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Theoritical frame work OF Dyscalculia In Learning Mathematics

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Abstract -

The term "dyscalculia" refers to a problem with the capacity to learn mathematical concepts. Number sense, retention of arithmetic knowledge, accurate and fluent calculation, and accurate math reasoning are some of the key components of this significant area of a specific learning disability in mathematics. About 3 to 6 percent of the population is thought to be affected by dyscalculia-related issues. This essay examines the theoretical implications of maths dyscalculia and discusses some effective pedagogical strategies to help dyscalculic students. Both theoretical and descriptive methodologies are used in the investigation. Focus is placed on the theoretical issue of dyscalculia, including its definition, types, causes, typical areas of difficulty, and effects on learning mathematics. Additionally, it outlines the best manner to teach information and offers assistance to learners who struggle with maths. This article comes to the conclusion that learners who struggle with math have a variety of challenges because of their poor number sense, poor basic math fluency, poor reasoning, and inaccurate arithmetic calculation. Therefore, it's crucial to offer specialised instruction as well as additional support to improve and maintain the arithmetic skills and performance of the dyscalculic learner. If not, the student may encounter more challenging situations that go outside the boundaries of classroom learning.

Key Words:
Dyscalculia, Mathematics Disability, Specific Learning Disorder

1.INTRODUCTION

The abstract nature of mathematics makes it a difficult subject. People all throughout the world are affected by difficulties with maths learning. Mathematics is recognised as a subject of great importance at the secondary school level because of its close relation to daily human activity. As a result, it occupies a significant place in the curriculum and is taught in schools all over the world as a fundamental and necessary topic. It has therefore always gotten special consideration in all school systems around the world (Kunwar, 2021). Despite the fact that students' negative attitudes towards learning math have not changed and expected math results have not yet been achieved (Kunwar & Sharma, 2020). The idea that children's numerical cognition could be developed in accordance with their developmental stages and that learners could be effectively taught using Piaget's stages of child development (Piaget, 1952) persisted for a long time. Piaget's philosophy was concentrated on the child's understanding of space, time, causality of number and quantity, and classes and relations of invariance and change, according to Baccaglini-Frank and Di Martino (2020).

However, as the causes of difficulties learning maths at the moment, academics are focusing more on the procedural and neurological foundations of the learner (Sharma, 2020). Mathematics is viewed as a result of human undertakings involved in the process of acclimating to the outside environment, according to Baccaglini-Frank and Di Martino (2020). It is advantageous to be able to calculate rapidly and properly in adolescence and adulthood (Tolar et al., 2009). The majority of researchers identify dyscalculia as having poor working memory, being caused by a brain disorder, being genetic, being caused by environmental factors, and being caused by a brain difference (Hornigold, 2015). Reasoning, working memory, visual-spatial processing, recall of math facts, and basic number processing are all significantly impacted by the causes of these inadequacies and the learner's incompetence. Khing (2016) asserts that these shortcomings have an effect on the students' ability to learn mathematics, particularly in terms of computation and reasoning. Studying and resolving computation- and application-related mathematical problems might become challenging as a result of such problems with the learner's learning deficit over time (Chinn, 2015). As a result, there is a more widespread problem with learning mathematics that is visible at the beginning of primary school. Although dyscalculia is a lifelong problem, it can be lessened through assistance and intervention that is carefully targeted (Hornigold, 2015).

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2.OBJECTIVE OF THE STUDY

- to investigate how dyscalculia in arithmetic learning is theoretically understood.
- To describe the methods for applying successful teaching to help dyscalculic students

3. RESEARCH METHODOLOGY

The research is supported by theoretical and descriptive-analytical techniques. It is used to explain the idea and definition of dyscalculia, as well as its type, causes, regions of typical difficulty, and effects. In a similar vein, the technique is shedding light on the elements of mathematical learning, efficient material delivery strategies, and student support for dyscalculic students. This approach makes use of descriptive analysis and summarises the pertinent information about the causes and effects of dyscalculia. In this procedure, secondary sources of information or literature are mostly employed to investigate concepts and understanding on the theoretical aspects of dyscalculia and to deal with dyscalculic students. The information for the study was gathered through the review of a variety of research materials in this course, including reports, publications, magazines, books, journals, and newspapers. The majority of this literature was taken from online databases or journal articles, as well as from various digital learning tools and libraries.

4.DISCUSSION AND MOJOR FINDINGS

- ***Concept of dyscalculia***

A particular kind of learning problem is dyscalculia. Not with every subject of mathematics, but with the ability of the learner to recall math abilities connected to computing numbers, is affected (Kunwar & Sharma, 2020). It is a catch-all phrase that is used to describe a variety of conditions that create particular difficulty with mathematics, including number fact disorder, developmental dyscalculia, mathematical impairment, and numerical learning disability (Emerson & Babtie, 2010). As a result, dyscalculia is a hereditary disorder that impairs a person's capacity to absorb mathematical concepts.

The words "dyscalculia" have both Latin and Greek roots. Dys is a Greek prefix that meaning "badly," and calculia is a Latin word that means "to count" (Khing, 2016). The Czechoslovak researcher Kosc coined the term in 1974, defining it as the difficulty in mathematics caused by injury to specific brain regions engaged in mathematical cognition, but without a general difficulty in cognitive function (Soares & Patel, 2015). Dyscalculia is frequently referred to as "number blindness," "difficulty with numbers," and "being bad at mathematics." Hornigold (2015) emphasised dyscalculia as a more pervasive issue than either having problems with maths or being lousy at it.

The ability of students with dyscalculia to comprehend the logical procedures required for solving a mathematical problem, memorise facts based on numbers, and carry out regular numerical tasks is affected. It is the incapability or disarray of the fundamental mathematical numerical operations (Kunwar et al., 2021). According to Grant (2017), memorization of arithmetic facts, number sense, accurate or fluent computation, and mathematical reasoning are the unique learning impairments in mathematics. Among these, number sense can be categorised as dyscalculia, and the main symptom of this disorder is a lack of numerosity or the inability to grasp the idea of more than/less than (Grant, 2017). Dyscalculia is therefore regarded as a special difficulty in comprehending numbers and their relationships.

Regarding mathematical learning ability, dyscalculia is sometimes regarded as a neurological condition. Genetic, neurological, and epidemiological data all point to it being a brain-based illness (Shalev, 2004). Dyscalculia and neurobiology are strongly correlated (Kucian & Von Aster, 2015; Soares & Patel, 2018). According to Hornigold (2015), dyscalculia affects both boys and girls equally and affects about 6% of youngsters.

Variations of Dyscalculia

Based on its various dimensions, dyscalculia can be divided into several categories. Diverse academics have investigated their theories to categorise the main varieties of dyscalculia in relation to the various facets of developing mathematical ability in the field of mathematical learning disabilities. According to Kosc (1974), a researcher who proposed six standard categories for dyscalculia in this context, the traits of knowledge impairments are as follows:

Speech dyscalculia

According to Kosc (1974), verbal dyscalculia refers to the unsettling capacity to name amounts and numbers of things, digits, numbers, operational symbols, and mathematical performances. Children with verbal dyscalculia can read and write numbers, but they find it challenging to understand verbal structure.

Calculational dysprognosis

Dyscalculia with a poor prognosis makes it difficult to manipulate mathematical actual or imagined items. Enumerations and comparisons make up these types of mathematical operations. When it comes to listening, comparing, and manipulating mathematical equations,

children with this sort of dyscalculia have difficulty understanding mathematical concepts.

Dyscalculia lexica

A reading impairment for mathematical symbols (such as digits, numbers, operational signs, and written mathematical operations) is known as lexical dyscalculia. Children with this type of handicap may struggle to read and comprehend mathematical symbols, numbers, expressions, and/or equations.

- **Types of Dyscalculia**

A disability in manipulating mathematical symbols in writing is called graphic dyscalculia. Children are able to understand, yet they have difficulty writing or utilising the correct symbols. If written, they might not be able to duplicate them either.

Imaginative dyscalculia

Ideognostical dyscalculia makes it challenging to perform mental calculations and comprehend mathematical concepts and relationships. Ideognostical dyscalculia affects children's ability to complete mental calculations and remember mathematical ideas after learning them.

Dyscalculia in operations

Operational dyscalculia is the inability to perform mathematical operations or calculations as a result of the frequent interchange of operations, such as adding instead of multiplying, subtracting instead of dividing, or replacing more difficult operations with easier ones.

Based on several factors of mathematical aptitude or areas of mathematics that affect the learner, Karagiannakis and Cooreman (2014) divided dyscalculia into four categories. The following are the types' succinct descriptions:

Core quantity

Basic number sense, or the capacity to use and comprehend numbers and our number system, estimation, evaluating numerical differences in quantity, understanding and use of mathematical symbols, place value, and placing numbers on a number line are all aspects of core number dyscalculia.

Reasoning

Dyscalculia of reasoning includes issues with comprehending mathematical ideas and relationships, generalising and applying mathematical knowledge, and comprehending intricate processes like decision-making and problem-solving.

Memory

Memory dyscalculia refers to the inability to accurately perform mental calculations, remember and carry out rules, procedures, and formulas, recall and understand mathematical terminology, comprehend and recall word problems, and carry out problem-solving steps.

Visual-spatial

Visual-spatial dyscalculia refers to problems with mathematical symbol recognition and comprehension, deciphering pictures of mathematical objects, writing numbers on a number line, visualising geometrical figures, and deciphering graphs and tables.

- **Causes of Dyscalculia**

Different perspectives allow for different classifications of the aetiology of dyscalculia. Different people have different ideas regarding what causes dyscalculia. Nevertheless, there is a consensus among researchers that dyscalculia is a brain-based disorder. It is debatable whether dyscalculia can be classified in terms of cognitive, behavioural, or biological features and how those aspects relate to the teaching and learning of mathematics. It may also be regarded as the primary contributor to dyscalculia or as a factor that affects students who struggle with maths.A few snags in Piaget's child development theory's developmental phases, as well as the presence of number concepts and the capacity to develop arithmetical abilities and comprehension, may be the reasons of dyscalculia. Similar to this, information processing theories may also be to blame for difficulties with numbers and the number idea (Dehaene & Cohen, 1997). The acquisition of the number concept and arithmetic skills can also be influenced by behavioural factors, the learning environment, and various aspects of effective teaching and learning such as teaching methods, materials, motivation, classroom environment, socio-cultural factors, stress, anxiety, etc. (Murphy et al., 2006). Drills and practise sessions on a regular basis can also aid in overcoming learning issues with numbers. The biological component consists of how the brain develops and genetic makeup. Prematurity and low birth weight may affect how the brain develops. Similar to dyslexia, dyscalculia can also be caused by a hereditary component (Shalev, 2004).

- **Effective Content Delivery Techniques**

Delivering learning activities and subject matter to the student via a physical or virtual medium is the most effective way of content delivery. The content can be delivered in a variety of ways. The learner's internalisation or understanding of the subject matter determines the most effective method of material delivery. The most efficient way to present knowledge to dyscalculic students also depends on their aptitude, interests, and background. However, the most effective way to present knowledge is through multi-sensory strategies that combine the greatest contemporary tools and techniques with the learner's needs and interests. Following are some of the main ways that content is delivered effectively:

True it up

The teaching of the fundamental mathematical concepts that the dyscalculic learner finds challenging should be applied. Use a variety of concrete teaching tools, such as cuisenaire rods, base ten blocks, numicon, abacuses, ten-frames, etc., as well as ready-made or prepared materials when teaching numbers and concepts to help dyscalculic students develop their understanding of numbers, place value, and mathematical reasoning.

Make school fun.

Making the teaching and learning environment enjoyable is a way to effectively present the subject matter using the content delivery mode "Make learning fun." Fears and bad outcomes are caused by poor mathematical concepts and knowledge (Kunwar, 2020). Therefore, using Dominoes, playing dice games, using Ten-frames, etc., can make learning enjoyable while also introducing the learner to the face of dice, Dominoes' dot patterns, and Ten-frames' counting and number relations. This can help the learner become more familiar with dot patterns, counting, and number relations.

Allocate enough time

When teaching mathematics, the student should be given enough time. Through manipulation of the materials, students can obtain a firm understanding of mathematical concepts and the relationship between numbers and number systems. It also facilitates the proper development of mental computation abilities. The student should be given enough time to manage the actual thing, which is made up of a range of concrete and semi-concrete elements. By using such resources, the learner can investigate the facts, patterns, concepts, meaning, and knowledge of the mathematics subject matter while also developing their critical thinking skills.

Imagine more

The most effective method of object feeling is visualisation. It is widely applied to academic instruction. If at all possible, use concrete materials to help students visualise the maths information while in the classroom. If not, use diagrams to model the material. The visualisation method used in math instruction aids in the learner's successful comprehension of the material as well as the development of self-efficacy in the area.

Make education multisensory.

The student can concentrate better and internalise the material more effectively with the aid of multi-sensory learning. Through this approach, learning becomes more efficient, applicable, and lasting. Learners learn more truly and effectively when they are actively engaged in the learning process. Therefore, for a dyscalculic learner, the multi-sensory mode of instruction may be the most effective method of knowledge delivery.

Use contemporary technologyTechnology is used to convey knowledge, but it also makes it possible for learners to take assessments of their education online. Every learner may easily access internet materials thanks to it, which facilitates collaborative learning. The use of technology also increases the effectiveness and interaction of learning. It can be used to accelerate, improve, and increase the development of fundamental reading, writing, and math skills (Kunwar, 2020). By boosting the student's involvement in instructional activities, it helps them learn more effectively. It aids in the learning process, making it quicker, simpler, and more enjoyable. It offers improved chances for children with special needs to play, enjoy, and learn maths in a playful way. Therefore, the utilisation of technology aids the dyscalculic learner in engaging in interesting and interactive mathematics learning.

Utilise group learning

Collaboration is teamwork or collaborative effort. As a result, during this learning process, a group of individuals learns and collaborates to solve a problem or complete a task. In this method, the students are encouraged to work together to solve the problem by providing them with specific clues. The students actively participate in order to learn and deepen their comprehension in this form of learning. It encourages engagement in and a love of learning mathematics in the student. The learner is especially helped by collaborative learning to share the abilities and concepts needed to do the assignment.

Relationship building

Building a strong rapport with students and teachers is important for creating an environment where learning can take place. Additionally, it assists children in becoming

motivated to learn mathematics and in forging bonds of friendship, trust, and affinity with others. It fosters a close relationship with the teachers and makes it simple for the students to constantly ask questions to their teacher whenever they experience learning difficulties. These two methods of communication undoubtedly assist the students in lessening their academic challenges. Building a rapport with the teacher is especially helpful in establishing expectations, understanding, and focus between the students and the teacher so that the students can pay close attention to the learning process. Adaptive instruction

Every child learns differently, and diverse things including motivation, past knowledge, and learning aptitude have an impact on how they learn. Therefore, the adaptive teaching technique puts an emphasis on addressing each learner's unique needs. In this method, the teacher's job is to keep an eye on each student and tailor the lesson to suit their needs. According to each set of learners' needs, interests, and learning levels, this strategy uses a variety of instructional techniques and materials to help them succeed (Borich, 2011). With the pupils' individual differences, this method seeks to accomplish a shared educational objective.

5. CONCLUSION

Dyscalculia, as opposed to just being poor at maths, has far deeper-seated issues with numbers and reasoning. It is a particular learning disorder that has an impact on the learner's mathematical skills. They struggle with numerical computations in their daily work as well. As a result, their math deficiencies have an effect not only on their academic performance but also on related subjects outside of the classroom. Often, it is first noticed in the early grades. Mathematical concepts like estimating, time, evaluating numerical quantities, money, sequencing and pattern recognition, counting backward, direction, etc. should be more challenging for the dyscalculic kid. Due to their poor fluency and reasoning in basic mathematics, dyscalculic learners face some challenges when studying mathematics, but these challenges can be overcome with well-targeted help and intervention. As a result, the learner's aptitude in some specific areas of mathematics is affected by the specific difficulty of studying mathematics. Dyscalculic students should have specialised training and devoted time when teaching in such challenging areas of mathematics. In a similar vein, extra classes should be offered at school to care for and properly treat them. The parents should do the same by giving their children enough time at home to discuss their issues. As a result, dyscalculic students can improve by using efficient teaching techniques.

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