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CHAPTER 6

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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