CHALLENGES AND PERSPECTIVES OF THE NEUROPSYCHOPEDAGOGUE'S PERFORMANCE IN THE FACE OF MATHEMATICAL LEARNING DIFFICULTIES

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Ana Paula Leite Viana Nogueira[1], Daniela Maria do Amaral Cubas[2], Elizegina Luiz da Silva[3], Karina da Conceição Almeida[4], Ana Carla Costa Santana Moraes[5], João Ferrera Lins Júnior[6], Renata Pontes da Silva[7], Ana Patrícia de Oliveira Ribeiro Silva Pinheiro[8], Paula Maria Grave Musser[9], Zuelide Brotas Ferreira[10], Raquel de Santana Fonseca[11] and Adriana Soely André de Souza Melo[12]

ABSTRACT

The present study aimed to present and analyze works that address the role of the neuropsychopedagogue in the face of mathematical learning difficulties. To this end, we used qualitative and bibliographic research using Google Scholar as a search platform, delimiting the period of the last 10 years (2013-2023), based on the descriptors: "mathematics difficulty", "mathematical learning difficulty", "mathematics and the role of the neuropsychopedagogue", with the contribution of theorists such as, Rosa (2022), Brazilian Society of Neuropsychopedagogy (SBNPp) (2021), Silveira (2023), among others.

Keywords: Learning Disability. Dyscalculia. Neuropsychopedagogy.

[1] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: annapleitte@gmail.com
[2] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: danielaamaralcubas10@gmail.com
[3] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: elizeginaaee@gmail.com
[4] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: karinaalmeida2011@hotmail.com
[5] Specialist in Special Education and Specialized Educational Service – FACESP
E-mail: anacarlawal@gmail.com
[6] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: joaolins25@hotmail.com
[7] Specialist in Public Health with emphasis on Family Health – AEG
E-mail: renatapontes66@gmail.com
[8] Specialist in Legal Psychology – FACAPE
E-mail: patricia.majua@yahoo.com.br
[9] Specialist in Legal Psychology – FACAPE
E-mail: pgravepsi@gmail.com
[10] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: zuleidebrotas122@gmail.com
[11] Specialist in Institutional and Clinical Neuropsychopedagogy – FACESP
E-mail: raquelfonsecafonseca@outlook.com
[12] Dr. in Human Ecology and Socio-Environmental Management – UNEB
E-mail: soelyadriana@gmail.com

INTRODUCTION

The evolution of studies in the area of education focused on learning difficulties in general, and mathematics, has undergone great advances over the years, facilitating the identification of factors that contribute to students having learning difficulties during the schooling period.

Neuroscience has been a great ally in this process, with studies on the functioning of the human brain and discoveries of how learning is consolidated, along with psychology and pedagogy, the transdisciplinary science called neuropsychopedagogy emerges, which plays a fundamental role in the lives of students and has been growing due to its importance in preventing learning difficulties and preventing school failure.

The awakening to research on this topic was due to the observation and reports of people with difficulties in learning mathematics due to the way it was presented in basic education, as well as concerns about mathematics so necessary in everyday life being considered difficult by many people, and possible contributions of the Neuropsychopedagogue to students with learning difficulties and learning disorders, making the necessary referrals.

It is intended, based on the study of articles on Google Scholar, to present and analyze what authors who research on this theme defend regarding the difficulties of learning mathematics and the role of the neuropsychopedagogue and possible interventions.

In view of this, it is necessary to highlight the importance of problematizing how the discipline is worked, rarely without the help of playfulness. The chosen theme is relevant to raise discussions about mathematics learning and change the idea that society permeates, that it is okay not to know mathematics because it is considered difficult.

Intervention in mathematics learning difficulties from the beginning of school life is of paramount importance to diagnose difficulties and disorders, as well as referrals in search of solutions.

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Article 10 of resolution 03/2014, of the SBNPp (Brazilian Society of Neuropsychopedagogy), points out that Neuropsychopedagogy is a transdisciplinary science that studies cognitive processes, for this purpose, it seeks the relationships between the studies of neurosciences, the knowledge of cognitive psychology and pedagogy.

This new field of knowledge brings important contributions to education because it has the possibility of perceiving the individual in his totality. The neuropsychopedagogue has a fundamental role in the school trajectory of students with learning difficulties, for Silveira (2019, p. 2) the "action of the neuropsychopedagogue must be aimed at preventing learning difficulties and preventing school failure not only of the student, but also of educators and all those involved in the educational process". Still on the role of the neuropsychopedagogue, the author defines that,

> In general terms, the work of neuropsychopedagogical counseling is related to the objective of educational/school psychology to assist the global development of the student through multiprofessional teamwork together with managers, teachers, advisors, parents and coordinators so that the learner has his basic learning needs developed. [...] it aims at prevention, assessment, psychological guidance and follow-up, preferably applied in the institutional context with a view to the aspect of educational inclusion, to the detriment of individual care, which is only carried out in cases for which there is really this need (SILVEIRA, 2019, p. 5).

The Brazilian Society of Neuropsychopedagogy regulates neuropsychopedagogical advice in two areas of activity, the institutional field and the clinical field, "Professional performance in Neuropsychopedagogy occurs in the institutional context in collective and, when necessary, individual care for probing and/or screening aiming at referrals to health professionals; and for individualized care occurs in the clinical context." (SBNPp, 2014, p. 1)

In this line of thought, Santos 2020, lists that the neuropsychopedagogue acts as a fundamental piece in the implementation of humanizing and meaningful Inclusive Special Education, renewing links between school, family and student, and through stimuli such as selecting, memorizing, storing and evoking information, the brain becomes a learner and transforms information into meaningful knowledge. For the author, the neuropsychopedagogue must intervene in a positive way, using neuropsychopedagogical methods and strategies with the contribution of neuroscience seeking to mitigate learning deficits.

As research and knowledge of neurosciences focused on education grows, the search for solutions for the learning of students with learning difficulties, those considered lost cases and who for some time were excluded for not learning, intensifies. The role of the neuropsychopedagogue is of fundamental importance in the academic life of these learners, assisting in the investigation of difficulties and seeking the necessary referrals to solve difficulties and school failure.

The neuropsychopedagogue plays a fundamental role in the area of education and in the development of children, adolescents and adults. Its importance lies in its ability to

understand and intervene in issues related to learning and cognitive development, considering both neurological and psychopedagogical aspects. The Diagnostic Evaluation in which the neuropsychopedagogue performs diagnostic evaluations to identify possible learning difficulties, neuropsychological disorders, cognitive deficits and other problems that may affect academic performance.

Personalized intervention based on assessment is also used, the neuropsychopedagogue develops personalized intervention strategies and plans to help individuals overcome their difficulties and reach their maximum potential in learning. Identification of learning disorders is especially important in the early identification of learning disorders, such as dyslexia, dyscalculia and ADHD (Attention Deficit Hyperactivity Disorder), allowing for early and appropriate interventions.

Guidance to educators The neuropsychopedagogue works closely with teachers and other education professionals, providing guidance on teaching methods, curricular adaptations, and pedagogical strategies that meet the individual needs of students. Promotion of cognitive development: In addition to helping overcome learning difficulties, the neuropsychopedagogue can also develop cognitive stimulation programs to improve skills such as memory, attention, logical reasoning, and socio-emotional skills.

School inclusion, this professional plays a crucial role in promoting the inclusion of students with special needs, ensuring that they have access to quality education and learning opportunities that are appropriate to their individual needs. Emotional support: In addition to the cognitive aspects, the neuropsychopedagogue can also provide emotional and psychological support to students who face difficulties at school, helping to increase their self-esteem and confidence.

Partnering with other professionals often collaborates with other health professionals, such as psychologists, speech pathologists, and occupational therapists, to offer a multidisciplinary and comprehensive approach to learning and development issues. In summary, the neuropsychopedagogue plays an essential role in promoting inclusive and quality education, helping to identify, understand and overcome the barriers that can affect the learning process and development of each individual. Their work contributes to the academic success and emotional well-being of students, providing them with the opportunity to reach their full potential.

THE DIFFICULTIES OF LEARNING MATHEMATICS

Studies show that the human brain is predisposed to learning mathematics, and with this teaching and learning in schools should be facilitated (Rosa 2022), which contradicts being labeled as difficult and considered a "bogeyman" for some people (Andrade 2018).

Thus, the table below shows factors that contribute to learning difficulties and disorders in the acquisition of important learning skills. Among the main factors that contribute to the student's learning difficulties, Garcia (1998, apud, SILVA, et al., 2017) highlights:

Key Factors	
•Low Motivation	• Improper handling of teaching materials and methodologies
•Economic Factors	• Incorrect presentation of stimuli
• Incorrect food in quantity and/or quality	• Inadequate or insufficient reinforcement
• Poor sleep quality	• Inflexible School Curriculum
•Superlotted Rooms	• Problems in the family nucleus

Source: Prepared by the authors (2023)

Regarding mathematics learning difficulties, Masola and Allevato (2019) define as the main teaching and learning difficulties, the lack of motivation of students to learn, the lack of interest in most of the content taught; traditionalist methodological approaches to the approach to contents; and difficulties in associating mathematical content with the studies of other disciplines and with the needs of daily life. In addition to learning difficulties, learning disorders can be highlighted (table below) which are factors that contribute to delays in learning mathematics (DUTRA, 2019).

Learning Disorders	
•Dyscalculia	•Dyslexia
•Dysgraphia	• ADHD

Source: Prepared by the authors (2023)

Regarding dyscalculia, ROSA (2022, p. 184) states that,

> It is a lifelong disorder that can be diagnosed at almost any age, but it is usually first recognized in childhood. As with other learning disabilities, dyscalculia is not treated with medication. Instead, specialized learning strategies and strategic accommodations are used to help children and adults with the condition compensate for difficulties and approach mathematics with confidence.

Still on dyscalculia, Silva (2022) argues that it cannot be considered a disease or a chronic condition, it must be [7] as a learning difficulty that through pedagogical interventions overcomes learning deficits. The teacher has a fundamental role in the investigation of

difficulties, distinguishing lack of interest and learning difficulties in order to make the necessary referrals.

Dutra, (2019) highlights that ADHD is characterized by inattention, agitation and impulsivity, symptoms that interfere with the learning of mathematics, as it requires concentration, learning difficulties are accentuated for these students. Regarding dyslexia, the author points out that some dyslexic students have problems with arithmetic and other aspects of mathematics, have difficulties solving simple calculations such as addition, subtraction, multiplication, division and multiplication tables.

Dysgraphia is a difficulty in the motor act of writing, it is characterized by illegible handwriting and difficult to understand, the child finds it difficult to write letters, words, numbers and symbols (Cordeiro, 2018).

Dyslexia has a neurobiological origin and affects learning, reading and writing, the dyslexic child has a slow learning pace compared to the rest of his peers, they may have difficulties with mathematics, assimilation of symbols and memorizing the multiplication table (Coelho, 2012).

NEUROPSYCHOPEDAGOGICAL INTERVENTION IN MATHEMATICAL LEARNING DIFFICULTIES

Learning math is considered difficult for some people, creating blockages that they can follow during school or throughout their lives. This problem has an aggravating factor when learners have a learning disorder, since they tend to leave the classroom pattern.

Rosa (2022) points out that the diagnosis of dyscalculia can be at any age and there is no single test, diagnostic assessments are used that test mathematical skills with scores based on school age and year and anamnesis is carried out to collect fundamental data on the learner's history.

For Caetano 2021, the neuropsychopedagogical intervention is didactic and playful, with the objective of improving learning, the neuropsychopedagogy professional cannot, under any circumstances, advise on medication. The same happens with the treatment of dyscalculia "there is no cure and cannot be treated with medication, it is necessary to monitor these students and, if necessary, a set of Neuropsychopedagogical evaluations," (ROSA 2022, p. 190).

PATHS OF RESEARCH

For the construction of this article, we adopted bibliographic research, which is materialized through reading works already published in printed and digital books and

articles published in periodicals (GIL, 2002). As for the approach, this article is characterized by a qualitative nature, seeking to reflect on works on "The Learning Difficulties of Mathematics and the Role of the Neuropsychopedagogue".

In this perspective, to carry out this article, we chose to search for the theme studied in the Google Scholar and Scielo databases, due to the credibility and the number of works deposited there, delimiting the period of the last 10 years, which correspond to 2013 to 2023, through the following descriptors "mathematics difficulty", "mathematical learning difficulty", "mathematics and the role of the neuropsychopedagogue", which are key terms related to the theme of this research. The filter followed the following procedures: I – the papers should have the characteristics of an article; II – be written in the Portuguese language; III – that were classified by the relevance of the theme. The search was made in order to provide and motivate the public interested in mathematical difficulties.

Chart 1: Articles found during the Google Scholar search

Title	Keywords	Year	Author
Neuropsychopedagogical Assessment of Mathematical Learning Disorder (Dyscalculia)	Dyscalculia; Learning Disorder; Neuropsychopedagogy; Mathematics Teaching.	2022	Claudionor Alves da Santa Rosa
Contributions of neuroscience and neuropsychopedagogue in the teaching and learning process	Neuroscience; Neuropsychopedagogy; Learning disability	2021	Silvana Ferreira Lima; Meiriane Lopes; Terezinha Sirley
Evaluation of mathematical predictive skills in the early grades of elementary school: an integrative literature review	Mathematical evaluation; Mathematical predictor skills; Neuropsychopedagogy	2021	Edvaldo Alves de Moraes; Fabrício Bruno Cardoso; Lígia Serrano Lopes
Neuroscience and the teaching of mathematics: a literature review	Neuroscience; Neuropsychopedagogy; Mathematics; Apprenticeship	2021	Elias Araújo da Silva Júnior

Source: Prepared by the authors (2023).

RESULTS FOUND

The first article presented in the results, "Neuropsychopedagogical Assessment of Mathematical Learning Disorder (Dyscalculia)", directly corroborates the discussions about mathematics learning disorder. This is a descriptive qualitative explanatory research, and aims to present the process of neuropsychopedagogical assessment to diagnose, treat, monitor and guide academic interventions for the Mathematics learning disorder, dyscalculia.

For the author, the early diagnosis of mathematics learning difficulties avoids problems throughout life, and can "act in a way that develops undeveloped parts of the brain to raise the level of learning of these individuals at all stages of teaching and learning." (ROSA 2022, p. 182) The author also points out that it is necessary to monitor

students with dyscalculia by professionals such as neuropsychopedagogue, psychopedagogue, neuropsychiatrist, neurologist, neuropediatrician, speech therapist, pediatrician, psychologist. For confirmation of Dyscalculia or other learning disorders.

The article "Contributions of neuroscience and the neuropsychopedagogue in the teaching and learning process" is a study in which the authors bring the important role of the neuropsychopedagogue combined with the knowledge of neuroscience, aims to present the contributions of the neuropsychopedagogue combined with teaching practices, the authors made a case study with an elementary school child in which they analyzed difficulties in reading and writing. And they concluded that the student was not within the expected standards for his age group.

For the authors, the lack of adequate stimuli for maturational and educational development resulted in "impairment in language, speech and specific learning in mathematics, suggestive of Dysphasia, Dyslalia and dyscalculia, as well as delay in cognitive development," (Lima; Lee; Sirley, 2021).

Another article found is "Evaluation of mathematical predictive skills in the early grades of elementary school: an integrative literature review", the study aimed to analyze from the integrative literature review the screening and evaluation instruments about the predictive or essential mathematical skills to be developed in the Initial Grades of Elementary School.

The results showed "the presence of studies that emphasize and prove the existence of difficulties in the mathematical learning of students in the Initial Grades of EF, without details regarding the instruments validated for the necessary intervention" (Morais; Cardoso; Lopes, 2021).

The work "Neuroscience and the teaching of mathematics: a bibliographic review" is an exploratory study of literature review based on research of bibliographic sources, aims to analyze the main teaching strategies based on neuroscience, contributing to a deeper learning in mathematical language by students.

For the construction of the work, the following steps were developed:

> neuroscience and cognitive neuroscience were conceptualized; the connection between neuroscience and the learning process of an individual was presented, especially in the area of mathematics; The main theories of learning were exposed and among these, the one with the greatest link with teaching strategies based on neuroscience was highlighted. (Júnior 2021, p. 46).

Thus, when analyzing the articles, we understand, based on the reflections enhanced by the authors of the four studies, that neuroscience combined with education has contributed to the improvement of mathematics learning difficulties and learning

disorders, as well as the importance of referral to professionals who confirm the disorders, as well as early diagnosis that avoids delays and even greater failures.

In view of all this presented so far, we observe that both studies reinforce the discussions about the importance of mathematics and professional intervention in solving difficulties, showing how relevant research in this area is.

FINAL CONSIDERATIONS

Understanding and addressing learning disabilities in mathematics is of utmost importance to ensure that students have an inclusive and quality education. In summary, demystifying the mathematics deficit and supporting students with learning disabilities requires a comprehensive approach that involves teacher training, differentiated teaching strategies, individualized support, and an inclusive mindset. It is essential to recognize that each student is unique and may need specific approaches to succeed in mathematics and other academic fields.

In this sense, it is necessary to demystify the deficit in mathematics and professionals to identify learning difficulties and learning disorders to mediate in the process of seeking learning in the best way. Discussions in this area are essential to update society on solutions to the difficulties in learning mathematics that is so necessary in daily activities.

Thus, we consider it important that the teacher is attentive to investigate the reason for non-learning, and thus seek the necessary referrals. Finally, we add that it is necessary that there is more research published on the learning difficulties of Mathematics, as it is essential for us to understand what the learning difficulties are and the ways to overcome these gaps and so that Mathematics stops being considered difficult and learners can take a liking to the knowledge focused on this area, demystifying the ideas that Mathematics is difficult to learn.

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