Revista InovaEduTech
INOVAÇÃO EM EDUCAÇÃO, ENGENHARIA E COMPUTAÇÃO

Revista InovaEduTech
Ibiá - MG
v.1 n.2 p.23-50
Jan/Dez

ISSN – 3085-6558

MATHEMATICS AND INCLUSION*
THE POTENTIAL OF GAMIFICATION IN EARLY CHILDHOOD EDUCATION

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ABSTRACT

Early childhood education is an essential stage for children's cognitive and social development, characterized by intense processes of maturation, construction and deconstruction of thought. In this context, the teacher plays a central role in mediating learning through appropriate strategies, resources and methodologies. Rethinking pedagogical practices and teacher training becomes fundamental, especially when the aim is to promote the inclusion of students who are the target public of Special Education. This article proposes gamification as a methodological resource in the teaching of inclusive mathematics, through qualitative, exploratory research with a bibliographic approach. The analysis of recent publications, together with contributions from classical authors, evidenced that gamification favors student engagement, motivation and meaningful learning, especially for those with specific educational needs. The results indicate that this playful approach contributes to the development of autonomy, stimulates socialization and enhances collaborative teaching, consolidating itself as an effective inclusive strategy in the context of Early Childhood Education.

Keywords: Gamification; Early Childhood Education; Special Education; Inclusive Mathematics; Playful Teaching.

* Submitted in17/07/2025 - accepted in 29/10/2025

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1 INTRODUCTION

Each stage of child development represents a fundamental pillar in the child's formation, but it is in Early Childhood Education that the teaching–learning process assumes an especially decisive role. This initial phase of the educational trajectory is marked by the intensity of discoveries, by the construction of new knowledge and by the maturation of skills that will be essential throughout school and social life. It is during this period that the child is most receptive to experiences and environmental stimuli, developing in multiple dimensions: intellectual, cognitive, emotional, affective, psychomotor and social.

The educational environment, therefore, should not be limited to activities centered on memorization or the mechanical repetition of standardized exercises. It needs to be conceived as an intentional and provocative space where pedagogical practices awaken the child's interest and favor the development of logical thinking, creativity and autonomy. Such elements are essential for the student to advance in the construction of knowledge, especially in structuring areas such as mathematics. The National Common Curricular Base (BNCC), when defining the fields of experience for Early Childhood Education, values these aspects by proposing axes that involve the self, the other and the collective; body, gestures and movements; lines, sounds, colors and shapes; listening, speaking, thinking and imagination; and spaces, times, quantities, relations and transformations (Brasil, 2017).

The teaching of mathematics in Early Childhood Education aims to expand learning capacity and deepen world knowledge at this initial stage of Basic Education. In this process, both teaching and learning are configured as continuous spaces of reflection and construction of knowledge. During activities, when interacting with children, the teacher not only promotes collective work but also constantly seeks to challenge them, encouraging their curiosity to explore, carry out and solve the various proposed situations. In this process the teacher acts as mediator and provocateur of learning, organizing experiences that stimulate logical reasoning and the construction of mathematical thinking.

Moreover, this teaching should be understood not merely as the introduction of a set of operations or rules, but as a language that enables the child to perceive, organize and comprehend the world around them. Mathematics at this stage should

Revista InovaEduTech Ibiá - MG, v.1 n.2 p. 23-50, Jan/Dez – DOI 10.63103/k6g8b944 e-ISSN 3085-6558

be experienced in a meaningful, contextualized and playful manner, promoting situations in which the student feels motivated to investigate, formulate hypotheses, experiment and solve real problems.

The insertion of games and play that break with traditional teaching becomes a powerful resource. When well planned, these playful practices enhance the child's involvement with knowledge, allowing them to learn while having fun. In Early Childhood Education, the creation of playful and creative games and activities that depart from the traditional method enables active learning for students. According to Gonçalves et al. (2024):

> "Play is essential for the child's development and well-being as a creative and pleasurable act. In recent years, education has sought ways to integrate playful practices into the teaching–learning process, recognizing that play is not merely a recreational activity but a fundamental tool for the integral formation of the individual"
> (Gonçalves *et al*. 2024, p. 25):

In this context, the teacher's role is paramount. It is their responsibility to develop a variety of pedagogical practices, such as selecting appropriate materials, proposing challenges, encouraging peer interaction and promoting moments of reflection, dialogue and meaningful exchanges. The diversity of concrete materials and pedagogical strategies enriches the process because it allows the student to observe, analyze, associate and relate different pieces of information, elaborating concepts even about themes that are still unknown or not yet mastered. Thus, teaching becomes a living, dynamic process centered on the learner.

The methodology adopted by the teacher therefore directly influences how the child learns and engages with content. When pedagogical practice is rigid, decontextualized and unstimulating, learning can become a negative experience, generating disinterest, frustration and even rejection of the subject. On the other hand, when teaching is meaningful, contextualized and challenging, it awakens in the student the desire to learn, investigate and overcome obstacles, transforming the act of learning into a pleasurable, productive and engaging experience in their learning process.

This care must be even more present when dealing with the target public of Special Education, composed of students with disabilities, global developmental disorders and high abilities/giftedness (Brasil, 2011). These students often face additional obstacles in the school environment, ranging from the absence of adequate resources and adaptations to exclusionary attitudes that compromise their retention

and participation in pedagogical activities.

According to the National Policy on Special Education from the Perspective of Inclusive Education, it is the school's duty to guarantee not only access but also retention, participation and learning for these students (Brasil, 2011). Thus, additional efforts are required from educational institutions to ensure not only material permanence—through resources, specialized services and adapted materials that promote equity in the teaching–learning process—but also symbolic permanence, which relates to overcoming attitudinal barriers within the school environment (Sommer, 2020).

School inclusion, however, is not exhausted by mere enrollment. Gattermann (2021) warns of the phenomenon of in/exclusion, which reveals the contradiction of practices that claim to be inclusive but in reality keep subjects at the margins of the educational process. This occurs when students are physically placed in the school space but do not find real conditions for participation, whether due to lack of accessibility or the absence of methodologies that respect their specificities.

In this sense, Gattermann (2021) emphasizes that "the perverse side of school inclusion lies in democratizing access to school but not enabling those deemed different to remain in it." Supported by Dal'Igna's analysis (2007 apud Gattermann, 2021), the author points out the "perverse side of school inclusion," in which the right of entry into school is guaranteed, but not qualified retention and academic success for all students.

Given this scenario, it is necessary that the discourse of inclusion be accompanied by effective, intentional and planned practices, especially in mathematics, the focus of this study. For this purpose, it is believed that gamification—understood as the application of game elements in educational contexts—can represent an innovative and inclusive methodological strategy. By promoting engagement, collaboration, problem solving and motivation, gamification contributes not only to the development of mathematical skills but also to the construction of interpersonal relationships and the strengthening of students' self-esteem.

Therefore, it is recognized that teacher training is essential for the review of school practices and the improvement of methodological aspects, with a view to building truly meaningful learning.

Fostering an environment that values the exchange of experiences, dialogue

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and critical reflection on pedagogical practices is essential for teachers' professional development. In this sense, by investing in the continuing education of their educators, educational institutions not only strengthen their teams but also raise the quality of teaching, promoting the integral development and success of all students, in line with the principles of inclusive education (Mantoan, 2021).

It is also important to highlight that teacher education, through continuing professional development, plays a central role in this process by enabling the construction of a school environment that values the exchange of experiences, dialogue and reflection on pedagogical practices. As Lima Rodrigues and Rodrigues (2024) assert, continuing professional development is essential for educators to develop competencies to recognize diversity and promote a truly inclusive learning environment.

This training must be continuous and aligned with the real needs of schools and teachers in a critical and reflective way. Thus, it will be possible to review exclusionary practices, reframe pedagogical planning and ensure that all students, with or without disabilities, have access to quality education. By investing in teacher training, schools not only strengthen their teaching staff but also improve the quality of teaching, directly benefiting the development and success of all students, in accordance with the inclusive approach. Investing in teacher training is therefore investing in the transformation of the school, making it fairer, more welcoming and more democratic (Lima Rodrigues; Rodrigues, 2024).

Thus, this literature-based study aims to understand how gamification can be incorporated into pedagogical work with students targeted by Special Education, especially in the context of mathematics teaching in Early Childhood Education, analyzing its potential as an inclusive strategy that promotes engagement, meaningful learning and the appreciation of differences.

Early Childhood Education represents a crucial phase in the cognitive, emotional and social development of children, being fertile ground for pedagogical experiences that promote meaningful learning. In this context, the teacher's action is fundamental, especially regarding the choice of methodologies that meet the specificities of each student.

When it comes to the target public of Special Education, the need for inclusive and adapted practices becomes even more evident, requiring strategies that expand

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possibilities for participation and development. Gamification, by its playful and interactive nature, emerges as a promising alternative to engage these students in the process of mathematical learning, a field that often presents barriers.

Given this scenario, the motivation for this research arises from the urgency to rethink pedagogical practices that consider diversity and enhance learning for all, contributing to a more equitable, inclusive and meaningful education.

2 METHODOLOGY

This is a study with a qualitative approach, of an exploratory nature and using a bibliographic procedure. The methodological choice is based on the need to understand how gamification can be incorporated as an inclusive pedagogical strategy in the teaching of mathematics for students who are the target audience of Special Education in Early Childhood Education.

Data collection was carried out through the analysis of scientific publications available in databases such as SciELO, CAPES Journals, and Institutional Repositories. Legal documents and studies published in the last ten years were considered, as well as classical authors in the fields of Education, school inclusion, and playful methodologies.

The analysis followed a thematic organization aligned with the research objectives, considering: the foundations of gamification, inclusive pedagogical practices, the challenges of Special Education, and the role of the teacher in mediating the learning process.

3 OBJECTIVES

The main objective of this research is to investigate the use of gamification as a methodological strategy in the development of mathematical skills of students who are the target audience of Special Education in Early Childhood Education. To address this purpose, the following specific objectives were defined:

- To analyze, through the literature, the theoretical and pedagogical foundations of gamification applied to Early Childhood Education and Special Education;
- To identify the main benefits and challenges of using gamification in the teaching of mathematics for children with special educational needs;

- To reflect on teacher training and inclusive pedagogical practices in the context of Early Childhood Education;
- To propose recommendations for the use of gamification as a tool for inclusion and stimulation of mathematical development among students in Special Education.

4 THEORETICAL FRAMEWORK

The construction of inclusive pedagogical practices in Early Childhood Education requires a foundation in theories and evidence that support innovative and accessible methodologies. In this context, gamification has gained prominence for its potential to make the teaching-learning process more dynamic, interactive, and student-centered.

This theoretical framework discusses the contributions of gamification as a methodological strategy aimed at students who are the target audience of Special Education, seeking to understand how this approach can promote the development of mathematical, cognitive, and socio-emotional skills. To this end, studies and authors who address the relationship between inclusion, playfulness, meaningful learning, and the teacher's role in this process are considered.

4.1 Evidence on the Contribution of Gamification as na Inclusive Methodological Strategy

Gamification has been widely investigated in various academic works in Brazil, standing out as a methodological strategy with great potential to promote engagement, motivation, cooperation, autonomy, and the cognitive and social development of children, both with and without disabilities. Specifically regarding the target audience of Special Education, some studies highlight its relevance in the educational context, demonstrating that gamification is a tool capable of significantly contributing to the comprehensive and healthy development of these students (Merotto et al., 2024).

The search for approaches that foster student engagement in mathematical learning has encouraged the use of active methodologies. Among them, gamification stands out as a promising tool for making classes more interactive and engaging.

According to Silva et al. (2023), gamification can be an effective strategy to assist mathematics teachers, as long as the activities are aligned with pedagogical objectives and the students' needs. This approach promotes student autonomy, encourages protagonism in the construction of knowledge, and stimulates learning through meaningful experiences.

Still within the context of active methodologies, problem-based learning also proves compatible with gamified proposals, since both stimulate critical thinking, the solving of challenges, and the active participation of students in the teaching-learning process. These characteristics are especially valuable in inclusive contexts, where respect for different learning paces and styles is essential.

4.2 Mathematics Education and the Challenges of School Inclusion

Inclusive education in mathematics teaching requires a reconfiguration of traditional pedagogical practices, considering the specificities of students who are the target audience of Special Education and other historically marginalized groups. As emphasized by Silva Cruz et al. (2020), inclusion transcends the boundaries of Special Education and also encompasses sociocultural and identity issues. The authors warn of the creation of exclusionary boundaries based on clinical diagnoses, which tend to label and marginalize students with disorders, even when inclusion is defended in discourse. These boundaries manifest through practices such as generalized adaptations, the centrality of deficits, and the blaming of learning processes which, rather than integrating, reinforce exclusion. This context highlights the urgency of pedagogical proposals that value each student's individuality and break with uniform practices.

From this perspective, the study by Marques, Miranda, and Duarte (2025) stands out for investigating the use of adapted games to promote the inclusion of students with disabilities in the school environment. The authors observed that both digital games, due to their flexibility, and board games, for their promotion of social skills, are effective for educational inclusion. They concluded that these tools significantly transform the educational experience of students with disabilities, fostering more inclusive and equitable learning environments that are essential to ensuring equal opportunities and encouraging the full development of all children.

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Nascimento (2017) highlights that gamification promotes social interaction and peer cooperation—fundamental elements in building a truly inclusive school culture. His study demonstrates that the use of gamified games in classes composed of students with disabilities enhances teamwork, mutual respect, appreciation of diversity, and the strengthening of interpersonal bonds, in addition to providing a more enjoyable and meaningful learning experience.

Corroborating this perspective, Sousa, Araujo, and Santana (2025) analyzed the impact of gamification on the inclusive learning process, exploring how the use of game elements can transform the educational experience, making it more accessible, motivating, and personalized. The authors emphasize that gamification offers opportunities for students to develop cognitive and social skills, promoting a more inclusive and equitable educational environment.

Additionally, Lima et al. (2023) investigated teachers' perceptions regarding the role of gamification in promoting school inclusion for students with disabilities. The results revealed that teachers recognize gamification as an effective strategy to foster active student participation, ensuring that everyone feels valued and included in the educational process.

Rodrigues (2021) also demonstrated engagement and motivation as outcomes of his research, observing that gamification significantly increases students' interest in school activities, especially among those with special educational needs.

When developing a gamified software designed to teach mathematics to children with Autism Spectrum Disorder (ASD), the author observed increased motivation, autonomy, engagement, and cognitive development among this group. He also argues that gamified activities must be pedagogically intentional and well-structured, stating that "[…] appropriate dynamics and correct strategies are excellent tools that can be used in inclusive education practice" (Rodrigues, 2021, p. 32).

In the case of students with high abilities/giftedness, stimulation is also essential. Although these students have distinct needs, they benefit from enrichment activities that promote autonomy, creativity, and personal interest, particularly in mathematics education.

Students with high abilities/giftedness require pedagogical practices that transcend traditional teaching, valuing autonomy, creativity, and individual interests. In this sense, resources such as gamification can be used as enrichment strategies, since

they foster student engagement through challenges, goals, and interactive activities, promoting skills such as cooperation, critical thinking, and problem-solving. Recent studies indicate that the implementation of dynamic and personalized approaches is fundamental to addressing this group's specificities, contributing to their integral development within the school context (Santos & Barreto, 2022; Pfeiffer, 2021).

In this regard, the need to align the educational process with new digital technologies corresponds with studies in computer education, which indicate that students tend to learn more effectively when technology-based approaches are used. For autistic children, for example, digital games serve as motivators for learning, as they are perceived as enjoyable activities, facilitating attention to content presented through gamification (Rodrigues & Clauss, 2022).

However, according to Rodrigues and Clauss (2022), the adoption of these technologies in education still faces numerous obstacles. Many schools lack adequate infrastructure or trained teachers capable of working with such tools, especially in early childhood education for students with specific needs. Furthermore, unequal access to digital technologies perpetuates barriers that hinder the realization of school inclusion. Although some initiatives represent significant progress, the accelerated pace of scientific and technological development demands that schools keep up with these changes, lest they miss the opportunity to prepare future generations for an increasingly digital and demanding world.

In this scenario, gamification stands out by introducing an explicit layer of interest and by integrating elements that create a language close to the everyday experience of individuals immersed in digital culture. This contributes to making the educational process more effective and enjoyable, particularly for students who are the target audience of Special Education in early childhood (Rodrigues & Clauss, 2022).

In the context of Early Childhood Education, Mendes et al. (2020) highlighted the motivation and active participation of students when transforming the classroom into a gamified environment. The proposal was based on playful and challenging elements that stimulated student involvement in learning activities.

Moran (2022) complements this perspective by stating that, for generations accustomed to games, the language of challenges, rewards, competition, and cooperation is naturally appealing and easily understood. According to the author:

> For generations accustomed to playing, the language of challenges, rewards, competition, and cooperation is attractive and easy to perceive. Collaborative and individual games—of competition and collaboration, of strategy, with well-defined stages and skills—are increasingly present across various areas of knowledge and levels of education. (Moran, 2022, p. 5).

In Early Childhood Education, where experiences and learning are grounded in play, the use of game-based language makes the environment dynamic, enjoyable, and stimulating. As Lima and Rodrigues Barbosa (2024, p. 26) state, “learning becomes meaningful, since gamification challenges the child to compete and pursue goals.”

It is evident, therefore, that the authors converge in recognizing the significance and applicability of gamification as a pedagogical tool capable of stimulating student development. Furthermore, no studies have been identified that report negative effects associated with the use of gamification as a methodological resource with students who are the target audience of Special Education.

However, it is known that high-quality teaching requires adequate training and constant professional development. The use of gamification as a pedagogical strategy demands planning, study, and intentionality on the part of the teacher. Carvalho (2018) underscores this necessity by developing an illustrated pedagogical manual for implementing gamification in teacher training. The results of her research indicated significant changes in teaching practice, including the creation of lesson plans focused on the literacy of students with intellectual disabilities, aligned with the inclusive perspective.

In this sense, the qualified use of gamification requires the continuous improvement of teachers, especially in contexts involving collaborative and inclusive learning. Nonetheless, it is necessary to break with the paradigms that still permeate traditional pedagogical practice and limit the adoption of more dynamic and innovative methodologies.

Furthermore, Rambo and Fernandes (2020, p. 82) reinforce this perspective, stating that: “Once the idea of segregation has been overcome, research shows that the inclusion of students with different special needs in regular classrooms is now recognized as essential for preparing them for life in society.”

However, they caution that inclusion still remains, in many contexts, confined to academic discussions and scientific works, without materializing in the everyday

practice of schools. Among the main obstacles identified is the initial and continuing education of teachers, which often fails to address the necessary competencies for working with inclusive and technological methodologies (Rambo & Fernandes, 2020).

Therefore, within the framework of active methodologies, learning proves compatible with gamified proposals, as they stimulate critical thinking, the solving of challenges, and the active participation of students in the teaching-learning process. These characteristics are especially valuable in inclusive contexts, where respect for different learning rhythms and styles is fundamental.

4.3 The Role of Digital Games and Teacher Mediation in Inclusion

Digital games significantly expand didactic possibilities in the teaching of mathematics—especially in Early Childhood Education—by fostering interactivity, playfulness, and personalized learning. However, for these resources to effectively contribute to students' development, particularly those who are the target audience of Special Education, the intentional and mediating role of the teacher is essential.

As emphasized by Alves de Oliveira and Ferreira (2021), the teacher must adopt an investigative and planning-oriented stance, capable of selecting games that incorporate solid learning principles, are aligned with the curriculum, and capture students' interest while respecting their individualities.

In this sense, the use of games should not be random or merely recreational. The application of gamification in pedagogical practice must be articulated with educational goals, focusing on cognitive development and the promotion of inclusion. Teacher mediation thus becomes essential to ensure that interactive environments truly contribute to mathematical learning while guaranteeing equitable access to content for all students.

This requires teachers not only to master technological and playful tools but also to possess a critical understanding of the attitudinal, pedagogical, and structural barriers that still persist in the school environment.

By integrating the principles of gamification with those of inclusive education, teachers can design pedagogical proposals that are more sensitive to the specific needs of students, promoting multiple forms of expression, participation, and assessment. As pointed out by Silva Cruz et al. (2020), a critical perspective is

necessary so that inclusion does not become limited to compliance with norms or superficial adaptations but truly represents an emancipatory process. Teacher mediation is therefore decisive to ensure that gamification functions as a transformative tool, recognizing the different ways of learning and interacting with mathematical knowledge.

Finally, gamified pedagogical practices fulfill their inclusive purpose only when they avoid standardization and break with the logic of homogenization in teaching. By embracing diversity as a central value in educational planning, the teacher transforms the school environment into a space of belonging—where all students, with or without disabilities, can actively participate and fully develop their potential.

4.4 Challenges of Breaking Paradigms in Teacher Training in Minas Gerais

Teacher training programs offered by educational institutions foster the ongoing pursuit of knowledge enhancement. In the state of Minas Gerais, Law No. 20.592 of 2012 guarantees teachers a paid workload reserved exclusively for extracurricular activities:

> **Art. 33. § 1.** The weekly working hours of the Basic Education Teacher shall include:
>
> I- Sixteen hours dedicated to teaching;
> II- Eight hours dedicated to extracurricular activities, distributed as follows:
> a) four hours per week in a location freely chosen by the teacher;
> four hours per week at the school itself or another location defined by the school's administration, with up to two hours per week devoted to meetings. (Minas Gerais, 2012, p. 04).

This mandatory workload ensures teachers have dedicated time for extracurricular activities such as grading, lesson planning, and completing class records. Within these hours, time is also allocated for continuing education meetings.

Although teacher training is widely recognized for its importance, its organization and systematization still raise concerns, especially in traditional schools. According to Villas Boas (2017), in such institutions, training sessions often occur passively, typically organized and led by administrators or supervisors. These meetings generally focus on studying regulations and guidelines from the Department of Education, analyzing external evaluations, assessing proficiency levels, reviewing assessment itineraries, and handling bureaucratic demands. In such dynamics, the

focus falls on teacher performance, requiring greater effectiveness in the classroom to ensure the consolidation of skills and competencies.

Villas Boas (2017, p. 15), when discussing the organization of pedagogical work, associates this passivity with societal structures and makes the following observation about teachers:

> Teachers receive ready-made materials to merely apply: pedagogical proposals, projects, evaluation tools, educational packages […] they make the textbook their work plan, without researching other information.

Furthermore, there is a gap in the preparation of administrative teams to conduct continuing education for teachers, which often ends up being limited to bureaucratic topics and neglects discussions about methodologies that value student protagonism. Peres (2023, p. 136) emphasizes: “It is important to recognize the need for training programs that encourage the inclusion of active methodologies in the educational environment as tools to transform teaching into a dynamic and challenging process.”

The author also points to the urgency of investing in specific training policies for pedagogical coordinators.

Another obstacle to consider is resistance to change. Breaking paradigms and dismantling long-established models embedded in the methodologies of traditional teachers is not an easy task. Many educators show reluctance to review and modify their methods, often justifying that these are based on years of professional experience and classroom practice.

With the implementation of the National Common Curricular Base (BNCC) and the Reference Curriculum of Minas Gerais, there has been greater investment in continuing education for adaptation to the new guidelines. One of the BNCC’s main goals is to foster student protagonism and autonomy, as students today—having broad access to information—are more capable of investigating and constructing their own knowledge (Brasil, 2017).

In this context, active methodologies have gained ground, challenging the traditional model in which students passively receive content through lectures and limited participation.

> Thus, in contrast to the traditional method, where students adopt a passive stance toward the reception of theories, the active method proposes the opposite movement: students are understood as historical subjects who assume an active role in learning, since their experiences, knowledge, and opinions are valued as starting points for knowledge construction (Diesel, Baldez, Martins, 2017, p. 271).

However, the adoption of active methodologies requires not only their practical application but also a theoretical deepening of their foundations, goals, and purposes. These aspects must be discussed and understood in teacher training. The use of resources and methods without sufficient understanding compromises their effectiveness, reduces the likelihood of successful outcomes, and hinders the improvement of students' proficiency levels.

> It is necessary to know where one wants to go with an activity—its learning objective, the student's needs, and how they learn the content. Using active methodologies merely for their own sake, without understanding their meaning and purpose, may lead the teacher to apply an "active" method that ends up being ineffective within its own proposal. (Carotenuto; Pereira, 2020, p. 05)

Breaking with traditional models still so prevalent in schools—as well as reviewing didactics, resources, materials, and the very conduct of training sessions—represents a major challenge and demands stepping outside one's comfort zone. Pedagogical work, being systematic, requires a broad understanding of its processes, which implies engagement, commitment, and proactivity. For this transformation to occur effectively, it is essential to promote dialogue, critical reflection, and the appreciation of teaching work.

In addition to the challenges already mentioned, implementing educational transformation faces even more complex obstacles. One of the main ones is the need for a profound cultural shift within schools, which are often rooted in traditional teaching models. Although these models were effective in certain historical contexts, they are frequently insufficient to meet the demands of contemporary society.

Traditional school culture tends to value the unidirectional transmission of content, with little interaction and student participation. However, this approach proves inadequate in a dynamic world that demands the development of skills such as critical thinking, problem-solving, and collaboration.

Another sensitive issue concerns continuing education for teachers to improve inclusive practices, particularly when working with students who are the target audience of Special Education.

Mantoan (2021) notes that, during teacher training courses, educators often express uncertainty with statements such as "I don't know how to teach that child" or "I wasn't/am not prepared for this work." According to the author:

> They expect preparation to teach students with disabilities or learning difficulties and behavioral problems—in other words, training that allows them

> to apply pre-defined pedagogical schemes in their classrooms, ensuring solutions to the challenges they assume exist in so-called inclusive schools. Many of these professionals view training as just another extension or specialization course, with a certificate that validates their capacity to be an inclusive teacher. (Mantoan, 2021, p.42).

Another challenge lies precisely in continuing education for improving inclusive practices, particularly when working with students who are the target audience of Special Education.

Therefore, overcoming paradigms in teacher training in Minas Gerais goes beyond the mere adoption of active methodologies. It requires a deep revision of the beliefs and values that shape the school environment. This process involves recognizing dialogue, experimentation, and reflection as essential pillars for building a more meaningful and transformative educational practice.

Furthermore, it is crucial to invest in the training of school administrators and pedagogical coordinators, equipping them to lead processes of change and foster a culture of innovation and continuous learning in educational institutions.

It is worth noting that implementing significant transformations in the educational system does not happen overnight. It is a process that demands time, effort, and above all, a collective commitment to improving educational quality. Only through a collaborative, reflective, and proactive approach will it be possible to confront existing challenges and build a more inclusive, participatory, and holistic school environment for student development.

Thus, overcoming paradigms in teacher training in Minas Gerais is not limited to incorporating new methodologies. It requires the revision of ingrained values and beliefs, the strengthening of pedagogical leadership, and the construction of a school culture based on dialogue, experimentation, and innovation.

Finally, it is essential to recognize that profound educational transformations do not occur immediately. They require time, collective effort, and a constant commitment to improving teaching quality. Only through a collaborative and engaged approach will it be possible to build a more inclusive, participatory, and student-centered school oriented toward holistic development.

This study is characterized as qualitative research of an exploratory nature, having bibliographic research as its main methodological procedure. This distinction is important: the exploratory aspect refers to the objective of the research—to investigate and deepen understanding of a topic that has been little addressed in an integrated

way, such as the use of gamification in mathematics teaching for students who are the target audience of Special Education in Early Childhood Education. The bibliographic research, in turn, refers to the method employed, that is, the analysis of previously published scientific works on the topic.

The research is considered exploratory because it aims to provide greater familiarity with the problem, clarify concepts, and raise possible hypotheses in a field where studies are still incipient. According to Gil (2010, p. 27), exploratory research aims to "develop, clarify, and modify concepts and ideas, with a view to formulating more precise problems or researchable hypotheses."

The choice of bibliographic research, as also guided by Gil (2010), allowed for the identification, analysis, and synthesis of the main studies already produced on the subject, fostering a critical dialogue among the authors. Academic works published recently—mostly between 2020 and 2025—were selected, prioritizing articles, books, dissertations, official documents, and classical authors who directly addressed the relationship between gamification, school inclusion, mathematical development, and teacher training.

Data collection was carried out through databases such as Scielo, the CAPES Journal Portal, and the Journal of Mathematics Education, using descriptors combined with Boolean operators such as "Early Childhood Education," "gamification," "special education," "mathematics," and "inclusive methodology." Materials were selected based on criteria of thematic relevance, timeliness, scientific merit, and contribution to the educational field.

Data analysis was guided by a critical and interpretative approach, anchored in the theoretical-methodological framework of qualitative research. The systematization of the corpus made it possible to identify recurring thematic axes in the studies, which were later discussed in light of current educational legislation, the principles of inclusive education, and the theoretical foundations of gamification as a pedagogical tool.

Mathematics teaching, in turn, constituted a specific focus of this investigation, being analyzed as a language that enables the child to organize the world, solve problems, and develop logical reasoning from the earliest school years. Gamification, in this sense, was examined as a resource that enhances the teaching of this area of knowledge through playful, personalized, and motivating experiences in Special Education.

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Thus, the study sought to ensure scientific rigor, conceptual precision, and analytical consistency necessary to support its conclusions, while respecting the ethical principles of academic research and contributing to expanding discussions on innovative and inclusive methodologies in Early Childhood Education.

4.5 Practical Examples of Gamification Adapted to Special Education

There are several practical possibilities for applying gamification in the context of Early Childhood Education, especially when it comes to serving students who are the target audience of Special Education. The following are examples of adapted strategies that can be incorporated into the school routine:

Mathematical Sensory Path Game: This activity consists of a tactile board with different textures, colors, and shapes, where children advance spaces by solving simple operations or identifying quantities. It is particularly effective for students with visual impairments or Autism Spectrum Disorder (ASD), as it integrates multisensory stimuli and predictable actions.

Challenge Cards with Positive Reinforcement: These cards feature short, context-based math problems adapted with pictograms or concrete figures. Reinforcement can come in the form of symbolic praise, medals, or stamps. This strategy benefits students with intellectual disabilities by making mathematics more relatable and understandable.

Point System for Collaboration: The focus is not only on individual achievement but also on teamwork. Students earn collective points for helping one another, promoting socialization and collaborative learning while developing socioemotional skills.

Use of Accessible Gamified Apps: These digital tools offer mathematical challenges in playful formats. With interface and audio adaptations, they can be used with students who have hearing impairments or learning difficulties.

When applied with pedagogical intentionality and sensitivity to each student's individual needs, these strategies not only promote mathematical development but also strengthen children's sense of belonging, autonomy, and motivation in the process of school inclusion.

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5 DATA ANALYSIS AND DISCUSSIONS

The analysis of the documentary corpus revealed that gamification has stood out as a promising inclusive methodological strategy, especially when applied to the teaching of mathematics in Early Childhood Education and the early years of schooling.

The data indicate that its adoption encourages the creation of more dynamic, accessible, and responsive learning environments that address the needs of students who are the target audience of Special Education. Sousa, Araujo, and Santana (2025) emphasize that by incorporating game elements—such as challenges, rewards, and missions—the educational process becomes more motivating and personalized, promoting not only learning but also the development of social and cognitive skills.

Rodrigues (2021) reinforces that gamification, when associated with clear pedagogical intentionality, can lead to significant advances in autonomy, engagement, and performance among children with Autism Spectrum Disorder (ASD). Similarly, Santos and Barreto (2022) and Pfeiffer (2021) point out that students with high abilities/giftedness also benefit from this methodology, as it allows for task diversification and higher levels of challenge, fostering creativity and critical thinking.

However, the results also reveal significant limitations to the large-scale consolidation of this practice. According to Rodrigues and Clauss (2022), the lack of adequate infrastructure and the insufficient preparation of teachers to mediate gamified environments compromise the effectiveness of such proposals, especially in public schools.

Furthermore, Lima et al. (2023) report that many teachers, despite recognizing the potential of gamification, still apply it sporadically and without alignment to curricular objectives, which reduces its pedagogical impact.

Another critical issue concerns the symbolic and cultural barriers still present in teaching practices. Silva Cruz et al. (2020) warn that the use of active methodologies can be ineffective—or even counterproductive—if not accompanied by a critical stance on the part of educators, particularly when there is a tendency to label students with disabilities or to apply generic curricular adaptations.

Thus, the data confirm that gamification is a tool with high inclusive potential, but its effectiveness depends directly on continuous teacher training, institutional commitment to pedagogical innovation, and the overcoming of paradigms deeply

rooted in school culture. Its use must therefore be part of a collective and intentional pedagogical project that is sensitive to the diversity of the educational context.

In the context of Early Childhood Education, the analysis revealed that gamification assumes an even more significant role because it directly dialogues with the playful universe that characterizes childhood. Mendes et al. (2020) demonstrated that, even without the use of digital media, it is possible to gamify classroom routines by incorporating elements such as rules, goals, challenges, and symbolic rewards. This approach stimulates children's active participation, promoting concentration, teamwork, and enjoyment in the learning process.

Complementing this view, Lima and Rodrigues Barbosa (2024) stress that gamification makes learning more meaningful by challenging children to pursue goals, build solutions, and interact cooperatively with peers. Moran (2022) adds that the current generations are naturally familiar with the language of games, which facilitates the assimilation of content in gamified environments.

Therefore, the analyzed data suggest that when properly planned, gamification enhances the pedagogical objectives of Early Childhood Education and contributes to inclusive practices from the earliest stages of schooling.

The analysis also demonstrated that consolidating gamification as an inclusive pedagogical practice requires structural changes in teacher education. The data show that many continuing education programs in public school systems still focus on regulatory content and bureaucratic guidelines, with little emphasis on methodological innovation. Villas Boas (2017) and Peres (2023) highlight that this passive model limits teachers' autonomy and protagonism, reducing their capacity to experiment with and adapt active methodologies such as gamification.

On the other hand, studies such as Carvalho (2018) demonstrate that, when teachers are trained with a pedagogical focus on gamification, they tend to design more intentional, effective, and student-centered proposals.

Mantoan (2021) warns of the risks of seeking "ready-made formulas" in teacher education without fostering genuine critical reflection on educational processes.

The findings therefore indicate that improving the quality of continuing teacher education is an indispensable condition for gamification to be applied with purpose, sensitivity, and commitment to diversity.

Revista InovaEduTech Ibiá - MG, v.1 n.2 p. 23-50, Jan/Dez – DOI 10.63103/k6g8b944 e-ISSN 3085-6558

6 CONCLUSION

Based on the bibliographic analysis conducted, it can be concluded that gamification constitutes a promising active methodology in the teaching-learning process of students who are the target audience of Special Education, especially in Early Childhood Education. Its application promotes engagement, motivation, socialization, and autonomy among students, while fostering meaningful learning through playful elements. These aspects make gamification a powerful strategy for inclusion—both material, by means of accessible resources, and symbolic, by stimulating a sense of belonging, cooperation, and the strengthening of interactions within the school environment.

However, methodological innovation still represents a significant challenge, particularly in more traditional educational contexts. The resistance to change underscores the need for an institutional movement that values dialogue, encourages continuous professional development, and promotes pedagogical practices centered on student protagonism. Within this scenario, gamification stands out as a resource that breaks away from the traditional expository model, offering dynamic and motivating narratives capable of integrating fantasy, challenge, and purpose into the learning process.

In the teaching of mathematics specifically, gamification expands pedagogical possibilities by connecting school content with everyday situations, stimulating logical reasoning, creativity, and autonomous problem-solving. Thus, it is reaffirmed that its successful implementation requires collective effort among teachers, administrators, and educational institutions, all committed to building a high-quality, inclusive education aligned with the needs of children's holistic development.

Revista InovaEduTech Ibiá - MG, v.1 n.2 p. 23-50, Jan/Dez – DOI 10.63103/k6g8b944 e-ISSN 3085-6558

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