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DIGITAL INFORMATION AND COMMUNICATION TECHNOLOGIES (DICT) AS MEDIATORS OF THE EDUCATIONAL INCLUSION OF STUDENTS WITH AUTISM SPECTRUM DISORDER (ASD)

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Marcel Pereira Pordeus[1], Caio Leonam Vieira Pordeus[2], Maria da Conceição do Nascimento Ferreira[3], Maria Fernanda Santana Melo Madeira[4], Maize de Vasconcelos Marques[5], Dione de Matos Freire Soares Pontes[6], Régia Mônica Gonçalves de Sousa[7], Francisca Claudene Gomes[8], Francisca Patrícia Rodrigues Lima[9], Serli Araújo da Rocha[10], Alison Ferreira da Silva[11], Francisca das Chagas Alves de Morais[12],

[1] Dr. student in Public Policy
State University of Ceará-UECE
E-mail: marcel.pordeus@aluno.uece.br
[2] Undergraduate student in Letters/Portuguese Language
Federal University of Ceará-UFC
E-mail: cvieirapordeus@gmail.com
[3] Master in Education
Universidad Politécnica y Artística del Paraguay-UPAP
E-mail: profacnascimento@gmail.com
[4] Master in Education
Universidad San Lorenzo-UNISAL
E-mail: fernandamelo.cmm@gmail.com
[5] Dr. in Education
Universidad Gran Asunción-UNIGRAN
E-mail: maizevl@hotmail.com
[6] Dr. in Education
Universidad Gran Asunción-UNIGRAN
E-mail: dionepontes@hotmail.com
[7] Dr. in Education
Universidad Gran Asunción-UNIGRAN
E-mail: regiamonicag@hotmail.com
[8] Master in Education
Universidad Gran Asunción-UNIGRAN
Email: claudenia.fg@gmail.com
[9] Master in Education
Universidad Gran Asunción-UNIGRAN
E-mail: fpatriciarlima@gmail.com.br
[10] Dr. in Education
Universidad Gran Asunción-UNIGRAN
E-mail: serliflor.rocha@gmail.com
[11] Doctor of Education
Universidad Gran Asunción-UNIGRAN
E-mail: alison.silva@prof.ce.gov.br
[12] Master in Education
Universidad Gran Asunción-UNIGRAN
E-mail: chaguinhamorais2017@gmail.com

Marisa Veras Gadelha[13], Ana Maria Costa dos Santos[14] and Kassius Demetrius Patricio dos Santos[15]

ABSTRACT

Digital Information and Communication Technologies (DICT) as mediators of the educational inclusion of students with Autism Spectrum Disorder (ASD), are part of a perspective that makes it possible to investigate how the inclusion of students with special needs can be favored by digital and technological resources, aligning research with the new demands of inclusion and accessibility in the educational environment, especially with regard to digital resources that are emerging today for this audience. In this context, ASD represents a significant challenge for educators, requiring teachers to constantly adapt their pedagogical practices combined with technologies, Artificial Intelligence and other digital resources responsible for enhancing the cognition and interaction of the learner with ASD. The difficulties faced by these professionals are multifaceted and manifest themselves in several areas of the teaching-learning process. Therefore, the lack of information not only limits the understanding of the potential of these resources for learners with ASD, but also prevents the formulation of effective pedagogical strategies that can meet the unique learning needs, for this we fostered in this study the significance of DICT combined with the teaching-learning of students with ASD.

Keywords: Education, Digital technologies, Inclusion, ASD.

[13] Master in Education
Universidad Gran Asunción-UNIGRAN
E-mail: marisaverasg@hotmail.com
[14] Master in Education
Universidad Interamericana-UI
E-mail: anamarisalaura@gmail.com
[15] Master of Education
Universidad Americana
E-mail: kassiusdemetrius@gmail.com

INTRODUCTION

Inclusive education or "Education for all", currently so present in the discourses and debates in the educational environment and postulated in the normative documents that guide education, is still a difficult challenge to be faced by the Brazilian educational system. This is because, even today, part of the student demand is without access to school and often aggregated in it, but far from language, ethnicity, purchasing power, special educational needs, technologies, among others.

Based on premises such as the right and respect for difference, the issue of the education of autistic children included in regular schools, as they constitute the most striking differences in terms of the pace of learning and development, should be the core of the need for changes in society, in the school and in pedagogical practices. Such issues are worthy of discussion, insofar as they can host the revision of the principles that guide pedagogical intentions and practices, overthrowing conceptions and certainties justified more by prejudices than by scientific knowledge, in addition to questioning the rigid model of teaching based on homogenization.

Research on the use of digital resources for literacy and educational inclusion of children with Autism Spectrum Disorder (ASD) is of paramount importance, considering the growing presence of digital technologies in the contemporary educational context, in addition to the need to be involved with these technologies outside the classroom (Pordeus *et al.*, 2022). The scarcity of studies that address digital accessibility in digital devices and the use of technological mechanisms for educational purposes for this specific audience highlights a significant gap in science itself and the production of materials and instruments based on scientific research.

This lack of information not only limits the understanding of the potential of these resources, but also prevents the formulation of effective pedagogical strategies that can meet the unique learning needs of children with ASD, leaving that mere scope of the teacher's action, without using the existing technological instruments possible. Therefore, research in this field is justified by the urgency of developing a theoretical and practical body that supports the inclusion and schooling of these young people, promoting a more equitable and accessible educational environment.

Considering the context of young people and adolescents in high school, digital resources for educational purposes have proven to be tools with promising potential for teaching fundamental skills, such as reading and writing, essential for the social and academic integration of young people with ASD. The use of these technologies can facilitate the learning of linguistic and cognitive skills, contributing to the formation of a

repertoire that enables communication and social interaction. In addition, this study identifies the best practices for the selection and use of applications, considering criteria such as quality evaluation, the approval of educators and the relationship with the schooling scale itself.

Supervision and mediation by managers and educators are crucial to ensure that digital resources are used safely and effectively, maximizing the benefits that these apps can provide in the learning process. In this vein, the context of public Basic Education presents a double challenge of training young people for the job market and subsequent higher education, considering the context of interdisciplinarity and inclusion as a determining factor in the teaching-learning process. In this sense, how has the educational process been facilitated by using digital instruments and tools for this training and schooling of students, especially considering those with ASD?

Thus, it is essential to recognize the challenges that permeate the development and implementation of educational applications, instruments, and tools aimed at children with ASD. To this end, the research not only aims to identify these barriers, but also to propose solutions that can be integrated into the design and functionality of the digital material used. Adopting approaches such as *Codesign*[16], which involves the active participation of users in the creation of solutions, can be an effective strategy to ensure that digital resources meet the specific needs of this audience. Thus, research on the use of digital resources for the digital literacy of learners with ASD is not only necessary, but also urgent, contributing to the construction of a more inclusive and accessible educational environment.

By methodology, we are supported by a qualitative approach, of bibliographic character, seeking to understand in a contextualized way the perceptions of students with ASD and their educators about the use of Digital Information and Communication Technologies (DICT) in pedagogical practice in the context of public state high school (Pordeus *et al.*, 2022). The choice for the bibliographic approach is justified by the need to capture and collate, in quantity and qualitative terms, the nuances, interpretations and subjectivities involved in the process of using DICT, since these technologies play a fundamental role, considering their scope in this research (Lakatos; Marconi, 2021), in the mediation of educational activities aimed at the linguistic and cognitive development of students with special needs.

It is important to emphasize that this theoretical framework is not exhaustive, on the contrary, it is only elucidative on the subject. To this end, we will incorporate as an initial reference, authors such as Pelosi (2011); Florian (2015); Magalhães *et al.* (2017); Manzini

[16] Shared design among stakeholders, with partnerships for companies.

and Fiorini (2018); Souza (2021); Balbino, Oliveira e Silva (2021); Shah; Pordeus (2021); Pordeus *et al.* (2022), as well as Ribeiro and Lustosa (2022), which can be effectively collaborated by what is developed during the course of the research.

AUTISM SPECTRUM DISORDER (ASD): CONTEXT, TECHNOLOGIES AND CHALLENGES FOR THE EDUCATIONAL ENVIRONMENT

According to the ideas of Gauderer (2000), for Kanner, the etiology of Autism had an affinity with the conduct of parents who described them as intellectualized, emotionally cold, without much interest in establishing more meaningful relationships with their children, preferring to observe them. Cavalcante and Rocha (2012) also record that the origin of Autism was seen by Kanner as resulting from "intellectual" fathers and "refrigerator" mothers, for whom the author draws a profile of emotionally cold mothers and intellectual fathers who spent more time taking care of their baby than in contact with it.

Based on this, the syndrome had its ancestry in problems in the first affectionate relationships, in the contact between the mother and the child that affected social contact, a concept that was very widespread in the 1970s approximately. This psychodynamic view has been abolished over the years as an exclusive model of explanation for the cause of autism; Discussions began to coalesce the ideas that both models (organic and psychodynamic) could more consistently explain the origin of such a complex syndrome.

From research in the area and advances in studies, researchers in the area began to adopt an intermediate behavior to the detriment of the ascendancy of autism, not only brain anomalies, but the environment would also influence the development of ASD in the child. This new posture called intermediate or multifactorial, at the origin of autism, composed a new vision among ASD researchers.

Today, as Gauderer (2000) explains, ASD is accepted as a syndrome with several etiologies, and maternal rubella (especially when there is later deafness or blindness), phenylketonuria, encephalitis, meningitis and tuberculosis can be cited as predisposing factors. But according to Dourado (1996), no biological marker present in all the cases studied that could be considered pathognomonic of the autistic condition has been identified, nor has it been possible to establish a causal relationship between biological abnormalities found in Autism, since they may be present in some individuals and absent in others.

The most likely hypothesis, according to the author, is that Autism ends up being a condition associated with several etiopathological agents, and that these include prenatal, peri- and postnatal factors, such as infections (rubella, cytomegalovirus, etc.), anoxia,

trauma, metabolic abnormalities, genetic alterations.

According to the Association of Friends of the Autistic – AMA (2003), genetic, epidemiological and neurophysiological observations convincingly demonstrate the existence of physical brain dysfunctions in ASD, which can be manifested by various pre, peri or postnatal, genetic or metabolic etiological agents.

Gauderer (2000) states that Autism is rarely detected before the age of two, and there is great difficulty in having an accurate diagnosis. The child with suspected syndrome may present an alteration in a certain exam and another not, and there are cases of children with Autism who do not exhibit any type of change that can be detected in biomedical exams, although there is a correlation between certain neurological findings and childhood ASD: cognitive deficits, epileptic seizures and a higher IQ in boys than in girls and the indication of organic factors.

From this fact, it is understood, in a particular view, that although ASD is now much better known through a series of clinical exams, such as radiological, neurological and neurochemical exams, it can provide and agglutinate information about possible causes of the syndrome and alterations that the child may present, the results still do not provide an immediate statistical correlation with the individual who presents ASD, And many questions about this syndrome are being answered, proving its complexity.

In fact, Autism Spectrum Disorder (ASD) represents a significant challenge in the educational context, requiring teachers to constantly adapt their pedagogical practices (Sousa; Pordeus, 2021). The difficulties faced by these professionals are multifaceted and manifest themselves in several areas of the teaching-learning process. Among the main difficulties, the adaptation of activities stands out, since teaching materials are often not designed to meet the specific needs of students with ASD (Magalhães *et al.*, 2017). This inadequacy of pedagogical resources makes the teaching work more complex, requiring educators to modify activities to ensure the equitable participation of all students, which can be a lengthy and challenging process (Sousa; Pordeus, 2021).

In addition to the adaptation of activities, the lack of adequate training on ASD during the initial training of teachers is a significant barrier. Many educators report that they have not received specific content about the disorder, which limits their ability to implement effective inclusive practices (Magalhães *et al.*, 2017). The lack of knowledge about the characteristics of ASD and its implications for learning makes it difficult to create an educational environment that favors inclusion and meaningful learning. Thus, continuing education and specific training to deal with autistic students become essential for teachers

to develop teaching strategies that meet the needs of these students (Magalhães *et al.*, 2017).

Another critical aspect is communication, which proves to be a substantial challenge in daily school life. The difficulty in communication of students with ASD, who often do not use speech, generates uncertainties about learning and the difficulties faced by them. This situation can lead teachers to feel insecure about the effectiveness of their pedagogical approaches, since the evaluation of students' progress becomes complex (Magalhães *et al.*, 2017). The lack of clarity in communication and interaction can result in a cycle of frustration for both educators and students, making it difficult to build a collaborative and inclusive learning environment. However, in children with verbal and non-verbal ASD, gesticulation is an uncommon characteristic, followed by the vocal environment in the interactional process (Amato; Fernandes, 2010).

In this sense, the absence of adequate resources and support for the inclusion of students with ASD in schools is an issue that deserves attention. Collaboration between different professionals, such as psychologists, occupational therapists and speech therapists, is essential to understand and meet the specific needs of these students (Romeu; Rossit, 2022). The lack of a multidisciplinary team and adequate resources can compromise the effectiveness of inclusive practices, making the work of educators even more challenging (Magalhães *et al.*, 2017); (Romeo; Rossit, 2022). Therefore, it is imperative that educational institutions promote the continuous training of teachers and offer adequate support, in order to ensure that all students, regardless of their needs, have access to quality and inclusive education.

This context so far approached from what Magalhães *et al*. teach. (2017) is already problematic in its nature, presenting several challenges to be overcome. When we include instruments, technological tools and digital applications, the context becomes even more complex. In this sense, Neto and Alves (2023) highlight the importance of digital technologies as facilitating tools in teaching, in their case Mathematics, providing a more accessible and interactive learning environment. According to the authors, there are technological mechanisms or some tools, such as the Spiko and Math Master software, Sebran's ABC and TuxMath, stand out for their effectiveness in promoting the understanding of mathematical concepts in a playful and engaging way. These technologies not only help in the practice of mathematical operations, but also encourage literacy and the development of cognitive skills, which are essential for learning.

In addition to facilitating the understanding of abstract content, the use of educational games and software in the teaching of Mathematics to students with ASD promotes social

interaction and the collaborative construction of knowledge. As pointed out by Balbino, Oliveira and Silva (2021), digital technologies offer viable alternatives that enable various ways of teaching and learning, contributing to the development of essential skills and competencies in an inclusive educational context. Based on this assumption, there is an urgent need to develop and make available more technological resources aimed at teaching the most diverse subjects to autistic students, especially in Brazilian public schools. The scarcity of adequate materials, as reinforced by Balbino, Oliveira, and Silva (2021), underscores the importance of collaboration between educators, researchers, and technology developers to ensure that all students have access to quality education, ensuring the right to inclusion and meaningful learning.

Assistive Technology (AT) has proven to be an essential tool in the educational context, especially for students with Autism Spectrum Disorder. The implementation of technological resources in the teaching and learning process not only facilitates the understanding of abstract content, but also promotes social interaction and the collaborative construction of knowledge. According to Manzini and Fiorini (2018), AT is an interdisciplinary area that aims to enhance users' skills, offering support that adapts to the individual needs of each student. This personalization of teaching is fundamental, since students with autism often present specific challenges in areas such as communication and social interaction (Sousa; Pordeus, 2021). The use of educational software and interactive games, for example, can stimulate student engagement and motivation, creating a more inclusive and accessible learning environment (Florian, 2015).

In addition, the Covid-19 pandemic brought to light new challenges for Specialized Educational Service (SES), requiring educators to adapt their pedagogical practices to remote teaching (Souza, 2021). In this scenario, AT becomes even more relevant, as it enables teachers to develop strategies that meet the needs of students with ASD, as a moment of impulse to the need for remote education. According to Ribeiro and Lustosa (2022), despite the difficulties faced, the adoption of assistive technologies and innovative pedagogical resources can contribute significantly to the progressive continuity of learning and the development of students' social and academic skills.

Thus, the integration of AT into SEA not only improves the quality of teaching, but also promotes the autonomy and social inclusion of students with autism, preparing them for more active participation in society. This panorama only reinforces the idea that there is information regarding the use of AT with SEA, AT for educational reinforcement and pedagogical difficulties with SEA in regular education, however, little has been developed

with data on the context of the use of AT with SEA in regular education and what possible ways to polish this pedagogical format.

EDUCATIONAL RESOURCE

The virtual environment uses educational software that allows the creation of visual content and adaptive sensory activities, adjustable to the individual needs of each student, promoting personalized learning. In addition to content aimed at the development of linguistic and cognitive skills, the virtual environment also has alternative and augmentative communication resources, facilitating interaction and understanding of information by students with ASD (Figueiredo; Lee; Mansur, 2023).

The virtual environment is structured to promote the active interaction of students, incorporating activities that encourage reading and writing, through applications and digital tools validated by pedagogical and accessibility criteria. These resources are selected considering the approval of educators and the adaptation to the specific demands of students with ASD (Figueiredo; Lee; Mansur, 2023). In addition, the virtual environment, if adjusted to Artificial Intelligence, ensures that the teaching and learning process occurs in an inclusive, safe and effective way, providing the teacher's mastery to adapt as necessary, as well as the student's well-being in this process. In fact, autistic learners end up being individuals so heterogeneous in their needs and aptitudes that each event determines a characteristic adaptation of the tactics and treatment designs, in their adaptations to technologies and sociointeractionism. The designs, therapeutic and educational processes are much more changeable, as it depends on the individual's conduct, in its disparate extensions.

In addition to serving as a specialized pedagogical support for the development of academic skills, the interactive virtual environment works as an inclusive space for experimentation, in which managers, teachers and students can collaborate to refine practices and content, maximizing the benefits of DICT in inclusive teaching. In this way, the educational resource not only helps in the training and schooling of young people with ASD, but also contributes to the construction of a more equitable and accessible educational environment, in line with the principles of inclusion and respect for educational diversity.

CONCLUSION

Digital Information and Communication Technologies as mediators of the educational inclusion of students with Autism Spectrum Disorder are promising inclusion mechanisms in a context in which Artificial Intelligence expresses itself quickly in the educational context. In

fact, educational research can elucidate elements of this universe and by appropriating them, that is, knowing this reality, it ends up being a beginning to identify points of overcoming their weaknesses in a safer way.

Therefore, the option to specify the ASD and DICT categories is due to the fact that they are considered tools that help advance the teaching-learning process of learners with special needs. It is also understood that the research is pertinent because it raises new discussions based on the specificities presented by each student, demystifies concepts, mistaken and unscientific ideas about disabilities, and, in particular, ASD, giving rise to the need to update discourses and practices by all professionals involved in this reality.

ASD, as it is a complex disorder, its trajectory even more than other disabilities, is to be marked by modalities of education in segregated spaces. Therefore, it is believed that this research has its importance for the current educational scenario, because children with and without disabilities now share the space of the regular school.

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