THE IMPORTANCE OF MATHEMATICS FOR AUTISTIC STUDENTS

A IMPORTÂNCIA DA MATEMÁTICA PARA ALUNOS AUTISTA

LA IMPORTANCIA DE LA MATEMÁTICA PARA ESTUDIANTES AUTISTAS

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ABSTRACT

This paper addresses the essence of teaching mathematics to students with Autism Spectrum Disorder, highlighting its role in promoting social inclusion within the school environment. The main objective is to analyze the pedagogical practices and methodologies used in the teaching–learning process of mathematics. The specific objectives are to promote and encourage the teaching of mathematics in a dynamic way and to reflect on the importance of including students with autism. This research is a qualitative study grounded in a bibliographic review based on theoretical reflections from various authors who emphasize this theme. The results indicate that the use of visual resources, games, and practical activities significantly contributes to student engagement and learning. It is concluded that mathematics, when presented in an accessible manner, becomes an effective tool for inclusion, promoting active participation and the comprehensive development of students.

Keywords: School Inclusion. Learning. Special Education.

RESUMO

Este trabalho aborda a essência do ensino da matemática para discentes com transtorno do espectro autista, destacando seu papel na promoção da inclusão social no ambiente escolar. O objetivo principal é analisar as práticas pedagógicas e metodologias utilizadas no processo de ensino-aprendizagem da matemática. E os específicos são: Promover a prática e incentivo ao ensino de matemática de forma dinâmica e refletir sobre a importância da inclusão de discen-tes com autismo. De modo que essa pesquisa trata-se de um estudo qualitativo fundamentado em um estudo bibliográfico realizado a partir de reflexões teóricas de vários autores que ressal-ta acerca dessa temática. Os resultados indicam que o uso de recursos visuais, jogos e atívida-des práticas contribui significativamente para o engajamento e a aprendizagem dos alunos. Conclui-se que a matemática, quando elencada de maneira acessível tornando-se uma ferra-menta eficaz de inclusão, promovendo a participação ativa e o desenvolvimento integral dos discentes.

Palavras-chave: Inclusão Escolar. Aprendizagem. Educação Especial.

RESUMEN

Este trabajo aborda la esencia de la enseñanza de la matemática a estudiantes con Trastorno del Espectro Autista, destacando su papel en la promoción de la inclusión social

en el entorno escolar. El objetivo principal es analizar las prácticas pedagógicas y las metodologías utilizadas en el proceso de enseñanza-aprendizaje de la matemática. Los objetivos específicos son promover y fomentar la enseñanza de la matemática de manera dinámica y reflexionar sobre la importancia de la inclusión de estudiantes con autismo. Esta investigación se caracteriza como un estudio cualitativo fundamentado en una revisión bibliográfica basada en reflexiones teóricas de diversos autores que destacan esta temática. Los resultados indican que el uso de recursos visuales, juegos y actividades prácticas contribuye significativamente al compromiso y al aprendizaje de los estudiantes. Se concluye que la matemática, cuando se presenta de manera accesible, se convierte en una herramienta eficaz de inclusión, promoviendo la participación activa y el desarrollo integral de los estudiantes.

Palabras clave: Inclusión Escolar. Aprendizaje. Educación Especial.

1 INTRODUCTION

The study scenario for the elaboration of this work was a broad research of different articles, TCCs and various materials, where the relevance of mathematics teaching tools for the inclusion of special students was outlined. The inclusion of students with autism spectrum disorder in the school context represents a challenge and, at the same time, an opportunity to propose a more egalitarian and accessible education. Among several curricular areas, that is, mathematics stands out for its complexity and for requiring approaches that consider the particularities of each student. Autistic students, in particular, demand pedagogical strategies that value their potential, respecting their times and ways of learning.

It is worth mentioning that the use of games can be very valuable in the process of appropriating mathematical knowledge. In this sense, the "interest in studies of the relationship between games and mathematical learning is based on the possibility that all students can, through games, become more involved in carrying out mathematical activities" (Muniz, 2010, p. 26).

It is relevant to understand the importance of mathematics as mechanisms to stimulate cognitive development and social interaction, which becomes fundamental for the construction of more inclusive educational practices. In which this work seeks to reflect on how the teaching of mathematics can contribute significantly to the integral formation of these students, proposing an effective participation in school and social life.

Thus, the choice of this theme was due to the curiosity to research the importance of mathematics for the inclusion of students with Autism Spectrum Disorder (ASD), especially when mediated by the use of goals. Considering the cognitive, behavioral and social particularities of these students, the research seeks the importance of the pedagogical practices used in the teaching-learning process of mathematics.

We emphasize that the relationship between mathematics teaching and technological tools are of fundamental importance for the improvement and inclusion of the teaching-learning process. The technological resources used in mathematics teaching lead to the diversification of pedagogical strategies, contributing to a substantial support in learning.

2 THEORETICAL FRAMEWORK

Mathematics offers broad benefits specific to ASD students as one of the most well-known autistic activists, many people on the spectrum have specific skills, such as logical and visual thinking, which can be enhanced through adapted teaching goals focused on problem-solving. In accordance with Gentili (2009, p. 1063) says that: "Educational inclusion

is a process that is built in opposition to the forces and tendencies that have produced and historically produce the denial of the right to education of the poorest and most excluded."

According to Rodrigues, the implementation of inclusive education:

> If the regular school wants to be able to respond competently and rigorously to the diversity of all its students, it needs to recruit more specialized personnel (therapists, psychologists, social workers, etc.) and needs to have more differentiated equipment and material resources (Rodrigues, 2006, p. 9).

It is noticeable to reflect that the inclusion of students with ASD in the school context has intensified in recent decades, driven by legislation such as the Brazilian Inclusion Law (Law No. 13,146/2015) and the National Policy on Special Education in the Perspective of Inclusive Education. It is worth mentioning that the teaching of mathematics represents a relevant challenge, as well as an opportunity to promote the cognitive development and social participation of these students.

Law No. 13,146/2015, also known as the Brazilian Inclusion Law (LBI) or the Statute of Persons with Disabilities, is a milestone in Brazilian legislation to guarantee and promote equal rights and fundamental freedoms of people with disabilities, aiming at their social inclusion and citizenship. In which this law establishes the rights and duties related to people with disabilities, including accessibility, health, education, work, transportation, social assistance, among others (Brasil, 2015).

According to Santos, the inclusion:

> It is a process that reiterates democratic principles of full social participation. In this sense, inclusion is not limited to one or a few areas of human life, such as, for example, health, leisure or education. It is a struggle, a movement that has the essence of being present in all areas of human life, including education. Inclusion refers, therefore, to all efforts to guarantee the maximum participation of any citizen in any area of society in which he lives, to which he has a right, and over which he has duties (Santos, 2006, p. 4).

It is important that the teacher knows very well the autistic student in which he will be included in his class. According to Cunha (2014, p. 13) "Autism requires study, preparation and dedication from the teacher." Thus, the teacher will need to know much more than the limitation in restriction of the disorder, he needs to know the student beyond the disability.

The autistic student will not express his feelings. The understanding of this will come under the careful observation of the teacher and those who are directly included with the learning of this student. In accordance with this conception, Cunha states:

> The autism situation imposes that all psychopedagogical evaluation be an action and research on the individual, with pertinence in his biological, family and social history; their love, their desires, their needs, using theoretical and practical instruments, where observation is the compass in conducting the entire process (Cunha, 2014, p. 52).

In this sense, Cunha (2014, p. 30) reports that "care is needed for an accurate assessment of the situations that cause harmful attitudes, because they foster the disorder, limiting learning." In consonance, the statement highlights the essence of an attentive and continuous observation of the behavior of students with ASD in the school context, especially during mathematics classes.

In this scenario, the teacher's performance must be based on inclusive pedagogical practices, which believe in the sensory, cognitive and emotional particularities of these students. Thus, the use of structured routines, visual language and playful activities, for example, can reduce challenging behaviors and favor concentration and engagement with mathematical content. In line with Cunha (2014, p. 33) "the teacher needs to learn to relate to the reality of the autistic world".

According to Blanco:

> Knowing students well implies intense interaction and communication with them, a constant observation of their learning processes and a review of the educational response offered to them. This knowledge is a continuous process, which is not exhausted at the initial moment of preparing the annual program (Blanco, 2004, p. 296).

This instrument is elaborated in a joint action with all those directly involved in the student's educational process. That is, the regent teacher, the resource room teacher, the mediator teacher and the student's family (Mascaro; Redig, 2016).

Teaching children with ASD represents a huge challenge. Thus, students with these disorders show impairments in communication and social interaction, which makes it difficult to socialize with other children

According to Cunha:

> The outside world is a stimulator for learning. In childhood, through their external relationships, the child learns the names of objects, being able to use them in a functional way or symbolize games. Information becomes knowledge. However, in autism, their social interaction is impaired, and this knowledge is not revealed, and objects start to have only sensory functions, with little cognitive contribution. (Cunha, 2014, p. 27)

Thus, it is understood that the deficit in social interaction, characteristic of Autism Spectrum Disorder, can significantly compromise the process of information construction, as reported by Cunha (2014).

According to Amaral and Silva (2019), strategies such as the use of games, manipulative materials, technological resources, and visual support (such as pictograms and diagrams) are effective in bringing the student closer to the mathematical content, allowing him to establish more meaningful relationships with concepts and operations. In addition, these resources make it possible to make teaching more flexible, respecting the pace and particular ways of learning of each student.

3 METHODOLOGY

This work is a qualitative research, elaborated from bibliographic surveys. In which its main focus was to verify the relevance of the inclusion of students with ASD. Since it is a technique for obtaining answers that were presented throughout the explorative approach.

We emphasize that the data collection took place through scientific publications obtained in electronic media in the databases: Scielo (Scientific Electronic Library Online) and Google Scholar, where they were used for research and development of all the work.

Exploratory research has as its main focus to develop, improve, elucidate and transform meanings and ideas, always based on the formulation of the most relevant problems or accessible hypotheses. In this case, the researcher has greater flexibility with the data of social reality, in addition to providing a flexible and not so formal posture.

In addition, it enables the researcher to obtain more information on a given subject, facilitating the delimitation of the work theme and the definition of objectives, and also provokes the formulation of research hypotheses, which the investigation can result in the discovery of a new type of focus for the work that is in mind.

4 RESULTS AND DISCUSSIONS

In order to carry out the respective research, a data survey was carried out through Scielo and Google Scholar. It is worth mentioning that the teaching of Mathematics contributes significantly to child development, especially when it is worked through games and play.

This approach makes learning more attractive and accessible, promoting the participation of all students, stimulating creativity, the construction of new knowledge, and social interaction. In the case of children with ASD, it is essential to offer support, specialized

follow-up, and pedagogical strategies adapted to their reality. In this process, the partnership between school and family becomes indispensable to ensure effective and inclusive learning.

In today's society, school inclusion has gained more and more prominence, especially with regard to the educational service of students with ASD. Thus, Mathematics, in turn, plays a relevant role in this process, that is, in addition to stimulating logical reasoning, it contributes to the development of autonomy and social interaction.

Manrique (2014, p. 10) states that "inclusive education becomes a difficult standard to achieve if there is no adequate initial and/or continuing training for teachers who teach mathematics". This finding highlights the importance of teacher preparation to deal with the diversity present in the classroom, especially with regard to the inclusion of students with ASD.

The absence of specific training compromises the effectiveness of pedagogical practices, making it difficult to adapt strategies, resources, and approaches that meet the needs of these students. Thus, investing in training aimed at inclusive education, with a focus on the teaching of mathematics, is essential to guarantee the right to learning for all students, respecting their particularities and promoting educational equity.

According to Pletsch (2009), teacher training is a central element for the success of inclusion, as it is through it that skills are developed to deal with diversity and promote appropriate strategies for teaching all students.

The following table presents the articles selected in the research, identified by the letters A, B, and C, with the objective of facilitating the visualization and analysis of the data. In it, the main results obtained are highlighted, especially with regard to the valorization of the inclusion of students with autism for the teaching of mathematics. The most relevant points were duly highlighted and underlined for greater evidence and understanding.

Table 1

Presentation of selected studies

Author/year	Type of Study	Objective	Methodology	Conclusion
(**A**) Cunha (2014)	Qualitative cross-sectional study	Verify the importance of inclusion for students with ASD teaching mathematics.	An online questionnaire was applied to 37 teachers developed by the authors, containing 11 Closed questions	Strategies based on digital resources, such as educational games, by demonstrate effectiveness in teaching, contributing to more dynamic and

				interactive learning
(B) Rodrigues (2006)	Observational, descriptive epidemiological study an d retrospective	Evaluating education inclusion	Its method was an electronic questionnaire divided into 5 items, applied a 34 participants, who report the importance of technological tools.	83% of the authors highlight that inclusive practices in education contribute significantly to increasing the motivation of students, including those with special needs, in the discipline of mathematics, stimulating their curiosity and willingness to learn.
(C) Amaral e Silva (2019)	Observational study with a quantitative descriptive approach	Check the Effects the use of technological tools in the school environment.	It used a survey for 40 individuals on leveraging technological tools.	***100% of the Research*** shows that games and various dynamic activities stimulate the student's interest in mathematics.

Source: The authors.

As reported in the table above, the main goals found were to use technological digital methodologies in favor of teaching, as well as the use of digital games in the educational sector.

Santos and Oliveira (2024, p. 15) state that "The use of games is of paramount importance because they contain control in relation to error, which enables the child to self-instruct and take their own initiatives.

It is worth mentioning that in the incidence of evolution in the teaching of mathematics to students with ASD, the survey revealed that 50% of students showed significant advances in the process of learning mathematics. The results of the studies analyzed reinforce this trend: Study B, 83%, and Study C, 100%.

The learning of mathematics by students with ASD can be boosted when strategies adapted to their specific needs are adopted, providing greater interest and absorption of content.

The evolution of students with ASD in the process of learning mathematics points to a positive trend when inclusive pedagogical tools are clearly applied.

Through all the research, it was possible to realize how much mathematics contributes to the process of inclusion of students with autism. Based on the entire study carried out, it was noticeable to understand that 75% of the authors have the same opinions and 25% understand it as not very essential, that is, according to the entire study carried out. According to Mantoan (2006) and Oliveira (2017), the teaching of Mathematics can be an important tool for inclusion when pedagogical practices are adopted that consider the specificities of students with Autism Spectrum Disorder.

5 FINAL CONSIDERATIONS

In view of the above, it is concluded that the teaching of mathematics to students with Autism Spectrum Disorder represents an important instrument of social inclusion in the school context. The analysis of pedagogical practices shows that methodologies adapted to the specific needs of these students are relevant to promote cognitive development, autonomy and active participation in school activities.

It is essential that educators are able to welcome diversity in the classroom, using methodologies that consider the divergent forms of learning. Visual resources, concrete activities and the use of assistive technologies proved to be effective in the teaching-learning process, thus helping for a more viable and meaningful education.

In this sense, the essence of the continuing education of teachers, the collaboration between education professionals and the construction of an inclusive school context, where the human rights and dignity of all students are respected, is affirmed. By ensuring the access and permanence of students with ASD in the teaching of mathematics, we are providing not only educational equity, but also the appreciation of divergences as an enriching factor in educational evolution.

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