on meaningful learning and respect for diverse ways of knowing. Technology does not replace educational sensitivity, active listening, affective mediation, or ethical commitment to student dignity. On the contrary: the more sophisticated the tools become, the greater the need for professionals capable of humanizing processes and resisting the temptation to automate judgments or reduce subjectivities to metrics.

It is concluded that AI can occupy a relevant place in inclusive education, provided it is integrated into pedagogical projects that recognize neurodiversity as a richness rather than a deficit to be corrected. This implies conceiving inclusion as a political and ethical practice, grounded in cognitive justice,

autonomy, and respect for different ways of learning, interacting, and perceiving the world. For intelligent technologies to truly contribute to emancipatory trajectories, it is essential that schools, researchers, and policymakers adopt a critical stance toward algorithmic logic, promote continuous teacher training, ensure digital rights, and build environments in which neurodivergent students are not merely AI users but subjects capable of understanding, questioning, and interacting with these technologies ethically and creatively. Inclusive education in the AI era is not achieved through uncritical adoption of tools but through reaffirming that every student—with their history, sensory profile, and way of thinking—deserves to be recognized in their fullness and dignity.

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FROM ERASURE TO RECOGNITION: PRE-COLUMBIAN ETHNOMATHEMATICS AND ITS POTENTIALITIES FOR MATHEMATICS EDUCATION

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ABSTRACT

The present chapter addresses Ethnomathematics as a field for valuing knowledge produced by non-Western civilizations, specifically focusing on the mathematical legacy of Pre-Columbian peoples. This is a qualitative and theoretical bibliographic research that revisits the historiography of mathematics to counter the Eurocentric narrative predominant in school curricula. The main objective of the study is to investigate the mathematical systems developed by the Maya, Aztec, and Inca peoples and discuss their pedagogical potential for a more inclusive and intercultural Mathematics Education. The methodology consisted of a literature review grounded in Ethnomathematics theorists, such as Ubiratan D'Ambrósio, and in historical and archaeological records on Mesoamerican and Andean science. The results demonstrate the high sophistication of these peoples: the Maya developed a positional vigesimal numeral system and the abstract concept of zero for astronomical purposes; the Aztecs used functional pictograms for tax accounting and urban planning; and the Incas created Quipus, a complex logical system of strings and knots for data recording and engineering. It is concluded that this knowledge transcends folklore and possesses scientific rigor, offering educators powerful tools to teach concepts of arithmetic, geometry, and information processing, in addition to promoting the recognition of cultural diversity and combating epistemicide in student education.

Keywords: Ethnomathematics; Pre-columbian; Mathematics Education; Interculturality.

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INTRODUCTION

Mathematics as taught in Brazilian schools still relies largely on a Eurocentric narrative that privileges the contributions of thinkers and traditions from the Old World, as if science were an exclusive creation of Europe. This hegemonic and universalist perspective tends to silence knowledge produced by other cultural matrices, marginalizing sophisticated mathematical practices of civilizations native to the Americas. Peoples such as the Maya, Inca, and Aztec developed, centuries before the arrival of colonizers, vigesimal numeral systems, highly precise astronomical calendars, and complex works of engineering and architecture. This knowledge was not isolated; it integrated technique, spirituality, agricultural needs, and social organization, revealing a unique and effective way of reading and interpreting the world.

Despite its undeniable historical and scientific relevance, such knowledge often remains invisible in school curricula or, when addressed, is reduced to folkloric curiosities devoid of mathematical rigor. The central problem guiding this study lies in the "historical erasure" and epistemological devaluation of Pre-Columbian mathematics in formal education. We ask: in what ways does the perpetuation of a monocultural curriculum limit students' critical formation and prevent the recognition that mathematics is a diversified human construction? This silencing is not mere forgetfulness; it reflects a structure of power that validates only Western science as legitimate.

The investigation of this theme is justified by the urgent need to promote cognitive justice in the school environment. By neglecting the intellectual contributions of native peoples, the school weakens the bond of Latin American students with their own cultural roots and perpetuates the erroneous idea that their ancestors did not produce science. Reintegrating such knowledge is fundamental to combating epistemic racism and providing plural models of logical reasoning. Moreover, for the mathematics teacher, contact with non-decimal numeral systems and distinct recording logics (such as quipus) enriches the didactic repertoire and challenges students to think outside the "box" of the traditional Indo-Arabic system.

Theoretically, this work is grounded in the Ethnomathematics Program proposed by Ubiratan D'Ambrósio, which asserts that each culture develops its own "mathematics"—that is, its own techniques for explaining and dealing with reality—in response to its needs for survival and transcendence. It also dialogues with the concept of "coloniality of knowledge," from sociologist Aníbal Quijano, which explains how the hierarchy of knowledge imposed by colonialism continues to operate in contemporary scientific validation. This theoretical basis allows us to understand that Pre-Columbian mathematics has the status of science and that its exclusion results from a coloniality that needs to be overcome through education.

In light of this scenario, this chapter has the general objective of investigating the fundamental characteristics of the mathematical systems of the Maya, Aztec, and Inca civilizations and discussing their pedagogical potentialities for current Mathematics Education. As specific objectives, we seek to: (a) describe the technical advances of these peoples, such as the Maya zero, Inca recording systems, and Aztec geometry; (b) review the relevant historical and ethnomathematical literature to understand the internal logic of these systems; and (c) present reflections on how these contents can be transposed to the classroom, promoting meaningful and intercultural learning.

To understand the depth of the knowledge that has been silenced and to substantiate the proposed pedagogical discussion, it is first necessary to undertake a historical and epistemological recovery. The following section is dedicated to the literature review on the mathematical production of the Maya, Aztec, and Inca civilizations, showing how these peoples developed complex and rational logical systems long before contact with European colonizers.

LITERATURE REVIEW: ETHNOMATHEMATICAL PRODUCTION OF PRE-COLUMBIAN CIVILIZATIONS

The Maya, Aztec, and Inca civilizations developed mathematical systems deeply intertwined with their cosmologies, everyday practices, and forms of political, economic, and territorial organization. Far from being mere technical instruments, their mathematical knowledge was also a form of symbolic expression, social control, and mediation with the spiritual world. According to D'Ambrosio (2001, p. 33), creator of the term Ethnomathematics, there are "different ways of explaining, understanding, and dealing with quantitative, spatial, and logical realities practiced by different cultural groups throughout history." For the author, such knowledge must be recognized as legitimate expressions of ethnomathematical knowledge.

These civilizations elaborated numeral systems, calendars, instruments of record-keeping, and sophisticated urban planning, revealing a mathematical rationality of their own—distinct from Western logic, yet equally complex and effective. Even so, Brazilian textbooks and school curricula continue to neglect these contributions, reinforcing a narrative that associates mathematical knowledge exclusively with the European tradition (Rosa & Orey, 2012, p. 35).

THE MAYA: ASTRONOMY, CALENDARS, AND THE CONCEPT OF ZERO

The Maya stood out for the depth and sophistication of their astronomical and mathematical knowledge, developed in intimate relation with their cosmology and social organization. Maya mathematics was not merely a technical tool, but a symbolic and ritual expression of their way of life and worldview, revealing a proper logic of timekeeping, recording, and astronomical prediction. According to

D'Ambrósio (2005, p. 30), "every culture develops its own mathematics as a function of the needs of survival and coexistence," and in this sense, Maya mathematical knowledge constitutes a legitimate cultural system shaped by the demands and beliefs of its people.

The Maya elaborated two principal calendars: the Tzolk'in, of 260 days, geared toward religious activities and sacred cycles, and the Haab', of 365 days, used for administrative and agricultural functions. The intersection of these two systems resulted in the so-called Calendar Round, a cycle of 52 solar years, which guided ritual, political, and productive life in Maya society. As Coe and Houston (2015, p. 47) highlight, this mastery of astronomical cycles allowed the Maya to predict eclipses and align their social events with celestial movements, revealing a cyclical conception of time that was profoundly sacred.

In the numerical domain, the Maya employed a vigesimal system (base 20), formed by three essential symbols: the dot (value 1), the bar (value 5), and the shell (representing zero). This system allowed for the composition of integers through positional notation, increasing in vertical columns from bottom to top, in a model of notable abstraction and functionality. As Gendrop (1987, p. 30) states: "[...] the dot for the unit, the bar for five, plus a sign in the form of an elongated shell equivalent to 'zero', or rather, signifying absence of value. These signs lent themselves easily to composing integers, capable of surpassing the thousands."

This use of zero as a mathematical symbol—one of the earliest records of this concept in the ancient world—demonstrates the advanced level of abstraction attained by the Maya. Restall (2003, p. 52) notes that it was "one of the most advanced numeral systems of antiquity, with the Maya being pioneers in the use of zero as a mathematical concept." This achievement precedes by centuries the use of zero in European and Indian mathematics, contradicting the Eurocentric narrative that mathematics developed exclusively in the West.

Beyond counting, Maya numbers also had ritual and cosmological functions: each number was associated with deities and spiritual forces, and its use in the calendars indicated auspicious or unfavorable days for certain actions, such as planting, marriages, and wars (Santos et al., 2023, p. 4). Thus, mathematics was interwoven with spirituality and everyday life, constituting a form of mediation among the human, natural, and divine worlds.

This knowledge, however, remains historically marginalized in school curricula and textbooks. Rosa and Orey (2012, p. 35) denounce the persistence of a monocultural logic in Brazilian Mathematics Education that privileges exclusively knowledge originating in the European tradition. The invisibilization of Maya mathematics, in both its technical and symbolic dimensions, is a clear example of what Quijano (2005) calls the "coloniality of knowledge," that is, the systematic erasure of non-Western epistemologies resulting from a hierarchy imposed by colonialism.

Reintegrating these contributions into mathematics teaching is, therefore, an act of epistemic and pedagogical justice. Valuing diverse mathematical knowledge allows us to “expand students’ cognitive and cultural repertoire, promoting the recognition and appreciation of different ways of thinking and organizing the world” (Rosa & Orey, 2015, p. 220).

THE AZTECS: URBANISM, TAXATION, AND PICTOGRAMS

Influenced by Mesoamerican cultural traditions, the Aztecs developed a numeral system based on base twenty, structured differently from the Maya, with greater emphasis on the use of pictograms. These symbols were recorded in codices—illustrated manuscripts on amate paper—and functioned as true visual systems of quantification and administration, employed in records of tributes, agricultural mapping, census organization, and urban planning of the empire (Baquedano, 1998, pp. 89–90).

Aztec numbers were represented by stylized everyday objects: dots for units, flags for multiplications by 20, feathers for hundreds, and bags for thousands. This numerical iconography, recorded in codices, facilitated the empire’s fiscal and administrative control (Baquedano, 1998; Coe & Houston, 2015). As we can see in the following figure:

Figure 1: Aztec Numeral System

Source: Mateprehispánicas (2020).

The figure illustrates the symbols used by the Aztecs in their vigesimal system: the dot for the unit, the flag for the value 20, the feather for 400, and the bag for 8,000. This model of representation was based on elements of daily life and was widely understood by the population, especially in administrative and fiscal records.

Such a system shows that the Aztecs did not conceive mathematics solely as abstraction but as a functional and culturally situated instrument, applied to taxation, urban planning, and social organization. The use of pictograms reinforces the visual and symbolic dimension of counting, revealing a rationality of its own, distinct from the Western tradition.

THE INCAS: THE QUIPU AND ANDEAN ENGINEERING

The Incas, one of the most sophisticated civilizations of Pre-Columbian America, developed social, political, and territorial organization articulated with mathematical knowledge. Settled in the Andes, they mastered techniques of counting, geometry, astronomy, and engineering with a precision that still impresses specialists.

Among their innovations, the quipu stands out—a system of colored strings with knots, used as an instrument of record-keeping, calculation, and memory. According to Urton (2003, p. 45), the quipu was not merely a rudimentary abacus but a "structured mathematical language" that expressed quantities, categories, and logical relations through variations in color, thickness, length, and position of the knots.

This structure was based on decimal and positional principles, demonstrating a binary logic that allowed for storing complex data related to administration of the empire, such as agricultural production, census, and tributes (Urton, 2003, p. 57; Favre, 2004, p. 68). Favre (2004, p. 68) explains that "each small cord corresponded to objects of the same nature, while the knots expressed their numerical value," revealing a proper mathematical rationality which, although distinct from European algebra, was equally advanced, articulating language, accounting, and worldview.

Beyond abstract mathematics, their architectural works, such as Machu Picchu, Sacsayhuamán, and Cusco, demonstrate techniques of fitting stones without mortar, resisting earthquakes for centuries. These constructions incorporated principles of symmetry, geometry, and astronomical alignments, reflecting a deep relationship between technique and spirituality (Coe & Houston, 2015, p. 112; Favre, 2004, p. 72; Vilca, 2022, p. 10).

The Inca lunar calendar, divided into 12 months, guided agricultural activities, rituals, and time management, showing a view of time as cycles connected to nature, celestial bodies, and spirituality (Favre, 2004, p. 69). Despite such sophistication, Inca mathematical knowledge remains marginalized in school curricula due to the coloniality of knowledge, which hierarchizes knowledge and delegitimizes non-Western epistemologies, relegating them to folklore or historical curiosity (Castro-Gómez, 2005, p. 76).

Ethnomathematics, proposed by D'Ambrósio (2005), emerges as a fundamental field for valuing these traditions, promoting a more democratic, plural, and anti-racist school that recognizes the mathematical knowledge of native peoples (Rosa & Orey, 2012, p. 215). Thus, the Incas—with their quipus, monumental cities, and lunar calendar—lived mathematics as a way of inhabiting the world with meaning, beauty, and precision.

Their vestiges, myths, and memories continue to cry out for recognition. The images that follow illustrate how different mathematical rationalities manifest in cultural practices, strengthening the view of Ethnomathematics as a pedagogical field committed to cognitive justice and epistemic plurality.

The image presented below aims to illustrate how different mathematical rationalities materialize in specific cultural practices. Such visual representations contribute to strengthening the argument of Ethnomathematics as a theoretical and pedagogical field committed to cognitive justice and recognition of epistemic plurality.

Figure 2: Example of an Andean Quipu (record-keeping system using strings and knots)

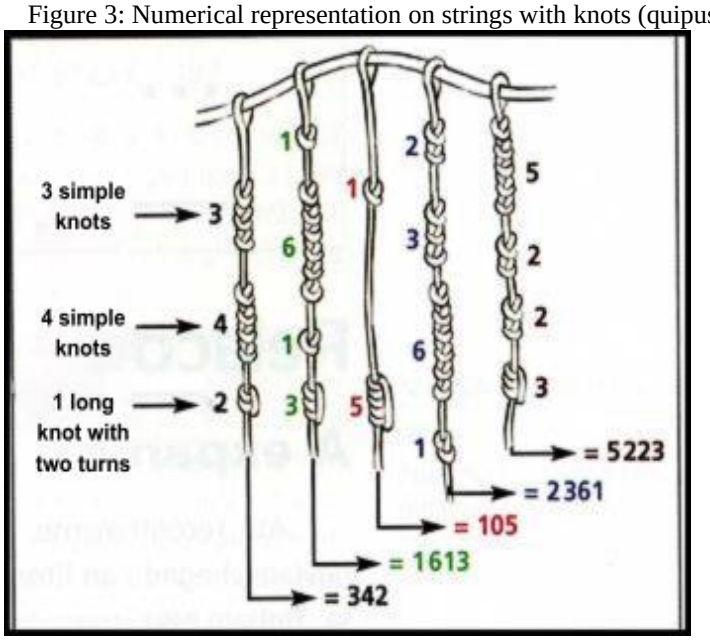
Source: Brainly (2025)

The quipu consisted of a cord measuring a few centimeters more than one meter in length. From this cord hung various small cords with knots, twists, and varied colors. Each small cord thus singularized corresponded to objects of the same nature, while the knots it contained expressed the numerical value of these objects (Favre, 2004, p. 68).

Figure 2 illustrates a didactic example of how different combinations of knots on strings can represent numerical values, evidencing the mathematical logic present in traditional systems such as Andean quipus. This type of representation directly confronts the idea that Mathematics is exclusively symbolic and algebraic, by demonstrating that there are numerical rationalities constructed in specific cultural contexts and based on their own recording technologies.

The presence of elements such as repetition of simple knots, double knots, and long knots, organized according to positions and sequences, reveals a structured logical system that operates outside the Western written matrix, yet still fulfills functions of counting, organization, and memory. This visual resource reinforces the argument of Ethnomathematics by defending the legitimacy of multiple forms of mathematical knowledge and the need to recognize these practices in school curricula.

Figure 3: Numerical representation on strings with knots (quipus)



Source: Mundo Incas 2016)

Figure 3 presents an authentic quipu, an artifact used by Andean peoples as a system of record-keeping and communication. The richness of colors, thicknesses, and knot patterns not only evidences the complexity of the system but also demonstrates its sophistication as a form of data encoding. Unlike alphabetic writing, the quipu operated based on a three-dimensional, tactile and visual language, capable of recording economic, demographic, tax, and possibly narrative information.

The analysis of this object, in the context of Ethnomathematics, expands understanding of the epistemological diversity that underpins mathematical knowledge. At the same time, it points to curricular epistemicide that occurs when these systems are ignored or erased from the history of Mathematics taught in schools. Incorporating the study of quipus into the school curriculum not only enriches students' mathematical repertoire but also values identities and cultures systematically marginalized.

INVISIBILIZATION OF MATHEMATICAL KNOWLEDGE IN SCHOOL EDUCATION

The mathematical knowledge of civilizations native to the Americas—such as the Maya, Aztec, and Inca—represents sophisticated knowledge that articulates cosmology, social organization, symbolic language, and logical rationality. However, this knowledge has historically been erased from school curricula and teaching materials in a process of epistemic silencing. The hegemony of the Greco-European tradition in Mathematics Education has imposed a monocultural, rationalist, and universalist conception of Mathematics that ignores diverse ways of thinking and calculating present in other cultures (D'Ambrósio, 2005, p. 30).

This erasure is not accidental but reflects a colonial logic of knowledge production and validation. Quijano (2005, p. 122) emphasizes that the "coloniality of knowledge" establishes a hierarchy among

epistemologies, conferring validity only to those originating in the Western European axis. This hierarchy legitimizes the exclusion of mathematical knowledge from native peoples, relegating it to folklore or historical curiosity (Castro-Gómez, 2005, p. 76).

In practice, this invisibilization manifests itself in textbooks, which function as ideological instruments, mediating cultural and political conceptions and reproducing dominant worldviews. Capelato (2009, p. 118) states that school manuals "are part of the machinery for maintaining historical interpretations and projects of society." Fonseca (2010, p. 57) reinforces that these materials omit or superficialize indigenous, African, and popular knowledge, forming a homogeneous and exclusionary narrative of Mathematics.

Studies indicate that when this knowledge appears in textbooks, it is generally presented superficially, as curiosities, without connection to the central contents of the discipline (Rosa & Orey, 2012; D'Ambrosio, 2005). D'Ambrosio's (2005, p. 30) Ethnomathematics proposal seeks to break with this monocultural logic, asserting that every culture develops its own way of mathematizing reality in accordance with its historical and social needs. Recognizing mathematical plurality is a condition for a fairer, more democratic, and culturally situated education.

Rosa and Orey (2012, p. 213) reinforce that including traditional mathematical knowledge in the school curriculum strengthens cultural identities, values diversity, and promotes curricular justice. For them, the school should cease to be a space of exclusion and become an environment of recognition and dialogue among different epistemologies.

Thus, this research criticizes the invisibilization of non-Western mathematical knowledge—especially in textbooks adopted in Brazilian schools—and advocates its incorporation as part of the history of human knowledge. As Oliveira and Araújo (2023, p. 5) indicate, integrating the knowledge of native peoples into mathematics teaching is a way to combat epistemicide, recognize silenced subjects, and build a truly intercultural curriculum.

Given the sophistication of the mathematical systems presented and the finding of their historical erasure, it becomes fundamental to structure the investigative path that enabled the analysis of these data from an educational perspective. The following section describes the methodological procedures adopted in this research, detailing the steps for selecting the theoretical framework and the criteria used to identify, in these ancestral forms of knowledge, the pedagogical potentialities that will be discussed later.

METHODOLOGY

This study is characterized as research with a qualitative approach, of the bibliographic and documentary type. The choice of this approach is justified by the nature of the object of study—the mathematical knowledge of civilizations that were extinguished or transformed by the colonial process—

which requires interpretive investigation of historical and archaeological sources, rather than manipulation of numerical variables. As Bogdan and Biklen (1994) point out, in qualitative research the central interest lies in understanding the meanings attributed by subjects to their actions and productions. In this sense, it is understood that "reality is socially constructed and that human experience is mediated by interpretation," distancing this work from a purely descriptive character and situating it in an analytical and reflective perspective.

The methodological path was structured from a literature review along two complementary fronts. The first, historiographical in nature, sought to gather data on numeral systems, measurement practices, and astronomical records of the Maya, Aztec, and Inca peoples. To this end, reference works on the history of science and Mesoamerican and Andean archaeological studies were consulted. The second front, theoretical-pedagogical in nature, used the Ethnomathematics framework to analyze these data. We adopted as a premise D'Ambrosio's definition (2005, p. 30), in which "every culture develops its own mathematics in function of the needs of survival and coexistence." This theoretical lens was essential to remove the stigma of "primitive" frequently attributed to such knowledge, allowing it to be reclassified as sophisticated and legitimate intellectual processes.

Data collection and analysis followed a three-stage protocol: **(i)** Identification, in which excerpts explicitly describing mathematical practices (such as the Maya use of zero or the logic of knots in quipus) were selected; **(ii)** Contextualization, the stage in which such knowledge was reconnected to its original social functions (religious, administrative, or agricultural), avoiding anachronisms; and **(iii)** Pedagogical Transposition, the moment of reflection on how these contents can dialogue with the National Common Curricular Base (BNCC) and current teaching practice.

Interpretive analysis was guided by the search for "pedagogical potentialities," that is, elements that could effectively contribute to mathematics teaching. Based on Rosa and Orey (2015, p. 220), the intention was to verify how this knowledge can "expand students' cognitive and cultural repertoire, promoting the recognition and appreciation of different ways of thinking and organizing the world." Therefore, the methodology employed here did not limit itself to compiling historical information but carried out an exercise in epistemological critique, confronting Eurocentric hegemony with the conceptual richness of Pre-Columbian ethnomathematics.

Finally, it is worth noting that the choice of sources prioritized authors who discuss the coloniality of knowledge and the need to decolonize the curriculum, ensuring that the pedagogical discussion was aligned with contemporary demands for an anti-racist and plural education.

Having outlined the investigative path and theoretical lenses that support the research, it becomes necessary to translate these historical findings into concrete educational practices. The subsequent section is therefore devoted to presenting the pedagogical potentialities identified, demonstrating how

Pre-Columbian Ethnomathematics can be didactically transposed to enrich the teaching of fundamental mathematical concepts and promote interculturality in the classroom.

RESULTS AND DISCUSSION: PEDAGOGICAL POTENTIALITIES

The inclusion of Ethnomathematics in the school curriculum transcends a mere methodological or ideological choice; it is a normative and ethical directive supported by the National Common Curricular Base (Brazil, 2018). The Specific Competence in Mathematics states that the student must "*Recognize that Mathematics is a human science, the result of the needs and concerns of different cultures at different historical moments, and is a living science that contributes to solving scientific and technological problems and to underpin discoveries and constructions.*" This directive breaks with the traditional view of mathematics as a static, neutral, and exclusively European body of knowledge, opening space for the recognition of other rationalities.

Based on this legal premise and the literature review conducted, analysis of historical data revealed that Pre-Columbian mathematical systems offer rich epistemological models to operationalize this competence in the classroom. We observe that Maya, Aztec, and Inca mathematics was not limited to solving everyday survival problems but was structured as complex logical systems of abstraction, capable of modeling astronomical phenomena, managing large territories, and processing statistical data with rigor. Therefore, bringing this knowledge into the school environment does not mean simplifying teaching but rather complexifying it, offering students multiple pathways to access fundamental mathematical concepts.

Unlike a superficial multicultural approach where indigenous culture appears only as illustration or folklore on commemorative dates, the discussion proposed here advocates structural inclusion. This means using the logical structures of these civilizations—such as the positional vigesimal base of the Maya or the binarity of Inca quipus—to develop rigorous mathematical concepts in Arithmetic, Geometry, and Statistics. In doing so, the teacher not only teaches mathematics but also historicizes knowledge, demonstrating that different human groups, faced with similar problems, developed distinct and equally valid solutions.

In this context, the pedagogical potentialities identified in this research point to three principal directions: **a)** Cognitive, by challenging students to think in non-decimal bases and non-alphabetic recording logics; **b)** Historical, by restoring scientific authorship to native peoples of the Americas; and **c)** Social, by combating epistemic racism that hierarchizes knowledge. Below, we detail these potentialities through specific intervention proposals for each civilization studied, articulating them directly with the skills set forth in the BNCC.

Among the various possibilities for pedagogical intervention, Maya arithmetic stands out for its potential to provoke productive cognitive estrangement. By presenting a counting logic distinct from the Western one, this system paves the way for the first activity proposed in this study, aimed at deconstructing and reconstructing the concept of numerical base.

THE MAYA VIGESIMAL SYSTEM: DECONSTRUCTING THE DECIMAL BASE

The Maya numeral system, positional and base 20, presents itself as a powerful cognitive tool for teaching Arithmetic. By confronting students with a grouping logic distinct from the decimal, the teacher provokes a healthy "cognitive conflict": the student needs to understand the *concept* of base and not merely memorize rules.

Table 1 systematizes an intervention proposal focused on the construction of number, emphasizing the use of the body (fingers and toes) and the abstraction of zero.

Table 1 – Intervention Proposal: Maya Arithmetic

Curricular Element	**Description of the Pedagogical Activity**
Theme	Numeral System and Place Value (Base 20)
Skill (BNCC)	**(EF06MA02)** Recognize the decimal numeral system as the result of a historical process, comparing it with other numeral systems.
Resources	Beans (unit), popsicle sticks (value 5), and shells or bottle caps (zero).
Development	1. **Contextualization:** Explain that the Maya counted using the 20 digits of the body.o. 2. **Manipulation:** Challenge students to represent quantities (e.g., their own age) using Maya symbols, grouping by 5 and by 20. 3. **Operation:** Perform simple sums by moving only the objects, without converting to Arabic numerals.

Source: Prepared by the authors (2025).

Applying this activity allows discussion of the role of zero. In traditional school mathematics, zero is often taught merely as "empty." In the Maya system, by using the shell to indicate that a place of value 20 or 400 was "complete," students visualize zero as an operational placeholder. Moreover, the activity breaks automatism. To calculate in base 20, the student must activate multiplicative reasoning (each level above is worth 20 times more), which reinforces, by comparison, understanding of the decimal system itself (where each level is worth 10 times more).

If the Maya contribution enriches Arithmetic by challenging positional logic, the Aztec civilization offers equally valuable support for Geometry and Measurement. Shifting focus from numerical abstraction to spatial organization, the next subsection explores how the administrative needs of that empire spurred the development of measurement techniques that speak directly to school content on area calculation.

AZTEC GEOMETRY AND MEASUREMENT: THE MATHEMATICS OF LAND

Aztec mathematics offers a practical context for teaching Geometry, specifically in calculating areas and perimeter. Historical records in the codices show that the Aztecs decomposed irregular plots into familiar shapes (triangles and rectangles) to calculate taxes, a practice that anticipates principles of area calculation by decomposition.

Table 2 presents how this age-old practice can be brought into the 7th and 8th grades, connecting abstract geometry with the social function of mathematics (taxation).

Table 2 – Intervention Proposal: Aztec Geometry and Algebra

Curricular Element	**Description of the Pedagogical Activity**
Theme	Area Calculation of Plane Figures and Introduction to Algebra.
Skill (BNCC)	**(EF07MA31)** Establish expressions for calculating the area of triangles and quadrilaterals; **(EF08MA06)** Solve problems involving area calculation.
Resources	Graph paper, fictitious maps of irregular plots, and a table of Aztec symbols.
Development	1. **Challenge:** The student assumes the role of an Aztec tax collector who must calculate the tax on an irregular plot (trapezoid or polygon). 2. **Resolution:** The student must decompose the figure into rectangles and triangles to calculate the total area. 3. **Recording:** The final value must be expressed using pictographic notation (e.g., flag = 20 units).

Source: Prepared by the authors (2025).

This intervention enriches the geometry lesson by introducing the concept of mathematical modeling. Students perceive that the area formula ($b \times h$) is not merely a school rule but a tool for solving real problems of territorial management. Moreover, the use of pictograms (where a “flag” substitutes for the number 20) functions as an intuitive introduction to Algebra and the concept of variable, in which a graphic symbol represents a fixed numerical value, facilitating the transition from arithmetic to algebraic language.

While Aztec mathematics provides visual tools for understanding space and measurement, the Inca civilization invites us to rethink the very nature of data recording. Moving away from two-dimensional graphic representation, the next subsection investigates a textile and three-dimensional technology that challenges the Western notion of writing, offering a unique material support for developing competencies in the Probability and Statistics strand.

THE INCA QUIPU: BINARITY AND INFORMATION PROCESSING

Frequently, the history of mathematics focuses only on numeric writing. The Inca quipu, however, allows exploration of Probability and Statistics by showing that it is possible to store and process complex data through tactile and logical resources (strings and knots), without using ink and paper.

Table 3 proposes the use of the Quipu to develop statistical literacy, challenging the view that technology is merely electronic.

Table 3 – Intervention Proposal: Statistics with Quipus

Curricular Element	Description of the Pedagogical Activity
Theme	Data collection, classification, and representation.
Skill (BNCC)	**(EF05MA24)** Interpret statistical data presented in texts, tables, and graphs and produce them.
Resources	Thick twine (main cord) and colored yarn.
Development **Development**	1. **Data Collection:** Conduct a class census (e.g., age, height, number of siblings). 2. **Coding:** Define a "logical legend" (e.g., Blue strand = Boys, Red strand = Girls; Simple knot = 1, Long knot = 10). 3. **Construction:** Students build the physical quipu with the collected data. 4. **Reading:** Another group must "read" the quipu and translate the data back into a table.

Source: Prepared by the authors (2025).

Building the quipu in the classroom develops computational and algorithmic thinking. To create a quipu, students must categorize information, establish hierarchies (main cord vs. secondary), and create a binary reading code. The discussion should focus on how different civilizations created information technologies appropriate to their contexts. This combats the hierarchy of knowledge, showing that the absence of alphabetic writing among the Incas did not mean an absence of mathematical rigor or capacity for data management.

However, the impact of these pedagogical interventions is not limited to cognitive development or acquisition of technical skills. The presence of this knowledge in the classroom also carries a strong symbolic and political dimension. The last stage of this discussion therefore turns to the ethical implications of this work, analyzing how teaching Pre-Columbian mathematics contributes to building an anti-racist education and to complying with Brazilian educational legislation.

LAW 11,645/08 AS A POLITICAL-PEDAGOGICAL POTENTIALITY

When discussing the potentialities of Pre-Columbian Ethnomathematics, it is common to focus only on technical aspects (arithmetic and geometry). However, one of the greatest contributions of this knowledge to the school environment is its capacity to operationalize Law No. 11,645 of March 10, 2008. This legislation amended the National Education Guidelines and Bases (LDB – Law No. 9,394/96), making the study of "Afro-Brazilian and Indigenous History and Culture" mandatory across the official school curriculum, including Mathematics (Brazil, 2008).

Although legislation is often associated with History and Arts courses, its text is clear in determining that content must be taught across the entire school curriculum. In this context, Mathematics

plays a crucial role in combating what is called "epistemic racism." By silencing the intellectual production of native peoples, traditional schooling perpetuates the myth of European cognitive superiority.

Frequently, mathematics teachers feel difficulty in complying with this law due to a lack of materials that are not merely illustrative. In this regard, the Maya, Aztec, and Inca systems emerge as a direct pedagogical potentiality because they offer rigorous mathematical content that places indigenous peoples as intellectual protagonists. Rather than approaching indigenous culture only from the perspective of folklore or art, working with Inca Engineering or Maya Astronomy combats what is called "epistemic racism"—the unfounded belief that the capacity for logical abstraction is exclusive to Euro-Western thought.

Bringing the sophistication of Inca engineering systems or the complexity of Maya astronomy into the classroom is a way to operationalize the law, demonstrating to students that mathematical rationality is an inherent characteristic of the human condition, not a privilege of a single ethnic group. This approach strengthens students' identities, promotes respect for diversity, and deconstructs stereotypes that associate indigenous peoples with technological backwardness, repositioning them as producers of high-precision science.

Therefore, applying this content in the classroom is not a deviation from the mathematics curriculum but a didactic strategy for Anti-Racist Education. It allows the indigenous student to see themselves in the science they study and the non-indigenous student to respect ancestral knowledge, fulfilling the law's objective of forming citizens aware of Brazil's and Latin America's cultural plurality.

Beyond complying with legislation and ethical commitment, it is imperative to highlight that this proposal is pedagogically effective. The articulation between culture and cognition is not an isolated invention but a vast field of study. The final stage of this discussion brings to light what scholars of Mathematics Education say about the validity and richness of teaching through the perspective of Ethnomathematics.

POTENTIALITIES: DIALOGUES WITH MATHEMATICS EDUCATION

The pedagogical validity of using Pre-Columbian Ethnomathematics is widely corroborated by scholars in Mathematics Education. The main potentiality identified lies in the capacity to humanize the discipline. As Ubiratan D'Ambrósio (2005) argues, Ethnomathematics is not merely the study of "different mathematics," but the analysis of how distinct cultural groups generate, organize, and disseminate knowledge to explain and deal with their reality. Applying this view shifts teaching from mere transmission of absolute truths to investigation of logical processes.

Complementing this view, Rosa and Orey (2012) highlight that the ethnomathematical approach strengthens students' cultural self-esteem. For these authors, when school mathematics dialogues with local or ancestral knowledge, a "translation" occurs that facilitates understanding of abstract concepts. By studying the Aztecs or Incas, students perceive that mathematics is a dynamic, living practice present in all civilizations, which combats mathematical anxiety and promotes a more inclusive and democratic learning environment.

In the same direction, Alan Bishop (1991) identifies six universal activities that give rise to mathematical knowledge: counting, locating, measuring, designing, playing, and explaining. The results of this research show that Pre-Columbian civilizations developed these activities with excellence—the Maya in "counting" (arithmetic), the Aztecs in "measuring" and "designing" (geometry), and the Incas in "locating" and "explaining" (data systems). Using these historical examples materializes Bishop's theory, proving to students that mathematics is a universal response to common human problems.

Furthermore, scholars such as Iran Abreu Mendes (2009) argue that the History of Mathematics should be used as a pedagogical resource for concept construction. Investigating how the Maya solved the problem of writing large numbers (creating zero and place value), the contemporary student retraces the cognitive path of discovery. This enhances learning, because the concept ceases to be an imposed rule (like "carry one" or "base 10") and becomes understood as a historically constructed logical solution.

Finally, it is essential to bring in Leite's (2014) perspective, which emphasizes the need for a mathematics curriculum that dialogues with local and historical realities. For the author, valuing the mathematical knowledge of native peoples is not merely a historical recovery but a political and pedagogical act aimed at decolonizing thought and forming teachers and students conscious of their Latin American identity. In this view, Ethnomathematics becomes a tool for empowerment and critical reading of the world.

Therefore, the potentialities for Mathematics Education go beyond content: they reside in developing critical thinking, understanding the nature of science, and forming subjects capable of dialoguing with different rationalities—skills essential for the twenty-first century.

CONCLUSION

This study undertook an investigative path, starting from the problem of historical erasure of Pre-Columbian knowledge and arriving at the proposition of its pedagogical potentialities. The literature review confirmed that the Maya, Aztec, and Inca civilizations developed highly complex mathematical systems that transcend a utilitarian vision of survival and reach sophisticated levels of abstraction and generalization.

Revisiting the proposed objectives, the research demonstrated that it is possible to identify rigorous mathematical logics in these cultures: the Maya vigesimal system and zero challenge understanding of positional arithmetic; Aztec land surveying offers alternative and effective methods for teaching geometry and areas; and Inca quipus prove to be a pioneering technology in information processing and data logic. It was thus confirmed that this knowledge has didactic potential to teach content set forth in the BNCC—such as numbers, quantities, and statistics—with the same rigor attributed to Western mathematics.

However, we conclude that the main contribution of this work does not reside solely in technique but in the ethical dimension of Mathematics Education. In answering the question about pedagogical potentialities, we identified that introducing this knowledge is an effective strategy for Anti-Racist Education. Although the term was not the initial focus of the historical review, analysis showed that teaching the science of native peoples is the most concrete way to combat "epistemic racism"—the idea that logical intelligence is the exclusive domain of Europeans.

In this sense, compliance with Law No. 11,645/08 ceases to be a bureaucratic imposition and comes to be understood as a pedagogical opportunity. Pre-Columbian mathematics provides teachers the tools necessary to operationalize this law—not through empty discourse but through practical demonstration of indigenous intellectual capacity.

As suggestions for future research, we recommend practical application of the pedagogical interventions outlined in this article in Basic Education classes. Field studies that analyze students' reception and the impact of these activities on learning mathematical concepts would be fundamental to empirically validate the potentialities discussed here theoretically.

In sum, this chapter argues that recognizing Pre-Columbian Ethnomathematics in the school curriculum is urgent and necessary. Overcoming the historical erasure of these peoples is not only an act of memorial justice but also a path to forming students with an expanded cognitive repertoire and a more plural worldview, in which mathematics is understood as a universal, diverse, and human heritage.

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DESIGN SCIENCE RESEARCH AND DESIGN THINKING: TOWARD METHODOLOGICAL RIGOR IN EDUCATIONAL INNOVATION

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ABSTRACT

This chapter discusses the articulation between *Design Science Research* (DSR) and *Design Thinking* as a methodological approach to educational innovation grounded in scientific rigor. It assumes that contemporary educational challenges constitute complex, situated, and sociotechnical problems, requiring research methods capable of integrating theory, practice, and artifact development. Based on a narrative literature review, the discussion engages key DSR authors such as Simon, Hevner, and Dresch, Lacerda, and Antunes Júnior, as well as foundational contributions to *Design Thinking*, particularly by Brown and Kolko. The chapter argues that, when understood as an epistemological approach rather than an instrumental technique, *Design Thinking* can strengthen DSR stages related to problem understanding, ideation, and iterative evaluation. It concludes that integrating DSR and *Design Thinking* enhances the

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relevance, validity, and scientific legitimacy of applied research in education, provided that this integration is guided by methodological rigor, systematic documentation, and solid theoretical grounding.

Keywords: *Design Science Research*; *Design Thinking*; Educational innovation; Methodological rigor; Applied research.

INTRODUCTION

Educational innovation has frequently been associated with the introduction of new technologies, digital platforms, and automated solutions, often presented as immediate responses to complex teaching and learning problems. However, the uncritical adoption of these solutions has revealed a recurring paradox: the more innovation is invoked, the more we observe the weakening of methodological rigor that should sustain the production of scientific knowledge in the educational field.

In this context, design-based methodologies have gained traction for promising to bring theory and practice, research and intervention closer together. Yet, when used without a clear epistemological foundation, such approaches run the risk of reducing educational innovation to isolated experiences, poorly systematized and hardly transferable to other contexts. The proliferation of projects based solely on creative intuitions or on off-the-shelf technological solutions highlights the need for methods that combine practical relevance, scientific rigor, and academic validity.

It is in this scenario that Design Science Research (DSR) is situated, a methodological approach oriented toward the construction and evaluation of artifacts as a legitimate form of scientific production. Unlike purely descriptive or exploratory research, DSR starts from real problems and seeks to solve them through artifacts designed systematically, documented, and validated. In the educational field, this approach has proven particularly promising by enabling the development of technological solutions aligned with concrete institutional demands, without relinquishing theoretical and methodological rigor.

In parallel, Design Thinking has been widely incorporated into education as a human-centered approach grounded in empathy and creativity. Although it offers important contributions to the development of innovative pedagogical practices, Design Thinking, when applied in isolation, tends to lack formal criteria for scientific validation, which limits its acceptance in more demanding academic contexts.

Against this backdrop, this chapter aims to discuss the contributions of articulating Design Science Research and Design Thinking to strengthen methodological rigor in educational innovation. It argues that integrating these approaches makes it possible to reconcile pedagogical sensitivity, creativity, and empathy with scientific criteria of validation, systematization, and replicability, offering a robust methodological pathway for applied research in education—especially in contexts involving digital technologies and artificial intelligence.

EDUCATIONAL INNOVATION AND THE PROBLEM OF METHODOLOGICAL RIGOR

Educational innovation is a concept widely mobilized in recent decades, often associated with the modernization of pedagogical practices and the incorporation of digital technologies into teaching and learning processes. However, the recurrent linkage between innovation and technology has contributed to

a reductionist understanding of the term, in which the mere adoption of digital tools is taken as synonymous with pedagogical transformation.

This technosolutionist logic tends to shift the focus of pedagogical reflection to the technological artifact itself, obscuring central issues such as educational intentionality, institutional context, teacher mediation, and the assessment of the real impacts of implemented solutions. As a consequence, we see the multiplication of innovative initiatives with little theoretical support, lacking methodological documentation and clear validation criteria.

In the field of educational research, this scenario reveals a historical tension between the need to respond to concrete problems of practice and the demand to produce rigorous scientific knowledge. Overly theoretical research, on the one hand, becomes distanced from school reality; on the other, innovative practices detached from scientific foundations undermine their academic legitimacy. This tension underscores the urgency of methodologies capable of articulating practical intervention and knowledge production.

Educational innovation, therefore, cannot be understood merely as instrumental novelty, but as a systematic process of investigation, design, implementation, and evaluation of solutions oriented by real problems. In this sense, methodological rigor does not appear as an obstacle to innovation, but as a condition for it to produce transferable, sustainable, and socially relevant knowledge.

It is at this point that design-based methodologies, such as Design Science Research, assume a strategic role by offering a theoretical-methodological framework capable of sustaining educational innovation as a legitimate scientific practice.

DESIGN SCIENCE RESEARCH: EPISTEMOLOGICAL AND METHODOLOGICAL FOUNDATIONS

Design Science Research (DSR) emerges as a methodological approach oriented toward solving complex problems through the systematic design, development, and evaluation of artifacts. Its origin is linked to applied sciences, especially Computer Science, Engineering, and Information Systems—fields in which knowledge production occurs not only by describing reality but by planned intervention in it. Unlike traditional positivist approaches, DSR recognizes that building solutions is, in itself, a legitimate form of scientific inquiry.

Epistemologically, DSR is grounded in a pragmatic perspective of knowledge, in which scientific validity is associated with utility, relevance, and the ability to solve real problems. Hevner et al. (2004) argue that design science produces knowledge by creating innovative artifacts and evaluating their effects in authentic contexts. This conception moves applied research from a secondary position to the center of scientific production, especially in areas where practice and theory constantly feed into each other.

In the educational field, this approach is particularly relevant, since the problems faced by schools, teacher education programs, and higher education institutions are mostly situated, complex, and traversed by multiple social, pedagogical, and technological variables. DSR enables dealing with this complexity by assuming that educational solutions cannot be abstractly generalized, but need to be designed, tested, and refined in specific contexts, based on explicit scientific criteria.

Dresch, Lacerda, and Antunes Júnior (2015) systematize DSR as a method structured in iterative cycles that articulate problem diagnosis, objective definition, artifact development, demonstration, evaluation, and communication of results. This structure ensures that innovation is not the product of improvisation, but of a rigorous process that is documented and open to critical analysis. The artifact—whether a model, system, framework, or technological platform—is not understood as an end product, but as a means of investigation and knowledge generation.

One of DSR's central elements is the distinction between rigor and relevance. While rigor refers to consistent theoretical grounding and the systematic application of scientific methods, relevance concerns the artifact's ability to respond to concrete demands in the investigated context. In education, this dual requirement becomes especially significant, as it prevents both the production of technically sophisticated yet pedagogically irrelevant solutions and the implementation of innovative practices without theoretical support.

Moreover, DSR requires formal processes for evaluating the artifact developed. This evaluation may take different forms—usability testing, functional analyses, expert validation, application in real contexts—provided it aligns with the research objectives defined. In educational contexts, this implies assessing not only the solution's technical efficiency but also its pedagogical, ethical, and institutional impacts.

Another relevant aspect of DSR is its commitment to scientific communicability. Research results are not limited to the artifact itself; they include explicit articulation of design principles, methodological decisions, and the learning generated throughout the process. This movement contributes to building transferable knowledge, enabling other researchers to adapt, replicate, or critique the proposed solutions.

When incorporated into educational research, Design Science Research helps overcome traditional dichotomies between theory and practice, research and intervention, innovation and rigor. It offers a methodological pathway capable of sustaining the production of innovative educational artifacts—including those involving digital technologies and artificial intelligence—without abandoning the criteria of scientificity required in the academic field. This characteristic renders DSR particularly powerful for responding to contemporary challenges in educational innovation.

DESIGN THINKING IN EDUCATION: CONTRIBUTIONS, POTENTIALITIES, AND LIMITS

The theoretical basis of Design Thinking adopted in this chapter is anchored mainly in the formulation proposed by Tim Brown, who conceives Design Thinking as a systematic approach to solving complex, human-centered problems, articulating empathy, experimentation, and continuous iteration. For Brown (2009), Design Thinking is not reduced to a set of creative techniques; it constitutes a structured innovation process that integrates human desirability, technical feasibility, and organizational sustainability. According to the author, this approach enables confronting ill-defined (wicked) problems common in educational, social, and organizational contexts.

This conception directly dialogues with the epistemological tradition inaugurated by Herbert A. Simon, who understands design as part of the so-called "sciences of the artificial." Simon (1996) argues that design involves the deliberate creation of artifacts intended to transform existing situations into preferred ones, which grants design thinking its own scientific status. By affirming that designing is a legitimate form of knowledge production, Simon provides the theoretical support that enables understanding Design Thinking as a valid methodological approach for applied research, especially when articulated with methods such as Design Science Research.

Contemporary authors deepen this perspective by emphasizing the cognitive and social aspects of Design Thinking. Jon Kolko highlights that design thinking operates as a process of synthesis, in which qualitative data, human experiences, and empirical observations are organized to make sense of complex and ambiguous problems. For Kolko (2014), empathy is not a rhetorical resource but a central epistemological mechanism of Design Thinking, as it enables understanding the real needs of users and guiding contextualized solutions. This dimension is particularly relevant in education, where problems rarely admit linear or purely technical solutions.

In education and pedagogical innovation, various studies indicate that Design Thinking contributes to developing reflective, collaborative, and iterative practices, provided it is not applied in an instrumentalized manner. Brown (2009) warns that the uncritical use of Design Thinking can hollow out its formative potential, turning it into a mere brainstorming technique. Kolko (2014) reinforces this critique by asserting that reducing Design Thinking to tools disconnected from theoretical foundations compromises its capacity to generate meaningful knowledge.

Thus, this chapter adopts Design Thinking not as an isolated method or intuitive approach but as a theoretical-methodological frame which, when articulated with Design Science Research, contributes to the rigor, systematicity, and scientific legitimacy of educational innovation. This articulation finds support in Simon's (1996) understanding of design as knowledge production oriented toward problem solving and in Brown (2009), who argues that innovation requires structured processes, continuous reflection, and empirical validation.

DESIGN SCIENCE RESEARCH AND DESIGN THINKING: TOWARD METHODOLOGICAL RIGOR IN EDUCATIONAL INNOVATION

The articulation between Design Science Research (DSR) and Design Thinking has proven a promising path to strengthen methodological rigor in educational innovation without sacrificing creativity and sensitivity to human contexts. Although distinct in their origins and assumptions, both approaches share a commitment to solving complex problems and producing contextualized solutions.

While Design Thinking emphasizes empathetic understanding of the problem, collaborative ideation, and rapid prototyping, DSR provides a robust methodological structure capable of scientifically supporting these processes. DSR incorporates formal stages of problem definition, theoretical grounding, systematic artifact development, and rigorous evaluation, ensuring that innovation is documented, analyzed, and communicated as legitimate scientific production.

In education, this complementarity is particularly relevant. Design Thinking can serve as an initial strategy for exploring the problem, involving actors in the educational context to identify demands, challenges, and possibilities. Building on this movement, DSR assumes the role of methodologically structuring the investigation, transforming creative insights into educational artifacts that are grounded, assessable, and transferable.

This integration helps overcome one of the main weaknesses of innovative practices in education: the gap between pedagogical creativity and scientific rigor. By combining the exploratory openness of Design Thinking with DSR's systematic cycles, it becomes possible to produce educational innovation that is simultaneously sensitive to the experiences of subjects and committed to academic criteria of validity, reliability, and relevance.

Furthermore, the articulation between DSR and Design Thinking favors the explicit statement of the design principles guiding the construction of educational artifacts. When properly recorded and analyzed, these principles constitute a theoretically relevant contribution to the field of education, enabling other researchers to understand the methodological decisions adopted and adapt the solutions to new contexts.

In educational research involving digital technologies and artificial intelligence, this integration becomes even more strategic. The sociotechnical complexity of these artifacts demands both empathetic listening and experimentation, as well as critical analysis, ethical evaluation, and consistent theoretical grounding. In this respect, DSR offers the framework necessary to ensure that technological innovation does not overshadow pedagogical purposes.

Thus, advocating for the articulation between Design Science Research and Design Thinking means proposing a methodological path capable of responding to contemporary educational challenges: to

innovate without losing rigor, to create without forgoing critique, and to intervene in school reality with scientific, ethical, and pedagogical responsibility.

Chart 1 – Design Science Research and Design Thinking: Methodological Convergences and Distinctions

Analytical Axis	Design Science Research (DSR)	Design Thinking
Epistemological Foundation	Applied research oriented towards the production of scientific knowledge through artifacts.	Creative approach oriented towards solving complex human-centered problems.
Methodological Purpose	Rigorous development and validation of solutions with explicit theoretical contribution.	Exploration of innovative solutions based on empathy, ideation, and prototyping.
Degree of Formalization	High, with systematic steps, evaluation criteria, and consistent theoretical foundation.	Flexible, iterative, and adaptable to the context, with lower requirement for scientific formalization.
Role in Educational Research	Sustains methodological rigor and academic legitimacy of educational innovation.	Favors creativity, engagement, and deep understanding of educational contexts.
Main Limitation	Risk of excessive technicality if dissociated from human experience.	Risk of theoretical fragility if not articulated with a scientific method.

Source: Created by the authors, 2025.

DESIGN SCIENCE RESEARCH AND DESIGN THINKING AS AN INTEGRATED METHODOLOGICAL APPROACH

Comparative analysis shows that Design Science Research and Design Thinking do not operate in antagonistic methodological domains but in distinct and potentially complementary planes of educational inquiry. While DSR is anchored in the tradition of applied research oriented toward producing validable scientific knowledge, Design Thinking emerges as a heuristic approach aimed at a sensitive understanding of problems and generating creative solutions. Integrating these perspectives addresses one of the chief tensions in educational research: how to innovate without sacrificing methodological rigor.

Within DSR, as systematized by Dresch, Lacerda, and Antunes Júnior, research is structured in iterative cycles involving problem identification, artifact conception, development, evaluation, and the explicit statement of theoretical contribution. The focus is not solely on practical solutions, but on producing knowledge that can be transferred, debated, and validated by the scientific community. In educational contexts, this means understanding pedagogical innovation not as an isolated experiment, but as the outcome of a grounded, documented, and evaluable investigative process.

Design Thinking, in turn, decisively enhances the initial and intermediate stages of this process. Emphasis on empathy, listening to those involved, and deep understanding of educational contexts broadens the researcher's capacity to formulate relevant, situated problems. Rather than starting exclusively from abstract theoretical gaps, Design Thinking favors identifying real problems in educational practice experienced by teachers, students, and administrators. This closeness strengthens the social pertinence of research and prevents solutions that are technically sophisticated yet pedagogically disconnected.

The articulation between DSR and Design Thinking proves especially fruitful when recognizing that educational innovation simultaneously demands creativity and systematicity. Design Thinking amplifies the ideation and prototyping phase, enabling the exploration of multiple solution possibilities, rapid hypothesis testing, and progressive artifact refinement based on contextual feedback. DSR, in turn, provides the criteria for conducting this creative process with scientific intentionality, ensuring methodological coherence, decision traceability, and rigorous evaluation of results.

This integration also responds to recurring critiques of innovative research in education, often accused of theoretical fragility or excessive pragmatism. By incorporating Design Thinking as a strategy for understanding and creation—without relinquishing DSR's epistemological structure—the researcher constructs a methodological trajectory capable of sustaining both innovation and scientific validity. It is, therefore, a balancing movement between creative openness and methodological control, essential for research that proposes intervention in complex educational contexts.

In the educational field, marked by multiple human, institutional, and cultural variables, this hybrid approach makes it possible to address complexity without reductionism. The school is not a controlled laboratory, but a dynamic ecosystem of relationships, affects, discourses, and practices. Design Thinking helps make these dimensions visible, while DSR offers instruments to systematize them analytically, transforming singular experiences into communicable scientific knowledge.

Thus, advocating the articulation between Design Science Research and Design Thinking does not mean diluting methodological boundaries, but recognizing that educational innovation requires methods capable of dialoguing with concrete reality without renouncing the production of rigorous knowledge. This perspective reaffirms educational research as a scientific practice committed to the qualified transformation of pedagogical practices, anchored in solid theoretical foundations and guided by ethical and formative principles.

METHODOLOGICAL RIGOR AND SCIENTIFIC LEGITIMACY IN EDUCATIONAL INNOVATION

One of the main challenges faced by research that proposes innovation in the educational field lies in the tension between pedagogical creativity and methodological rigor. Innovative initiatives—especially those involving technologies, active methodologies, or the development of educational artifacts—are often questioned regarding their scientific validity, sometimes being classified as experience reports or interventions of a merely instrumental nature. In this context, Design Science Research provides an epistemological framework that grants academic legitimacy to innovation by structuring research as a systematic process of knowledge production oriented toward solving complex problems.

Rigor in DSR is not established by strict replication of procedures, as in traditional experimental models, but by the internal coherence of the investigative process. This coherence involves clear problem explication, consistent theoretical grounding, justification of design decisions, documentation of iterations, and careful evaluation of the developed artifact. By making the methodological trajectory visible, DSR enables other researchers to understand, critique, and reuse the principles and learnings generated—even when the artifact itself is contextual and situated.

Integration with Design Thinking does not weaken this rigor; on the contrary, it helps qualify it. The empathy stage, for example, when conducted systematically, can be understood as a qualitative investigation procedure involving observation, active listening, context analysis, and identification of real needs. When such processes are properly recorded and analyzed, they become relevant research data, strengthening the validity of the formulated problem and the proposed solutions.

Furthermore, the iterative logic shared by both approaches reinforces the notion of rigor as a continuous process, not as a final stage. In DSR, the artifact is continuously evaluated and refined, allowing identification of limitations, unforeseen effects, and possibilities for improvement. This epistemological stance recognizes the complexity of educational phenomena and moves away from pretensions of neutrality or absolute control, without, however, relinquishing scientific systematicity.

In the realm of educational innovation, this understanding of rigor is particularly relevant. Schools and formative contexts are traversed by historical, social, cultural, and institutional factors that render linear cause–effect models unfeasible. Thus, methodologies that recognize the situated nature of knowledge—such as DSR articulated with Design Thinking—prove more suitable for producing applicable, reflective, and socially relevant knowledge. Rigor, in this case, manifests in the capacity to make decisions explicit, dialogue with theory, and critically evaluate results, rather than in the uncritical standardization of procedures.

Another central aspect of scientific legitimacy concerns the research's theoretical contribution. In DSR, artifact development is not an end in itself, but a means to generate knowledge. Analysis of the

design process, choices made, challenges faced, and solutions constructed enables the formulation of principles, models, or guidelines that transcend the immediate context of the investigation. When articulated with Design Thinking, this movement is enriched by incorporating human, ethical, and pedagogical perspectives, broadening the research's interpretive reach.

Thus, educational innovation is no longer understood as the simple application of methodological or technological novelties, but as a rigorous investigative practice oriented by real problems and sustained by solid theoretical foundations. The articulation between Design Science Research and Design Thinking therefore helps consolidate a methodological paradigm capable of responding to contemporary demands in educational research: innovating with scientific responsibility, pedagogical sensitivity, and formative commitment.

DESIGN SCIENCE RESEARCH APPLIED TO EDUCATION: PRACTICE-ORIENTED KNOWLEDGE PRODUCTION

The application of Design Science Research in the educational field has been consolidated as a methodological response to the limitations of traditional approaches in the face of complex, contextualized, and dynamic problems. Unlike research restricted to describing or explaining phenomena, DSR starts from the recognition that many educational challenges require intervention, proposition, and construction of solutions. In this sense, research not only observes reality but acts upon it in a systematic, reflective, and theoretically grounded manner.

In educational contexts, the problems that motivate DSR investigations often involve issues such as curricular innovation, pedagogical mediation with technologies, formative assessment, knowledge management, teacher education, and inclusion. Such problems cannot be fully understood through isolated variables, as they emerge from institutional ecosystems marked by multiple actors, values, and constraints. DSR therefore offers a suitable methodological pathway for dealing with this complexity, by articulating diagnosis, theoretical grounding, artifact development, and iterative evaluation.

A central element of DSR applied to education is the notion of artifact. Unlike a restricted understanding of artifacts as technological objects, the educational artifact can take multiple forms: pedagogical models, virtual environments, decision-support systems, conceptual frameworks, teaching methodologies, or assessment instruments. The scientific value of the artifact lies not only in its functionality, but in its capacity to materialize theoretical knowledge in a concrete solution that can be analyzed, tested, and improved.

In this process, theoretical grounding plays a structuring role. Artifact construction does not occur intuitively or improvisationally; it is guided by consolidated references from Education, the Human Sciences, and—when pertinent—Computer Science and Information Science. This articulation between

theory and practice ensures that the artifact is not an ad hoc response, but a proposition situated within a broader field of scientific debate. Thus, DSR helps reduce the historical distance between academic production and educational practice.

Evaluation constitutes another fundamental axis of DSR in education. Unlike exclusively quantitative or experimental evaluative models, evaluation in DSR is formative and iterative. The artifact is analyzed in relation to criteria such as utility, contextual adequacy, pedagogical coherence, formative potential, and ethical alignment. This evaluation may involve varied strategies—document analysis, observation, user feedback, case studies, or data triangulation—always respecting the qualitative and situated nature of the investigated problem.

When articulated with Design Thinking, this evaluative process is enriched by the active listening of those involved. Teachers, students, administrators, and other participants cease to be merely data sources and become co-evaluators of the proposed solution. This participation helps refine the artifact and, at the same time, strengthens its pedagogical legitimacy, insofar as it considers the real experiences, expectations, and needs of the educational context.

Another relevant aspect concerns knowledge production arising from the design process. In DSR, knowledge emerges not only from final results, but from the entire investigative trajectory. Decisions taken, challenges faced, adaptations made, and criteria used in artifact evaluation constitute relevant analytical data. Systematizing this trajectory allows identifying design principles, pedagogical guidelines, and conceptual models that can guide future research and other initiatives in educational innovation.

Thus, Design Science Research applied to education reaffirms research as an intellectual practice committed to qualified transformation of reality. By articulating methodological rigor, conscious intervention, and theoretical reflection, DSR offers the educational field a paradigm of investigation capable of responding to contemporary demands for innovation without abandoning scientific consistency and ethical commitment. This approach proves especially powerful when integrated with Design Thinking, as it combines investigative systematicity and sensitivity to the human dimensions of the educational process.

INTEGRATION BETWEEN DESIGN SCIENCE RESEARCH AND DESIGN THINKING IN EDUCATIONAL INNOVATION

The articulation between Design Science Research and Design Thinking constitutes a promising methodological movement for contemporary educational research, especially when the goal is to produce innovation with scientific rigor and social relevance. Although they have distinct origins, both approaches share the understanding that complex problems require iterative investigative processes that are context-

sensitive and solution-oriented. Integrating them does not imply uncritical fusion, but epistemological and methodological complementarity.

Design Thinking contributes to DSR by introducing an investigative stance centered on subjects and lived experiences in educational contexts. By emphasizing empathy, active listening, and co-creation, this approach broadens the understanding of the research problem beyond its technical or functional dimensions, incorporating cultural, emotional, and institutional aspects. In educational environments—where values, beliefs, and human relationships are central—this sensitivity is indispensable to avoid solutions detached from pedagogical reality.

For its part, Design Science Research offers Design Thinking a methodological structure capable of ensuring scientific rigor, process systematization, and transferable knowledge production. While Design Thinking tends to privilege creative problem-solving for specific issues, DSR requires that proposed solutions be anchored in solid theoretical foundations, carefully evaluated, and explicated as scientific contributions. This requirement prevents educational innovation from being reduced to isolated practices or methodological fads.

In education, this integration addresses a recurring challenge of applied research: the difficulty of reconciling practical relevance and scientific validity. From the perspective of DSR, the construction of pedagogical artifacts—whether models, systems, methodologies, or learning environments—comes to be understood as a legitimate investigative process, provided it is accompanied by theoretical analysis, methodological justification, and rigorous evaluation. Design Thinking, in turn, ensures that these artifacts respond to real needs and are conceived in dialogue with the subjects who will use them.

Another point of convergence between the approaches lies in iterative logic. Both DSR and Design Thinking reject linear models of research and intervention, recognizing that problem understanding deepens over the course of the process. In education, this logic is particularly relevant, since pedagogical practices and institutional contexts are dynamic, demanding continuous adjustments. Iteration enables the educational artifact to be constantly refined, incorporating feedback, empirical evidence, and new theoretical interpretations.

Evaluation plays a strategic role in this integration. In DSR, artifact evaluation is not limited to verifying functionality; it involves analyzing theoretical contribution, pedagogical adequacy, and formative impact. Design Thinking adds to this evaluation the users' perspective, valuing experiences, perceptions, and meanings attributed to the solution. Thus, evaluation ceases to be a final stage and becomes a continuous process of investigative learning, strengthening both artifact quality and analytical density of the research.

This articulation also helps redefine the role of the educational researcher. Rather than a distant observer or applier of predefined methods, the researcher adopts a reflective, authorial stance, acting as a

designer of theoretically grounded educational solutions. This position demands high ethical responsibility, since it entails intervening in real contexts with direct impacts on pedagogical practices, formative trajectories, and institutional policies. Methodological rigor, in this sense, is not opposed to creativity; it functions as a condition for socially responsible innovation.

Finally, integrating Design Science Research and Design Thinking reaffirms educational research as a space for producing situated knowledge committed to qualified transformation of reality. By combining empathy, creativity, theoretical grounding, and rigorous evaluation, this hybrid approach offers a consistent methodological pathway for confronting contemporary challenges in education. In times marked by demands for innovation, technology, and evidence, such integration enables progress toward investigative practices that are simultaneously scientific, human, and socially relevant.

FINAL CONSIDERATIONS

This chapter discussed the articulation between Design Science Research and Design Thinking as a consistent methodological pathway for educational innovation, maintaining that the production of pedagogical solutions simultaneously requires sensitivity to context, project-based creativity, and scientific rigor. It started from the assumption that contemporary educational challenges are complex, sociotechnical, and multifactorial, and cannot be adequately addressed by linear or exclusively descriptive methodological approaches.

Throughout the discussion, it became evident that Design Thinking helps broaden understanding of educational problems through empathy, qualified listening, and co-creation with the subjects involved. This perspective strengthens the practical relevance of research, preventing artificial solutions detached from institutional and pedagogical realities. However, it was also emphasized that, when taken in isolation, Design Thinking may lack methodological systematization and explicit statement of scientific contributions generated in the process.

In this sense, Design Science Research presents itself as a methodological structure capable of conferring rigor, validity, and theoretical density to educational innovation. By recognizing the artifact as a legitimate research result, DSR requires conceptual grounding, methodological justification, well-defined iterative cycles, and careful evaluation, contributing to the production of knowledge that is transferable and accumulative in the educational field. The integration between DSR and Design Thinking, therefore, is not a superposition of methods but an epistemological complementarity.

Another central aspect addressed was the iterative logic shared by both approaches, which is especially well-suited to education. The possibility of reformulating problems, refining solutions, and re-evaluating artifacts throughout the investigative process allows greater adherence to school dynamics, pedagogical timelines, and institutional transformations. This characteristic reinforces the understanding

of educational research as a continuous reflective process, rather than the mechanical application of pre-established models.

From an epistemological standpoint, articulating Design Science Research and Design Thinking helps reposition educational research within the field of applied sciences, without abandoning solid theoretical foundations. The researcher assumes the role of designer-investigator, responsible for conceiving, justifying, evaluating, and critically reflecting on educational solutions. Such a stance demands ethical commitment, methodological clarity, and social responsibility, especially when artifacts impact pedagogical practices, institutional policies, and formative trajectories.

It is concluded that integrating Design Science Research and Design Thinking offers a robust methodological pathway for educational innovation, capable of balancing creativity with rigor, practical relevance with scientific validity. In contexts marked by demands for pedagogical transformation, use of technologies, and production of evidence, this hybrid approach stands out as a consistent alternative for strengthening educational research and qualifying innovation processes committed to human formation, educational justice, and the effective improvement of teaching and learning practices.

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TEACHING INDIGENOUS LITERATURE IN THE INTERCULTURAL INDIGENOUS TEACHER EDUCATION PROGRAM OF PARFOR EQUIDADE

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ABSTRACT
This article analyzes the teaching of Indigenous literature within the context of the Intercultural Indigenous Teacher Education program linked to Parfor Equidade, considering its contribution to the education of Indigenous teachers in higher education. The study is grounded in the understanding of Indigenous literature as a cultural, historical, and epistemological expression of Indigenous peoples, articulated with the principles of intercultural education. Methodologically, the research is qualitative in nature, based on bibliographic and documentary analysis of academic productions and legal frameworks that guide Indigenous school education and intercultural teacher education. The results indicate that Indigenous literature plays a structuring role in formative processes, acting as a mediator between traditional knowledge and academic knowledge, while also fostering contextualized and culturally grounded pedagogical practices. It is concluded that the teaching of Indigenous literature within Parfor Equidade has legal and institutional support and contributes to the consolidation of teacher education committed to intercultural dialogue and the recognition of Indigenous sociocultural diversity.

Keywords: Indigenous literature; Indigenous teacher education; Intercultural education; Parfor Equidade; Higher education.

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INTRODUCTION

The expansion of Indigenous peoples' access to higher education in Brazil is related to a historical process of recognizing these peoples' educational, cultural, and territorial rights, intensified from the end of the twentieth century onward. This movement resulted in the formulation of public policies aimed at overcoming assimilationist educational models, which for decades guided Indigenous school education, and in the creation of formative proposals that recognize ethnic, linguistic, and cultural diversity as a structuring principle of Indigenous education (Pellegrini, Ghanem & Góes Neto, 2021).

In this context, Intercultural Indigenous Licentiate programs have been consolidated as a formative alternative aimed at preparing Indigenous teachers to work in their own communities, considering the sociocultural, territorial, and linguistic specificities of Indigenous peoples. Studies point out that these licentiate degrees are organized through dialogue between traditional knowledge and academic knowledge, seeking to break with the epistemological hierarchies that have historically marginalized Indigenous knowledge in formal educational spaces (Sanchez & Leal, 2021; Melgaço Valadares & Pernambuco, 2018).

The National Program for the Training of Basic Education Teachers (Parfor), especially in its equity-oriented strand, is positioned as a strategic policy in the field of Indigenous teacher education. Research carried out within Parfor indicates that the program has contributed to expanding Indigenous teachers' access to higher education, while also highlighting challenges related to course delivery conditions, student retention, and the suitability of curricula to Indigenous realities (Martins, 2024; Deveza, 2021; Calegare & Sales, 2023).

Within the Intercultural Indigenous Licentiates offered by Parfor Equidade, the teaching of Indigenous literature plays a relevant role in teacher education by enabling the valorizations of orality, collective memory, cosmologies, and traditional narratives of Indigenous peoples. Indigenous literature, understood as the cultural, aesthetic, and political production of original peoples, constitutes a field of knowledge that articulates identity, territory, and history, contributing to the construction of intercultural pedagogical practices (Assunção & Arantes, 2025; Siqueira, 2020).

The inclusion of Indigenous literature in formative processes makes it possible to problematize the centrality of the Western literary canon in school curricula and favors the construction of pedagogical practices committed to anti-racist and intercultural education. Studies indicate that work with Indigenous texts, oral narratives, and contemporary productions by Indigenous authors helps future teachers recognize their own knowledge and ways of life as legitimate knowledge within the school space (Guedes & Souza, 2025).

Research developed in intercultural licentiate programs shows that teaching Indigenous literature favors the articulation between orality and writing, tradition and contemporaneity, strengthening

formative processes anchored in territory and culture. In addition, such teaching enables dialogue among different systems of knowledge, without subordinating traditional knowledge to Western scientific epistemologies—a central aspect of critical intercultural education (Assunção & Arantes, 2025; Melgaço Valadares & Pernambuco, 2018).

Within Parfor Equidade, analyses of Indigenous teacher education indicate that, despite the institutional and pedagogical challenges encountered, these licentiates have contributed to strengthening Indigenous teacher identity and to consolidating pedagogical practices committed to cultural valorization and the intellectual autonomy of Indigenous peoples (Padilha & Oliveira, 2025; Leite et al., 2025).

Considering the centrality of Indigenous literature in the formative processes of Intercultural Licentiates and the relevance of Parfor Equidade as a public policy for Indigenous teacher education, it becomes pertinent to analyze how the teaching of Indigenous literature is conceived and developed in this context. Thus, this article aims to analyze the teaching of Indigenous literature within the scope of the Intercultural Indigenous Licentiate of Parfor Equidade, based on qualitative research grounded in bibliographic and documentary analysis.

METHODOLOGY

This research is characterized as qualitative, with a descriptive and exploratory approach, aiming to analyze the teaching of Indigenous literature within the Intercultural Indigenous Licentiate linked to Parfor Equidade. The choice of a qualitative approach is justified by the need to understand formative conceptions, curricular orientations, and pedagogical practices expressed in academic productions and institutional documents, considering their sociocultural and educational contexts.

As for methodological procedures, the research was developed through a bibliographic survey and documentary analysis. The bibliographic survey was conducted in publicly accessible scientific databases, including SciELO, the CAPES Journal Portal, Google Scholar, and institutional repositories of federal universities. The search aimed to identify academic productions related to Indigenous teacher education, intercultural education, and the teaching of Indigenous literature in higher education.

For the searches, combined descriptors were used, such as: Indigenous literature, intercultural education, Indigenous teacher education, intercultural licentiate, and Parfor. The combinations of descriptors were performed using the Boolean operator “AND,” in order to increase the precision of results. The temporal scope adopted comprised publications between 2018 and 2025, a period marked by the expansion of studies on Indigenous teacher education within equity-oriented public policies.

Inclusion criteria for the selected materials involved thematic pertinence to the research objectives; addressing Indigenous teacher education or intercultural education in higher education; and availability of full text in digital format. Productions that did not directly engage with the field of

Indigenous education or that dealt exclusively with levels of education other than higher education were excluded.

Documentary research focused on the analysis of institutional documents that guide curricular organization of the Intercultural Indigenous Licentiate in the context of Parfor Equidade. These documents were analyzed with the objective of identifying pedagogical guidelines, conceptions of teacher education, and orientations related to the teaching of Indigenous literature, as well as the valorization of traditional knowledge and Indigenous cultural productions in the program's curriculum.

The research corpus consisted of scientific articles, undergraduate theses, and pedagogical documents selected according to the established criteria. Data analysis took place through analytical and interpretive reading, seeking to identify thematic and conceptual recurrences related to the place of Indigenous literature in the curriculum, intercultural formative practices, and the contributions of such teaching to the education of Indigenous teachers.

The categories of analysis were constructed from recurring themes observed in the material, in line with the research objectives. It should be noted that the study used exclusively public-domain sources, did not involve research subjects or empirical data collection with human participants, and therefore did not require submission to a research ethics committee.

RESULTS AND DISCUSSION

The bibliographic and documentary analysis carried out made it possible to identify that the teaching of Indigenous literature, within the Intercultural Indigenous Licentiate linked to Parfor Equidade, presents itself as a structuring element of formative processes, articulating cultural, epistemological, and pedagogical dimensions. The results show that Indigenous literature is recurrently understood as an educational practice linked to collective memory, orality, cosmologies, and the Indigenous peoples' own forms of knowledge production—surpassing the restricted conception of literature as an aesthetic object detached from sociocultural context.

Convergently, the analyzed productions indicate that the presence of Indigenous literature in the curricula of intercultural licentiates is associated with a conception of teacher education that recognizes Indigenous peoples as historical and epistemic subjects. This perspective breaks with formative models based exclusively on Eurocentric references and dialogues with proposals for critical intercultural education, in which the curriculum is conceived as a space for negotiating knowledge and valuing Indigenous epistemologies (Assunção & Arantes, 2025; Sanchez & Leal, 2021; Melgaço Valadares & Pernambuco, 2018).

THE CENTRALITY OF INDIGENOUS LITERATURE IN INTERCULTURAL CURRICULAR ORGANIZATION

Curricular centrality is related to a broadened conception of literature that recognizes orality as a legitimate form of literary production and knowledge transmission. The studies analyzed indicate that Indigenous literature, by articulating orality and writing, contributes to the preservation of collective memory and the strengthening of cultural identities, while also enabling the production of pedagogical materials contextualized to the realities of Indigenous communities (Siqueira, 2020; Assunção & Arantes, 2025).

The results also show that this curricular approach finds support in the legal framework of Indigenous school education in Brazil. Educational legislation establishes the right of Indigenous peoples to differentiated, intercultural, and bilingual education, as expressed in Article 78 of Law No. 9,394/1996, which states:

> "The Union's education system, in collaboration with federal agencies fostering culture and assisting Indigenous peoples, shall develop integrated teaching and research programs to offer bilingual and intercultural school education to Indigenous peoples" (Brazil, 1996).

The presence of Indigenous literature in the curricula of intercultural licentiates, therefore, is not merely a pedagogical choice but a consequence of an educational right legally guaranteed, which guides the valorization of languages, cultures, and Indigenous peoples' own ways of organizing knowledge.

INDIGENOUS LITERATURE AND TEACHER EDUCATION IN PARFOR EQUIDADE

The analyzed productions show that, when incorporated systematically into formative processes, Indigenous literature contributes to recognizing traditional knowledge as legitimate foundations of pedagogical practice, breaking with teacher education models based exclusively on Eurocentric references. Documentary analysis also showed that the teaching of Indigenous literature and the education of Indigenous teachers within the Intercultural Indigenous Licentiate of Parfor Equidade are supported by a consistent set of norms constructed in the period following the 1988 Federal Constitution.

This legal framework establishes principles, guidelines, and orientations that underpin the organization of Indigenous school education and intercultural teacher education at the higher-education level, ensuring recognition of Indigenous languages, cultures, and knowledge systems.

The documents analyzed indicate that, since Presidential Decree No. 26/1991, Indigenous education has been formally assigned to the coordination of the Ministry of Education, in articulation with states and municipalities, inaugurating a process of institutionalizing public policies aimed at Indigenous schooling. Later norms, such as the National Curricular References for Indigenous Schools

(1998) and the opinions and resolutions of the National Council of Education, consolidated principles such as specificity, interculturality, bilingualism, and flexible curricular organization—elements directly related to teaching Indigenous literature in teacher education programs.

With respect specifically to Indigenous teacher education, Resolution CNE/CP No. 1/2015 stands out; it institutes the National Curricular Guidelines for the Education of Indigenous Teachers in Higher Education programs. Among its principles, the document establishes respect for Indigenous peoples' sociopolitical and territorial organization and the valorization of Indigenous languages as legitimate forms of expression, communication, and knowledge production. These principles directly dialogue with the inclusion of Indigenous literature in the curricula of intercultural licentiates, recognizing traditional narratives and Indigenous oral and written productions as structuring components of teacher education.

Official information released by CAPES indicates that, in the Equity strand of the Parfor and PIBID programs, 3,540 students and professionals are being served in courses related to Indigenous education, with 2,412 of the 7,642 Parfor Equidade openings filled by pedagogy and intercultural Indigenous licentiate courses, and 1,128 of the 5,016 PIBID Equidade scholarships allocated to Indigenous education. These data were presented at a national meeting on Indigenous school education as part of the strategy to strengthen Indigenous teacher education in the country (Brazil, 2024).

Consistently, the studies point out that contact with traditional narratives, myths, chants, and Indigenous-authored texts enables teachers in training to establish a critical relationship with academic knowledge based on their own cultural, linguistic, and territorial experiences. This relationship favors formative processes that articulate collective memory, orality, and writing, allowing future teachers to understand Indigenous literature not only as school content but as a social practice linked to the history and community organization of Indigenous peoples (Assunção & Arantes, 2025; Siqueira, 2020).

Analysis of the formative experiences developed in Parfor Equidade indicates that Indigenous literature acts as a mediator between traditional knowledge and academic knowledge, contributing to the construction of pedagogical practices that are contextualized and culturally referenced. This mediation allows Indigenous teachers in training to relate school content to their territorial experiences, strengthening differentiated Indigenous school education and promoting greater coherence among school, community, and culture (Martins, 2024; Deveza, 2021).

The results also show that the teaching of Indigenous literature in Parfor Equidade contributes to strengthening the intellectual autonomy of Indigenous teachers by legitimizing their narratives, histories, and cultural productions as objects of academic study and reflection. This recognition breaks with the logic of epistemological subordination historically imposed on Indigenous knowledge and favors the construction of formative trajectories marked by identity valorization and cultural affirmation (Padilha & Oliveira, 2025; Melgaço Valadares & Pernambuco, 2018).

Convergently, the analyzed studies indicate that Parfor Equidade has expanded Indigenous teachers' access to higher education, while also highlighting challenges related to student retention, institutional conditions for course delivery, and epistemological tensions present in academic spaces. Even so, the results suggest that the teaching of Indigenous literature helps face these challenges by strengthening students' ties to the program and promoting formative processes that recognize their identities, languages, and cultures as central to teacher education (Calegare & Sales, 2023; Leite et al., 2025).

In this context, Indigenous literature assumes a strategic function in teacher education by enabling the construction of pedagogical practices committed to intercultural dialogue and to overcoming stereotyped representations of Indigenous peoples. The analyzed studies indicate that pedagogical work with Indigenous texts favors critical reflection on the school curriculum and contributes to building anti-racist education by questioning historical and literary narratives that render Indigenous experiences invisible or distorted (Guedes & Souza, 2025).

Furthermore, the results indicate that teacher education mediated by the teaching of Indigenous literature favors the production of tailored didactic materials, developed from the linguistic and cultural realities of Indigenous communities. This pedagogical production constitutes one of the outcomes of Parfor Equidade and reinforces the pedagogical autonomy of Indigenous schools by enabling teachers to develop educational practices aligned with the political and cultural projects of their peoples (Siqueira, 2020; Sanchez & Leal, 2021).

INDIGENOUS LITERATURE, INTERCULTURALITY, AND PEDAGOGICAL PRACTICES

Within the Intercultural Indigenous Licentiate linked to Parfor Equidade, the bibliographic and documentary analysis indicates that the teaching of Indigenous literature is integrated in a structured manner into the processes of educating Indigenous teachers, articulating pedagogical, cultural, and epistemological dimensions. The analyzed productions point out that Indigenous literature is incorporated into teacher education as an educational practice linked to orality, collective memory, and Indigenous peoples' own forms of knowledge production, assuming a significant role in organizing formative processes.

The examined studies indicate that systematic contact with traditional narratives, myths, origin stories, chants, and Indigenous-authored texts favors the construction of formative pathways anchored in the recognition of community knowledge. This approach enables teachers in training to establish relationships between academic content and the sociocultural experiences lived in their territories, broadening the possibilities for understanding school knowledge from their own frames of reference (Assunção & Arantes, 2025; Siqueira, 2020).

As the analyzed productions suggest, Indigenous literature acts as a mediating element between traditional knowledge and academic knowledge in the context of Parfor Equidade. This mediation contributes to the constitution of formative practices that do not dissociate the schooling process from the cultural and linguistic experiences of Indigenous peoples, allowing teacher education to develop in line with the principles of differentiated Indigenous school education (Martins, 2024; Deveza, 2021).

Regarding teacher identity, the studies indicate that the teaching of Indigenous literature is associated with formative processes that recognize Indigenous teachers as historical subjects and producers of knowledge. The presence of Indigenous texts and narratives in the formative pathway enables recognition of Indigenous histories, memories, and cultural productions as legitimate content in academic training, expanding the epistemological repertoire mobilized in intercultural licentiates (Padilha & Oliveira, 2025; Melgaço Valadares & Pernambuco, 2018).

The analysis of academic productions also shows that Parfor Equidade has enabled Indigenous teachers' access to higher education in different regional contexts, while revealing challenges related to student retention and the institutional conditions for course delivery. In this scenario, the teaching of Indigenous literature appears associated with formative strategies that favor students' ties to the program by recognizing their cultural and linguistic identities as constitutive parts of the educational process (Calegare & Sales, 2023; Leite et al., 2025).

The analyzed productions further indicate that Indigenous literature, when addressed within intercultural teacher education, contributes to problematizing the school curriculum and pedagogical practices historically guided by Eurocentric references. Working with Indigenous texts makes it possible to broaden discussions of ethnic and cultural diversity in the formative space, promoting reflections on the representations of Indigenous peoples in teaching materials and school content (Guedes & Souza, 2025).

Another recurring aspect in the studies concerns the relationship between the teaching of Indigenous literature and the production of tailored pedagogical materials within intercultural licentiates. The analyses indicate that contact with Indigenous narratives and texts favors the development of teaching proposals aligned with the sociocultural realities of the communities, expanding the pedagogical possibilities for Indigenous teachers' work in basic education (Siqueira, 2020; Sanchez & Leal, 2021).

In an articulated way, the analyzed academic productions point out that the teaching of Indigenous literature in Parfor Equidade is embedded in a broader set of formative practices guided by interculturality. This orientation presupposes dialogue among different systems of knowledge—without prior hierarchization—and the valorization of Indigenous epistemologies within the academic space, configuring a field of epistemological tensions and negotiations that traverse intercultural teacher education (Assunção & Arantes, 2025; Melgaço Valadares & Pernambuco, 2018).

CONCLUSION

The analysis developed throughout this article made it possible to examine the teaching of Indigenous literature in the context of the Intercultural Indigenous Licentiate linked to Parfor Equidade, based on a qualitative approach grounded in bibliographic and documentary research. The results presented show that Indigenous literature is integrated in a structured manner into the processes of educating Indigenous teachers, articulating cultural, epistemological, and pedagogical dimensions that dialogue with the principles of differentiated Indigenous school education.

From the analysis of the selected corpus, it was observed that Indigenous literature is recurrently understood as an educational practice linked to orality, collective memory, and Indigenous peoples' own forms of knowledge production. This understanding broadens the notion of literature present in the curricula of intercultural licentiates, by recognizing traditional narratives, myths, chants, and contemporary Indigenous-authored productions as legitimate content in teacher education.

Within Parfor Equidade, the results indicate that the teaching of Indigenous literature is articulated with the education of Indigenous teachers in a way that enables recognition of community knowledge as foundations of pedagogical practice. The analyzed productions point out that this articulation favors the construction of formative pathways that relate academic knowledge to the sociocultural experiences lived in Indigenous territories, contributing to the consolidation of pedagogical practices that are contextualized and culturally referenced.

The analysis also showed that the teaching of Indigenous literature, in the context of intercultural licentiates, is associated with processes of problematizing the school curriculum and pedagogical practices guided by Eurocentric references. Working with Indigenous texts makes it possible to expand intercultural dialogue in the formative space and to challenge representations historically constructed about Indigenous peoples in teaching materials and school content.

Another observed aspect concerns the relationship between the teaching of Indigenous literature and the production of tailored pedagogical materials within intercultural teacher education. The analyzed productions indicate that systematic contact with Indigenous narratives and texts favors the development of teaching proposals aligned with the linguistic and cultural realities of the communities, expanding the possibilities for Indigenous teachers' work in basic education.

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ETHNIC–RACIAL RELATIONS IN EDUCATION: CONTEMPORARY CHALLENGES AND PEDAGOGICAL PERSPECTIVES

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ABSTRACT

Ethnic–racial relations in Brazilian education constitute a privileged space for addressing historical inequalities and promoting social equity. Schools, as environments for comprehensive development and mediation of social interactions, reflect structural tensions such as racism, yet also possess the potential to value cultural diversity, recognize historically marginalized knowledge, and foster inclusive practices. In

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this context, this study aims to analyze contemporary challenges and pedagogical perspectives regarding ethnic–racial relations in education, considering legal frameworks, institutional practices, and theoretical foundations that guide the implementation of antiracist educational policies. This research adopts a qualitative, exploratory, and descriptive approach, conducted through bibliographic and documental review between November and December 2025, using databases such as SciELO, CAPES, CLACSO, and UNESCO, in addition to educational legislation. The results indicate that, despite a consistent normative framework, the implementation of ethnic–racial education faces obstacles related to structural racism, the predominance of Eurocentric curricula, insufficient teacher training, and institutional weaknesses. Therefore, it is evident that ethnic–racial education should be understood as a constitutive dimension of the pedagogical project, integrating legislation, theory, and educational practices to promote diversity, strengthen equity, and transform social relations within the school context.

Keywords: Antiracist Education; Cultural Diversity; Educational Policies; Inclusion; Teacher Training.

INTRODUCTION

Ethnic–racial relations in the educational field have intensified in recent decades, driven by the recognition of inequalities historically produced in Brazilian society and of their unfoldings in schooling processes. The school—understood as a space for human formation, knowledge production, and the construction of meaning—occupies a strategic position in mediating social relations, being able both to perpetuate exclusionary practices and to foster educational experiences guided by the recognition of diversity and the promotion of racial equity (Freire, 2001). In this context, education presents itself as a privileged field for confronting racial hierarchies and for consolidating pedagogical practices committed to social justice.

At the normative level, the Brazilian legal framework establishes relevant foundations for promoting racial equality in the educational context. The 1988 Constitution of the Federative Republic of Brazil guarantees education as a fundamental social right and reaffirms the principle of equality, guiding public policies aimed at overcoming social and racial inequalities (Brasil, 1988). Complementarily, the National Education Guidelines and Framework Law defines education as a broad formative process aimed at the full development of the learner (Brasil, 1996). The mandatory inclusion of the theme of Afro-Brazilian and Indigenous History and Culture in school curricula, instituted by Law No. 11,645/2008, represents a significant advance in recognizing ethnic–racial diversity; however, its pedagogical implementation still reveals challenges related to teacher training, curricular organization, and institutional practices (Brasil, 2008).

The problem that guides this study arises from the persistence of racial inequalities within school institutions, even in the face of legal advances and specific guidelines directed at education on ethnic–racial relations. Racism, understood as a structural phenomenon, operates systemically, traversing institutions, public policies, and social practices, which contributes to the reproduction of educational and symbolic inequalities in everyday school life (Almeida, 2019). This dynamic directly affects the school experiences of Black students, interfering with their educational trajectories and with processes of social recognition.

In the pedagogical sphere, building an education committed to ethnic–racial relations requires confronting naturalized discriminatory practices and the historical silences present in school curricula. Research indicates that racism manifests itself from the earliest stages of schooling, often in covert ways, influencing processes of socialization, learning, and the constitution of subjects' identities (Cavalleiro, 2003).

This study engages with approaches that understand education as a transformative social practice. The Freirean conception of education, grounded in dialogue, critical consciousness, and the emancipation of subjects, offers consistent foundations for constructing a pedagogy committed to overcoming

oppression (Freire, 2005). Convergently, contributions by Gomes (2017) highlight the role of the Black Movement as an educating agent and producer of knowledge that challenges hegemonic curricula, while Munanga (2001) emphasizes the need to value African and Afro-Brazilian matrices as a central element of antiracist education.

Given this context, the general objective of this study is to analyze the contemporary challenges and pedagogical perspectives of ethnic–racial relations in education, considering normative advances, theoretical contributions, and practices developed within the school environment. Specifically, it seeks to examine the role of educational legislation in promoting education on ethnic–racial relations; to identify obstacles and potentialities of pedagogical practices aimed at confronting racism in everyday school life; and to discuss theoretical foundations that support the construction of an education committed to racial equity, the recognition of diversity, and the transformation of social relations.

METHODOLOGY

The study was developed through a bibliographic and documentary review, with a qualitative approach and an exploratory–descriptive nature, with the objective of analyzing the contemporary challenges and pedagogical perspectives of ethnic–racial relations in the educational field. This methodological design enables the collection, systematization, and critical interpretation of academic productions and normative documents, favoring an expanded understanding of the phenomenon under investigation, in line with methodological guidelines proposed by Gil (2019).

SEARCH PROCEDURES

The searches were guided by the following question: “In what ways do academic production and normative documents address the challenges and pedagogical perspectives of ethnic–racial relations in education?” References were retrieved between November and December 2025 in the Scientific Electronic Library Online (SciELO), the CAPES Periodicals Portal, the Latin American Council of Social Sciences (CLACSO), and the UNESCO Digital Library, in addition to institutional repositories and the Legislation Portal of the Presidency of the Republic, especially with regard to documents produced by the Ministry of Education.

Descriptors in Portuguese were used, applied both individually and in combination through the Boolean operators AND and OR, including the terms (relações étnico-raciais), (educação), (educação antirracista), (currículo), (formação docente), and (racismo estrutural).

Inclusion and exclusion criteria

Academic productions and official documents that presented a direct relation to the field of ethnic–racial relations in education were included, encompassing scientific articles, books, book chapters, and educational legislation. Inclusion criteria considered thematic pertinence, theoretical relevance, and alignment with the study's objectives.

No temporal cut-off was established for source selection, since the topic under investigation requires dialogue between classic works and contemporary contributions, both fundamental to the historical, political, and pedagogical understanding of ethnic–racial relations in the educational context. Excluded materials comprised duplicates, items without linkage to the educational field, and texts that addressed the topic superficially or without articulation to the adopted theoretical framework.

SELECTION AND SAMPLE OF RESULTS

The initial search identified 21 productions. After reading the titles and abstracts, it was verified that all adhered to the research objective, with no duplicates identified. Subsequently, a full reading of the material was conducted, confirming its theoretical and thematic relevance. Thus, the selected productions constitute the study sample and were analyzed qualitatively.

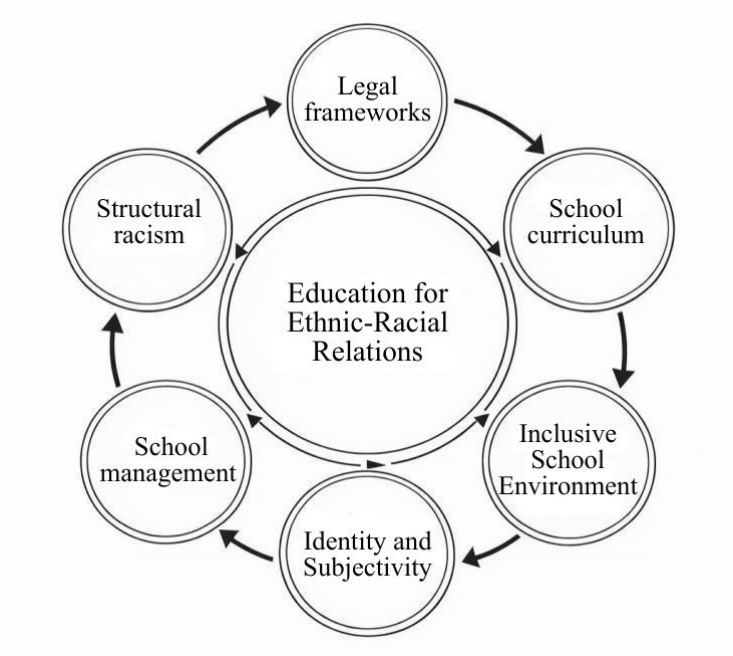
ANALYSIS TECHNIQUES

Analysis of the selected material was conducted through content analysis, as proposed by Bardin (2016). The process began with floating reading, enabling familiarity with the corpus and the identification of recurring ideas related to ethnic–racial relations in education. Next, the material was explored by identifying units of meaning and organizing thematic axes, considering the recurrence, relevance, and coherence of the contents with the study's objectives. Finally, an interpretive treatment of the results was carried out, articulating the analytical axes with the adopted theoretical framework, which enabled the construction of inferences and critical reflections on the challenges and pedagogical perspectives of ethnic–racial relations in the educational context.

RESULTS AND DISCUSSION

The implementation of Education on Ethnic–Racial Relations within the school context constitutes a systemic and interdependent process, as illustrated in Diagram 1. The results indicate that this process is sustained by multiple structuring axes that articulate continuously, directly influencing pedagogical practices and the institutional organization of schools.

Diagram 1 – Structuring axes of Education on Ethnic–Racial Relations in the school context.



Source: Authors (2025).

LEGAL AND INSTITUTIONAL FRAMEWORKS OF EDUCATION ON ETHNIC–RACIAL RELATIONS

Analysis of the normative corpus shows that education on ethnic–racial relations in Brazil is grounded in constitutional principles that ensure both the social right to education and equality as a structuring value of the democratic rule of law (Brasil, 1988). Within educational legislation, there is explicit attribution to the school of a social function that goes beyond the transmission of content, orienting toward the integral formation of subjects and the confrontation of historically produced inequalities (Brasil, 1996).

The establishment of mandatory teaching of Afro-Brazilian and Indigenous History and Culture in school curricula represents a relevant normative milestone in recognizing ethnic–racial diversity (Brasil, 2008). However, documents produced by the Ministry of Education indicate that the effectiveness of this legislation depends on articulation among curricular proposals, teacher-training policies, and school management practices (Brasil, 2006). The National Plan for Implementing the Curricular Guidelines reinforces the understanding that consolidating this theme requires continuous, systemic, and institutionalized actions within educational networks (Brasil, 2009), as shown in Table 1.

Table 1 – Main legal milestones of education on ethnic–racial relations in Brazil

Legal document	Year	Central contribution
Federal Constitution	1988	Guarantee of the right to education and the principle of equality
Law No. 9,394 (LDB)	1996	Social function of the school and integral formation
Law No. 11,645	2008	Mandatory teaching of Afro-Brazilian and Indigenous History and Culture
National Curricular Guidelines	2006	Pedagogical guidance for education on ethnic–racial relations
National Implementation Plan	2009	Structuring of continuous educational policies

Source: Authors (2025).

STRUCTURAL RACISM AND EVERYDAY SCHOOL LIFE

The analyzed studies converge in indicating that racism continues to operate as a structuring element of social relations, manifesting persistently in the school context (Almeida, 2019). This condition has a direct impact on institutional dynamics, influencing pedagogical practices, everyday interactions, and evaluation processes, which contributes to the reproduction of educational inequalities.

Regarding the initial stages of schooling, investigations show that racism tends to express itself subtly and in a naturalized manner through attitudes, discourses, and silences that permeate everyday school life (Cavalleiro, 2003). Such manifestations compromise the construction of positive school experiences for Black children and reinforce mechanisms of symbolic exclusion that affect educational trajectories from childhood (Cavalleiro, 2004), as presented in Table 2.

Table 2 – Main manifestations of racism in the school context

Dimension	Identified examples
Pedagogical practices	Eurocentric content and lack of representativeness
Interpersonal relations	Microaggressions and stigmatization
School assessment	Differentiated performance expectations
Institutional organization	Silencing of the racial theme

Source: Authors (2025).

CURRICULUM, COLONIALITY, AND KNOWLEDGE PRODUCTION

The results indicate that the school curriculum constitutes a central space of symbolic dispute in the field of ethnic–racial relations (see Table 3). The persistence of Eurocentric approaches in content and historical narratives contributes to the invisibilization of African and Afro-Brazilian knowledge, limiting the recognition of cultural diversity in the educational environment (Quijano, 2005).

Productions focused on antiracist education highlight that a critical review of curricula is an indispensable condition for valuing African and Afro-Brazilian matrices as legitimate components of school knowledge (Munanga, 2001). From this perspective, the ethnic–racial theme should not be treated episodically, but integrated in a transversal and structuring manner into the pedagogical projects of educational institutions (Gomes, 2005).

Table 3 – Curricular challenges in education on ethnic–racial relations

Curricular aspect	Observed challenges
Content	Predominance of Eurocentric narratives
Pedagogical approach	Ad hoc treatment of the racial theme
Curricular integration	Low transversality of the theme
Didactic materials	Scarcity of contextualized resources
Pedagogical project	Lack of clear institutional guidelines

Source: Authors (2025).

TEACHER TRAINING AND PEDAGOGICAL PRACTICES

The analyzed productions show that teacher training is one of the main challenges for implementing education on ethnic–racial relations, as demonstrated in Table 4. The incipient presence of the racial theme in initial teacher education programs compromises teachers' ability to critically handle situations of discrimination and prejudice in everyday school life (Silva, 2007).

More recent studies point out that continuing education plays a strategic role in building antiracist pedagogical practices, as it fosters reflective processes regarding curriculum, identity, and racial inequalities (Silva, 2018). Pedagogical conceptions grounded in dialogue and the emancipation of subjects reinforce the necessity of an educational practice committed to social transformation and to confronting oppression (Freire, 2001). This perspective assigns educators an indispensable ethical and political engagement to promote equity in the school environment (Freire, 2005).

Contemporary approaches further emphasize that antiracist pedagogical practices must recognize the experiences of subjects and promote educational environments based on listening, respect for differences, and the valorization of identities (hooks, 2017). In this sense, teaching practice emerges as a central element for consolidating an education committed to racial justice (Pinheiro, 2023).

Table 4 – Challenges in teacher training for antiracist education

Dimension	Main obstacles
Initial training	Limited inclusion of the racial theme
Continuing education	Fragmented and discontinuous actions
Teaching practice	Insecurity in the face of situations of racism
Critical reflection	Lack of systematic formative spaces
Institutional commitment	Weak support from education networks

Source: Authors (2025).

IDENTITY, SUBJECTIVITY, AND EXPERIENCES OF RACIALIZATION

The results show that ethnic–racial relations in the educational context also express themselves in subjective dimensions related to identity construction processes and experiences of racialization (Table 5). Classic studies indicate that racism produces profound impacts on the psychic constitution of Black subjects, influencing perceptions of belonging, self-esteem, and social recognition (Fanon, 2008).

Contemporary analyses point out that everyday racism manifests through symbolic practices that directly affect Black students' school experiences, reinforcing feelings of devaluation and exclusion (Kilomba, 2019). These dynamics underscore the importance of pedagogical practices that recognize subjects' lived experiences and promote inclusive and welcoming school environments (Silva, 2018). International documents reinforce the role of education as a strategic space for promoting social justice and democratic coexistence in contexts marked by diversity (UNESCO, 2022).

Table 5 – Subjective and institutional dimensions of education on ethnic–racial relations

Dimension	Educational implications
Identity	Impacts on self-esteem and belonging
Subjectivity	Experiences of racialization in everyday school life
School management	Strategic role in promoting equity
Institutional climate	Construction of inclusive environments
Collective participation	Strengthening of democratic management

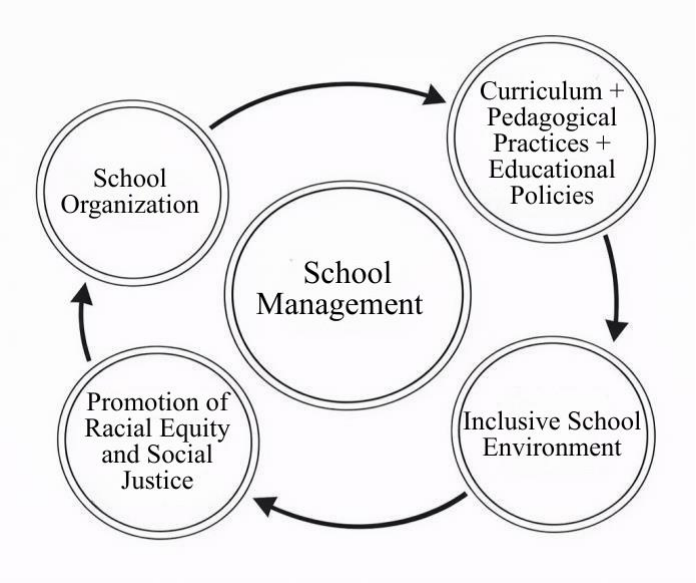
Source: Authors (2025).

SCHOOL MANAGEMENT AND INSTITUTIONAL ORGANIZATION

The analyzed productions indicate that implementing education on ethnic–racial relations is intrinsically related to schools' institutional organization, as shown in Diagram 2. School management plays a central role in articulating curriculum, pedagogical practices, and educational policies, directly influencing the construction of more inclusive school environments (Libâneo, 2007).

Models of democratic management are considered fundamental for promoting collective participation, institutional dialogue, and commitment to racial equity, contributing to the consolidation of educational practices aligned with the principles of inclusion and social justice (Vasconcellos, 2008).

Diagram 2 – School Management and Education on Ethnic–Racial Relations



Source: Authors (2025).

CONCLUSION

Education, as a social and political practice, occupies a strategic position in promoting equity and recognizing ethnic–racial diversity, while simultaneously reflecting the tensions and inequalities historically constituted in Brazilian society. In this sense, the school proves to be a privileged space for confronting racism and for building social relations oriented toward justice and inclusion.

Accordingly, this study aimed to analyze the contemporary challenges and pedagogical perspectives of ethnic–racial relations in education, articulating legal frameworks, academic productions, and relevant theoretical contributions. The bibliographic and documentary review showed that, although Brazil has a consistent normative framework, the implementation of education on ethnic–racial relations in everyday school life still appears uneven, conditioned by institutional, curricular, and formative limitations.

The results indicated that structural racism remains a structuring element of school practices, manifesting in curricula, pedagogical relations, and socialization processes. It was observed that the persistence of Eurocentric frameworks contributes to the invisibilization of Afro-Brazilian and African knowledge, while weaknesses in teacher training hinder the consolidation of systematic pedagogical practices aimed at confronting racial inequalities.

As a contribution, this study reaffirms the need to understand education on ethnic–racial relations as a constitutive dimension of the pedagogical project of educational institutions. By integrating legislation, theoretical foundations, and educational analyses, the research expands understanding of the obstacles and possibilities for building educational practices committed to racial equity, the recognition of diversity, and the transformation of social relations.

Finally, it is suggested that future research deepen the analysis of pedagogical experiences and institutional policies aimed at antiracist education, especially regarding teacher training and school management, so as to support more consistent educational actions aligned with the demands of democratic and inclusive education.

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INCLUSIVE EDUCATION IN BASIC EDUCATION: THEORETICAL FOUNDATIONS, PUBLIC POLICIES, AND TEACHING PRACTICES

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ABSTRACT
Inclusive education in basic education has been consolidated as a fundamental principle of contemporary educational policies, reaffirming the right to education and the appreciation of diversity within the school context. In this scenario, this study aimed to analyze inclusive education in basic education, considering its theoretical foundations, public educational policies, and teaching practices developed in the school environment. This study consists of an integrative literature review with a qualitative approach and an exploratory-descriptive design, conducted between November and December 2025, based on searches in the SciELO database, the CAPES Periodicals Portal, institutional repositories, and official normative documents. The results indicate significant advances in the Brazilian legal framework, which reaffirm the central role of mainstream schools and the right to inclusive schooling. However, the literature points to persistent challenges related to teacher education, school infrastructure, and the implementation of public policies in the daily routine of educational institutions. Regarding pedagogical practices, didactic games, educational technologies, and assistive technologies stand out as strategies that support knowledge mediation and student participation when used in a planned and intentional manner. Therefore, the effective implementation of inclusive education requires integrated policies, continuous investment in teacher education, and pedagogical practices committed to equity and educational justice.

Keywords: Diversity; Educational equity; Educational justice; Teacher education; Educational technologies.

INTRODUCTION

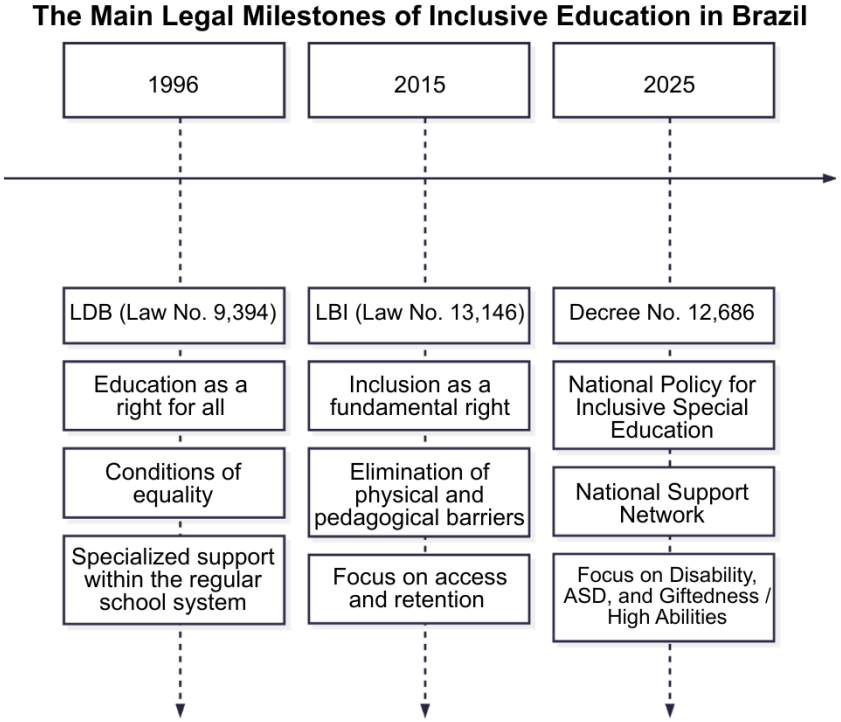
Inclusive education in basic education has been asserted as a structuring principle of contemporary educational policies, by reaffirming the right of all students to quality education guided by the values of equity, participation, and respect for differences. This conception understands human diversity as a constitutive element of the educational process, shifting the focus from selective practices to pedagogical proposals that consider the singularities of subjects in the school context (Mantoan, 2003). Thus, the school comes to be conceived as a plural space, committed to building educational opportunities for all.

In Brazil, the consolidation of inclusive education finds support in a set of legal provisions that guide the organization of education systems. The Law of Guidelines and Bases of National Education establishes that education is the right of all and must be guaranteed under equal conditions, providing educational services to students with disabilities, preferably in the regular school system (Brazil, 1996). This legal orientation represents a milestone in overcoming segregating educational models and in promoting more inclusive pedagogical practices.

The expansion of this understanding occurs with the promulgation of the Brazilian Law for the Inclusion of Persons with Disabilities, which reaffirms inclusive education as a fundamental right and highlights the need to eliminate physical, pedagogical, and attitudinal barriers that hinder students' access, retention, and learning (Brazil, 2015). This normative provision strengthens the perspective of education committed to social justice and to valuing diversity in the school environment.

More recently, Decree No. 12,686, of October 20, 2025, establishes the National Policy on Inclusive Special Education and the National Network of Inclusive Special Education, setting forth guidelines aimed at coordination among federal entities and the expansion of Specialized Educational Assistance (Brazil, 2025). This regulatory milestone reinforces the centrality of mainstream schools as spaces for schooling, while proposing support mechanisms and pedagogical resources to promote the learning and retention of students with disabilities, autism spectrum disorder, and high abilities or giftedness.

Figure 1. Main legal milestones of inclusive education in Brazil.



Caption: Flowchart representation of the guidelines of the LDB, LBI, and Decree No. 12,686/2025, highlighting the transition toward a National Policy on Inclusive Special Education. Source: Authors (2025).

Despite legal and institutional advances, the implementation of inclusive education in basic education still faces challenges in daily school life. Issues related to teacher education, curricular organization, and adaptation of pedagogical practices have been identified as obstacles to consolidating truly inclusive education. Studies show that teachers demonstrate insecurity when facing the diversity present in the classroom, revealing weaknesses in initial and continuing training processes aimed at inclusion (Amorim; Mendes; Macêdo, 2025).

In this context, teaching practices play a central role in the realization of inclusive educational policies. Pedagogical strategies that consider students' specificities and use diverse teaching resources favor participation and meaningful learning. Research indicates that the use of didactic games contributes to the mediation of knowledge and to students' cognitive and social development, especially in inclusive educational contexts (Almeida; Oliveira; Reis, 2021).

From a theoretical and pedagogical point of view, inclusive education requires changes in school culture and in the organization of teachers' work. Bertolini (2017) emphasizes that the construction of inclusive practices demands institutional commitment to diversity and the adoption of pedagogical strategies that promote students' active participation. This understanding reinforces the need for articulation among public policies, scientific production, and school practices to consolidate equitable education.

Given this, the general objective of this study is to analyze inclusive education in basic education, considering its theoretical foundations, public educational policies, and teaching practices developed in the school context. Specifically, it seeks to discuss the main theoretical references that underpin inclusive education, identify the legal framework that guides this educational modality in Brazil—with emphasis on recent regulations—and reflect on pedagogical practices that promote inclusion in the daily life of schools.

METHODOLOGY

The study was developed through an integrative literature review, conducted between November and December 2025, with a qualitative approach and an exploratory–descriptive nature. The integrative review was adopted because it enables the compilation, analysis, and synthesis of results from different types of scientific productions, allowing a broadened and systematized understanding of inclusive education in basic education—its theoretical bases, public policies, and teaching practices (Whittemore; Knafl, 2005).

SEARCH PROCEDURES

The searches were guided by the following investigative question: "In what ways have theoretical foundations, public policies, and teaching practices contributed to the realization of inclusive education in basic education?" To identify studies, the following databases were consulted: Scientific Electronic Library Online (SciELO), the Portal de Periódicos of the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES Periodicals Portal), and institutional repositories of Brazilian universities, in addition to the Diário Oficial da União (Federal Official Gazette).

Descriptors in Portuguese, Spanish, and English were used, combined using the Boolean operators AND and OR, namely: educação inclusiva, educación inclusiva, inclusive education, educação básica, basic education, políticas públicas educacionais, práticas docentes, educação especial inclusiva, jogos didáticos, and tecnologias assistivas. The combinations of descriptors enabled the retrieval of studies aligned with the research objectives.

Inclusion and exclusion criteria

Included were studies published between 2015 and 2025, available in full, that explicitly addressed inclusive education in the context of basic education, covering theoretical, normative, or practical aspects related to teaching activities and public educational policies. Considered were scientific articles, books, undergraduate theses, dissertations, doctoral theses, and works published in proceedings of scientific events, provided they had a direct relationship with the object of study.

Excluded were duplicate studies; productions dealing exclusively with higher education; works focused on corporate or clinical contexts; and publications that addressed school inclusion superficially or disconnected from pedagogical practices and public policies in basic education.

STUDY SELECTION AND SAMPLE

The initial search yielded 247 publications. After removing duplicates, 189 studies remained. Reading titles and abstracts led to the exclusion of 131 productions that did not meet the established criteria. Of the 58 studies selected for full reading, 21 publications fully met the eligibility criteria and comprised the final sample of this integrative review.

The analyzed studies encompassed national and international journal articles, academic productions, and normative documents, covering different theoretical approaches and experiences related to inclusive education, teaching practices, the use of didactic games, assistive technologies, and the implementation of public policies in the context of basic education.

ANALYSIS OF STUDIES

Data analysis was carried out using content analysis in the thematic modality, according to Bardin's proposal (2016). Initially, a floating reading of the selected studies was undertaken to promote familiarity with the material and to identify the main ideas related to the research object.

Subsequently, the most relevant excerpts were coded and organized into core meaning units, considering aspects linked to the theoretical bases of inclusive education, public educational policies, and teaching practices. These cores were then grouped into broader thematic categories, enabling the construction of an interpretive synthesis of advances, challenges, and potentialities of inclusive education in basic education, as evidenced by the literature analyzed.

RESULTS AND DISCUSSION

Twenty-one articles were selected that show inclusive education in basic education has been progressively consolidated as a guiding principle of contemporary educational policies, grounded in guaranteeing the right to education and recognizing diversity as a constitutive dimension of the formative process (Bertolini, 2017). There is broad consensus that inclusion is not a compensatory action, but rather an intentional reorganization of educational systems, shifting the focus from individual limitations to the structural, pedagogical, and attitudinal barriers present in the school context (Narciso et al., 2024).

In the realm of public policies, expansion of the normative framework aimed at schooling students who are the target audience of special education in the regular school network—with emphasis on basic education—has been observed (Pletsch; Mendes, 2024). Nevertheless, the results indicate that the

materialization of these policies remains conditioned by recurring challenges such as insufficient pedagogical resources, precarious school infrastructure, and fragile processes of continuing teacher education, factors that limit the effectiveness of inclusive actions (Silva; Santos, 2022). The relevance of family support and the role of school support professionals stand out as elements that foster retention, academic development, and social participation of students with disabilities (Silva; Souza, 2016).

With regard to pedagogical practices, studies indicate that didactic games have been widely used as methodological strategies capable of promoting student engagement and fostering pedagogical mediation processes in inclusive contexts (Almeida; Oliveira; Reis, 2021). These resources are understood as instruments that enable curricular flexibility by integrating playfulness, social interaction, and meaningful knowledge construction, contributing to students' cognitive, social, and emotional development (Cardoso, 2019). Moreover, didactic games foster more dynamic and contextualized pedagogical approaches, expanding possibilities for understanding curricular content (Ferreira; Almeida, 2017).

In Science education, results indicate that the use of didactic games contributes to constructing scientific concepts by stimulating active student participation and collaborative learning (Gonzaga et al., 2017). Experiences developed in high school demonstrate that these resources favor assimilation of content, making the teaching–learning process more accessible and meaningful (Santos et al., 2020). Similar results are observed in elementary education, especially in learning content related to vertebrate animals (Santos; Cruz, 2017). In Biology teaching, didactic games prove effective in addressing conceptually complex content such as genetics, by fostering student understanding and participation (Mendes, 2021). In Geography teaching, these resources have been used as a strategy to diversify methodologies and broaden student engagement (Oliveira, 2018).

Studies also show the importance of specialized teaching resources in the process of including deaf students, especially in multifunctional resource rooms, in which such materials contribute to curriculum access and pedagogical mediation (Araújo, 2024). Regarding teacher education, research conducted in Professional and Technological Education indicates that although teachers recognize the relevance of inclusive education, they still face difficulties in systematically operationalizing inclusive pedagogical practices (Amorim; Mendes; Macêdo, 2025).

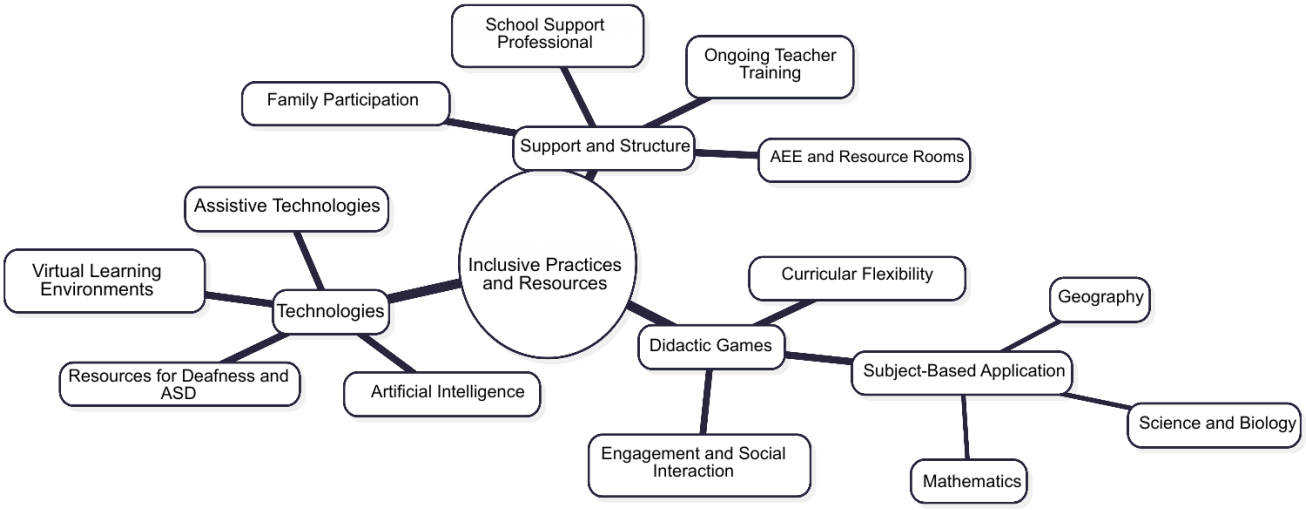
Finally, the analyzed literature points to significant growth in the use of educational and assistive technologies as support for inclusive practices, expanding possibilities for accessibility and student participation in the school curriculum (Castellano-Beltrán; Moriña; Carballo, 2024).

Virtual environments and mobile technologies are highlighted as strategies that foster processes of educational and social inclusion (Read, 2020). Recent studies indicate that assistive technologies applied to Mathematics teaching contribute to the learning of students with Autism Spectrum Disorder in the early

years of elementary school (Oliveira; Lopes; Oliveira, 2025). The diversity of inclusive educational technologies also has the potential to reduce educational barriers (Navas-Bonilla et al., 2025). In this context, technologies based on artificial intelligence emerge as promising resources for personalizing teaching and strengthening inclusive practices (Kooli; Chakraoui, 2025).

For a clearer visualization of this structure, Figure 2 presents a flowchart of the main resources and teaching practices identified in the analyzed literature.

Figure 2. Flowchart of Strategies and Pedagogical Resources for Inclusion.



Caption: Organization of teacher action fronts and teaching resources identified in the review, divided among playful tools, technological support, and human/institutional support for knowledge mediation. Source: Authors (2025).

The analysis of these studies demonstrates important points of convergence in the field of inclusive education in basic education. In general, the studies converge in recognizing inclusion as a structuring principle of school organization that goes beyond the logic of students' physical integration and requires the reorganization of pedagogical, curricular, and evaluative practices, in consonance with valuing diversity and guaranteeing the right to education (Bertolini, 2017). There is consensus that learning barriers do not reside exclusively in individuals, but in the institutional and pedagogical conditions offered by schools (Narciso et al., 2024).

Another point of convergence concerns recognition of normative advances in public educational policies aimed at school inclusion. The analyzed literature agrees that the Brazilian legal framework represents a significant achievement with regard to access and retention of students who are the target audience of special education in basic education (Pletsch; Mendes, 2024). Furthermore, the studies converge in identifying teacher education as a central element for realizing inclusive education, emphasizing that the absence of appropriate theoretical–methodological preparation compromises the implementation of inclusive pedagogical practices (Silva; Santos, 2022).

As for pedagogical practices, there is convergence regarding the potential of didactic games as strategies that favor meaningful learning and students' active participation in inclusive contexts. The literature recognizes that these resources contribute to curricular flexibility and to knowledge mediation, especially when used in a planned manner and aligned with pedagogical objectives (Almeida; Oliveira; Reis, 2021). There is also consensus that educational and assistive technologies expand possibilities for curriculum accessibility and for personalizing teaching, establishing themselves as important allies of inclusive education (Castellano-Beltrán; Moriña; Carballo, 2024).

Despite these consensuses, the literature also reveals points of divergence that deserve attention. One concerns the effectiveness of public policies in everyday school life. While some studies emphasize institutional advances resulting from legal standardization, others problematize the distance between legislation and its operationalization, highlighting structural and organizational weaknesses that limit the consolidation of school inclusion (Pletsch; Mendes, 2024).

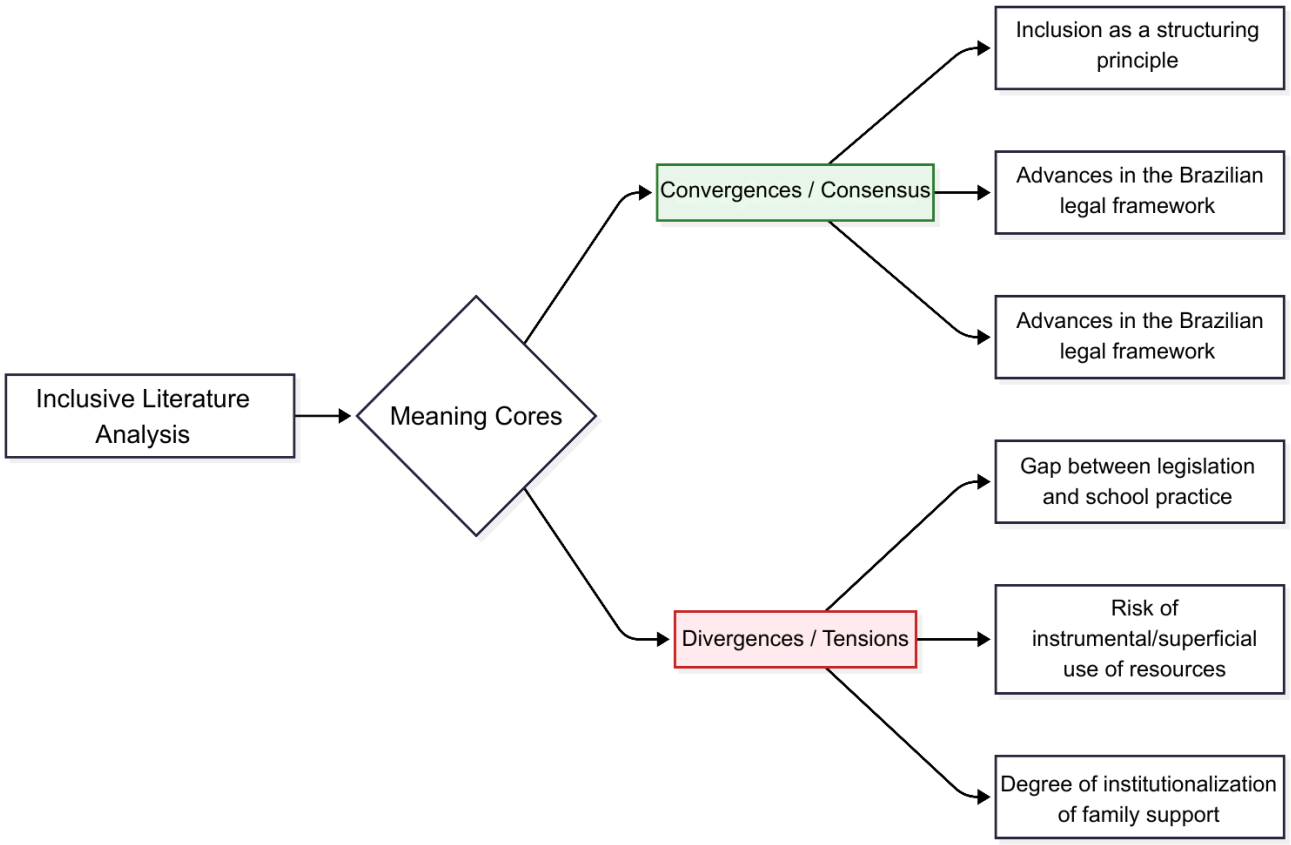
Another divergence concerns the use of didactic games and educational technologies. Part of the studies highlights the transformative potential of these resources when integrated into intentional and contextualized pedagogical practices, whereas others warn of the risk of superficial or instrumentalized approaches that reduce these resources to punctual strategies without structural impact on the teaching–learning process (Cardoso, 2019; Read, 2020).

In the field of assistive technologies—especially those based on artificial intelligence—divergence is observed regarding their reach and implementation conditions. While some studies underscore their potential to increase students' autonomy and personalize teaching, others emphasize the need for public policies that guarantee teacher training, adequate infrastructure, and equity of access, under the risk of deepening educational inequalities (Kooli; Chakraoui, 2025).

Finally, although there is consensus on the importance of family involvement and school support professionals in the inclusion process, the studies diverge on the degree of institutionalization of these partnerships. While part of the literature points to successful experiences based on articulation among school, family, and specialized professionals, other works reveal fragility of these relationships and the absence of systematic actions that sustain inclusion continuously (Silva; Souza, 2016).

Accordingly, the discussion shows that inclusive education in basic education is marked by conceptual and normative advances, but also by tensions and challenges that require integrated policies, consistent teacher education, and pedagogical practices committed to equity and educational justice.

Figure 3. Theoretical Synthesis Matrix: Convergences and Divergences in Literature.



Caption: Schematic representation of the main points of consensus and debate identified in the integrative review on the realization of inclusive education in Basic Education. Source: Authors (2025).

CONCLUSION

Inclusive education in basic education establishes itself as a structuring axis of contemporary educational policies and as an indispensable condition for guaranteeing the right to education from an equitable perspective. By recognizing human diversity as constitutive of the educational process and shifting the focus from individual limitations to overcoming pedagogical, institutional, and attitudinal barriers present in everyday school life, this study aimed to analyze inclusive education in basic education based on its theoretical foundations, public educational policies, and teaching practices; it is possible to affirm that inclusion has been consolidated, at the conceptual and normative levels, as a fundamental principle for guaranteeing the right to education and for building more equitable educational systems. The integrative literature review showed that inclusive education goes beyond the logic of students' physical insertion into the school space, demanding structural transformations in pedagogical practices, curricular organization, and institutional school culture.

The analyzed studies demonstrate that the Brazilian legal framework represents a significant advance in promoting inclusive education, by reaffirming the centrality of mainstream schools and establishing guidelines aimed at eliminating barriers that compromise access, retention, and learning of students who are the target audience of special education. Even so, the literature reveals that the

materialization of these policies in everyday school life remains conditioned by recurring challenges, especially those related to insufficient pedagogical resources, infrastructure limitations, and weaknesses in initial and continuing teacher education processes.

Regarding teaching practices, the findings indicate that diversified pedagogical strategies—such as the use of didactic games, educational technologies, and assistive technologies—have the potential to foster knowledge mediation and broaden student participation in inclusive contexts. When employed intentionally and articulated to pedagogical objectives, these strategies contribute to curricular flexibility and to the construction of meaningful learning. However, studies also warn of the risk of punctual and disjointed practices that tend to empty the pedagogical meaning of these resources.

The analysis further shows that teacher education is a central axis for realizing inclusive education in basic education. The absence of adequate theoretical–methodological preparation limits teachers' capacity to respond to the diversity present in the classroom, reinforcing the need for public policies that continuously invest in professional qualification and institutional support for schools.

As a contribution, this study presents a critical synthesis of recent scientific production on inclusive education in basic education, by articulating theoretical foundations, public policies, and teaching practices, highlighting advances, tensions, and challenges that traverse this field. Moreover, the review points to relevant gaps, especially regarding implementation of inclusive policies in everyday school life, equitable access to educational and assistive technologies, and the pedagogical, ethical, and social implications of using emerging technologies such as those based on artificial intelligence.

Therefore, it is reaffirmed that consolidating inclusive education in basic education requires strengthening integrated policies, consistent investment in teacher education, and development of pedagogical practices committed to equity and educational justice. It is a continuous process that demands collective engagement of different educational actors and commitment to building a truly inclusive school capable of ensuring learning and development opportunities for all students.

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NEUROSCIENCES, COGNITION, AND EDUCATION: THEORETICAL-PRACTICAL INTERFACES FOR TEACHING PRACTICE

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ABSTRACT
The integration between neurosciences, cognition, and education has significantly contributed to the understanding of teaching and learning processes, providing scientific support for teaching practice. This study aims to analyze the interfaces between neurosciences, cognition, and education, focusing on the contributions of neuroscience to the improvement of pedagogical practices and the promotion of meaningful learning. This is an integrative literature review with a qualitative, exploratory-descriptive approach, conducted in the SciELO, ERIC, and CAPES Periodicals databases, including studies published between 2015 and 2025. After applying the inclusion and exclusion criteria, twenty-two studies were selected for analysis. The results indicate that learning emerges from the interaction between cognitive, emotional, neurobiological, and contextual processes, highlighting the role of attention, memory, motivation, emotional self-regulation, and executive functions in academic performance. Furthermore, the findings emphasize that brain plasticity, respect for individual differences, the intentional use of educational technologies, and evidence-based teacher education are central elements for enhancing pedagogical practices. It is concluded that the integration between neuroscience and education provides solid foundations for a more reflective, inclusive, and scientifically grounded teaching practice.

Keywords: Neurosciences; Cognition; Education; Neuroeducation; Learning.

INTRODUCTION

The rapprochement between neurosciences, cognition, and education has significantly contributed to understanding teaching and learning processes, offering scientific support that helps teachers make more effective pedagogical decisions. Studies in the field of neuroeducation indicate that knowledge about brain functioning enables the development of instructional strategies more closely aligned with the ways students learn, process information, and construct knowledge (Al Khassawneh; Al Sharif, 2025).

In this context, teaching practice comes to be grounded not only in empirical approaches but also in scientific evidence related to cognition, memory, emotions, and attention. Grossi, Oliveira, and Fonseca (2024) highlight that incorporating neuroscience contributions into the curriculum and teacher education fosters more reflective pedagogical practices, contributing to improved school performance and the promotion of meaningful learning.

Moreover, neuroeducation makes it possible to understand how emotional and cognitive factors directly influence the learning process. Silva, Santos, and Santos (2024) emphasize that emotions, memory, and motivation are central elements for learning, reinforcing the need for teachers to consider such aspects when organizing instruction. This approach broadens the view of the student, recognizing them as an integral subject with interdependent cognitive and affective dimensions.

The relationship between neuroscience and pedagogical practices also becomes evident in the construction of more effective teaching strategies. Coelho and Malheiro (2024) point out that using indicators of cognitive skills can help teachers plan activities that respect individual differences and enhance students' intellectual development.

Similarly, Brandão (2025) underscores that pedagogical strategies based on brain functioning positively impact school performance by promoting active methodologies and practices that stimulate participation, attention, and the consolidation of learning.

Given this, the present study aims to analyze the interfaces between neurosciences, cognition, and education, focusing on teaching practice, considering the contributions of neuroscience to improving pedagogical practices and promoting meaningful learning.

METHODOLOGY

The study was developed through an integrative literature review, conducted in December 2025, with a qualitative approach and exploratory–descriptive nature. This type of review, as stated by Whittemore and Knafl (2005), allows for the collection, comparison, and synthesis of different types of scientific evidence, favoring a comprehensive and structured understanding of a given phenomenon.

SEARCH PROCEDURES

The searches were guided by the leading question: "How do the interfaces between neurosciences, cognition, and education contribute to improving teaching practice and to qualifying teaching and learning processes?"

The Scientific Electronic Library Online (SciELO), Education Resources Information Center (ERIC), and the Portal de Periódicos of the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES Periodicals) were consulted, in addition to institutional repositories. Descriptors were used in Portuguese and English, combined with the Boolean operators AND and OR, including *(neurociência), (cognição), (educação), (neuroeducação), (aprendizagem),* and *(processo cognitivo);* and, in English, (neuroscience), (cognition), (education), (neuroeducation), (learning), and (cognitive process).

Inclusion and exclusion criteria

Studies published between 2015 and 2025, available in full, that presented a direct interface between neuroscience and learning in educational contexts were included. Theoretical and empirical productions, reviews, and applied studies discussing the role of cognitive or emotional mechanisms in the learning process were selected. Duplicated articles, productions with an exclusively biomedical focus, and studies that mentioned the theme only superficially were excluded.

STUDY SELECTION AND SAMPLE

The initial search resulted in 289 studies. After removing duplicates, 174 publications remained. Reading titles and abstracts led to the exclusion of 96 productions that did not meet the established criteria. Of the 85 articles submitted to full reading, 22 studies met all the requirements and comprise the final sample used for analysis.

ANALYTICAL TECHNIQUES

The analysis followed Bardin's (2016) procedures for thematic analysis, beginning with a floating reading of the material, which enabled familiarization with the content and the identification of the first units of meaning. After this stage, an initial coding was performed, grouping relevant excerpts that addressed the research objective. Next came categorization, when the codes were organized into broader thematic groups, eliminating repetitions and establishing relationships among ideas. This process made it possible to construct an interpretive synthesis that presents, in an integrated manner, neuroscience's contributions to learning.

RESULTS AND DISCUSSION

The twenty-two studies analyzed show that the interfaces between neurosciences, cognition, and education offer consistent theoretical and practical foundations for teaching practice. In general, the results indicate that learning stems from the interaction among cognitive, emotional, neurobiological, and contextual processes, reinforcing the need for pedagogical practices aligned with the scientific evidence produced in the field of neuroeducation.

COGNITIVE AND EMOTIONAL PROCESSES IN THE CONTEXT OF LEARNING

The analyzed studies converge in indicating that cognition and emotion are inseparable dimensions of the learning process. Silva, Santos, and Santos (2024) show that memory and emotion operate in an integrated manner, directly influencing the consolidation of information and the permanence of school knowledge. These findings reinforce that positive emotional states favor attention, retention, and retrieval of information.

Complementarily, Brandão (2025) shows that pedagogical strategies grounded in brain functioning contribute to greater student engagement and better academic performance. Frais (2025) deepens this discussion by indicating that understanding cognitive mechanisms enables teachers to select methodologies better suited to students' mental capacities, promoting more effective learning. Beltrão (2024) adds that applying neuroscience in the school context fosters the construction of educational environments more sensitive to students' cognitive and emotional needs. In this sense, Santos Ribeiro and Johnson (2023) point out that initial mastery of neuroscientific concepts contributes to pedagogical planning and the intentional organization of teaching practices.

BRAIN PLASTICITY AND RESPECT FOR INDIVIDUAL DIFFERENCES

The results show that brain plasticity is a central principle for organizing pedagogical practices. Guimarães et al. (2023) demonstrate that recognizing neural plasticity favors teaching practices that stimulate multiple cognitive routes, expanding the possibilities for meaningful learning. These authors emphasize that a diversity of instructional strategies enhances cognitive development by respecting different learning styles and rhythms.

From the same perspective, Coelho and Malheiro (2024) indicate that constructing indicators of cognitive skills makes it possible to monitor students' development more individually and systematically. The systematic review conducted by Oliveira and Silva (2025) reinforces that educational practices aligned with cognitive neuroscience contribute to addressing the heterogeneity present in elementary education. In addition, Prediger, Carvalho, and Cardoso (2025) show that neuropsychopedagogical

interventions grounded in neuroscientific principles favor more inclusive educational processes, especially in contexts marked by school diversity.

BRAIN MATURATION AND DEVELOPMENT THROUGHOUT SCHOOLING

The analyzed studies emphasize that knowledge about brain maturation is essential for teaching practice at different stages of schooling. Oliveira et al. (2022) point out that the development of executive functions directly influences skills such as planning, self-regulation, and decision-making, which requires that instructional practices respect students' neurodevelopmental timing and capacities.

Convergently, Peregrina Nievas and Gallardo-Montes (2023) show that initial teacher education still presents significant gaps regarding the approach to neuroeducation, which limits the application of this knowledge in pedagogical practice. The study by Siqueira, Aguiar, and Colares (2020) reinforces that early-childhood teachers' continuing education needs to incorporate neuroscientific foundations to align teaching with children's brain development processes, fostering more adequate pedagogical interventions.

TEACHER EDUCATION AND THE PEDAGOGICAL USE OF NEUROSCIENCE

The results indicate that teacher education is a structuring axis for the proper application of neuroscience in the educational context. Grossi, Oliveira, and Fonseca (2024) show that the articulation among curriculum, neuroscience, and teacher education fosters more reflective pedagogical practices grounded in scientific evidence. McMahon (2022) shows that including neuroscience and cognitive psychology content in initial training broadens teachers' understanding of learning processes.

The study "Impact of educational neuroscience teacher professional development: perceptions of school personnel" (Frontiers in Education, 2022) shows that teacher professional development programs grounded in neuroscience principles promote positive changes in pedagogical practices, especially in lesson planning and the selection of teaching strategies. Cordeiro (2025) highlights that neuroscience applied to school teaching contributes to qualifying pedagogical practices and to teacher decisions more aligned with students' cognitive functioning. Complementarily, Soares, Costa, and Paschoal (2025) reinforce that the articulation among neuroscience, education, and technology expands the possibilities for pedagogical innovation and strengthens educational practices consistent with contemporary demands.

EDUCATIONAL TECHNOLOGIES AND LEARNING

The analyzed studies show that educational technologies enhance learning when grounded in neuroscientific principles. Marinho et al. (2024) show that technology-mediated environments favor multisensory stimuli capable of activating different neural networks, increasing student engagement.

Nascimento et al. (2022) corroborate this perspective by showing that educational technologies contribute to developing cognitive autonomy in the teaching–learning process.

The study by Montiel and Medeiros (2024) indicates that the use of technologies in language teaching expands learning opportunities in multilingual contexts. Complementarily, Al Khassawneh and Al Sharif (2025) show that instructional strategies grounded in neuroeducation favor the implementation of educational technologies that are more effective and aligned with brain functioning.

NEUROSCIENCE CONTRIBUTIONS TO SPECIFIC AREAS OF KNOWLEDGE

The results show relevant contributions of neuroscience to specific areas of knowledge, especially Mathematics and Science. Andrade et al. (2025) show that mathematical skills are associated with specific neural circuits, which guides the development of targeted pedagogical strategies. Oliveira et al. (2022) indicate that understanding these cognitive bases helps overcome persistent learning difficulties.

In Science education, Ribeiro et al. (2025) show that neurolearning promotes the understanding of complex scientific concepts by connecting cognitive processes and meaningful experiences. Complementarily, Oliveira et al. (2022) point out that integrating neuroscience and education strengthens teaching–learning processes by bringing theoretical foundations closer to pedagogical practice.

CONCLUSION

It is understood that the study achieved its objective by analyzing, through an integrative review, the interfaces among neurosciences, cognition, and education, highlighting their contributions to improving teaching practice and qualifying teaching and learning processes. The analysis of the selected studies made it possible to identify that learning is a complex phenomenon resulting from the interaction among cognitive, emotional, neurobiological, and contextual processes, which reinforces the need for instructional practices grounded in scientific evidence.

The results show that functions such as attention, memory, motivation, emotional self-regulation, and executive functions have a direct influence on academic performance, establishing themselves as central elements for pedagogical planning. The integration between cognition and emotion, widely discussed in the analyzed studies, shows that educational environments that are emotionally safe and pedagogically intentional favor engagement, learning consolidation, and students' holistic development.

It was also shown that brain plasticity is a fundamental principle for recognizing individual differences in the school context. Diverse pedagogical practices aligned with brain functioning and different learning rhythms expand the possibilities for cognitive development and favor more inclusive educational processes. Likewise, knowledge about brain maturation throughout schooling proved essential for adapting instructional strategies to students' neurodevelopmental capacities.

Another relevant finding concerns the role of educational technologies which, when used intentionally and grounded in neuroscientific principles, enhance learning by favoring multisensory stimuli, cognitive autonomy, and problem-solving. Furthermore, specific areas of knowledge such as Mathematics and Science benefit significantly from pedagogical strategies based on understanding neural circuits and emotional factors that affect school performance.

With regard to research perspectives, it is recommended to expand empirical studies that investigate the direct application of neuroscientific principles in the classroom, as well as research analyzing the impact of initial and continuing education programs in neuroeducation. Future investigations can also deepen analyses of the use of educational technologies aligned with brain functioning and of pedagogical strategies that consider students' cognitive and emotional diversity.

Therefore, neuroscience should not be understood as accessory knowledge but as a field that provides essential support for contemporary teaching practice. By integrating science and pedagogy, we increase the likelihood of promoting more meaningful, contextualized, and lasting learning, strengthening educational practices that are more humane, inclusive, and scientifically oriented

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ARTIFICIAL INTELLIGENCE AND THE REINVENTION OF EDUCATIONAL PRACTICES: BETWEEN TECHNOLOGIES, COMPETENCIES AND HUMAN FORMATION

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ABSTRACT
The growing presence of Artificial Intelligence (AI) in educational contexts has generated significant transformations in pedagogical practices, teaching-learning processes and knowledge production. Beyond the incorporation of new technological tools, AI challenges education to rethink pedagogical, curricular and ethical conceptions, particularly regarding the development of competencies and integral human formation. This chapter analyzes the reinvention of educational practices mediated by Artificial Intelligence, articulating digital technologies, educational competencies and ethical principles. Grounded in classical and contemporary authors in education, critical technology studies and sociology, as well as in formative guidelines on educational transformation, the text argues that the integration of AI in education must be guided by a critical, pedagogical and human-centered approach. It concludes that Artificial Intelligence can contribute to educational innovation when understood as a pedagogical means rather than an end, strengthening formative practices committed to intellectual autonomy, equity and social responsibility.

Keywords: Artificial Intelligence; Educational Practices; Competencies; Human Formation; Ethics.

INTRODUCTION

The intensification of the use of Artificial Intelligence (AI) in different spheres of social life has triggered profound transformations in the ways knowledge is produced, work is organized, social relations are mediated, and citizenship is exercised. In the educational field, these transformations are not limited to the incorporation of new technological tools; they imply a structural reconfiguration of pedagogical practices, of teaching-learning processes, and of the very role of the school in contemporary society. AI begins to act as cognitive, discursive and organizational mediation, directly affecting the ways of learning, assessing, producing meaning, and building formative trajectories.

This scenario demands that education move beyond instrumental readings of technology, often anchored in discourses of efficiency, innovation or modernization, and advance toward a critical, ethical and pedagogical understanding of AI's presence in educational contexts. As Selwyn (2019) and Holmes and Tuomi (2022) warn, intelligent technologies are not neutral: they carry values, rationalities and interests that must be interrogated in light of educational principles, human rights and the integral formation of subjects.

In this sense, the notion of educational competencies becomes central. As discussed by Perrenoud (1999) and Zabala (1998), and taken up in studies on educational transformation, competencies are not limited to technical skills; they involve the integrated mobilization of knowledge, attitudes, values and reflective capacities when faced with complex situations. The presence of AI in everyday school life intensifies this requirement, as it places educators and students before unprecedented challenges related to authorship, ethics, intellectual autonomy, information curation and living with algorithmic systems.

This chapter aims to analyze how Artificial Intelligence contributes to the reinvention of educational practices, articulating digital technologies, the development of competencies and human formation. It starts from the premise that pedagogical innovation mediated by AI is sustainable only when guided by ethical principles, by an expanded conception of competence, and by a critical view of education as a social, cultural and political practice. To that end, it engages in dialogue with classical and contemporary authors in education, sociology and critical technology studies, as well as with international guidelines and theoretical contributions present in the materials Competencies to Transform Education.

ARTIFICIAL INTELLIGENCE AND EDUCATIONAL TRANSFORMATION

The educational transformation associated with Artificial Intelligence is part of a broader context of the digitalization of social life, characterized by the massive circulation of data, the automation of processes, and the growing presence of algorithmic systems in decision-making. Castells (2018) names this scenario the network society, in which informational and technological flows reconfigure the relations among time, space and knowledge. In the educational sphere, this logic manifests itself in the

expansion of digital platforms, recommendation systems, virtual learning environments and tools for the analysis of educational data.

AI, unlike previous digital technologies, introduces the possibility of automated adaptation, personalized learning, and the prediction of educational behaviors. Systems based on algorithms are capable of analyzing performance patterns, identifying learning gaps, and suggesting individualized formative paths. This potential is often presented as a solution to historical problems in education, such as dropout, lack of motivation or learning difficulties. However, as Selwyn (2016) and O'Neil (2016) point out, such promises must be examined critically, as they may reinforce inequalities, oversimplify complex educational processes, and reduce learning to quantifiable metrics.

In the materials Competencies to Transform Education, technology is understood as a tool for educational transformation, provided it is integrated in a pedagogical, ethical and contextualized manner. Kenski (2012) emphasizes that technology must be understood as a means to achieve educational objectives, not as an end in itself. This assertion becomes even more relevant in the context of AI, where there is a risk of subordinating pedagogical practices to the logics of platforms and the commercial interests that sustain them.

Personalized teaching, often associated with AI, clearly illustrates this tension. Although it may favor more flexible and adaptive learning trajectories, it may also limit the educational experience to individualized paths, weakening collective, dialogical and critical dimensions of learning. Freire (1996) cautions that education cannot be reduced to the technical adaptation of the individual to the world; it must promote a critical reading of reality and the possibility of transforming it. Thus, algorithmic personalization must be challenged by pedagogical practices that value dialogue, problem-posing and the collective construction of knowledge.

Another central aspect of educational transformation mediated by AI is the redefinition of the teaching role. As discussed by Tardif (2002) and Moran (2000), the contemporary teacher ceases to be a mere transmitter of content to act as a mediator, curator and guide of learning processes. The presence of intelligent systems does not eliminate this function; on the contrary, it makes it more complex. It is the educator's role to interpret data, contextualize information, problematize automated responses and promote formative experiences that go beyond what algorithms can offer.

Moreover, educational transformation involves inescapable ethical and political dimensions. The massive collection of educational data, algorithmic surveillance, and the use of commercial platforms jeopardize principles such as privacy, autonomy and equity, as discussed in the e-books themselves when addressing the General Data Protection Law (LGPD) and the ethical challenges of technology in education. In this context, education must adopt a critical stance toward AI, forming subjects capable of

understanding, questioning and intervening in the technological logics that permeate their formative experiences.

EDUCATIONAL COMPETENCIES IN THE AGE OF ARTIFICIAL INTELLIGENCE

The emergence of Artificial Intelligence in the educational field intensifies the debate on which competencies are necessary to form subjects capable of acting critically in complex digital contexts. The notion of competence, as widely discussed by Perrenoud (1999), Zabala (1998) and taken up by Libâneo (2001), goes beyond the idea of technical mastery of tools; it involves the integrated mobilization of knowledge, skills and attitudes to address real and unprecedented situations. In the age of AI, this mobilization becomes even more demanding, as subjects begin to interact not only with information, but with algorithmic systems that produce, filter and organize meaning.

In the materials *Competencies to Transform Education*, the centrality of competencies is presented as a condition for effective educational transformation aligned with the demands of the 21st century. It is emphasized that digital literacy, pedagogical competence and socio-emotional competencies constitute inseparable axes of teacher and student formation. This understanding converges with the studies of Lankshear and Knobel (2011), who assert that contemporary literacies are configured as situated social practices, deeply permeated by digital technologies and new forms of cultural production.

In the context of AI, digital competence takes on an expanded dimension. It is not merely about knowing how to use platforms or applications, but about critically understanding how algorithmic systems function, what data they collect, what logics guide their responses, and what impacts they have on educational processes. Holmes and Tuomi (2022) argue that educational formation must include AI literacy, capable of promoting conceptual understanding, critical thinking and ethical responsibility in the use of these technologies.

Alongside technical and cognitive competencies, socio-emotional competencies gain prominence, widely discussed in the analyzed e-books. Del Prette and Del Prette (2005) and Tardif (2002) highlight that aspects such as empathy, emotional self-regulation, cooperation and relational ethics are fundamental for constructing meaningful learning environments, especially in contexts mediated by technologies. AI, by automating interactions and decisions, may weaken human dimensions of the educational process if it is not accompanied by pedagogical intentionality and teaching mediation.

Another fundamental axis is ethical competence. Living with intelligent systems demands that educators and students develop criteria to evaluate the reliability of information, recognize algorithmic biases and understand the limits of automation. Floridi (2018) proposes an ethics of information that recognizes human responsibility in the creation and use of digital systems. In the educational field, this

implies forming subjects capable of making conscious decisions, respecting principles of justice, equity and human dignity.

In this sense, competence cannot be understood as an isolated individual attribute, but as a social and pedagogical construction situated in institutional, cultural and political contexts. Competency-oriented education, especially in times of AI, requires flexible curricula, formative assessment practices and spaces for collective reflection, as advocated by Moran (2000) and Saviani (2007). It is about preparing subjects not only to operate technologies, but to understand them, question them and transform them in favor of emancipatory educational projects.

Table 1 – Educational Competencies Mobilized in the Integration of Artificial Intelligence

Dimension of Competence	Characterization in the context of AI	Main theoretical references
Critical digital competence	Understanding the functioning of algorithmic systems, critical reading of data, information discernment and conscious use of intelligent technologies	Perrenoud; Lankshear & Knobel; Holmes & Tuomi
Pedagogical competence	Ability to intentionally integrate AI into the curriculum, learning design, and active methodologies, preserving teacher mediation	Moran; Kenski; Valente
Socioemotional competence	Development of empathy, cooperation, emotional self-regulation, and relational ethics in technology-mediated environments	Del Prette & Del Prette; Tardif
Ethical competence	Critical evaluation of the impacts of AI, recognition of algorithmic biases, responsibility in the production and use of content and data	Floridi; Noble; O'Neil
Reflexive competence	Ability to problematize the presence of AI in education, articulating technology, human formation, and social commitment	Freire; Morin

Source: prepared by the authors, 2026.

REINVENTING EDUCATIONAL PRACTICES: LEARNING DESIGN, METHODOLOGIES AND AI

The incorporation of Artificial Intelligence into educational processes drives the reinvention of pedagogical practices, demanding new ways of planning, executing and assessing learning. This reinvention does not occur spontaneously or automatically; it requires pedagogical intentionality, theoretical grounding, and alignment with ethical and formative principles. The concept of learning design, widely discussed in the e-books Competencies to Transform Education, emerges as a central element in this process.

Innovative learning design presupposes the articulation among educational objectives, active methodologies, technological resources and formative assessment. As Kenski (2012) points out, pedagogical planning mediated by technologies must consider not only the technical potential of tools, but their effective contribution to knowledge construction. In the context of AI, this implies using intelligent systems to support learning, without replacing the teacher's role or reducing the complexity of the educational process.

Active methodologies, such as project-, problem- and challenge-based learning, gain new momentum when articulated with intelligent technologies. Valente (1999) and Moran (2000) argue that student protagonism is an essential condition for meaningful learning. AI can contribute to this protagonism by offering immediate feedback, simulations, adaptive environments and multimodal resources. However, these resources only become pedagogically relevant when inserted into proposals that value reflection, authorship and collaboration.

Authorship, in fact, becomes especially relevant in the reinvention of educational practices mediated by AI. Generative systems challenge traditional conceptions of textual production, creativity and assessment. Paveau (2021), in discussing technodiscursivity, points out that the production of meaning in the digital environment occurs in a distributed manner between humans and technical devices. In education, this demands rethinking assessment practices, recognizing technological co-authorship without relinquishing the student's intellectual and ethical responsibility.

Another fundamental aspect of learning design in the age of AI is assessment. The analyzed e-books emphasize the importance of formative, continuous assessment oriented by competencies. AI systems can assist in the collection and analysis of educational data, offering indicators of performance and engagement. However, as O'Neil (2016) and Selwyn (2019) caution, the uncritical use of metrics may reinforce inequalities and reduce learning to numbers. It is the educator's responsibility to interpret these data in light of the pedagogical context, avoiding automated decisions that disregard individual and collective trajectories.

The reinvention of educational practices also involves expanding the spaces and times of learning. Hybrid, virtual and collaborative environments become increasingly present, requiring new teacher competencies for pedagogical mediation. As highlighted in Competencies to Transform Education, the educator assumes the role of facilitator, guide and curator of learning experiences, promoting meaningful interactions even in contexts mediated by technologies.

Finally, it is essential to recognize that pedagogical innovation is not limited to the adoption of advanced technologies. As Freire (1996) emphasizes, transformative education is that which promotes critical consciousness and a commitment to social transformation. When integrated in a reflective and ethical way, AI can contribute to more inclusive, personalized and meaningful educational practices.

However, when guided by market or technocratic logics, it runs the risk of emptying education's formative sense.

ETHICAL DIMENSIONS OF ARTIFICIAL INTELLIGENCE IN EDUCATION

The incorporation of Artificial Intelligence into educational contexts imposes ethical challenges that go beyond the technical field and reach pedagogical, political and social dimensions. Education, as a social practice committed to human formation, cannot ignore the ethical impacts arising from the use of algorithmic systems in teaching, learning and assessment processes. As discussed by Floridi (2018), information ethics must guide the conception, use and regulation of digital technologies, especially in sensitive contexts such as education.

One of the main ethical challenges concerns the collection, storage and use of educational data. AI-based systems depend on large volumes of data to function, which implies constant monitoring of students' activities. In the analyzed e-books, this issue is addressed through discussions of privacy, information security and legislation, with emphasis on the General Data Protection Law (LGPD), which establishes fundamental principles for protecting the rights of educational subjects. However, the existence of legal frameworks does not, in itself, guarantee ethical practices; educators and institutions must develop competencies to interpret and apply these principles in everyday school life.

Another relevant ethical aspect concerns algorithmic biases. As Noble (2018) and O'Neil (2016) warn, algorithms are not neutral: they reproduce values, priorities and inequalities present in the data that feed them. In the educational field, this may result in unfair classifications, stigmatization of students and automated decisions that reinforce social exclusions. Competency-oriented education, as advocated by Perrenoud (1999) and Saviani (2007), demands contextualized and formative assessment, incompatible with purely automated models for judging performance.

Equity in access to technologies is also a central ethical challenge. Although AI is often presented as a solution for personalizing learning, its implementation may deepen existing inequalities, especially in contexts marked by socioeconomic disparities. Kenski (2012) and Valente (2005) emphasize that technological integration is transformative only when accompanied by public policies, adequate infrastructure and continuous teacher training. Without these conditions, AI risks becoming yet another factor of educational exclusion.

The ethical dimension of AI in education further involves the issue of intellectual autonomy and authorship. Generative systems challenge traditional conceptions of knowledge production, demanding that schools rethink criteria of authorship, originality and assessment. Paveau (2021) proposes understanding contemporary discursive production as techno-discursive, that is, resulting from the interaction between human subjects and technical devices. However, recognizing this co-authorship does

not mean abdicating the subject's ethical responsibility. On the contrary, it demands that education form students capable of reflecting critically on the use of AI, adopting an ethical and conscious stance toward technologies.

In this context, the educator's role is fundamental. As discussed in the e-books, the teacher acts as an ethical mediator, guiding choices, problematizing uses and promoting a responsible digital culture. Tardif (2002) emphasizes that teaching knowledge is constructed through the articulation of scientific, pedagogical and experiential knowledge. In the age of AI, this knowledge must also incorporate an ethical and political dimension, capable of confronting the challenges imposed by the automation and datafication of education.

FINAL CONSIDERATIONS: ARTIFICIAL INTELLIGENCE AS A MEANS, NOT AN END

The analysis developed throughout this chapter shows that Artificial Intelligence occupies an ambivalent place in contemporary education. On the one hand, it offers significant possibilities for personalizing learning, expanding access to knowledge and reinventing pedagogical practices. On the other hand, it imposes ethical, political and pedagogical challenges that demand critical reflection, responsible regulation and educational intentionality.

By articulating technologies, competencies and human formation, we have argued that the reinvention of educational practices mediated by AI cannot be guided by a technocratic or market logic. As Freire (1996) and Morin (2000) argue, education must remain committed to forming critical, autonomous subjects capable of intervening in reality. In this sense, AI must be understood as a pedagogical means, not as an end in itself.

The centrality of educational competencies proved fundamental to sustaining a critical integration of AI in education. Digital, pedagogical, socio-emotional and ethical competencies form an inseparable set necessary for educators and students to navigate consciously in complex algorithmic environments. The materials Competencies to Transform Education reinforce this perspective by highlighting the importance of continuous teacher training, innovative learning design, and competency-oriented formative assessment.

The reinvention of educational practices, therefore, is not limited to adopting AI-based tools; it involves a deeper transformation of the conceptions of teaching, learning and assessment. It demands flexible curricula, active methodologies, spaces for dialogue and an educational ethics committed to equity, privacy and human dignity. As Holmes and Tuomi (2022) stress, the future of education with AI depends less on technological advancement and more on the pedagogical and political choices that guide its use.

We conclude that Artificial Intelligence can contribute significantly to educational transformation, provided it is integrated into a pedagogical project that is critical, ethical and oriented toward human formation. It is incumbent upon education to take an active role in building this project, forming subjects capable not only of using intelligent technologies, but of understanding them, questioning them and placing them at the service of a more just, inclusive and socially committed education.

Table 2 – Main ethical challenges of Artificial Intelligence in the educational field

Ethical dimension	Central challenge	Pedagogical implications
Privacy and data	Collection, storage and massive use of educational data	Need for clear institutional policies, teacher training and critical reading of systems
Algorithmic biases	Reproduction of social and educational inequalities	Risk of stigmatization, unfair classifications and automated decisions
Equity of access	Inequality of infrastructure and technological training	Expansion of exclusions if there are no public policies and educational investment
Authorship and intellectual autonomy	Use of generative systems in academic and school production	Review of evaluative practices and strengthening of the student's ethical responsibility
Teacher mediation	Reduction of the teacher's role in the face of automation	Reaffirmation of the educator as a critical and ethical mediator

Source: prepared by the authors, 2026.

The discussion developed in this chapter allows us to affirm that Artificial Intelligence occupies an ambivalent place in contemporary education: while it expands pedagogical and organizational possibilities, it also intensifies ethical, political and formative tensions that cannot be ignored. AI may favor personalized pathways, the expansion of multimodal resources and access to broader informational repertoires, but it may also reinforce inequalities, naturalize control logics and reduce complex educational processes to performance metrics. Therefore, the reinvention of educational practices mediated by AI does not rest on the promise of technological efficiency, but on the pedagogical intentionality that guides its use, the clarity of formative objectives, and the centrality of teaching mediation.

By articulating technologies, competencies and human formation, it became evident that the presence of AI requires a shift from an instrumental focus to a critical and educational approach capable of interrogating the ways in which algorithmic systems produce selections, hierarchies and meanings.

This requirement converges with the understanding of competence as the integrated mobilization of knowledge, skills and attitudes when facing unprecedented situations—a perspective present in Perrenoud, Zabala and in contemporary approaches to educational transformation. In this horizon, digital competencies are not restricted to tool mastery; they include informational discernment, a critical reading of algorithmic environments, and ethical responsibility in the production and circulation of content. The materials Competencies to Transform Education reinforce this understanding by advocating pedagogical, ethical and contextualized integration of technologies, emphasizing continuous teacher training and a commitment to equity.

In this sense, reinventing educational practices also implies reconfiguring learning design and modes of assessment. Active methodologies, projects and collaborative approaches can be enhanced by intelligent systems, provided they do not substitute pedagogical dialogue or empty the human dimension of learning. Assessment, in turn, must remain formative and interpretive, preventing automated indicators from becoming decontextualized judgment criteria. The teacher, as indicated by Tardif and Moran, assumes an expanded role of curator, mediator and ethical guide precisely because AI's presence increases the complexity of pedagogical decisions and the need for critical contextualization.

We therefore conclude that Artificial Intelligence can contribute to educational transformation when understood as a pedagogical means and not as an end, subordinated to a formative project committed to intellectual autonomy, social justice and human dignity. In consonance with Freire and Morin, we reaffirm that education cannot be limited to technical adaptation; it must form critical subjects capable of intervening in the world, including in the technological architectures that organize contemporary life. Thus, integrating AI demands responsible institutional policies, continuous teacher training, explicit ethical criteria and pedagogical practices that preserve the public and humanizing sense of education, ensuring that technological advancement does not eclipse the school's central commitment: to form people, not merely to optimize processes.

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EDUCATIONAL SERVICE FOR STUDENTS WITH DISABILITIES IN ELEMENTARY EDUCATION AT JOÃO CHAMA MUNICIPAL SCHOOL, LOCATED IN THE MUNICIPALITY OF APARECIDA DO TABOADO – STATE OF MATO GROSSO DO SUL

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ABSTRACT

Students with disabilities may display exceptional abilities or face difficulties in their learning. These specificities are considered special insofar as they require teachers to provide targeted responses to learning difficulties. The general aim of this research was to understand the importance of teacher training at the elementary level at João Chama Municipal School, located in the municipality of Aparecida do Taboado, state of Mato Grosso do Sul (MS). The research problem was framed as follows: Do the teachers at João Chama Municipal School feel qualified to provide educational services to students with special needs? To carry out this study, we employed a qualitative methodology, with documentary and bibliographic review. In addition to these approaches, it was necessary to conduct field research directly with teachers, by delivering questionnaires in person to the female teachers. The questions addressed items related to the service provided to students with disabilities and to the training of teachers working in the field of special education. The results demonstrated the importance of continuing education for teachers so that they know how to design instructional plans to serve students with the most diverse needs. For the development of this work at the aforementioned school, we obtained authorization from the school's administration and from the teachers who were research participants. This is the Educational Unit where we carried out the Supervised Professional Internship for the Pedagogy Program at João Chama Municipal School, located in the municipality of Aparecida do Taboado/MS.

Keywords: Special education; Disability; Teacher training.

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INTRODUCTION

This study addressed the educational service provided to students with disabilities in Elementary Education at João Chama Municipal School, located in the municipality of Aparecida do Taboado, state of Mato Grosso do Sul (MS).

The work was developed within the school environment, which is a space of constant construction of diverse learning processes and of students, each with their own way of understanding knowledge. Within this context, the study focused on students with disabilities.

The research problem was: Do the teachers at João Chama Municipal School feel qualified to provide educational services to students with special needs?

The general objective was to understand the importance of teacher training at the Elementary level at João Chama Municipal School, located in the municipality of Aparecida do Taboado/MS. The specific objectives were: to identify the main disabilities present in the educational environment; to list the training of teachers at João Chama Municipal School for serving students with disabilities; to analyze the need for and importance of continuing education for the teachers at this school to serve these students.

The development of the study arose from the demands observed in the school environment with regard to students with disabilities, which require teachers to develop a methodological practice and to organize their planning aimed at meeting the needs that arise in the teaching–learning process of these students.

Continuation of this work may bring further knowledge about students with disabilities in the school environment who require that teachers possess the appropriate knowledge to assist them on their journey toward knowledge construction, encouraging greater pursuit of training among these professionals.

To better understand the topic, in item 2 we present the methodology and theoretical framework used to carry out this study. In item 2.2 we discuss the inclusion of students with disabilities, citing the relevant legislation; item 3 addresses the importance of continuing education in the field of special education for teachers to provide quality and equitable service to students with disabilities; and finally, item 4 discusses the continuing education in special education offered to teachers at João Chama Municipal School with respect to Special Education.

PATHS OF THE RESEARCH: METHODOLOGY AND THEORETICAL FRAMEWORK

METHODOLOGY

The study was developed using the Scielo and Google Scholar databases, the library of the State University of Mato Grosso do Sul (UEMS), UEMS's digital library, and literature related to the topic.

Periodicals in the field of special education were used, such as Revista Brasileira de Educação, among others.

The study had a qualitative approach, with bibliographic, documentary, and field research components.

This methodology was chosen as a way to add greater theoretical support to the topic, given the extensive literature in the field in the case of the bibliographic review.

Qualitative research is characterized as privileging the analysis of microprocesses, through the study of individual and group social actions, conducting an intensive examination of the data, and being characterized by heterodoxy at the moment of analysis (Martins, 2004, p. 2).

Fávero; Centenaro (2019, p. 171) state that "thus, documentary research is understood as a process that uses methods and techniques for the apprehension, understanding, and analysis of documents of the most varied types."

According to Cavalcante and Oliveira (2020), bibliographic review studies are defined by the use and analysis of documents within the scientific domain—such as books, theses, dissertations, and scientific articles—without directly relying on empirical facts. They make use of secondary sources, considering the contributions of authors on a given topic, which distinguishes them from documentary research, characterized by the use of primary sources that have not yet received scientific treatment.

Field research was chosen because of the real-world perspective and reflection it can provide on the training of teachers to work in serving students with disabilities.

For the initial development of the work, the following descriptors were used: disability, teacher, training. We first selected works and published articles, considering the topic and the research objectives; subsequently, we created reading notes (fichamentos) of the material found. Then, for the field research, we prepared a questionnaire with questions addressing the theme of the study. The questionnaire was delivered personally to the research participants, that is, two teachers, followed by analysis and discussion of the results obtained. The questions were semi-structured, with both open and closed questions.

THEORETICAL FRAMEWORK

In this item we sought authors whose works address inclusion and teacher training, considering students with disabilities in the school environment. On this basis, we present our theoretical framework: Silva; Carvalho (2017); Menezes (2001); Rosa (2010); Neto et al. (2018); Barbosa (2006); Rosin-Pinola; Del Prette (2014); Vygotsky (1991); Melo (2016).

In addition to these theorists, the legislation used included: (Brasil, 2003); Brasil (2001).
We present below the statement by Silva; Carvalho (2017, p. 294), who writes:

> "It should be emphasized that 'inclusive education is the acceptance of differences, not merely placement in the classroom,' and that it demands transformations in the education system, involving respect for individual differences, cooperation among students, teachers trained to include all students in all school activities, and, above all, work on the issue of respect and dignity." (Silva; Carvalho, 2017, p. 294)

Needs are related to individuals who have learning difficulties in the school context and demand specific responses from the teacher in his or her pedagogical practice.

Students who generate special needs due to high ability or difficulty in their learning are not only those with disabilities; rather, by virtue of the needs they present, they become "special" because they require specific responses adequate to each difficulty (Menezes, 2001).

Rosa (2010) highlights that educational needs may include those related to people with different physical, social, intellectual, emotional, and sensory conditions; people who work or live on the streets; remote or nomadic populations; linguistic, ethnic, or cultural minorities; and disadvantaged or marginalized groups.

The presence of students with disabilities in the teaching–learning process requires more specific responses and significant attention from the teacher to the development of methodologies and the use of resources that facilitate their access to curricular content and the development of skills.

The creation and implementation of inclusive educational policies have brought a new perspective on the presence of students with disabilities and their real importance in this process.

> In Brazil, the National Policy on Special Education from the Perspective of Inclusive Education ensures access to regular education for students with diverse disabilities—intellectual, physical, deaf, blind—those with pervasive developmental disorders, and students with high abilities/giftedness, from early childhood education through higher education (Neto et al., 2018, p. 84).

With the creation of legislation aimed at serving students with disabilities in the context of education, it became possible to open a wide range of significant opportunities for these students to be seen through a new lens within the educational context.

> The Federal Constitution and the Statute of the Child and Adolescent ensure the population's right to quality education, understood as an educational process that leads learners to a comprehensive and civic formation. This quality school, through the content it offers and the social relations it provides, promotes human development in its fullness, conditions of freedom and dignity, respecting and valuing differences (Silva; Carvalho, 2017, p. 294).

The relevance of the teacher's practice in his or her context is also considered, taking into account the need for work geared toward students' needs, their expectations, and forms of development, with challenging and enriched activities. The teacher's practice should be mediational in the student's

learning, valuing the student. Barbosa (2006) states that the obstacle faced by the teacher requires that he or she be able to learn to deal with it, working with various levels of understanding and welcoming conclusions with varying degrees of complexity, without generating in the student feelings of inferiority or superiority.

This professional should help the student overcome fears. Barbosa (2006) emphasizes that the teacher should provide the student with ways to establish a bond with learning, helping the student overcome fear and defensiveness regarding new knowledge to be learned.

The school's aim is to help students acquire skills and knowledge so that they may live in society independently, and support services should be adapted to assist the general classroom. Considering that support services are important in the schooling of students with special needs, teacher training—both for generalists and specialists—has fallen short of current educational demands; this is one of the challenges faced by today's schools (Rosin-Pinola; Del Prette, 2014).

In this context, interaction within the school space is essential for the subject's development. Based on the studies of Piaget (1970), whose focus is the epistemic subject, he states that the subject constructs himself through his action upon the object of knowledge; there is a direct relationship between subject and object that allows the subject to construct his learning, understanding characteristics and establishing relationships necessary for learning (Santana, 2008).

> Considering that the proposal of inclusion signifies a change in teaching conditions and that this change depends largely on teacher training and practice, in the sense of leading innovative practices that foster the participation of all students, it is understood that published materials must be accompanied by guidelines on the actions and skills that the teacher should display to create conditions for learning for all students (Rosin-Pinola; Del Prette, 2014, p. 345).

Serving students with disabilities presupposes that the teacher seeks the necessary knowledge to deal with existing demands and to meet the student's learning expectations.

> The demands of today's world with respect to teacher training and practice require not only curricular knowledge but also skills of reflection on practice and many other abilities in carrying out educational action. Such behaviors are not disconnected from the specific role the teacher assumes, nor from the teacher's conceptions and responsibility toward historically produced knowledge, but they must be directed toward promoting articulation between academic learning and students' socioemotional development (Rosin-Pinola; Del Prette, 2014, p. 345).

The teacher's practice in the educational process requires constant reflection on his or her work and the pursuit of knowledge, knowing students' disabilities and characteristics so as to assist in the construction and practice of learning.

For Vygotsky (1991), properly organized learning results in the subject's mental development, setting in motion many developmental processes; this is seen as an essential aspect so that psychological functions may be organized (Vygotsky, 1991).

Education is a right of all subjects. The school as a whole plays a relevant role in the individual's formation and in upholding his or her rights before society.

> Education is considered a right of all, a duty of the State and the family, and is to be promoted and encouraged together with society, fostering personal development, preparation for the exercise of citizenship, and qualification for work. It may also be seen as a factor of cohesion that must take into account the diversity of individuals and human groups; respect for diversity and for the specificity of individuals is a fundamental principle of educational practices. Thus, educational systems must respect pluralism, the richness of cultural expressions of the various social groups that make up society, and the multiplicity of individual talents (Silva; Carvalho, 2017, p. 294).

Mello (2016) states that, for Vygotsky (1991), in his theoretical school, the teacher's task is to offer opportunities for the reproduction of human aptitudes produced by this collective of people; thus, teachers must ensure the appropriation of these qualities by identifying the elements that need to be assimilated by the child so that he or she may develop skills.

Students with disabilities require a more specific and satisfactory response in their learning. The inclusion of these students demands that the responsible team be prepared and that the teaching process be organized, since teaching based on diversity relies on implementing adaptations to the school curriculum and work methods, aiming at results and success in the learning of all students (Brasil, 2003).

Serving students with disabilities requires careful attention to methods and resources that enhance their learning. Serra (2010) considers that effective service to students with disabilities is ensured by public policies and must provide a pedagogical intervention to serve these students and offer an appropriate education that meets expectations.

Pedagogical practice should help students develop autonomy and interaction. Rosa (2010) highlights that activities should support processes of creation, students' actions, and their discoveries, as they are able to invent knowledge through relationships established with the environment.

The Salamanca Statement presents the following guidelines for building an inclusive school: every student has the right to education and should have the opportunity to reach and maintain the appropriate level of learning; every student has unique characteristics, interests, abilities, and learning needs; educational systems must be reorganized and educational programs implemented to consider the diversity of such characteristics and needs; students with special educational needs must have access to the regular school, which should accommodate them within a child-centered pedagogy; regular schools with an inclusive orientation are the most effective means to combat discriminatory attitudes, creating

welcoming communities, building an inclusive society, and achieving education for all (Rosin-Pinola; Del Prette, 2014).

Special education confers upon all the right to schooling. Students who are the target of service in special classes must be assured of teachers specialized in special education; the organization of the class must be in accordance with their educational needs; specific equipment and materials; curricular adaptations (Brasil, 2001).

It is important that the teacher take care with regard to the routine of proposed activities. Weber (2010) emphasizes that the teacher must have the student experience different possibilities through various activities so that the student develops skills and potential inherent to the process.

The next item addresses the importance of continuing education in special education for teachers in the service provided to students with needs.

THE IMPORTANCE OF CONTINUING EDUCATION IN SPECIAL EDUCATION FOR TEACHERS: A DOCUMENTARY AND BIBLIOGRAPHIC REVIEW

Continuing education for teachers working in special education constitutes an object of reflection and dialogue, given its importance for the development of a pedagogical practice that is effective in serving students with disabilities.

Professional training occupies a prominent place in academic, professional, and political debates concerning the school inclusion of students with special needs. It is important to emphasize the need for appropriate professional training to meet the specific demands of students in complex and dynamic contexts such as the classroom or other school spaces. Considering that in a large part of discussions and texts about school inclusion of students with special needs, teacher training is deemed necessary, it is understood that such professional preparation does not end upon completion of an undergraduate program (Cruz, 2011).

The National Curriculum Guidelines for Teacher Education in Basic Education (BRASIL, 2002) stress that higher education institutions must train teachers who are prepared to deal with issues involving diversity in schools. In Article 6, the Guidelines affirm the relevance of content that contemplates students with special educational needs (Greguol; Gobbi; Carraro, 2013).

It is necessary to understand that changes in education to meet the paradigm of educational inclusion depend on the social, economic, and cultural context in which the school is inserted, on the conceptions and social representations related to disability, and on the material and financial resources available to the school. In this sense, teacher education must meet the needs and challenges of the present. Thus, it is relevant that the teacher be trained in such a way as to mobilize his or her knowledge,

articulating it with competencies through the action and reflection of theory with practice (Pletsch, 2009).

For Cruz (2011), academic and professional knowledge must be articulated in pursuit of teacher training, fostering a closer relationship between basic education teachers and higher education faculty. In this sense, the teacher's everyday life must be seen as a stage for the development of knowledge that supports practice.

Teacher education acquired a new perspective in 2009 with the approval of the National Plan for Teacher Training in Basic Education (PARFOR), which was proposed to meet the legal requirement for the minimum training necessary for all teachers, seeking articulation with public institutions of higher education and state and municipal departments of education, with the aim of ensuring that all teachers working in basic education have access to an undergraduate program (Greguol; Gobbi; Carraro, 2013).

In Special Education, debates about the training of the teacher responsible for the educational service of students with disabilities involve pedagogical meetings held in school units, the definition of public education policies, and theoretical reflections. In this context, the importance of professional experience in the teacher's day-to-day practice is observed in continuing education (Cruz, 2011).

The next item discusses the continuing education in Special Education offered to teachers at João Chama Municipal School, also considering the importance of such training for serving students with disabilities.

CONTINUING EDUCATION IN SPECIAL EDUCATION OFFERED TO TEACHERS AT JOÃO CHAMA MUNICIPAL SCHOOL

João Chama Municipal School is located in the municipality of Aparecida do Taboado/MS, at Rua Confins, no. 2,210, in the Jardim Aeroporto neighborhood. The school was inaugurated on 10/28/2010 and had as its first principal Professor Edileide Aparecida Xavier da Cruz and as pedagogical coordinator Professor Vera Lucia Pereira.

Its Political-Pedagogical Project (PPP) was prepared in 2010 in accordance with the following regulations: the National Education Guidelines and Framework Law (LDB no. 9394/1996), the 1988 Federal Constitution (CF), the Statute of the Child and Adolescent (ECA – Law no. 8.069/1990), the National Common Curricular Base (BNCC), the Reference Curriculum of the State of Mato Grosso do Sul (2021), and the deliberations of the Municipal Education Council of the municipality of Paranhos/MS, namely Deliberations no. 004 and 005/2012 of January 27, 2012. The document expresses the principles and guidelines of pedagogical decisions approved by the segments of the educational institution which, after analyses, reflections, and discussions on educational legislation and in accordance with the expectations and needs of its school community, was drafted.

Regarding the field research, it was conducted with two female teachers. We established questions for the semi-structured interview script based on the practice of professionals who work in special education in the elementary level at João Chama Municipal School. In conducting the interviews with open and closed questions, we sought to understand from the interviewees issues related to their training to work in special education, length of practice in special education, whether continuing education is offered to work in special education, possible training needs for working with students with disabilities, whether the school under study offers humane service to parents of students with disabilities, and whether the interviewee feels qualified to work with these students.

The first item addresses length of service in special education. In this context, teacher A.S. states: I have been working at the school for 5 months (A.S.). Teacher P.A. has worked in the field longer, i.e., 15 years.

The responses show that one professional's length of service is quite significant compared to the other, which may lead us to understand that she has taken part in specific training in special education.

Regarding higher education training of these professionals, or specific training to work in special education, it is observed that only professional A.S. has training to work in the field.

As for the Municipal Department of Education of Aparecida do Taboado/MS offering training for teachers to deal with students with special educational needs, the interviews indicate that no training is offered. See teacher P.A.'s response: "No, to date we have not had specific training in the area to work in special education."

The responses reveal the absence of training on the part of the Municipal Department of the municipality in question.

Regarding identification of gaps in teacher training in special education, the first interviewee (A.S.) states that there is no training, but she emphasizes the concern and efforts of the Municipal Department of Education in serving students with disabilities.

The second interviewee (P.A.) asserts that there are many shortcomings with regard to continuing education.

Concerning the provision of humane service to parents of students with disabilities by João Chama Municipal School, professional A.S. emphasizes that there is space for parents to participate in accompanying their children: "Yes, the school allows parents to be present in the Educational Unit for the good performance of their children with special needs."

Interviewee P.A. showed a lack of knowledge about the space intended for parents of students with disabilities.

Regarding whether the professionals interviewed feel qualified to work with students with disabilities, interviewee A.S. reported that she seeks learning outside the school. Let us see: "Yes,

however I seek each day to learn strategies and methods for teaching, because each day we face situations and demands in this area."

Interviewee P.A. tells us: "No, unfortunately I do not think I am qualified to work with students with disabilities (PCD)."

From the participants' responses, we perceive a lack and a concern regarding the need for continuing education for teachers. Although one of them has a significant length of service in special education, she reveals the need for more training on the part of the school in special education.

It is important to clarify that this is the school where we carried out the Supervised Professional Internship related to the Pedagogy Program at the State University of Mato Grosso do Sul. The school's principal was informed about the conduct of this research, and the teachers signed the Free and Informed Consent Form, agreeing to answer the questionnaire, which was personally delivered to them.

FINAL CONSIDERATIONS

In the course of the research it was possible to learn a bit about the reality of special education in the elementary level at João Chama Municipal School, located in the municipality of Aparecida do Taboado/MS, specifically regarding the continuing education of the teachers working in this field. It is observed that there is a gap and a concern among these professionals regarding the absence of specific continuing education for the area of special education.

The service provided to students with disabilities enrolled in elementary education is supported by the National Policy on Special Education, which ensures the access of this segment of the population to regular education, requiring the adoption of methodologies and also the preparation of professionals to receive these students. The National Curriculum Guidelines for Teacher Education in Basic Education (DCNs) highlight that higher education institutions must train teachers to deal with issues involving diversity in schools.

Specifically in analyzing the research object, it was observed that there is a lack of continuing education among the professionals interviewed, who seek, on their own, the knowledge necessary to work in their practice with students with disabilities.

Considering the documentary analysis that included access to the Political-Pedagogical Project of João Chama Municipal School, it was verified that the school seeks to integrate its teaching in consonance with the National Curriculum Parameters and current national legislation.

As for continuing education, it is observed that there is no specific training intended for professionals working in special education; however, there is a concern on the part of these teachers regarding the service provided to these students, offering support through the hiring of support

professionals (PA) and childhood development assistants (DI). Nevertheless, we emphasize the absence of continuing education for these professionals who work directly with this population.

In response to the research objective, the professionals working in the area reveal that they seek knowledge through strategies and methods to work in serving these students, since continuing education is not effectively offered to these professionals, which leaves them at the mercy of having to teach certain needs that are unknown to them without specific methodologies and diversified assessment instruments.

The results demonstrate the importance of continuing education and, at the same time, its absence in the practice of these professionals in elementary education at João Chama Municipal School, further revealing a concern among these professionals in seeking knowledge and preparation for serving students with disabilities.

The research concludes that continuing education is relevant to strengthen and provide a solid foundation for professionals who serve students with disabilities, considering not only the stance and support of current legislation on this issue, but also the need to prepare these professionals for the performance of their practice.

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AN ANALYSIS OF THE PROBLEM-SOLVING-BASED TEACHING METHODOLOGY IN THE APPROACH TO GEOMETRY

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ABSTRACT
This article discusses the teaching of geometry through problem-solving as a methodology, characterizing itself as a literature review of authors who deliberate on the subject. Thus, this investigation aims to understand how problem-solving can contribute as a methodology for approaching geometry in the classroom context. The strategy used for data collection was an in-depth study of the literature, in order to confront different points of view and thus consolidate considerations on the subject. At the end of the research, it is observed that this offers support in terms of learning and improving the teaching processes of Mathematics and, above all, Geometry.

Keywords: Problem solving; Methodology; Teaching; Geometry.

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INTRODUCTION

We are embedded in a world filled with shapes that are, in most cases, not fully understood in their breadth. The notion of the space occupied by a body gives rise to significant discussions about its existence. Estimating the volume of a geometric solid, as well as analyzing its dimensions and the applicability of forms in daily life, is not a recent human need. When we examine the history of mathematics and the evolution of humankind in terms of understanding, we notice that, as societies advanced, problems related to geometric aspects appeared with increasing frequency.

Within this scenario, practical needs spurred the formulation of situations in which spatial geometry was present, as well as the difficulties in dealing with such concepts. At other times, the sheer beauty that this knowledge could provide was sufficient to inspire the creation of such situations. The quest for advances in mathematical knowledge led to the development of ideas and methods that traverse paths where the completeness of processes permeates their complexity, without, however, revoking their irrefutable relevance and applicability both in mathematical procedures and in the representation of the reality around us. Thus, this teaching work bears the following theme: an analysis of the problem-solving-based teaching methodology in the approach to geometry.

Based on the teaching of geometry in a general context, as well as on problem solving related to the theme, the study seeks to answer the following research question: in what ways can problem-solving practice be applied to the teaching of geometry in basic education? We began with the hypothesis that, in addition to reducing the arguments and artifices necessary for the deduction and use of formulas related to the geometric context, problem solving assists in constructing and developing spatial reasoning and the capacity to associate geometric concepts with realistic situations.

The main purpose of this work is to understand how the teaching of geometry occurs in basic education and how problem solving can be applied to the approach to this field of mathematics. Specifically regarding the development of the study, the initial intention is to understand problem solving as a teaching methodology at the elementary level, correlating the practice with the teaching of geometry.

The relevance of this work may be considered undeniably indispensable, given that understanding concepts related to geometry and to problem solving begins in basic education, still in elementary school, and is deepened in high school. However, both the teaching of this field of knowledge in a general context and that of mathematics are tied to a range of abstractions and cognitive perceptions that, in most cases, cause irreversible harm to the learner's education when they are not well defined and worked through. Thus, it is necessary to seek strategies that facilitate the teaching of such concepts, and problem solving is grounded as a crucial tool for understanding geometric concepts—which gives significant importance to the need for its understanding even within the academic environment.

The development of this work took place using bibliographic research processes with qualitative emphases. For data collection, we propose a literature review addressing the topic in order to characterize a qualitative parallel among the different conceptions on the matter. This research, in turn, is grounded in various authors, both from applied mathematics and from mathematics education. Among them we highlight: Boyer, Carl B. (História da matemática); PAVANELLO, R. M., "O abandono do ensino de geometria no Brasil: causas e consequências"; LORENZATO, S., "Por que não ensinar Geometria?" Revista da Sociedade Brasileira de Educação Matemática; FAINGUELERNT, E. K., "O Ensino de Geometria no 1º e 2º graus." Revista da Sociedade Brasileira de Educação Matemática; DANTE, Luiz Roberto, Formulação e resolução de problemas de matemática, among others.

This work is divided into three fronts of discussion. First, we discuss the practice of problem solving from the perspective of the mathematics teacher. Second, we present an analysis of the phases of problem solving through the lens of the teacher as a mediator. Third and finally, we highlight possibilities in teaching practice for the teaching of geometry through problem solving.

METHODOLOGY

THE MATHEMATICS TEACHER AND INSTRUCTION ORIENTED TOWARD PROBLEM SOLVING

In the exercise of their profession, mathematics teachers face various barriers that challenge and deconstruct their identity. Devaluation, lack of professional preparation, and lack of school infrastructure are among the main problems that afflict the educator's work. However, the principal difficulty faced by education today is the student's blockage with respect to mathematics as a subject—a blockage that has been the result of doctrines and traditional teaching practices that place the student in the background. The consequences of this blockage are reflected in a lack of motivation, disinterest, school dropout, and the high rates of illiteracy and poverty in the country. Aware of the reality of Brazilian education, the main challenge of contemporary education is to bring young people back to classrooms, showing them the possibilities that quality education can afford. It is necessary that students become the fruit of their own knowledge and learn from their experiences, as Freire asserts:

> "Education is a response from finitude to infinitude. Education is possible for human beings because they are unfinished and know themselves to be unfinished. This leads them toward their perfection. Education, therefore, implies a search carried out by a subject who is the human being. 'The human being must be the subject of their own education.'" (Freire, 1985, p. 14).

From the understanding that we are in a constant process of evolution and refinement, knowledge is forged. Education, in turn, is the fruit of that understanding, and from the young person must come the

comprehension of their role vis-à-vis the needs of the world that surrounds them. It is no different with mathematics. Mathematical concepts—together with the geometric concepts that form the subject of this work—act directly and decisively in representing reality and, as such, should be explored in their full breadth. Nonetheless, the traditional pedagogy—which is still present today in some Brazilian schools—fails to fulfill this role, resulting in the learning deficits found across various levels of schooling.

Reformulating the instruction developed in public schools is the only way to change this reality that afflicts contemporary education. Here we propose instruction based on the problem-solving methodology as a way out of the aforementioned problems. In most cases, this methodology has succeeded in drawing students' attention to mathematics education insofar as it proves challenging and an attractive way to represent a mathematical situation. Dante argues that:

> "Rapid social changes and the ever-greater and faster enhancement of technology prevent us from making an exact prediction of which mathematical skills, concepts, and algorithms would be useful today to prepare a student for their future life. Teaching only those concepts and algorithms that are currently relevant does not seem to be the way, because they may become obsolete in fifteen or twenty years, when today's child is at the height of their productive life. Thus, a quite reasonable path is to prepare the student to deal with new situations, whatever they may be. For this reason, it is essential to develop initiative, an exploratory spirit, creativity, and independence through problem solving." (Dante, 2007, p. 12).

It is evident that a teaching methodology based on the mere mechanical transmission of knowledge is no longer a viable route to meet the current demands of society. Mathematically speaking, instruction based on concepts, formulas, and procedures with high rigor and complexity is not the path to achieving education of social relevance and quality—education that can represent the real world in which the student is embedded. Problem solving can contribute significantly to changing this reality, since it can directly support the teaching-learning process.

Speaking of "problem" in the context of mathematics may at first cause some apprehension, given that we are proposing here a methodology capable of bringing students back to the school environment. Nevertheless, drawing on studies by different researchers in the field, one can see that this methodology truly has an effect in pursuing this objective. Solving problem situations in the classroom elevates students to a higher level of intellectual and cognitive development, since such situations allow the refinement of mental structures and confront learners—directly and indirectly—with their reality. According to Dante:

> "A mathematics class in which students, encouraged and guided by the teacher, work actively—individually or in small groups—on the adventure of seeking the solution to a problem that challenges them is more dynamic and motivating than one that follows the classic scheme of explanation and repetition. The real pleasure of studying mathematics lies in the satisfaction that arises when the student, on their own, solves a problem. The more difficult it is, the greater the satisfaction in solving it. A good problem arouses curiosity and triggers in the student a research behavior, reducing their passivity and conformism." (Dante, 2007, pp. 13–14).

For Dante, when a teacher develops instructional work from the perspective of problem solving, they offer the student the possibility of ceasing to be a passive subject—one who is merely present to receive information and copy pre-established patterns of thought—and becoming an active subject who will be the protagonist in constructing their own knowledge. Dante further states that problem situations in the classroom contribute significantly to energizing teachers' work, as well as to motivating students regarding mathematical knowledge.

With meaningful and transformative learning as the principal focus, it is necessary to understand that problem solving, in and of itself, does not guarantee success in achieving such an objective. This methodology must be accompanied by factors that substantiate its application. One fundamental factor in this perspective is the development of sound planning that addresses the different challenges encountered in the classroom, as well as possible avenues for resolution. It is a fact that, in a single school environment, we observe the presence of children with different levels of learning—some with relative ease in developing the proposed activities, others with attention deficits and difficulties learning the content covered, especially in mathematics. The teacher's planning of didactic situations involving problem solving to be experienced in the classroom must include strategies that address the different learning conditions encountered and that guarantee equitable instruction for all.

Still according to Dante, among the skills to be developed in individuals through this teaching methodology is the capacity to develop in them the conditions necessary to identify and use their own resources to solve real-world problems—those present both inside and outside the school environment. He reaffirms this when he states that: "[…] it is necessary to develop in the student the ability to make a logical argument and to make intelligent and effective use of available resources, so that they can propose good solutions to the issues that arise in their daily lives, at school or outside it." (Dante, 2007, p. 11).

More than merely proposing a problem for students to solve, the teacher must be able to identify which problems are relevant to be discussed in the school environment. This is the second factor to be considered when working with this methodology. A problem that is aligned with current curriculum proposals should be a challenging situation—one that leads the student to think and to seek the best strategy for solving it. Fundamentally, it must also have a context oriented toward reality, which is so often discussed as the principal stumbling block for mathematics teachers today. In other words, it is necessary to discuss situations that motivate the student to take a stand in relation to the solution, placing

themselves fully within the problem at hand. Only in this way will students develop the habit of questioning what they are learning, setting aside learning based merely on repeating what the teacher is doing. As Ana Lúcia Braz Dias states:

> "The great objective of the school is to prepare the student to solve problematic situations that they encounter in their daily life and that they will encounter in their adult life. It is expected that each area of school learning will contribute to this objective. Mathematics can also contribute to the resolution of problematic situations. For example, it is certain that the knowledge built about numbers and operations, about shapes, about measurements, and about the organization and interpretation of quantitative information may be necessary in this task." (Gestar II – Matemática, MEC, 2009).

For Dias, the problem situations proposed by the teacher in the classroom—which she calls "problematic situations"—must align with those that students will likely face in their adult life; that is, the student must be able to interpret, give meaning to the solution, relate it to daily life, and select means for its resolution. The posture of the teacher as the owner of knowledge and truth—the figure who transmits knowledge—must be set aside, making room for the teacher as mediator, whose role will be to assist the student in constructing knowledge. This raises the question: how should one work with problem solving in the mathematics classroom? This is what we will now address.

MAKING MATHEMATICS TEACHING DYNAMIC: A LOOK AT THE PHASES OF PROBLEM SOLVING AND MATHEMATICS INSTRUCTION FROM THE STANDPOINT OF A TEACHER-MEDIATOR

Instruction from the perspective of problem solving can be an important tool for the student's intellectual development and for overcoming difficulties related to learning mathematics. However, it also becomes evident that this practice will only be effective if accompanied by good planning and by a change in the teacher's posture regarding their role in the classroom. Up to this point, we have discussed the practice of problem solving and its applicability in Brazilian schools. But, after all, what is a problem?

According to Silveira Bueno's Novo Dicionário da Língua Portuguesa: "problem /ê/ [from Late Latin problema] s.m. 1. Question, difficulty to resolve. 2. That which is difficult to explain." Nonetheless, problem solving in the classroom is not based on proposing questions with a high degree of complexity and difficulty of understanding, since such questions discourage students and hinder their learning. Here we discuss a teaching methodology whose main objective is to support the teacher's work in the teaching of geometry by means of problems that are significant to students' engagement with the world around them. To work with this practice, however, it is necessary to understand the essential elements in its development—that is, the steps for solving a problem. According to the National Curriculum Parameters (Parâmetros Curriculares Nacionais, PCNs):

> "Problem solving, in the perspective indicated by mathematics educators, enables students to mobilize knowledge and develop the capacity to manage the information at their disposal. Thus, students will be more likely to increase their knowledge of concepts and procedures as well as their view of problems, of mathematics, and of the world as a whole, developing self-confidence about this learning." (PCNs, 2007, p. 40).

Students employ a range of strategies to solve mathematical problems; there are also many types of problems to analyze. The most common are open problems and those that involve several steps before reaching a solution. Real problems, however, are the ones that best represent reality, since they incorporate, in their structure, more than a question or a challenge: an appropriate contextualization. By understanding mathematical problem solving, students begin to use mathematical concepts meaningfully and correctly to seek strategies that lead to a satisfactory result. Upon achieving this result, the student comes to understand their own potential and is spurred by the satisfaction of learning to forge their identity.

We come to understand that a problem exists from the moment there is a need to achieve a common objective—what we call the solution. In mathematics, based on conceptions of problems, we understand the true meaning of the educator's importance in carrying out quality work. When these same problems are formulated by the educator from the perspective of a broader context representing the student's daily life, we call them problem situations (situações-problema). In parallel with the practical meaning of learning, problem situations act on the student's cognitive structures, offering great challenges and potentialities. Therefore, problem solving—much more than a method that aids the construction of mathematical concepts—also helps students' intellectual development. Dante writes:

> "Problem situations are application problems that portray real, day-to-day situations and that require the use of mathematics to be solved. Through mathematical concepts, techniques, and procedures, one seeks to mathematize a real situation by organizing data in tables, drawing graphs, performing calculations, etc. In general, these are problems that require research and data collection. They can be presented in the form of projects to be developed using knowledge and principles from other areas besides mathematics, provided that the answer relates to something that arouses interest." (Dante, 2003, p. 20).

Mathematics instruction mediated by problem solving becomes much more interesting when the educator uses good exercises that stimulate students' learning and curiosity instead of relying on simple repetitive activities—practices that have persisted since the traditional school and that lead to tedious reproductions of drill exercises, thereby contributing to the eventual distancing from the student's reality. Study based on problem solving, however, should follow certain stages that ensure understanding of this type of activity and facilitate students' search for a solution. These are the stages we now describe.

The first step in solving a problem is its **comprehension**. At this stage, the student will ask: what is the proposed problem? What are the data provided by the question, and what do they indicate? Are the

data provided sufficient or insufficient with respect to what is being asked? In view of these questions, the student can take a position regarding the situation and prepare for the next stage, which is called **devising a plan of action**.

Here, the student will build bridges between the information provided and the problem proper, which, in some moments, we may call the unknown. It is of fundamental importance to characterize the situation under analysis, asking about its connections with mathematics and its tools. It is crucial for the student to consider whether they have seen the problem in previously experienced situations—even if under different circumstances. Perceiving these characteristics will help identify which theorems, properties, or conceptual fields of mathematical knowledge will be useful when seeking a solution.

At this stage of resolution, it is common for the first difficulties to appear, mainly related to the information provided. However, if the student is unable to solve the proposed problem immediately, the educator can broaden the range of strategies by proposing that the student first solve a problem that is connected to the context of the situation addressed, or by specifying a component of the problem that can be solved first; as Dias states:

> "It is clear that the knowledge available to the person attempting to solve a problem has considerable influence on the success of obtaining a solution. This includes both mathematical knowledge and extra-mathematical knowledge related to the problem. Knowledge of similar problems and of strategies used to solve other problems also increases the chances of success." (Gestar II – Matemática, MEC, 2009, p. 50).

In this sense, the importance of the knowledge acquired by the student for solving tasks of this type—those proposed by the educator—becomes clear. Thus, problem solving not only develops mathematical knowledge in its fullness, it also contributes to establishing links between mathematics and other fields of knowledge. Once the stages of comprehension and plan-setting that will guide the resolution process are completed, it is time to put the plan into action—that is, the moment of execution arrives.

In the third stage, called **executing the plan**, the student defends their arguments (in this case, the mathematical knowledge at their disposal) in practice. Doubts arise with greater force, since, once the strategy has been outlined, most students face difficulties in manipulating the tools of knowledge and applying them to the appropriate contexts. From the perspective of the traditional teacher, the response is, on many occasions, to indicate the answer to the student, thereby blocking their cognitive capacities for reasoning and perception. From the perspective of the teacher-mediator, a bridge is established between knowledge and the student, who will be encouraged to draw their own conclusions and construct their answer to the proposed problem.

The difference lies in how the student is guided to reach the result. In the first case, the traditional teacher will "complete" the student's answer, failing to provide the conditions for the student to do so themselves. In the second case, the teacher-mediator will work precisely to explore each student's potential, enabling them to surpass their own limits and achieve transformative learning. According to Oliveira, the manner in which the teacher explores the problem is also a fundamental point to be discussed. For him:

> "For the student to be able to read and understand the problem, it is useful that, during class, the problems be explored orally, working through different ways of finding the solution. It is worth remembering that it is also important to work with problems involving the student's daily life so as to make them more interesting." (Carvalho, 2007, p. 18).

The fourth and final step in problem solving—often forgotten by students and by mathematics teachers—is verification or **retrospection**. At this stage, the student verifies the result obtained as well as the reasoning employed. It is desirable that, at this stage, the student perceives whether it would be possible to reach the same result by different paths. This awareness contributes significantly to understanding that, in solving mathematical problems, there are multiple paths that can be used to arrive at the same result.

FROM THEORY TO PRACTICE—ANALYZING POSSIBILITIES IN TEACHING PRACTICE FOR THE TEACHING OF GEOMETRY THROUGH PROBLEM SOLVING

As seen previously, pedagogical work through problem solving is not merely a simple teaching methodology; rather, it is a proposal that involves the interaction of diverse mathematical concepts in activities developed in the classroom with the world beyond the classroom's limits. This is not easy work. To this end, it is of fundamental importance that the teacher, as mediator of learning, interact with everyday situations that are part of each student's reality.

The educator must bear in mind the importance of learning new content through mathematical problem solving. However, for this learning to be consolidated, the student must possess some mathematical knowledge enabling them to find paths that lead to diverse strategies in the problem-solving process. In teaching geometry, students should be guided to read and correctly interpret the information contained in the proposed activities; understanding the basic components used to reach the solution of the problem—which were discussed earlier—is paramount.

Amid the neglect of geometry teaching discussed earlier—whether due to school systems or to educators themselves—the fact remains that this branch of mathematical knowledge establishes strong connections with the student's intellectual development, helping to develop mental perceptions and the

representation of the space in which the student is situated. In this sense, geometry in the school context should provide means by which students can establish representations of the real world, and its approach in the final years of elementary education should create opportunities for the first encounters with more developed and systematized thinking. According to Lorenzato:

> "Geometry studies from the 5th to the 8th grade should provide opportunities for students to carry out their first systematic explorations. It is at this stage that the first logical deductions are constructed; the results and processes should be discussed, though without concern for formalization." (Lorenzato, 1995, p. 8).

For him, at this stage the student needs to understand the process that made the result possible, leaving formalizations and rigor in developing the proposed problems to a secondary plane. In other words, the principal concern of the mathematics educator when presenting geometric concepts at this moment of learning should be directed toward discussing the understanding and meaning of the paths used by the student in order to arrive at a result and promote learning. Applying problem situations that prompt students to use strategic mechanisms of geometry and that contribute to content development becomes essential.

In geometry, problem solving enables the student to think critically about their learning, developing logical reasoning amid external representations and demonstrating good and creative solutions to the proposed problems—including those directly related to daily life. This teaching methodology also plays a fundamental role in identifying students' weaknesses related to mathematical knowledge, helping to resolve doubts that have persisted over the years and that traditional teaching fails to eliminate. By awakening in the student an interest in and curiosity about learning mathematics, the problem-solving methodology promotes an approximation between young people and school—or between young people and knowledge itself—especially with regard to geometric thinking. According to Dias:

> "Teaching via problem solving means considering the problem as a triggering element of a process for constructing mathematical knowledge. That is, problems aim to contribute to the formation of concepts even before their presentation in mathematical language. It is the need to solve the problem that leads the student to appropriate—alone or collectively—the intellectual tools necessary to construct a solution." (Gestar II – Matemática, MEC, 2009, p. 51).

Engaging students in situations that motivate them to solve problems—besides strengthening the quality of learning through the search for alternative ways to reach results—proposes understanding, analysis, and contact with new situations so that they can efficiently attain solutions to mathematical problems. In the geometric field, moreover, there is an additional benefit: the possibility of contextualizing knowledge with elements of reality. For many specialists, geometry is the great bridge not only between the student and reality, but also among the different conceptual fields of mathematics itself.

For many years, the teaching of algebra has dominated the Brazilian curriculum matrix in various respects. However, it has long been apparent that the absence of geometric thinking can cause large gaps in the construction of human thought. As Fainguelernt writes:

> "Geometry offers a vast field of ideas and methods of great value when it comes to the student's intellectual development, their logical reasoning, and the passage from intuition and concrete, experimental data to processes of abstraction and generalization. Geometry also facilitates the passage from the stage of concrete operations to that of abstract operations. It is, therefore, an integrating theme among the various parts of mathematics as well as a fertile field for practicing learning-by-doing and learning-to-think. It plays a primary role in teaching because intuition, formalism, abstraction, and deduction constitute its essence." (Fainguelernt, 1995, p. 45).

In a broader context, geometric thinking fosters in the student a more advanced degree of logical reasoning and intellectual growth. When well-grounded, it marks the passage from the phase of concrete thinking to a higher level of abstraction—toward working with abstract operations. However, when content is taught without establishing the proper connections, the teacher ends up interfering negatively in this transition, causing irreparable losses in learning. In this regard, problem solving emerges as a transformative tool in the educator's work concerning the approach to such content. The National Curriculum Parameters underscore that:

> "The study of geometry is a fertile field for working with problem situations and is a topic that students are naturally inclined to find interesting. Work with geometric notions contributes to learning numbers and measures, as it stimulates the student to observe, perceive similarities and differences, identify regularities, and vice versa." (Brazil, 2001, pp. 55–56).

By providing tools that ensure comprehension of other fields, geometry gains greater importance both in elementary and in secondary education. In both contexts, problem solving becomes a methodology that enhances learning, ensuring education capable of developing in the student the competencies necessary to understand space in its specificities.

RESULTS AND DISCUSSION

Amid the world of forms in which we are immersed, geometry—like mathematics—was developed from humankind's practical need to understand the surrounding universe. Its evolution represented a great leap in knowledge and gained increasing prominence through the work of major figures such as Euclid, Thales, Pythagoras, and Descartes, among others. Thus, over the years, geometry began to "give life" to human creations, and its inclusion in basic education became indispensable. Today, this branch of mathematics constitutes an organized body of knowledge indispensable to society; however, its treatment in the teaching-learning process has been losing ground to other aspects of basic mathematics, such as Algebra and Arithmetic.

It is important to emphasize that this research does not aim to raise the teaching of mathematics exclusively to geometric knowledge, but rather to analyze the contributions of geometry to the student's intellectual and cognitive development. In this sense, the approach through problem solving is the primary instructional proposal to which we refer here. This teaching methodology, which gained many adherents in the 1990s, proved to be of fundamental importance as a supporting strategy for the approach to geometry in the classroom, particularly in the context of elementary education.

Teaching from the perspective of problem solving means creating possibilities for meaningful learning that is close to the student's reality—who is increasingly immersed in spaces where the creation and mediation of conflicts, the search for swift and simplified solutions, and scientific and technological innovation are ever more prominent. Thus, based on this study, we understand the need for the teaching of mathematics—especially geometry—to overflow the limits of the classroom and take on practical meaning in each student's daily experiences.

Problem-solving methodology, in its essence, triggers the reflection–action–reflection process, defended by many authors as a key pillar in teaching and learning. Through it, it is possible to lead the student to think, organize, and understand their learning process, generating pertinent reflections on the path embarked upon. Beyond criticality—while serving as the driving force for transformation and creation of the new—thoughts, ideas, and understandings come to life through the actions performed by each student, whether inside or outside the classroom, constructing meanings pertinent to the investigative process of the classroom. Conversely, action also ensures new reflections in a continuous process of deconstruction and reconstruction that leads to learning.

It must be made clear and kept in mind that teaching geometry via problem solving goes beyond the mere application of theorems and axioms in a given context; rather, it is associated with the very act of understanding the path in order to make sense of the results found. In this sense, the teacher, as mediator of the teaching–learning process, must seek strategies that establish students' protagonism in the construction of knowledge—not only in the classroom, but also beyond it. In short, the problems and situations that will guide the process need to be endowed with information and outlines that encompass not only geometric content, but also the practical visualization of its application, modeling, abstraction, and, above all, the construction of meaning.

CONCLUSION

In its specificity, problem solving brings students closer to reality, fostering meaningful learning with significant social contributions. According to specialists in the field—for example, Dante—an education grounded in problem solving awakens in students curiosity and pleasure in learning mathematics, in addition to being a strategy that enhances understanding of the content addressed.

However, it is necessary to understand the true meaning of the term *problem solving* as applied to education. Many teachers claim to teach through this methodology, yet rely on simple repetition exercises with no stimulation of student reasoning. Thus, to ensure quality education, it is first necessary to develop in the student critical reasoning and autonomy in learning. Only in this way will education be complete and the educator have fulfilled their role.

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CRITICAL APPLIED LINGUISTICS, CRITICAL LITERACY, AND LGBTQIA+ ISSUES IN ENGLISH LANGUAGE TEACHING IN BRAZIL: A LITERATURE REVIEW

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ABSTRACT

This literature review article proposes an in-depth reflection on the urgency of incorporating the LGBTQIA+ agenda into the context of English Language Teaching (ELT) in Brazil, grounded in the theoretical assumptions of Critical Applied Linguistics (CAL) and Critical Literacy (CL). The investigation starts from the premise that, although official documents such as the BNCC and Brazil's national curricular guidelines advocate the formation of a critical and participatory citizen, day-to-day pedagogical practice and the school curriculum remain largely conservative, operating under a "pedagogy of silence" that renders issues of gender and sexuality invisible. Through a bibliographic survey that spans from initial teacher education to practices in Integrated Secondary Education and university extension projects, the study analyzes how CAL, as an interdisciplinary and politically engaged social science, makes it possible to problematize the power relations and hegemonic identities present in language. The results of the analysis of four main case studies demonstrate that the application of Critical Literacy, mediated by disruptive textual genres such as LGBT Rap and multimodal materials, not only helps combat homophobia and prejudice but also drives more meaningful and authentic linguistic-discursive development. It is concluded that English teaching must function as a space of "re-existence," where ethical formation and social justice go hand in hand with linguistic proficiency, requiring a restructuring of teacher education so that the teacher assumes their role as a transformative intellectual in the face of diversity.

Keywords: Critical Applied Linguistics; Critical Literacy; Gender and Sexuality; English Language Teaching; Citizenship.

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INTRODUCTION

The field of English Language Teaching (ELT) in Brazil has been called upon to transcend merely structural teaching and to embrace pedagogical practices aligned with the demands of a plural and just society. The Curricular Guidelines and other guiding documents of Brazilian education (Brazil, 1996, 2000, 2017) propose a reconciliation between linguistic development and civic formation, requiring the teacher to act as an agent of social transformation.

However, research indicates that the Brazilian school curriculum often operates under the aegis of heteronormativity and conservatism (Junqueira, 2009), resulting in the silencing or minimization of crucial topics such as gender and sexuality (Ferraz, 2014; Pereira, 2023). Symbolic violence and exclusion against non-heterosexual subjects (LGBTQIA+) persist in the school environment, demanding an ethical and intentional pedagogical intervention.

In this context, Critical Applied Linguistics (CAL) and Critical Literacy (CL) emerge as theoretical and practical frames to confront invisibility and homophobia in ELT. This extended abstract aims to analyze recent literature that advocates and implements discussion of the LGBTQIA+ agenda in English teaching, showing how criticality can be mobilized to foster reflection and the expansion of perspectives among students and teachers in training.

DEVELOPMENT

This section presents results and the corresponding discussion, based on the appropriate interpretation of data and articulated with the theoretical foundation that underpins the study of Critical Applied Linguistics (CAL). CAL, seen as an engaged social science (Moita Lopes, 2006), requires the teacher to assume the role of a reflective researcher (Pennycook, 2001), one who must question the power relations that manifest in language and in the curriculum. According to Rajagopalan (2003), CAL investigates language in use within its socio-historical-political context, challenging the neutrality of practices that have historically privileged hegemonic identities.

Critical Literacy (CL) constitutes the methodological framework for such action. McLaughlin and DeVoogd (2004) define it as an expansion of comprehension that leads the reader to go beyond the surface of the text. The works follow Janks (2013, 2014), who proposes an approach more focused on how the "I" produces meaning, which is fundamental for the student to read themself critically, confronting their own prejudices. The studies analyzed demonstrate the impact of this approach in different contexts:

1. **Teacher Education:** Ferraz's (2015) study on addressing homosexuality and homophobia in an Academic Writing course with pre-service English teachers showed that, despite the lack of preparation during their undergraduate training, future teachers engaged in critical debate,

indicating that the topic is both possible and necessary. The author highlights the problem of a "pedagogy of silence" concerning these themes.

2. **Teaching and Outreach:** The results of action research in extension projects (França & Ifa, 2021) and in Integrated Secondary Education classes (Pereira, 2023) converge. In both cases, the intentional creation of "environments for the development of critical awareness" (França & Ifa, 2021) and the use of multimodal texts with CL (Pereira, 2023) generated reflections, reconstructions, and broadened perspectives on gender and sexuality, confirming the contribution to an education committed to inclusion and egalitarianism.
3. **Analysis of Text Genres:** Trevisan and Cristóvão (2019) point out that the LGBT rap song genre, also called queer rap, can be used as a pedagogical resource in language teaching, fostering discussions about social issues related to LGBTphobia. The authors also emphasize that rap, as a form of resistance, confronts dominant school culture and amplifies the debate on diversity.

These findings reinforce the urgency of confronting the conservative curriculum (Junqueira, 2009) and homophobia (Borrillo, 2010), transforming the English language class into a space for effective social action.

CONCLUSION

The conclusions of this extended abstract indicate that Critical Applied Linguistics and Critical Literacy constitute the most appropriate theoretical and practical path for inserting the LGBTQIA+ agenda into English Language Education in Brazil, thereby meeting the objective of the study. The analyzed works show that such approaches strengthen ethical and civic formation by combating symbolic violence and internalized homophobia in the school environment, while also supporting students' linguistic-discursive development (França & Ifa, 2021).

The capacity for students to "read themselves" critically, as advocated by CL, is fundamental to the deconstruction of prejudice. For future work, it is recommended that greater focus be placed on continuing teacher education to equip teachers to address sexual diversity in an ethical, intentional manner and without fear of a "pedagogy of silence" in the classroom.

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ARTIFICIAL INTELLIGENCE AS A PEDAGOGICAL MEDIATION IN THE CONTEXT OF INCLUSIVE EDUCATION

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ABSTRACT
Artificial intelligence (AI) emerges as an innovative resource, capable of enhancing pedagogical practices and promoting educational inclusion. This study analyzed how AI functions as a pedagogical mediation tool in the context of inclusive education, considering learning personalization, support for the educational process, and the challenges faced by teachers and institutions. It is an integrative literature review conducted between November and December 2025, with a qualitative approach and an exploratory-descriptive nature. A total of 21 articles from national and international databases, including SciELO, ERIC, and CAPES Journal Portal, were selected, addressing the use of intelligent technologies to promote inclusive pedagogical practices. The results show that AI contributes to the adaptation of content to students' individual needs, increases engagement, autonomy, and protagonism, while reducing teachers' administrative workload. It was observed that the effectiveness of implementation depends on continuous teacher training and adequate infrastructure. Despite ethical and technological challenges, the studies converge on AI's potential to strengthen inclusive practices, complement pedagogical strategies, and promote educational equity. The study emphasizes the importance of teacher training, continuous evaluation of digital tools, and the adoption of educational policies that encourage responsible use of AI, pointing to future research directions on long-term impacts, comparative analyses across educational contexts, and technological solutions adapted to diversity.

Keywords: Personalized Learning; Educational Equity; Intelligent Technologies; Inclusive Schooling; Teacher Training.

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INTRODUCTION

The digital transformation has brought about significant changes in educational processes, with the use of technological resources standing out as instruments capable of supporting pedagogical practices and enhancing learning. The integration of these resources into the school context makes it possible to develop strategies tailored to students' individual needs, promoting inclusion and equity in access to knowledge (Albertoni et al., 2024).

Inclusive education is understood as the construction of equitable educational opportunities, taking into account the diversity of abilities, paces, and learning styles present in the classroom. Studies indicate that innovative pedagogical practices, supported by educational technologies, help reduce barriers to learning and strengthen processes of social and cognitive interaction (Alves et al., 2024).

Pedagogical planning that values each student's uniqueness enables the personalization of teaching, the adjustment of methodologies, and the fostering of active participation and engagement in the learning process (Amorim, 2025). Moreover, the use of differentiated strategies is associated with the development of cognitive and socio-emotional competencies, broadening the possibilities for meaningful learning (Carvalho et al., 2025).

The effectiveness of inclusive practices also depends on teacher education and preparedness, which directly influence the ability to implement activities mediated by technological resources and to meet each student's needs (Fitas, 2025). Other research highlights that careful pedagogical planning and the adoption of diversified resources help make the educational process more accessible and effective for all students (Freitas et al., 2023).

Pedagogical mediation grounded in digital resources makes it possible to monitor student performance, identify difficulties, and provide appropriate support, consolidating a more flexible, collaborative, and student-centered learning environment (Rios; Schlünzen; Schlünzen Junior, 2025). These practices contribute to building an inclusive education in which the teaching-learning process is adapted to each student's particularities, promoting equity and quality (Marino et al., 2023).

In this context, the purpose of this study is to analyze how pedagogical mediation, through technological resources, contributes to promoting inclusive educational practices, considering the different dimensions of learning and the challenges faced by educators in implementing these strategies.

METHODOLOGY

This is an integrative literature review conducted between November and December 2025, with a qualitative approach and an exploratory-descriptive nature. This type of review enables the gathering, comparison, and synthesis of different types of scientific evidence, fostering a broad and systematized understanding of the phenomenon under investigation, as highlighted by Whittemore and Knafl (2005).

SEARCH PROCEDURES

The searches were guided by the following research question: “How do studies address artificial intelligence as pedagogical mediation in the context of inclusive education?” Data collection was carried out in the following databases: Scientific Electronic Library Online (SciELO), Education Resources Information Center (ERIC), and the Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES Journal Portal).

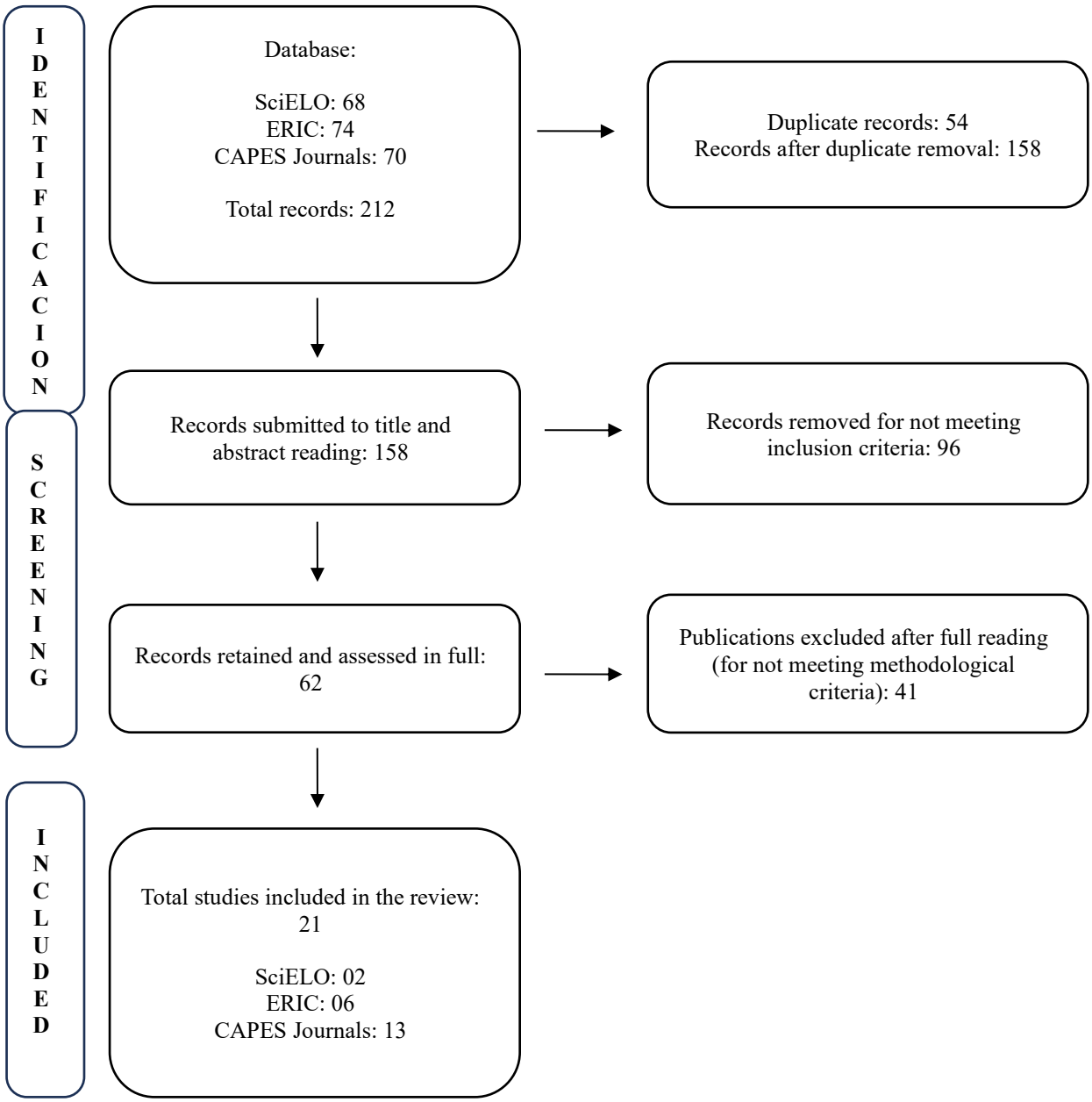
Descriptors in Portuguese and English were used, combined through the Boolean operators AND and OR, including: *(inteligência artificial), (educação inclusiva), (mediação pedagógica), (tecnologias educacionais)*, (artificial intelligence), (inclusive education), (pedagogical mediation), and (educational technologies).

Inclusion and exclusion criteria

Studies published between 2015 and 2025, available in full, that presented a direct interface among artificial intelligence, pedagogical practices, and inclusive education were included. Articles that discussed the role of artificial intelligence in supporting learning, personalizing teaching, and promoting educational inclusion were considered. Duplicate publications were excluded, as were studies with an exclusively technical or computational focus without articulation with the educational field, as well as works that addressed the theme superficially or without connection to the inclusive context.

SELECTION AND CONTENT SAMPLE

The initial search resulted in 212 studies, with 68 publications from the Scientific Electronic Library Online (SciELO), 74 studies identified in the Education Resources Information Center (ERIC), and 70 productions found in the CAPES Journal Portal.



Source: Authors (2025).

After removal of duplicates, 158 publications remained, distributed across the databases consulted. In the title and abstract screening stage, 96 studies were excluded for not meeting the previously established inclusion criteria. Thus, 62 articles were selected for full-text reading.

At the end of the eligibility process, 21 studies fully met the methodological criteria and constitute the final sample of the research, distributed as follows: SciELO = 2; ERIC = 6; CAPES Journal Portal = 13, encompassing national and international works.

ANALYSIS TECHNIQUES

Data analysis was conducted through thematic content analysis, based on Bardin (2016), as it is a systematic and rigorous method that enables the interpretation of meanings present in the selected scientific productions, as shown in Table 1.

Table 1

Stages of the Content Analysis Technique

Analysis Stage	Description	Application in the Study
Pre-analysis	Phase of organizing the material, characterized by skimming and defining the corpus, objectives, and analytical criteria.	An exploratory reading was carried out of the 18 selected studies, aiming at familiarization with the content and initial identification of recurrent ideas related to artificial intelligence and inclusive education.
Corpus constitution	Definitive selection of the documents to be analyzed, ensuring exhaustiveness, representativeness, and relevance.	The corpus consisted of 18 scientific articles, published between 2015 and 2025, selected from the SciELO, ERIC, and CAPES Journal databases.
Material exploration	Encoding stage, in which recording units and context units are identified.	Passages were highlighted that addressed the use of artificial intelligence as pedagogical mediation, inclusion strategies, personalization of learning, and support for students with specific educational needs.
Coding	Process of classifying and grouping data into initial codes according to semantic similarity.	The selected excerpts were organized into codes related to the contributions, challenges, potentialities, and limits of artificial intelligence in the inclusive educational context.
Categorization	Grouping the codes into broader and analytically consistent thematic categories.	The codes were reorganized into thematic categories, allowing for an understanding of recurrent trends in the studies, as well as theoretical and empirical gaps and convergences.
Treatment of results and interpretation	Synthesis of findings, inferences, and interpretation in light of the theoretical framework.	The categories were interpreted based on Bardin's content analysis, enabling an interpretive synthesis of the contributions of artificial intelligence as pedagogical mediation in inclusive education.

Source: Authors (2025).

RESULTS AND DISCUSSION

PERSONALIZATION AND INDIVIDUALIZED LEARNING

The twenty-one selected studies revealed different perspectives on the role of artificial intelligence (AI) in pedagogical mediation within inclusive contexts, highlighting significant advances and challenges to be overcome. Albertoni et al. (2024) conducted an experimental study with elementary school students, using AI systems to monitor performance in reading and mathematics activities, identifying patterns of individual difficulties. The results indicated that students who received personalized activities showed significant improvements in comprehension and content retention, demonstrating that AI can act effectively in differentiated learning. Alves et al. (2024), through qualitative research with interviews with teachers, analyzed how intelligent platforms enable real-time pedagogical adjustments, promoting the inclusion of students with different learning paces. Amorim (2025) studied the implementation of adaptive systems in heterogeneous classes, observing that technology-mediated personalization encouraged student autonomy and protagonism, while Carvalho et al. (2025) assessed students' interaction with AI tools and found increased engagement and motivation in traditionally more challenging subjects.

SUPPORT FOR LEARNING

The support provided by AI for individualized learning was addressed by Carvalho et al. (2025) in a case study on the use of educational chatbots. The authors found that, in addition to answering questions, these tools encouraged collaborative discussions among students, strengthening active learning. Fitas (2025) analyzed accessibility software for students with visual and hearing impairments, highlighting that AI overcame communication barriers and facilitated access to curricular content. Freitas et al. (2023) evaluated systems that recommend adapted pedagogical activities, finding that continuous monitoring of student progress enabled early and personalized interventions. Rios, Schlünzen, and Schlünzen Junior (2025) investigated the application of Universal Design for Learning (UDL) associated with AI in inclusive classes, showing that the combination of inclusive pedagogical strategies and technology promoted greater equity and student participation. Melo-López et al. (2025) analyzed adaptive learning platforms at the university level, showing that detailed monitoring of academic progress made immediate feedback possible, reinforcing adaptive and continuous learning.

PEDAGOGICAL MANAGEMENT AND TEACHER EDUCATION

Goldman et al. (2024) conducted an exploratory study on the impact of AI on teachers' daily routine, showing that automating administrative and grading tasks freed time for pedagogical planning and individualized support. Holman et al. (2024) investigated teacher education programs that included

AI-based simulations, showing that teachers felt more confident in applying inclusive and adaptive strategies in the classroom. Marino et al. (2023; 2024) analyzed the use of large-scale performance analysis algorithms, showing that data processing enabled immediate and precise pedagogical interventions. Li, Yan, and Zeng (2025) examined adaptive systems that automatically adjusted task complexity according to the student profile, observing increased engagement and persistence in challenging tasks. Pagliara et al. (2024) highlighted AI's potential to promote collaborative learning by suggesting pairs and groups based on complementary skills. Finally, Plooy, Casteleijn, and Franzsen (2024) analyzed higher education learning environments, showing that AI contributed significantly to academic performance through personalization and continuous monitoring.

CHALLENGES AND FUTURE PERSPECTIVES

Despite the benefits associated with the use of artificial intelligence (AI) in education, the selected studies—systematized in Table 2—show the presence of significant challenges to its effective implementation. Ribeiro et al. (2024) also conducted a review on teacher training and technological integration, finding that the effectiveness of AI-mediated practices strongly depends on teacher preparedness and pedagogical planning. Smith et al. (2024) studied students' perceptions of AI tools, finding that acceptance and engagement are directly related to clarity of use and interaction with the teacher. Mesquita et al. (2025) explored AI implementation in Specialized Educational Assistance, showing that adaptive activities promote greater independence and confidence among students. Garczón, Patiño, and Marulanda (2025) analyzed international trends, highlighting that countries with technological inclusion policies observe significant gains in personalization and equity. Fitas (2025) reinforced that the structured application of AI in pedagogical practices increases the effectiveness of inclusive learning, while Ribeiro and Lopes (2024) emphasized that, with appropriate pedagogical support, AI decisively contributes to engagement and equity, underscoring that integration among technology, teacher education, and inclusive strategies is essential for educational success.

Table 2

Characterization of the selected studies on challenges and future perspectives of artificial intelligence in inclusive education

Author(s)	Year	Study Title	Methodology	Main Findings
Albertoni, N. R. M. et al.	2024	Inteligência artificial e tecnologias digitais: contribuições para práticas pedagógicas [Artificial intelligence and digital technologies: contributions to pedagogical practices]	Integrative review	Shows contributions of AI to inclusive pedagogical practices, highlighting the potential for teaching personalization.
Alves, D. L. et al.	2024	Impacto da inteligência artificial na educação inclusiva [Impact of artificial intelligence on inclusive education]	Empirical study	Identifies improvements in access and engagement for students with special needs, but points to challenges in infrastructure and teacher training.
Amorim, H. D. de	2025	Educação inclusiva e inteligência artificial: perspectivas e desafios [Inclusive education and artificial intelligence: perspectives and challenges]	Systematic review	Highlights positive perspectives of AI in school inclusion, stressing the need for adequate teacher education.

Assunção; Maia	2025	Use of ChatGPT as a complementary study and teaching tool in medical education	Experimental study	Demonstrates that ChatGPT supports personalized learning, providing pedagogical support in specific contexts.
Fitas, R.	2025	Inclusive education with AI: supporting special needs and tackling language barriers	Empirical study	Shows that AI helps overcome language barriers and address special educational needs, promoting inclusion.
Freitas, E. L. S. X. et al.	2023	Inteligência artificial para educação: um caminho para um campo mais inclusivo [Artificial intelligence for education: a path toward a more inclusive field]	Integrative review	Analyzes how AI broadens access to education, proposing pathways for more inclusive pedagogical practices.
Garczón, J.; Patiño, E.; Marulanda, C.	2025	Systematic review of artificial intelligence in education: trends, benefits, and challenges	Systematic review	Identifies trends in AI use, benefits in personalized learning, and challenges in educational implementation.
Goldman, S. R. et al.	2024	Using AI to support special education teacher workload	Experimental study	Shows that AI reduces teachers' workload, allowing focus on pedagogical strategies and individualized support.
Holman, K. et al.	2024	Navigating AI-powered personalized learning in special education: a guide for preservice teacher faculty	Practice review	Presents guidelines for teacher training focused on AI use in inclusive education.

Li, J.; Yan, Y.; Zeng, X.	2025	Exploring artificial intelligence in inclusive education: a systematic review of empirical studies	Systematic review	Shows that AI facilitates teaching personalization and inclusion of students with special needs, highlighting research gaps.
Lima, A. A. de	2025	Formação docente e inteligência artificial: implicações para a inclusão escolar [Teacher education and artificial intelligence: implications for school inclusion]	Qualitative study	Points out that teacher training in AI is crucial to promote effective inclusive practices.
Marino, M. T. et al.	2023	The future of artificial intelligence in special education technology	Literature review	Shows the potential of AI in assistive technologies, with a positive impact on special education.
Marino, M. T. et al.	2024	Special education administrators use of artificial intelligence (AI) to synthesize data	Case study	Shows that school administrators can use AI for data-driven decision-making, optimizing educational resources.
Melo-López, V.-A. et al.	2025	The impact of artificial intelligence on inclusive education: a systematic review	Systematic review	Shows a positive impact of AI on inclusive learning, especially for adaptive support to students with special needs.
Mesquita, E. S. A. dos et al.	2025	Inteligência artificial como ferramenta de apoio pedagógico no atendimento educacional especializado [Artificial intelligence as a pedagogical	Field study	Indicates that AI offers complementary resources in specialized educational assistance, improving learning outcomes.

		support tool in specialized educational assistance]		
Pagliara, S. M. et al.	2024	The integration of artificial intelligence in inclusive education: a scoping review	Scoping review	Shows the integration of AI in inclusive schools, with emphasis on personalization and monitoring of student progress.
Plooy, E. D.; Casteleijn, D.; Franzsen, D.	2024	Personalized adaptive learning in higher education: a scoping review of key characteristics and impact on academic performance and engagement	Scoping review	Shows that AI-based adaptive learning increases engagement and academic performance, with implications for inclusion.
Ribeiro, G. C. et al.	2024	Inteligência artificial na educação inclusiva: desafios e oportunidades para alunos com necessidades educacionais especiais [Artificial intelligence in inclusive education: challenges and opportunities for students with special educational needs]	Empirical study	Identifies opportunities for inclusion through AI, but points to technological barriers and the need for teacher training.

Ribeiro, V. A.; Lopes, L. A.	2024	Influência do uso da inteligência artificial no ensino [Influence of the use of artificial intelligence in teaching]	Experimental study	Shows that AI strengthens teaching strategies, promoting more individualized and inclusive learning.
Rios, G. A.; Schlünzen, E. T. M.; Schlünzen Junior, K.	2025	[Educação inclusiva com desenho universal para a aprendizagem e inteligência artificial: uma revisão de escopo] Inclusive education with universal design for learning and artificial intelligence: a scoping review	Scoping review	Highlights that universal design allied with AI promotes accessibility and inclusion of all students.
Smith, S. J. et al.	2024	A guide for special education leaders to utilize artificial intelligence: students' perspectives for future consideration	Qualitative study	Points to student perspectives on AI use, helping leaders plan future inclusive practices.

Source: Authors (2025).

The analysis of the selected studies reveals a set of convergences regarding the role of artificial intelligence (AI) in inclusive education. A large portion of the works, such as those by Albertoni et al. (2024), Freitas et al. (2023), and Li, Yan, and Zeng (2025), highlight that AI offers resources for teaching personalization, allowing pedagogical activities to be adapted to students' individual needs, especially those with special educational needs. Complementarily, Fitas (2025) and Melo-López et al. (2025) reinforce that AI helps to overcome linguistic and cognitive barriers, promoting greater inclusion and equity in the learning process.

Beyond personalization, another point of convergence is the importance of teacher education for the effectiveness of AI in inclusive contexts. Studies such as Lima (2025) and Holman et al. (2024) indicate that, although digital technologies offer multiple possibilities, their impact strongly depends on teacher training, evidencing the need for continuous professional development strategies. In this regard, Alves et al. (2024) add that the lack of infrastructure and adequate training still constitutes a significant barrier, despite AI's potential.

In terms of practical impacts, empirical studies such as those by Assunção; Maia (2025), Goldman et al. (2024), and Ribeiro et al. (2024) converge in showing that AI reduces teachers' workload and supports specialized educational assistance, freeing teachers to focus on more meaningful pedagogical strategies. This evidence is reinforced by Mesquita et al. (2025), who show that AI acts as a complementary tool, strengthening adaptive teaching and broadening the reach of inclusive practices.

Despite these convergences, some studies present divergent perspectives or unresolved challenges. For example, Garczón, Patiño, and Marulanda (2025) highlight that AI implementation still faces ethical and technological challenges, while Rios, Schlünzen, and Schlünzen Junior (2025) emphasize that, even with universal design for learning, not all AI solutions equally serve all students, indicating the need for flexible, contextually adjusted solutions. Smith et al. (2024) also point to divergences in students' own perceptions of AI use, suggesting that technology should be constantly evaluated and adapted according to students' real needs.

Finally, a complementarity is observed between review studies and empirical studies. Reviews such as those by Pagliara et al. (2024) and Amorim (2025) provide a broad synthesis of AI trends and benefits, while field and experimental studies, such as those by Marino et al. (2023, 2024) and Plooy, Casteleijn, and Franzsen (2024), offer concrete evidence of application, allowing a better understanding of impacts on learning, engagement, and inclusion. This interplay between theory and practice reinforces the topic's relevance and points to future research paths, especially regarding teacher training, ethical monitoring, and contextual adaptation of technology.

In summary, the discussion indicates that AI has significant potential to promote inclusive education, but its effectiveness depends on factors such as teacher training, infrastructure, student perceptions, and continuous evaluation of the tools implemented. The studies complement one another by showing that technology, when used strategically and consciously, can transform pedagogical practices, increasing equity and personalization of learning.

CONCLUSION

In short, this study shows that artificial intelligence plays a relevant role in promoting inclusive pedagogical practices, fostering teaching personalization, student engagement, and individual protagonism. The present study aimed to analyze how artificial intelligence acts as pedagogical mediation in the context of inclusive education, considering the possibilities for learning personalization, support for the educational process, and the challenges faced by teachers and institutions.

The results indicate that AI makes it possible to adapt content and activities to students' specific needs, especially those with special educational needs. Intelligent educational technologies promote increased autonomy, reinforcement of learning, and reduction of teachers' administrative workload,

allowing greater focus on pedagogical planning and individualized follow-up. It is emphasized that the effectiveness of implementation depends directly on continuous teacher training and adequate infrastructure—factors essential for AI to be an effective instrument of inclusion.

The research also reveals convergences among different studies: despite ethical and technological challenges noted in some publications, there is consensus about AI's potential to strengthen inclusive practices, complement pedagogical strategies, and foster equity in the teaching-learning process. The integration between theoretical reviews and empirical studies provides a more robust understanding of the opportunities and limitations of technology in inclusive education.

As contributions, the study reinforces the need for teacher training, continuous evaluation of digital tools, and implementation of educational policies that promote the responsible and strategic use of AI. In addition, it points to paths for future research, including analyses of AI's long-term impacts on students' socio-emotional development, comparative studies across different educational contexts, and exploration of technological solutions tailored to multiple learning profiles, respecting classroom diversity.

In summary, the research shows that artificial intelligence—when used consciously, in a planned manner, and articulated with inclusive pedagogical practices—has transformative potential, promoting equity, teaching personalization, and expanding learning opportunities for all students.

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