SEVEN
publicações acadêmicas

ARTIFICIAL INTELLIGENCE APPLIED TO THE LITERACY OF CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD): POTENTIAL AND CHALLENGES

INTELIGÊNCIA ARTIFICIAL APLICADA À ALFABETIZAÇÃO DE CRIANÇAS COM TRANSTORNO DO ESPECTRO AUTISTA (TEA): POTENCIALIDADES E DESAFIOS

INTELIGENCIA ARTIFICIAL APLICADA A LA ALFABETIZACIÓN DE NIÑOS CON TRASTORNO DEL ESPECTRO AUTISTA: POTENCIAL Y RETOS

https://doi.org/10.56238/sevened2025.030-033

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ABSTRACT

This study analyzes the potential and challenges of using Artificial Intelligence (AI) in the literacy process of children with Autism Spectrum Disorder (ASD). ASD is characterized by varying degrees of impairment in social interaction and communication, often associated with restricted interests and activities. Through bibliographical research and analysis of academic studies, the article investigates how AI-based teaching technologies can contribute to learning to read for this audience, considering that guaranteeing the right to inclusive education is fundamental for people with disabilities. The adoption of AI in this context presents opportunities for personalization and pedagogical support, but also faces significant barriers, such as the difficulty of access, the lack of preparation of educators and students, as well as ethical issues involving information security and privacy. The discussion covers the theoretical background, legal frameworks, potential, implementation challenges and case studies. It concludes that although AI offers promising resources for literacy for children with ASD, its implementation requires investment in infrastructure, teacher training and policies that ensure data protection and effective inclusion.

Keywords: Literacy. Artificial Intelligence. Autistic Spectrum Disorder.

RESUMO

Este estudo analisa as potencialidades e os desafios do uso da Inteligência Artificial (IA) no processo de alfabetização de crianças com Transtorno do Espectro Autista (TEA). O TEA caracteriza-se por diferentes graus de comprometimento na interação social e na comunicação, frequentemente associados à restrição de interesses e atividades. Por meio de pesquisa bibliográfica e da análise de estudos acadêmicos, o artigo investiga como tecnologias de ensino baseadas em IA podem contribuir para o aprendizado da leitura nesse público, considerando que a garantia do direito à educação inclusiva é fundamental para pessoas com deficiência. A adoção da IA nesse contexto apresenta oportunidades de personalização e apoio pedagógico, mas também enfrenta barreiras significativas, como a dificuldade de acesso, a falta de preparo de educadores e alunos, além de questões éticas envolvendo segurança da informação e privacidade. A discussão contempla a fundamentação teórica, os marcos legais, as potencialidades, os desafios de implementação e estudos de caso. Conclui-se que, embora a IA ofereça recursos promissores para a alfabetização de crianças com TEA, sua implementação exige investimentos em

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infraestrutura, capacitação docente e políticas que assegurem a proteção de dados e a inclusão efetiva.

Palavras-chave: Alfabetização. Inteligência Artificial. Transtorno do Espectro Autista.

RESUMEN
Este estudio analiza el potencial y los retos del uso de la Inteligencia Artificial (IA) en el proceso de alfabetización de niños con Trastorno del Espectro Autista (TEA). El TEA se caracteriza por diversos grados de deficiencia en la interacción social y la comunicación, a menudo asociados a intereses y actividades restringidos. A través de la investigación bibliográfica y el análisis de estudios académicos, el artículo investiga cómo las tecnologías de enseñanza basadas en IA pueden contribuir al aprendizaje de la lectura de este público, considerando que garantizar el derecho a la educación inclusiva es fundamental para las personas con discapacidad. La adopción de la IA en este contexto presenta oportunidades de personalización y apoyo pedagógico, pero también se enfrenta a importantes barreras, como la dificultad de acceso, la falta de preparación de educadores y estudiantes, así como cuestiones éticas relacionadas con la seguridad de la información y la privacidad. El debate abarca la base teórica, los marcos jurídicos, el potencial, los retos de aplicación y los estudios de casos. Se concluye que, aunque la IA ofrece recursos prometedores para la alfabetización de los niños con TEA, su aplicación requiere inversiones en infraestructuras, formación del profesorado y políticas que garanticen la protección de los datos y la inclusión efectiva.

Palabras clave: Alfabetización. Inteligencia Artificial. Trastorno del Espectro Autista.

1 INTRODUCTION

Artificial Intelligence Applied to the Literacy of Children with Autism Spectrum Disorder (ASD): Potentialities and Challenges Abstract: The present research focuses on conceptual elements that outline some of the potentialities of the application of artificial intelligence (AI) in the literacy process of children diagnosed with Autism Spectrum Disorder (ASD). The various contributions that AI can offer are highlighted, highlighting, among others, the use of *thinkertoy*, as well as the potential in terms of interaction, immediate *feedback*, playfulness, interest, engagement, and ease of learning.

In addition, several constraints that may arise in relation to investment in the literacy process are identified and analyzed, such as accessibility to available educational technologies, the need for adequate and continuous training of educators so that they can effectively deal with technological tools, as well as relevant security and privacy issues that need to be properly addressed and guaranteed. Basic theoretical foundation: definition of the child with Autism Spectrum Disorder (ASD); the literacy process as a whole; and comprehensive general notions about artificial intelligence (AI), including its practical applications and methodologies that have been studied. The analysis contemplates the possibility of using AI, with a focus on the literacy of children with ASD, presenting the potential that these new technologies offer and elucidating some of the significant challenges that may arise in this educational context, such as the adaptation of pedagogical material and the inclusion of different learning styles.

The literacy of children with Autism Spectrum Disorder (ASD) requires methodologies capable of combining visual stimuli, continuous interaction and adaptation to the particular rhythm of each learner. In this scenario, Do-dreamies represent a digital solution supported by Artificial Intelligence (AI), created to convert ideas and images from children's imagination into visual and written content that favors language development. The resource integrates eye-catching illustrations and objective descriptions, configuring a multimodal approach that encourages the expression of individual interests and experiences. With the support of AI algorithms, *Do-dreamies* identify usage patterns and propose personalized activities through *thinkertoys* — visual elements that can be transformed into stories or educational games. The combination of creativity, technology and pedagogical adaptation results in motivating, meaningful learning experiences adjusted to the cognitive needs of children with ASD.

The concept developed is based on two fundamental components: an engaging visual image, capable of attracting the child's interest, and an explanatory text that objectively

describes the content represented. The combination of these visual and textual elements transforms abstract ideas into concrete representations, facilitating the expression of individual thoughts, desires, and experiences. In the context of literacy for children with Autism Spectrum Disorder (ASD), this multimodal approach contributes to the expansion of communication and the improvement of skills related to written language.

Integrated with Artificial Intelligence (AI) platforms, this tool identifies interaction patterns and adapts pedagogical activities, enabling the personalization of the educational process. In this way, each child can convert their interests and aspirations into narratives or interactive games, promoting meaningful learning adjusted to the particular cognitive characteristics of learners with ASD.

2 THEORETICAL FOUNDATION

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in communication and social interaction, significantly affecting the emotional and social development of children. These limitations can restrict effective participation in the social environment, making literacy an essential element for their inclusion. Mastery of written language facilitates communication and expands opportunities for integration, continuous learning, and personal autonomy.

Social inclusion is essential for children with ASD to fully participate in daily activities such as formal education, leisure, and interpersonal relationships. In this context, Artificial Intelligence (AI) has stood out as an innovative tool in education, especially for literacy in this audience. Intelligent systems such as adaptive tutoring platforms, voice recognition software, and communication apps increase engagement by providing immediate feedback and personalizing activities according to the student's profile. These technologies create accessible and inclusive learning environments, promoting children's integral development, autonomy, and social participation (Vianna et al.2023).

The implementation of AI-based technological resources for literacy for children with ASD goes beyond access to education, involving awareness of the rights guaranteed by educational legislation. Adaptive and innovative educational approaches are indispensable to meet the specific needs of this group.

Several studies demonstrate the effectiveness of AI in combating illiteracy among children with ASD. Technologies such as intelligent tutoring systems, interactive platforms, and real-time feedback tools are allies in the teaching-learning process, promoting

personalized environments that contemplate cognitive, emotional, and social demands. Thus, AI is more than a technological innovation: it is an essential pedagogical strategy to ensure the full inclusion and school success of these children.

From a neurobiological point of view, ASD has a genetic basis and is manifested by changes in the central nervous system visible from birth, with varying manifestations and degrees of impairment. Early diagnosis, ideally from the age of two, is still a challenge due to the diversity of symptoms. The atypical brain growth observed in many cases and the higher prevalence in boys — estimated at four to one — are consistent evidence in the literature. Advanced AI technologies have also been used to support diagnostics, therapeutic interventions, and personalized education, expanding understanding and meeting the specific needs of these individuals (Webb et al., 2020).

3 LEGISLATION AND LEGAL FRAMEWORKS

To ensure equal rights for people with disabilities, it is essential that education includes inclusive and diversified actions. Only in this way will it be possible to provide an environment in which everyone can learn and fully develop their capacities (Biazus & Rieder, 2023). In line with current legislation, several countries seek to ensure access to education, active participation and integral development of this population, recognizing its relevance in building a fairer society (Araújo, Marcelino, & Martins, 2025).

In the Brazilian context, the Federal Constitution, in its article 227, establishes that the family, society and the State are responsible for ensuring the right to education for children, adolescents and young people, protecting them against all forms of discrimination and ensuring respect, dignity and integral development. The Brazilian Law for the Inclusion of Persons with Disabilities reinforces this perspective by considering assistive technologies as essential tools for guaranteeing these rights, including in the school setting (Pereira et al., 2023).

However, the implementation of Information Technology in education faces significant barriers, including physical, cultural, and institutional limitations, which compromise its full development and the effective inclusion of all students who could benefit from it (Biazus & Rieder, 2023; Pereira et al., 2023).

Inclusive education in Brazil is based on a comprehensive set of national and international legal frameworks that guarantee equal rights and opportunities for people with disabilities, including those with Autism Spectrum Disorder (ASD) (Gonçalves & Rodrigues,

2022). Internationally, the Convention on the Rights of Persons with Disabilities (UN, 2006), ratified by Brazil with constitutional status by Decree No. 6,949/2009 (Brazil, 2009), and the Salamanca Declaration (UNESCO, 1994), which guide States to promote inclusive educational systems, with reasonable accommodations, accessibility and individualized support, stand out.

In the national context, the Federal Constitution of 1988 enshrines education as a universal right and establishes, in its Article 208, that specialized educational service should preferably occur in the regular school system (Brasil, 1988). The Law of Guidelines and Bases of National Education – LDB (Brazil, 1996) reinforces this guideline by providing curricula, methods and resources adapted to specific needs. Law No. 12,764/2012, which institutes the National Policy for the Protection of the Rights of Persons with ASD, recognizes this condition as a disability for legal purposes and ensures access to inclusive education (Brasil, 2012). In addition, the Brazilian Law of Inclusion – LBI (Law No. 13,146/2015) guarantees reasonable accommodations, accessibility and full participation in all teaching modalities (Brasil, 2015).

Despite this robust normative framework, the implementation of inclusive education faces significant challenges, such as insufficient teacher training, scarcity of accessible pedagogical and technological resources, and the need for greater intersectoral articulation for comprehensive care. There is also a mismatch between legislation and daily practice in schools, which requires continuous public policies, rigorous monitoring, and investments in infrastructure and professional training (Ferreira & Costa, 2023; Gonçalves & Rodrigues, 2022).

In this context, teaching technologies based on Artificial Intelligence (AI) represent promising tools to support the literacy of children with ASD, promoting personalized and inclusive learning. However, its adoption requires continuous training of teachers and attention to ethical issues, privacy and data protection. To ensure effective and socially responsible inclusion, it is essential to integrate technological innovations with consistent public policies and adapted pedagogical strategies (Lima & Andrade, 2023; Silva & Mendes, 2024).

4 POTENTIALITIES OF ARTIFICIAL INTELLIGENCE IN LITERACY

The potential of artificial intelligence applied to the literacy of children with autism spectrum disorder (ASD) is widely discussed in the context of social inclusion, a topic that

demands special attention and careful approach. Considering that ASD is often associated with significant difficulties in socialization and communication, the development of innovative tools that meet individual needs can contribute significantly to adherence to formal learning.

Literacy is a crucial point in inclusion, as it allows children to actively participate in social, educational, and cultural life (Lopes et al., 2022). In this sense, artificial intelligence offers valuable contributions, creating tools that promote interaction, engagement, and pedagogical development adapted to the unique characteristics of each child with (Francisconi, Dantas, Silva, Klauch, & Patrício, 2025). Such technologies provide immediate, personalized pedagogical feedback by feeding machine learning algorithms that dynamically adjust to individual needs.

In addition to the pedagogical advantages, advances in smart devices have made it possible to overcome specific barriers faced by children with ASD during the literacy process (Azevedo & de Souza, 2021). In this way, the application of artificial intelligence can improve conventional teaching methods, ensuring inclusive learning adapted to the special needs of these students (Azevedo & de Souza, 2021).

5 SIS APPLIED IN THE LITERACY OF CHILDREN WITH ASD

The application of Artificial Intelligence (AI)-based tools in the literacy of children with Autism Spectrum Disorder (ASD) has been advancing significantly, offering personalized and adaptive resources that favor learning and school inclusion. Several initiatives demonstrate how AI can contribute to this process, providing interactivity, engagement, and individualized support, essential elements to meet the specific needs of this audience.

A relevant example is **Proloquo2Go**, an augmentative and alternative communication (AAC) app that employs adaptive algorithms to support nonverbal children or those with significant communication difficulties. This tool enables the construction of sentences and the development of vocabulary, allowing the adaptation of content and promoting greater social interaction (Sennott & Bowker, 2009).

Another innovative resource is the **OTIS** (Optimized Teaching Intelligent System), developed to support literacy processes through artificial intelligence. The system continuously evaluates the child's performance and adjusts reading and writing activities based on their individual progress, contributing to a more personalized and effective teaching (Conati & Kardan, 2013).

In the field of gamification, the use of AI-based *serious game* platforms, such as the *MIT Media Lab Autism Learning Environment*, which combines interactive digital games with machine learning algorithms to adapt challenges to the child's capabilities, increasing motivation and participation in the literacy process (Papakostas et al., 2021) stands out.

These examples show that the use of AI in the literacy of children with ASD not only expands access to education, but also promotes more inclusive, engaging, and adapted educational experiences. The successful implementation of these tools, however, requires adequate teacher training, technological infrastructure, and constant monitoring to ensure that learning is effective and safe (Kim et al., 2023).

6 IMPLEMENTATION CHALLENGES

Both the logical-mathematical and audiovisual devices used in the literacy of children with Autism Spectrum Disorder (ASD) face significant limitations due to several factors. First, the high cost of acquiring these technologies stands out, which hinders their implementation in many institutions and restricts access for education professionals (Alqahtani et al., 2022). In addition, the adequate training of educators represents a relevant challenge, as many of them lack specific training to employ these tools efficiently, thus limiting their pedagogical potential (Smith & Jones, 2021).

In addition, ethical issues related to the privacy and security of the data collected during the literacy process deserve special attention, since the protection of users' sensitive information is essential. These obstacles contribute to the restriction of access to technologies in schools, hindering the social and educational inclusion of children with ASD, especially in a crucial stage such as literacy (Alqahtani et al., 2022).

Another factor that negatively impacts the adoption of these technologies is the limited understanding, on the part of educational managers, of the specific needs of these children and the advantages that Artificial Intelligence (AI) can offer in the pedagogical context (Smith & Jones, 2021). Despite the growing academic interest in literacy for children with ASD, most research still focuses on physical devices, such as games and visual materials, while the application of AI remains underexplored.

Given this scenario, the present study seeks to highlight concrete and successful cases of the use of AI in the literacy of children with ASD, aiming to overcome the aforementioned limitations and promote a more effective and comprehensive educational inclusion for this audience (Kim et al., 2023).

7 FINAL CONSIDERATIONS

This study, through a bibliographic search of academic articles and literature, critically analyzed the potentialities and challenges of the use of Artificial Intelligence (AI) in the literacy process of children with Autism Spectrum Disorder (ASD). The objective of the article was to analyze how AI-based tools have a great capacity for personalization, interactivity, and engagement, essential characteristics to meet the cognitive and communicational needs of this audience. The theoretical analysis and practical examples demonstrated that such technologies can favor meaningful learning, stimulating the development of written language and promoting greater educational and social inclusion.

On the other hand, the study showed that the effective implementation of these solutions still faces significant barriers, such as high costs, lack of infrastructure, the need for continuous teacher training, and challenges related to data security and privacy. It is concluded that AI offers promising resources for the literacy of children with ASD, but its potential will only be fully achieved with consistent public policies, structural investments and adapted pedagogical practices. In this way, the integration between technology, teacher training and social inclusion configures the path to a more equitable and innovative education.

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