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Assistive Technology resources in Brazilian schools for students with autism spectrum disorder: an integrative review

Recursos de tecnologia assistiva nas escolas brasileiras para estudantes com transtorno do espectro autista: uma revisão integrativa

Recursos de tecnología asistiva en las escuelas brasileñas para estudiantes con trastorno del espectro autista: una revisión integrativa

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Abstract

This study aims to investigate how Assistive Technologies have supported the educational inclusion of students with Autism Spectrum Disorder (ASD) in Brazil. Grounded in the Brazilian Inclusion Law (13.146/2015) and educational policies, it highlights the importance of technological tools in addressing the diverse needs of this population, fostering autonomy, inclusion, and educational development. Using an integrative review, articles and dissertations available in the Brazilian Digital Library of Theses and Dissertations and the CAPES Journal Portal were analysed, covering the period from 2001 to 2024. The review examined 10 dissertations and 1 article, focusing on technologies such as exergames, virtual reality, applications, and augmentative communication. The findings indicate progress in social, motor, and cognitive skills but underscore limitations such as the lack of longitudinal studies and insufficient integration with Specialised Educational Support. The study calls for greater investment in research and teacher training to enhance the effectiveness of assistive technologies.
Keywords*:* Inclusive Education; Assistive Technology in Education; Pedagogical Support for Autism; Technological Interventions for Autism.

Resumo

Este estudo investiga como as Tecnologias Assistivas têm contribuído para a inclusão educacional de estudantes com Transtorno do Espectro Autista (TEA) no Brasil. Com base na Lei Brasileira de Inclusão (13.146/2015) e nas políticas educacionais, o estudo destaca a importância das ferramentas tecnológicas para atender às necessidades dessa população, promovendo autonomia, inclusão e desenvolvimento educacional. Por meio de uma revisão integrativa, foram analisados artigos e dissertações disponíveis na Biblioteca Digital Brasileira de Teses e Dissertações e no Portal de Periódicos da CAPES, abrangendo o período de 2001 a 2024. Foram examinadas 10 dissertações e 1 artigo, com foco em tecnologias como exergames, realidade virtual, aplicativos e comunicação aumentativa. Os resultados indicam avanços em habilidades sociais, motoras e cognitivas, mas destacam limitações como a ausência de estudos longitudinais e a integração insuficiente com o Atendimento Educacional Especializado. O estudo enfatiza a necessidade de mais investimentos em pesquisas e capacitação docente para maximizar a eficácia das tecnologias assistivas.
Palavras-chave: Educação Inclusiva; Tecnologia Assistiva na Educação; Apoio Pedagógico para Autismo; Intervenções Tecnológicas para Autismo.

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Resumen

Este estudio investiga cómo las Tecnologías Asistivas han contribuido a la inclusión educativa de estudiantes con Trastorno del Espectro Autista (TEA) en Brasil. Con base en la Ley Brasileña de Inclusión (13.146/2015) y en las políticas educativas, destaca la importancia de las herramientas tecnológicas para abordar las diversas necesidades de esta población, fomentando la autonomía, la inclusión y el desarrollo educativo. A través de una revisión integrativa, se analizaron artículos y disertaciones disponibles en la Biblioteca Digital Brasileña de Tesis y Disertaciones y en el Portal de Periódicos de CAPES, cubriendo el período de 2001 a 2024. Se examinaron 10 disertaciones y 1 artículo, centrados en tecnologías como exergames, realidad virtual, aplicaciones y comunicación aumentativa. Los resultados indican avances en habilidades sociales, motoras y cognitivas, pero destacan limitaciones como la falta de estudios longitudinales y la integración insuficiente con el Apoyo Educativo Especializado. El estudio enfatiza la necesidad de más inversión en investigación y formación docente para maximizar la eficacia de estas tecnologías.
Palabras clave*:* Educación Inclusiva; Tecnología Asistiva en la Educación; Apoyo Pedagógico para el Autismo; Intervenciones Tecnológicas para el Autismo.

Introduction

Assistive technology, in the context of inclusive education, has become an essential means of removing barriers that restrict the development, learning, independence and quality of life of people with disabilities. The aim of this article is to investigate how Assistive Technology, in conjunction with Specialised Educational Support and Multifunctional Resource Rooms, contributes to the inclusion of students with Autism Spectrum Disorder in Brazilian schools, based on an integrative review (2001–2024).

While its relevance is already recognised in simple tools, such as pencil grips, paper holders, and adapted furniture, recent advances in information and communication technologies have enhanced the visibility of Assistive Technology, providing more technological solutions to meet special educational needs.

Conceptually, the Brazilian Inclusion Law No. 13,146/2015 defines Assistive Technology as products, equipment, devices, resources, methodologies, strategies, practices, and services aimed at promoting functionality in activities and participation for people with disabilities or reduced mobility, with a focus on autonomy, independence, quality of life, and social inclusion (Brasil, 2015).

In Brazil, the expressions “Technical Aids” and “Support Technology” have often been used as synonyms. The Technical Aids Committee (CAT) of the Special Secretariat for Human Rights defined Assistive Technology as a multidisciplinary field of knowledge that involves products, resources, strategies, practices, processes, methods, and services aimed at people with disabilities, reduced mobility, and the elderly, with the goal of promoting autonomy, quality of life, and social inclusion across various social contexts (CAT, 2007; Galvão Filho, 2009).

An advancement in the field of Assistive Technology was highlighted by the publication of the National Assistive Technology Plan (Brasil, 2021), which signals the government's interest in investing in and promoting the use of Assistive Technology in schools for people with disabilities, reduced mobility, and autism spectrum disorder. Authors such as Bersch (2006) and Deliberato (2005) highlight Assistive Technology as an initiative

that strengthens school inclusion by directing the knowledge of professionals to meet pedagogical demands.

In the educational context, assistive technologies “aim to break down sensory, motor, or cognitive barriers that limit or prevent access to information, as well as the recording and expression of acquired knowledge” (Bersch, 2017). Examples of educational resources include Augmentative Communication software, virtual keyboards, and screen readers. According to Burgstahler (2003), Assistive Technology in the school context provides students with disabilities opportunities for inclusion and development, promoting the following features:

I. Independence in carrying out activities;
II. Participation in classroom discussions;
III. Autonomous participation in other experiences;
IV. Access to a greater diversity of educational opportunities.

Assistive Technology services in schools are primarily offered through Specialised Educational Support, a complementary resource to regular education that provides greater attention to the specific needs of students with disabilities, aiming to enhance teaching and learning processes and promote inclusion. According to Decree No. 7,611/2011, Specialised Educational Support is a set of activities, accessibility resources, and pedagogical tools organised institutionally and continuously, provided as ongoing support but limited in time and frequency within Multifunctional Resource Rooms, or as supplementary support for the education of students with high abilities (Brasil, 2011).

Each school must incorporate Multifunctional Resource Rooms into its Pedagogical-Political Project and ensure the presence of a teacher specialised in educational support, providing targeted assistance to students with disabilities within the school environment. These rooms should be equipped with various resources, such as adapted furniture and Assistive Technology, to meet the individual needs of students.

Continuous updating of these tools and practices is essential, and professionals in the field must constantly seek the development and improvement of assistive technology. This process is facilitated by the direct interaction of educators with the Multifunctional Resource Rooms, creating an environment conducive to the implementation of more effective technical solutions and the continuous adaptation of teaching methodologies, ensuring increasingly personalised and inclusive support.

Resolution No. 4 of the Ministry of Education of Brazil, dated 2 October 2009, establishes that one of the responsibilities of the teacher in Specialised Educational Support is to use Assistive Technology to enhance students’ functional skills, promoting their autonomy and participation (Brasil, 2009). In this context, it is pertinent to examine how Assistive Technology, within the scope of Specialised Educational Support, has contributed to the development, learning and inclusion of students with special educational needs.

This paper, based on articles, master's dissertations, and doctoral theses, examines how assistive technologies in the school environment have contributed to the inclusion of

students with autism spectrum disorder, highlighting the main resources used and the benefits observed in the development of these students. For this research, the integrative review method was adopted, which enables the synthesis and analysis of relevant studies in the field (Souza, 2010).

Inclusion in the school environment is an urgent need in our society, given the numerous barriers and ableist discrimination that hinder the learning and autonomy of students with disabilities. Inclusive education, therefore, requires the participation of all, and it is essential that teachers and other members of the school community seek and build the means to promote a just and equal society. Thus, Assistive Technology and Specialised Educational Support must be increasingly improved and valued, as they are tools that bring us closer to these political and social ideals.

Educational Context of Students with Autism Spectrum Disorder

Autism Spectrum Disorder is a syndrome that primarily affects communication and social interaction, with variations in intensity ranging from mild to severe, depending on the individual's level of development and age. Other associated disorders may occur, such as depression, epilepsy, and hyperactivity. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, 2013), autism spectrum disorder is classified under neurodevelopmental disorders and includes autism, Asperger's syndrome, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (APA, 2013).

According to Goldman-Rakic (1981), the deficits often observed in individuals with autism spectrum disorder correspond to alterations in executive functions located in the frontal lobes and prefrontal cortical regions. These areas of neuroanatomy are responsible for the development of speech planning, motor skills, and impulse control in response to different situations and environments.

Law 12,764/2012, which establishes the National Policy for the Protection of the Rights of Persons with Autism Spectrum Disorder, known as the Berenice Piana Law, defines the clinical framework of autism spectrum disorder in article 1, sections I and II, as follows (Brasil, 2012):

I. Persistent and clinically significant impairment in communication and social interaction, evidenced by marked difficulties in verbal and non-verbal communication aimed at social interaction; lack of social reciprocity; inability to develop and maintain relationships appropriate to the level of development;
II. Restricted and repetitive patterns of behaviour, interests, and activities, evidenced by stereotyped motor or verbal behaviours or unusual sensory responses; excessive adherence to routines and ritualised patterns of behaviour; limited and fixed interests.

Since it is a condition typically identified in early childhood, the school environment becomes a crucial space for diagnosis and for fostering the development of these individuals (Santos, 2008). However, for the educational process of a person with autism spectrum disorder to be effective, it is necessary to have a qualified teaching team and resources that promote development and inclusion (Monteiro; Barrone, 2015).

The barriers faced by people with disabilities are imposed by a society that makes human diversity invisible and creates exclusionary and discriminatory living conditions. A possible solution to combat these barriers can be implemented in schools through the training of teaching teams capable of developing awareness-raising and effective practices and methodologies to support this group. In addition, it is essential to adapt and develop the curriculum and strengthen the bonds and partnerships between the school, family, and community.

Specialised Educational Support has been consolidating in the contexts of basic education in recent years, but professionals still face a lack of support and the necessary structure to perform their roles and overcome daily challenges. In this context, one way to enable the effective practice of Specialised Educational Support teachers is through the use of Multifunctional Resource Rooms, where Assistive Technology is assessed and implemented according to the needs of the target audience for special education. The National Special Education Plan in the Inclusive Perspective establishes that (Brasil, 2011): “Specialised Educational Support provides curriculum enrichment programmes, the teaching of specific communication and signalling languages and codes, technical aids and assistive technology, among others. Throughout the entire schooling process, this support must be integrated with the pedagogical proposal of mainstream education.”

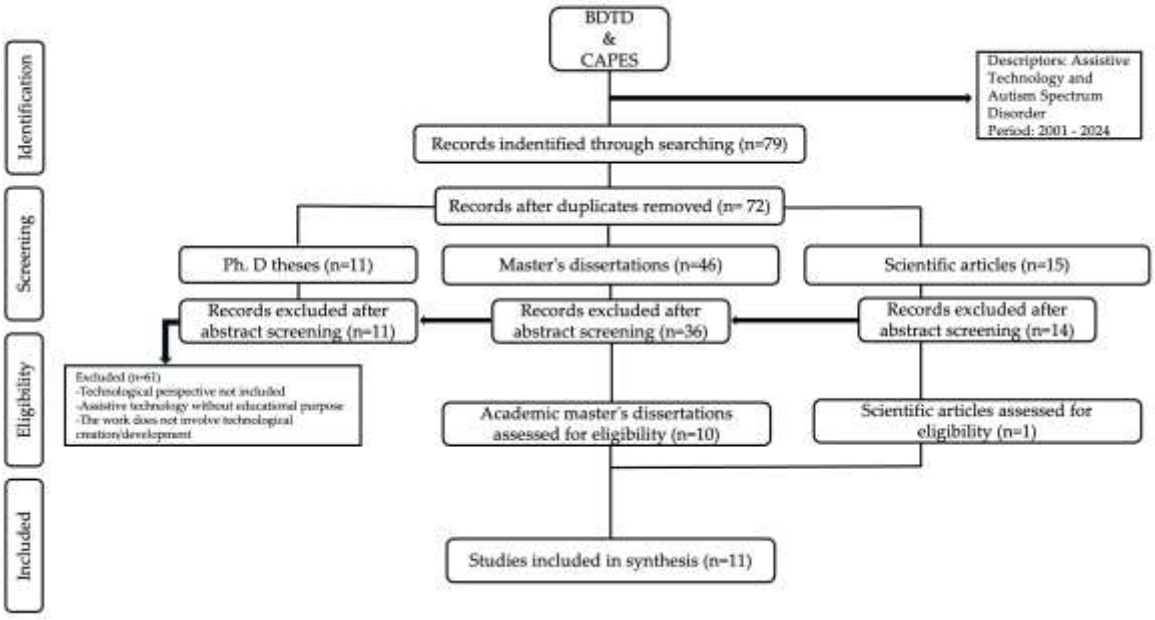
Given the established relationship between Assistive Technology resources and Specialised Educational Support, an important issue is whether scientific production has kept pace with the integration of these professionals and has reflected advances in, and the development of, new Assistive Technology resources. Furthermore, it is necessary to identify which resources have been tested or analysed in the school context, even if they are not applied alongside Specialised Educational Support.

Materials and Methods

This investigation employed an integrative review, a methodological approach that enables the systematic synthesis of existing knowledge and the translation of findings from relevant studies into practice. This type of qualitative systematic review seeks to gather, synthesise, analyse, and evaluate research of various natures, whether empirical, theoretical, experimental, or non-experimental, on specific themes, questions, or issues. The primary objective is to produce results and generalisations about the existing literature related to a specific object of study (Sousa; Bezerra; Egypto, 2023).

We defined the temporal scope from 2001 to 2024 for the analysis and used the descriptors “Assistive Technology” and “Autism Spectrum Disorder” to search the Brazilian Digital Library of Theses and Dissertations (BDTD).

Figure 1. PRISMA diagram of the integrative review process - Brazilian Digital Library of Theses and Dissertations (BDTD) - CAPES Journals Portal.



Source: PRISMA diagram prepared by the authors

The diagram presented illustrates the detailed methodological process for selecting studies on the use of assistive technologies in the context of autism spectrum disorder between 2001 and 2024, with data sourced from the Brazilian Digital Library of Theses and Dissertations (BDTD). Initially, 79 records were identified, which, after the removal of duplicates, totalled 72 studies. These records were organised into three main categories: doctoral theses (n=11), academic master's dissertations (n=36), and scientific articles (n=15). This classification demonstrates the initial scope of the analysis, which encompassed different levels of academic production.

During the abstract screening phase, 61 records were excluded on the basis of clearly defined and rigorously applied criteria. This step was essential to ensure that only studies aligned with the central aim of the review were retained, namely the exploration of Assistive Technologies with an explicit educational purpose for individuals with autism spectrum disorder. As a result of this process, 10 academic master's dissertations met the eligibility requirements and proceeded to full analysis.

The exclusion criteria applied were:

- **No technological perspective** – studies that did not address technology as a central or relevant component.
- **Non-educational use of assistive technology** – works focusing on Assistive Technologies for clinical, therapeutic, medical or purely functional purposes, without a clear educational objective.
- **Absence of technological creation or development** – studies that did not involve the design, development, adaptation or implementation of technological solutions.

A parallel search was carried out in the CAPES Journals Portal — a Brazilian virtual library maintained by the Coordination for the Improvement of Higher Education Personnel (CAPES), which provides access to an extensive collection of national and international scientific publications — using the same time frame and Boolean search terms. This search initially identified 15 articles. After excluding works that had not undergone peer review, this number was reduced to 4 scientific articles, of which only 1 met the inclusion criteria and specific analytical focus of the present study.

Results

The results are presented using analytical tables that summarise and compare the research objectives of studies on Assistive Technology for students with autism spectrum disorder in school settings. Each article or dissertation identified in the databases described above will be systematically examined and coded according to a set of predefined thematic parameters, as outlined below:

I. Which resource or tool was developed or applied in the school setting for students with autism spectrum disorder;
II. Identification of the context in which the research was conducted, considering Specialised Educational Support and/or Multifunctional Resource Rooms;
III. What results were observed in the analysed study.

Thus, Table 1 presents the articles and their respective proposals, followed by the dissertations (Table 2), which are analysed based on the same parameters. The article highlighted in Table 1 directly discusses the analysis and development of assistive technologies designed for individuals with autism spectrum disorder in the school phase, highlighting their contributions and implications for the educational context.

The studies reviewed indicate that, owing to the clinical variability that characterises the autism spectrum, a wide range of resources, strategies and methodologies is required to address the specific needs of each individual. This complexity demands that research be continually updated and refined to respond adequately to the evolving needs of this population. Although the article analysed was not conducted directly within a school setting, the practices it employed or evaluated show clear potential for adaptation and implementation in educational contexts — a possibility also highlighted by the authors themselves.

The majority of the analysed studies do not establish a direct relationship with Specialised Educational Support and, furthermore, do not mention the use of Multifunctional Resource Rooms. This may indicate that these structures are not yet widely accessible or are not uniformly present in schools. This gap is also evident in the dissertations analysed, which, although presenting relevant and promising technological resources for the school context, only three of them, as indicated in Table 2, demonstrate a direct connection with Specialised Educational Support or the use of Multifunctional Resource Rooms.

The studies emphasise the diverse technological approaches designed to address the needs of students with autism spectrum disorder, such as exergames to foster social interaction, apps like “Teacch.me” and “Rotina Divertida” to promote autonomy and organisation, and digital games to support literacy development. Some research, such as those utilizing augmentative and alternative communication, successfully integrated Specialised Educational Support and Multifunctional Resource Rooms, showcasing the value of structured and tailored support in enhancing inclusion and personalizing learning experiences.

Nevertheless, many studies, including those on the “Casulo TEA” and “Rotina Divertida” apps, did not incorporate Specialised Educational Support or Multifunctional Resource Rooms, which limits their practical applicability. Integration with Specialised Educational Support and Multifunctional Resource Rooms is crucial for scaling these innovations beyond isolated cases and achieving meaningful institutional impact, fostering broad dissemination as part of inclusive education strategies. Moreover, while innovative, some studies inadequately address the need for teacher and aide training to optimise the effective use of these technologies, as highlighted in research on augmented reality.

The Table also reveals a significant gap in research, as most studies on Assistive Technology and autism spectrum disorder have been conducted at the master’s level, with no doctoral studies identified in the BDTD database. This absence highlights the urgent need for doctoral-level research to validate Assistive Technology resources and propose scalable implementations, particularly through longitudinal studies that evaluate long-term impacts on educational outcomes. Additionally, a similar gap is evident in the articles retrieved from the CAPES database, which are further limited by the fact that many are not double-blind peer-reviewed, raising concerns about the rigor of the research.

By integrating practices with Specialised Educational Support and Multifunctional Resource Rooms, these innovations can transcend individual classrooms and become part of institutional culture, potentially evolving into widely applicable educational policies. This approach ensures that Assistive Technology achieves its full potential in fostering meaningful, inclusive learning for students in special education.

Table 1. Scientific article.

Title	Authorship	Year	Thematic Parameter I	Thematic Parameter II	Thematic Parameter III
Title in Portuguese: *Utilização de exergames no desenvolvimento da interação social de discentes com TEA*. [Use of Exergames in Developing Social Interaction in Students with ASD]	Borges-Sales, K. M; Machado, C. M.	2020	The use of exergames, through game consoles equipped with motion sensors, serves as a mediating technological resource that can potentially enhance the social interaction of students with Autism Spectrum Disorder. These games, by combining physical activity with interactive stimuli, provide opportunities for the development of social skills in a playful and controlled environment, fostering communication, cooperation, and engagement among participants.	The research was conducted at a Specialised Educational Support Centre, and the results obtained were carefully catalogued in collaboration with the teacher responsible for the SEA. This process ensured that the observations were aligned with pedagogical practices and the specific needs of the students served, enabling a more contextualised and applied analysis within the specialised educational environment.	The research results indicate significant growth in the social interaction of students with Autism Spectrum Disorder, assessed based on three main categories: communication, identity, and interactivity. These advances suggest that the strategies employed contributed to the development of social skills, fostering greater communicative engagement, strengthening self-perception, and enhancing interactions within the specialised educational environment.

Table 2. Master's dissertations produced on the theme of Assistive Technology and autism spectrum disorder.

Title	Authorship	Year	Thematic Parameter I	Thematic Parameter II	Thematic Parameter III
Title in Portuguese: *Elaboração de Tecnologia Assistiva para inclusão de crianças com Transtorno do Espectro Autista em ambiente Escolar*. [Development of Assistive Technology for the Inclusion of Children with Autism Spectrum Disorder in the School Environment]	Landim, A. M. D	2018	As part of the research stages, a guidebook was developed with the aim of assisting teachers in supporting students with Autism Spectrum Disorder (ASD) in their classes. This material was designed to provide practical guidance, pedagogical strategies, and information on the use of Assistive Technologies, aiming to promote school inclusion and facilitate the teaching and learning process. The guidebook also seeks to support educators in understanding the specific characteristics of ASD, contributing to the creation of a more welcoming and adapted educational environment to meet the needs of these students.	The research did not include the institution's Specialised Educational Support in its stages. This omission may indicate a limitation of the study, as SEA is an essential structure for implementing inclusive pedagogical practices and utilising Assistive Technologies in the school context. The absence of this approach highlights the need for future investigations that incorporate the participation of SEA, aiming to expand the scope and applicability of the results within the specialised educational setting.	It is concluded that the guidebook, as an Assistive Technology resource, represents a valid and effective tool to support the inclusion of individuals with Autism Spectrum Disorder (ASD) in the school environment. Its content, aimed at teachers, provides practical and strategic support, contributing to the promotion of inclusive pedagogical practices and the adaptation of the educational context to the specific needs of students with ASD.

Title in Portuguese: *O uso dos Exergames como Tecnologia Assistiva no Atendimento Educacional Especializado para a estimulação da interação social em estudantes com Transtorno do Espectro Autista – TEA*. [The Use of Exergames as Assistive Technology in Specialised Educational Support to Stimulate Social Interaction in Students with Autism Spectrum Disorder (ASD)]	Machado, A. C. M.	2019	Exergames, as a form of Assistive Technology (AT), show great potential for students with ASD. These interactive games, based on motion sensors, combine physical activities with visual and motor stimuli, creating a playful environment that fosters student engagement. Studies indicate that exergames can significantly contribute to the development of social skills, such as communication and interactivity, in addition to improving motor coordination and attention. When adapted to the school context, these resources become inclusive tools that facilitate the learning and socialisation of students with ASD.	The research involved the institution's Specialised Educational Support.	It is observed that the use of Assistive Technology (AT) led to a significant improvement in the social interaction of students, yielding notable benefits in three key areas: communication, identity, and interactivity. These advancements highlight the effectiveness of AT in fostering meaningful connections, enhancing self-awareness, and promoting active engagement within educational and social environments, ultimately contributing to the holistic development of the students involved.
Title in Portuguese: *Tom Tom: jogo educacional digital de Suporte à Teoria da Mente para crianças no Transtorno do Espectro do Autismo.* [Tom Tom: A Digital Educational Game Supporting Theory of Mind for Children with Autism Spectrum Disorder]	Monteiro, M. F.	2021	Digital Game (ToM ToM) for Assessment and Intervention in the Domain of Theory of Mind for Children Aged Six to Eight with Autism Spectrum Disorder (ASD)	The research involved the institution's Specialised Educational Support.	The game was considered suitable and recommended as an effective tool for enhancing student learning. The product developed from this study offers an innovative tool that enables both assessment and intervention, contributing to the acquisition of competencies and the development of new skills related to Theory of Mind (ToM) in students with autism. This approach demonstrates potential for fostering significant progress in the cognitive and social domains of these students, highlighting the importance of interactive tools in the educational context.
Title in Portuguese: *Construção de sequências didáticas com Realidade Aumentada para alunos com Transtorno do Espectro Autista nos anos finais do ensino fundamental - 6º ano*. [Development of Didactic Sequences with Augmented Reality for Students with Autism Spectrum Disorder in the Final Years of Elementary School - 6th Grade]	Melo, F. A. F.	2021	The creation and validation of didactic sequences using Augmented Reality (AR) for students with Autism Spectrum Disorder (ASD) represent an innovative and promising approach in the field of inclusive education. This methodology enables the integration of virtual elements into the real environment, creating interactive and multisensory experiences that can enhance concept comprehension, stimulate engagement, and promote active learning.	The research did not involve the institution's Specialised Educational Support.	The use of adapted school activities enabled greater participation of students with Autism Spectrum Disorder, demonstrating the potential of inclusive strategies to foster engagement and interaction within the educational environment. However, the study also highlighted the need to train teachers and aides for the effective use of digital technological resources. This training is essential to broaden the implementation of technological tools and maximise their benefits for students, strengthening inclusion and the development of skills in the school context.

Title in Portuguese: *Realidade Virtual como Tecnologia Assistiva para desenvolver habilidades de vida diária em crianças diagnosticadas com Transtorno do Espectro Autista*. [Virtual Reality as Assistive Technology to Develop Daily Living Skills in Children Diagnosed with Autism Spectrum Disorder]	Menezes, S. V.	2021	The Virtual Reality (VR) tool was developed to assist children aged 7 to 10, with ASD at levels 1 and 2, in enhancing independent living skills through the simulation of everyday activities in a controlled and interactive environment. Customisable to individual needs, the technology enables practice of tasks such as organisation, simple shopping, and following instructions, fostering engagement and autonomy. The results indicate that VR is an innovative and effective resource for reinforcing essential skills, while also providing support for assessment and intervention by educators and therapists.	The research did not involve the institution's Specialised Educational Support.	The Virtual Reality (VR) tool stands out for its potential to assist children with ASD in learning and practising basic daily tasks in a safe and interactive way. Through realistic and customisable simulations, children can develop skills such as organisation, simple shopping, and following instructions, engaging with scenarios that reflect everyday situations. This approach not only enables repetitive practice, which is essential for learning, but also fosters greater autonomy and confidence, highlighting the effectiveness of VR as an innovative educational and therapeutic resource.
Title in Portuguese: *Um estudo de caso sobre o uso da Tecnologia Assistiva no Ensino de Ciências para alunos com Transtorno do Espectro Autista: criação do aplicativo/software educacional*. [A Case Study on the Use of Assistive Technology in Science Education for Students with Autism Spectrum Disorder: Development of an Educational App/Software]	Pantoja, B. F. F. J.	2022	The educational app "Casulo TEA" was developed to support children with Autism Spectrum Disorder (ASD) in developing academic, social, and functional skills through interactive and tailored activities. Featuring an intuitive and customisable interface, the software provides modules focused on daily life learning, communication, and social interaction, while also enabling progress monitoring by families and educators.	The research did not involve the institution's Specialised Educational Support.	"Casulo TEA" assisted students in understanding the topic "Human Body." After using the app, it was observed that students were able to identify hygiene objects, body parts, bone functions, and classifications. "Casulo TEA" was regarded as a supportive tool in the teaching and learning process for students with ASD.
Title in Portuguese: *Tecnologia Assistiva sob a ótica da infância: aplicativo Teacch.me e o Transtorno do Espectro Autista*. [Assistive Technology from the Perspective of Childhood: The Teacch.me App and Autism Spectrum Disorder]	Rodrigues, M. S.	2022	The Teacch.me app is an Assistive Technology (AT) tool designed to support children with Autism Spectrum Disorder (ASD) in early childhood education, utilising the principles of the TEACCH program. With an intuitive interface and structured visual support, the app fosters the development of basic skills such as organisation, communication, and routine management while facilitating personalised activities and consistent routines. By encouraging playful and pedagogical engagement, Teacch.me enhances children's autonomy and contributes to their inclusion in school and family environments, expanding opportunities for meaningful learning.	The research did not involve the institution's Specialised Educational Support.	The Teacch.me app is considered a powerful tool for supporting the development of children with ASD, particularly for its ability to promote structural skills and routine. However, its effective use relies on an integrated approach, where the reference teacher employs the app as a complementary resource without relying exclusively on it. Combining the app with other pedagogical strategies is essential to address the individual needs of students and maximise its benefits within the educational context.

Title in Portuguese: *Jogos digitais como recurso de Tecnologia Assistiva na alfabetização de alunos com Transtorno do Espectro Autista*. [Digital Games as an Assistive Technology Resource in the Literacy of Students with Autism Spectrum Disorder]	Ferreira, S.	2022	This research aims to identify the specific aspects in which educational digital games contribute to the literacy process of students with Autism Spectrum Disorder (ASD). The study examines how interactive, visual, and auditory elements of the games can facilitate the development of reading and writing skills, fostering engagement and personalised learning. Additionally, it analyses how these resources can overcome common barriers in conventional teaching, providing an inclusive and tailored approach to meet the needs of students with ASD.	The research did not involve the institution's Specialised Educational Support.	The research confirmed that educational digital games have a positive impact on the learning process of students with ASD, particularly during the literacy phase. As a result of this work, a technological guide in the form of an interactive e-book was developed for educators. This material provides practical guidance and pedagogical strategies for the effective use of digital games in teaching children with ASD, promoting a more inclusive learning experience tailored to the individual needs of students.
Title in Portuguese: *O adolescente com Transtorno do Espectro Autista (TEA): a utilização de um aplicativo móvel e suas contribuições para o processo pedagógico*. [The Adolescent with Autism Spectrum Disorder (ASD): The Use of a Mobile App and Its Contributions to the Pedagogical Process]	Gomes, P. B.	2022	The research analyses the use of the mobile app “Rotina Divertida”, focusing on its application in developing organisational skills and promoting the autonomy of children with ASD. Despite its potential to support inclusive practices, the study did not directly involve Specialised Educational Support, which can be seen as a limitation given the central role of SEA in integrating assistive technologies into the school environment. This omission underscores the importance of future studies that incorporate SEA to enhance the applicability and effectiveness of the app's use within the specialised educational context.	The research did not involve the institution's Specialised Educational Support.	The “Rotina Divertida” app demonstrates great potential as a tool to stimulate autonomy and pedagogical organisation in students, significantly contributing to the teaching and learning process. Its versatile use allows for application in both school and family settings, assisting in the creation of structured routines that facilitate task assimilation and promote greater independence among students. Furthermore, the app provides visual and interactive support that adapts to individual needs, making it a valuable resource for inclusive education.
Title in Portuguese: *O uso da Comunicação Aumentativa e Alternativa no desenvolvimento do vocabulário de crianças pré-escolares com autismo: um estudo em uma escola da rede municipal de São Luís-MA*. [The Use of Augmentative and Alternative Communication in Vocabulary Development of Preschool Children with Autism: A Study in a Municipal School in São Luís-MA]	Pereira, P. M. M.	2022	This research investigates how the use of Augmentative and Alternative Communication (AAC) influences the formation and development of vocabulary in preschool children with autism. The analysis focuses on how the visual and symbolic resources of AAC can facilitate the comprehension and expression of words, promoting language acquisition and enhancing the communicative abilities of the children. The results highlight the effectiveness of AAC as an inclusive strategy, enabling students to develop linguistic skills tailored to their specific needs.	The research involved the institution's Specialised Educational Support.	This integration provided a structured and accessible environment to enhance the vocabulary development of preschool children with autism, highlighting the importance of specialised support and adapted resources in the inclusive teaching and learning process.

Brief Reflective Analysis

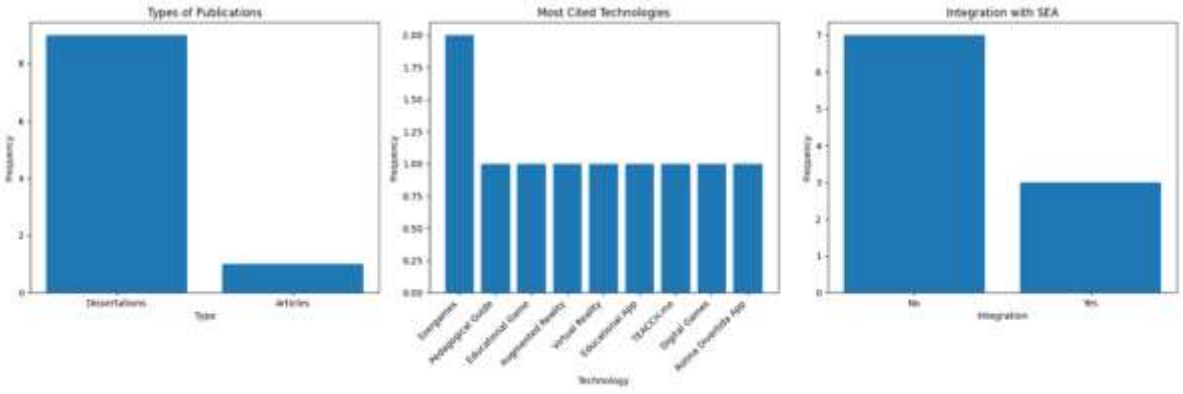
To compare the Brazilian findings with a brief international perspective, we also conducted a contextual search in RCAAP (Portugal) and the OATD database (United States), using the same time frame (2001–2024) and the descriptors “Assistive Technology” and “Autism Spectrum Disorder”.

An examination of RCAAP, Portugal’s national open-access repository, identified only two journal articles, one doctoral thesis, one master’s dissertation, one report and one additional publication on Assistive Technology for students with autism spectrum disorder between 2001 and 2024. This small body of work, despite its varied formats, reveals a clear shortfall in sustained research on the topic.

In the United States, data from the Open Access Theses and Dissertations (OATD) database indicate substantially higher academic output for the period 2001–2024, with 75 doctoral theses and 39 master’s dissertations addressing Assistive Technology and autism spectrum disorder. This volume suggests significant research investment and the consolidation of academic work in the field. However, the dominance of theses and dissertations points to a possible shortfall in converting this research into peer-reviewed journal articles, which restricts the international dissemination and practical uptake of the findings. These comparisons underscore the need not only to increase the volume of research, but also to diversify publication formats and ensure that results are translated into concrete practices and inclusive public policies.

Within the Brazilian integrative review corpus, Chart 1 displays the distribution of publication types analysed in this study. A predominance of dissertations is evident, representing the majority of academic output on assistive technologies and autism spectrum disorder. Of the 11 publications analysed, 10 are dissertations and only one is an article.

Chart 1. Analysis of publications and technologies in Assistive Technology for autism spectrum disorder



Source: prepared by the authors

This predominance indicates that the topic has been addressed predominantly through master’s research, which is consistent with its position as an emerging field still in consolidation in Brazil. The limited number of articles in peer-reviewed journals points to a

shortfall in the dissemination of findings, restricting their visibility and limiting their use in educational and scientific contexts.

Viewed in relation to other contexts, these patterns reveal a mismatch between the volume of research produced, the range of publication formats and the actual impact of the studies. They highlight the need for sustained investment in robust empirical research, the strengthening of international collaboration networks and the systematic conversion of dissertations and theses into peer-reviewed publications, so that advances in the field can be consolidated and more effectively incorporated into educational practice and inclusive public policies.

Within this broader scenario, the second chart presents the technologies most frequently examined in the studies reviewed. Exergames are the most prominent resource, reported in two studies, while digital games, educational applications, virtual reality, pedagogical guides and the Teacch.me application each appear in one study.

This diversity of technologies reflects the wide range of approaches employed to meet the specific needs of students with autism spectrum disorder. Exergames stand out as an innovative and promising tool, particularly in the development of social and motor skills. However, the dispersion of other resources indicates a lack of a widely established reference technology, demonstrating the need for further research to explore the efficacy and integration of these tools in different school contexts.

The third chart illustrates the degree of integration between the analysed technologies and Specialised Educational Support. It reveals that 7 out of 10 studies do not mention or explore this integration, while only 3 studies demonstrate direct application or alignment with Specialised Educational Support.

This gap is concerning, given the critical role of Specialised Educational Support in the educational inclusion of students with disabilities and autism spectrum disorder. The lack of integration poses challenges in the practical implementation of assistive technologies in everyday school life. Additionally, it underscores the need for future studies to investigate how Specialised Educational Support can be more effectively incorporated into the use of technologies, ensuring specialised and contextualised support.

Critical review and insights from analysed studies on Assistive Technologies

This section critically synthesises the main contributions and limitations of the studies reviewed, with particular attention to the educational use of Assistive Technologies for students with autism spectrum disorder.

The analysed studies, including the article by Borges-Sales and Machado (2020) and various dissertations, highlight the transformative potential of assistive technologies in the educational process of students with autism spectrum disorder. The use of exergames, discussed both in the article and in Machado's dissertation (2019), underscores the significant contribution of interactive technologies in promoting social skills, such as communication and interactivity. However, common limitations, such as reliance on

expensive equipment and the lack of longitudinal studies, point to the need for more accessible solutions and investigations that assess the sustainable impacts of these technologies.

Landim's (2018) dissertation reinforces the importance of accessible teaching materials by proposing a guide for teachers, an approach that aligns with Monteiro's findings (2021). Monteiro's creation of the “Tom Tom” game provides a robust tool for assessing and developing social skills. Both studies emphasise the necessity of teacher training, a key issue also addressed in Melo's analysis of didactic sequences using Augmented Reality (2021). The reliance on specific devices, evident in several dissertations such as those by Melo and Menezes (2021), highlights a recurring practical challenge, underscoring the urgency for adaptable solutions in resource-limited contexts.

In Pantoja’s dissertation (2022), the creation of the “Casulo TEA” app, aimed at teaching science, demonstrates the value of interactive technologies in literacy and teaching complex concepts, complementing Ferreira's exploration of digital games for literacy (2022). Both highlight the need to expand access to specialised teaching materials, particularly in public schools. Similarly, Rodrigues introduces Teacch.me as a free and accessible tool promoting autonomy and organisation (2022). However, like other studies, it underscores the need for greater training of professionals to integrate these tools into daily pedagogical practices.

Gomes’s dissertation on “Rotina Divertida” (2022) and Pereira’s work (2022) on augmentative and alternative communication both emphasise the positive impact of accessible technologies on the autonomy and vocabulary development of students with autism spectrum disorder. However, the absence of longitudinal analyses remains a common limitation, restricting the understanding of the long-term impacts of these initiatives. Despite this, the development of resources such as teaching guides and interactive e-books in the analysed dissertations represents a significant step forward in the pursuit of more inclusive education.

In summary, the academic outputs converge in demonstrating the potential of Assistive Technologies to personalise and enhance the teaching and learning processes of students with autism spectrum disorder. However, the limitations identified in Tables 1 and 2 underscore the need to delineate future research pathways capable of addressing these gaps and amplifying the impact of Assistive Technologies within inclusive educational contexts. In this regard, we highlight the following six priority perspectives:

I. The integration of effective collaboration with Specialised Educational Support;
II. The development of longitudinal research;
III. The expansion of doctoral-level investigations;
IV. A focus on training teachers and aides;
V. Ensuring greater scientific rigour in peer-reviewed articles;
VI. The exploration of emerging technologies and the promotion of scalability and institutionalisation of practices.

Taken together, the studies reviewed in this section point to a decisive yet still emerging role for assistive technologies in advancing inclusive education for students with autism spectrum disorder. They reveal both the pedagogical promise of innovative digital resources and the structural constraints that limit their sustained and equitable use, particularly in under-resourced contexts. Building on these insights, the next section will critically examine how the identified priorities — including collaborative practice, longitudinal evidence, robust teacher education and the institutionalisation of successful initiatives — can be operationalised within real school systems. This transition from mapping existing contributions to interrogating their wider implications is essential for informing policies, practices and future research agendas that genuinely support long-term, systemic inclusion.

Conclusions

Over the first twenty-four years of the twenty-first century and considering the continental scale and sociocultural complexity of Brazil, a substantial gap remains in the scientific literature on Assistive Technology and autism. Public data from the Ministry of Education indicate that Brazil has 2,608 higher education institutions, of which 2,306 are private and 302 are public. Despite this extensive academic infrastructure, research production that specifically addresses the themes examined in this article only begins to appear from 2018 onwards. This temporal and thematic lag reveals not only a structural deficit in the field, but also the urgency of expanding funding, strengthening research groups, and fostering inter-institutional collaborations focused on Assistive Technology for individuals on the autism spectrum.

Inclusive education is based on the premise that all children and young people, irrespective of their individual characteristics, have the right to learn together in the same educational environments. Such environments should acknowledge, respect, and value diverse learning trajectories, rhythms, and styles. Within this framework, schools take on a pivotal role by adopting pedagogical practices that are both flexible and evidence-based, by organising specialised multidisciplinary teams, and by designing curricular strategies that are sensitive to difference. These elements are essential to ensure that teaching and learning processes are accessible to all students, without segregation or exclusion.

For students with autism spectrum disorder, the demands made on the school environment become even more complex. Autism spectrum disorder is a heterogeneous condition, with considerable variability in communication, social interaction, sensory processing, and behaviour. Consequently, the school must function not only as a locus of formal instruction, but also as a privileged context for developmental support and, in many cases, for the early identification of needs that may indicate diagnostic pathways. In this sense, the school environment can offer structured opportunities for students to recognise, exercise, and expand their specific abilities, thereby contributing to their autonomy, participation, and overall quality of life.

The analysis of the selected articles and dissertations reveals a set of critical gaps that hinder the consolidation of this agenda. First, the limited volume of research on Assistive

Technology for autistic students restricts the development, validation, and refinement of more sophisticated and contextually appropriate technological solutions. This scarcity of empirical studies reduces the availability of robust evidence to inform decision-making by educators, families, and policy-makers. Secondly, the weak articulation between Assistive Technology initiatives and Specialised Educational Support points to a disjunction between what is prescribed in legislation and what is effectively implemented in schools. In many cases, the legally guaranteed services, resources, and support structures either do not materialise, or are implemented in a fragmented, intermittent, or poorly coordinated manner.

Although the technological resources identified in the reviewed studies show promising potential — for example, by facilitating communication, enhancing engagement, or supporting the development of specific skills — they remain quantitatively and qualitatively insufficient to respond to the heterogeneity and complexity of the autistic population. The limited scale and scope of these initiatives reinforce the need for increased and sustained investment in research, development, evaluation, and dissemination of Assistive Technologies that are scientifically validated and socially relevant. At the same time, public policies must move beyond formal guarantees to ensure coherent implementation, adequate funding, continuous training for professionals, and systematic monitoring and evaluation of outcomes.

In summary, the inclusion of students with autism spectrum disorder in Brazilian schools continues to pose significant challenges, even though the context already shows modest but meaningful advances. The existing body of research and practice reveals an ambivalent scenario: on the one hand, there are legal frameworks and promising technological experiments; on the other, there are persistent gaps in policy implementation, insufficient articulation between sectors, and limited recognition of the specificities of autism in educational planning. Each Assistive Technology initiative tends to address demands associated with functional limitations or developmental needs of children and adolescents, which underscores the importance of moving towards more integrated, multidimensional, and person-centred approaches. Only with coordinated and sustained action will it be possible to guarantee high-quality services that respond to individual needs in a comprehensive, equitable, and rights-based manner.

Looking ahead, future perspectives in this field require a strategic combination of scientific, technological, and political efforts. At the scientific level, longitudinal and interdisciplinary studies are needed to examine the impact of different types of Assistive Technology on the academic trajectories, social participation, and emotional well-being of autistic students in diverse Brazilian contexts. At the technological level, researchers and developers should co-create solutions with active participation from autistic individuals, their families, and school professionals, thereby ensuring that tools are usable, culturally appropriate, and aligned with real needs. At the policy level, it is essential to strengthen governance mechanisms that connect universities, schools, health and social services, and civil society organisations, enabling comprehensive and coordinated support networks. By advancing along these interconnected axes, Brazil can progressively reduce the current temporal and scientific gap and move towards an inclusive educational system in which

Assistive Technology genuinely contributes to the full exercise of citizenship for people on the autism spectrum.

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