

Prevalence of Dyscalculia among Elementary School Students

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Abstract: The present study focused on identifying elementary school students with dyscalculia. The study sample comprised 351 elementary school (mean age = 12.31) students in the seventh grade. The tools of this study used by the researcher were the previous two years' performance in Mathematics, teacher referral forms to identify dyscalculia students, a non-verbal intelligence test by Raven et al. (2004), and a learning disabilities battery test of dyscalculia (Part-I) by Bhargava and Bhardwaj (2014). The study revealed that mathematics learning difficulties occur in students with low IQs. The majority of the students suffer arithmetic difficulties (or dyscalculia), with no impairment of abstract mathematical reasoning abilities. Furthermore, 2.5 % of students had an above-intelligence level, 12.82 % of students had an average intelligence level, and 9.97% had a below-average intelligence level. Additionally, 15.95 % of students had mild dyscalculia and 4.55 % of students suffered from severe dyscalculia. Furthermore, addressing dyscalculia through a comprehensive approach that includes early identification, tailored instruction, use of technology, and consideration of gender differences is essential for fostering an inclusive and supportive learning environment. Surveys and research on dyscalculia must continue to inform educational practices, ensuring that all students have the opportunity to succeed in mathematics.

Keywords: Dyscalculia, Elementary School Students.

Introduction

The primary goal of the National Education Policy (2020) is to produce engaged, productive citizens who will contribute to preserving the inclusive, socialist, and plural society envisioned by the Indian Constitution. Nonetheless, there is still a significant issue with the

uneven educational standard that needs to be resolved. There is no denying that education is important for everyone. It should go without saying that education enhances human existence. According to the 37th Annual Report to Congress highlight in their report 68.2% of students with learning disabilities spend more than 80% in general schools while 24.1% spend around 40–79% of the day in general schools that pursuance by Individuals with Disabilities Education Act (US Department of Education, 2015). Whereas the majority of students with learning disabilities spend their day in a general school education system, this statistic also presented that some students still attend special education classes and reveals that special education classrooms are the most effective settings for instructing students with disabilities. The importance of learning outcomes—which indicate the degree of literacy and numeracy competency and abilities among the nation's citizens—in the educational system has been highlighted in the Annual Status of Education Report (2022).

According to Rief and Stern (2010) report, the majority of the students are associated with learning disabilities, which might interfere with one or more learning tasks like reading, writing, or mathematics activity and also affect individual ability to speak, listen, write, remember, or organize information. In simple terms, a learning disability is characterized as mental incapacity or retardation, brain abnormality, or delayed brain development due to a neurological condition that affects a learner's fundamental language, writing, reading, speaking, or math skills. When diagnosing such circumstances, students' performance in particular subject areas can be achieved. The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, 1994) describes the mathematics disorder of individuals difficulty performing mathematical tasks classroom (academic) or in daily life. Furthermore, using insufficient strategies when solving math problems, students with dyscalculia are frequently referred to as dyscalculic. NEP 2020 mainly highlights a significant number of students in classrooms who have particular learning disabilities and require ongoing assistance. All teacher education programs must include gender sensitization and education on how to educate children with specific disabilities, including learning disabilities, to reverse the present trend of under-representation and low representation.

They were mostly found immature in learning and remembering number facts, slow in mathematics activities, operations, counting numbers, concepts, computations, measurement, time-telling, mental math, and word problem-solving. The mathematics learning difficulties faced by an individual which termed as “Dyscalculia” which affects the individual ability to understand basic numerical concept and their application.

The term dyscalculia was first used in 1919 by Swedish neurologist Selomon Henschen, who found that a person's poor arithmetic skills might exist independently of IQ/intelligence. Other names for it include developmental arithmetic difficulties and "number blindness". Developmental dyscalculia was identified by the Department for Education and skills (2001) as "a disorder which impacts the ability of children to develop arithmetical skills." Developmental dyscalculia is a learning disability that affects the average acquisition of number-crunching abilities regardless of the ability to develop a thorough comprehension, strong firmness, or motivation Shalev and Gross-Tsur Gross-Tsur (1993). Dyscalculic students mainly struggle to learn number facts and procedures, or difficult to understand basic number ideas, and lack an intuitive knowledge of numbers. Rights of Persons with Disabilities (RPWD) Act, 2016 passed by Parliament. The "Children with Specific Learning Disabilities" bill was introduced in the Rajya Sabha in 2017 to identify and assist children who have learning difficulties. In 2018, the Ministry of Social Justice and Empowerment published a notification outlining the steps that needed to be taken to certify children with a particular learning disability. The notification strongly emphasizes identifying, diagnosing, and certifying children with a particular learning disability.

National Council of Teachers of Mathematics (1989) defines it as the mathematical power of the individual capability to explore and practice reason in a logical way so that he will be able to use a variety of methods in mathematical to solve routine problems and all these concepts based on a collection of mathematic concept and proficiency to be expert/mastered. NCTM (2000) also defined that instructional programs from prekindergarten through grade two should enable all students to use a variety of models to develop a beginning understanding of place value and the base ten number system. Storytelling is considered a pedagogical technique not to be considered a "model" that can enhance the understanding of abstract mathematics concepts and their application. NCTM (2000) Communication Standard defined all crucial parts of learning mathematics as talking, listening, writing, and communicating in mathematics.

A mathematical learning disability is when a person's expected mathematical aptitude is below than considered normal given their age, education, etc. Many researchers proved that it was an educational issue. Developmental dyscalculia has several types that are verbal, Ideognostic, prognostic, linguistic, graphical, and operational/functional dyscalculia. Basic mathematical problem solving is tough for school children who struggle with mathematics learning and they also struggle to determine their knowledge and abilities to solve mathematical

issues such as memorize and recall basic mathematical concepts. However, students may find it more challenging to perform basic mathematical applications than how they possess a solid understanding of fundamental mathematics. Dyscalculia is considered a developmental as well as an acquired learning disability, and with the right support, direction, and family and school interventions, the disorder's effects can be managed. Learning difficulties in mathematics and literacy skills might arise from deficiencies in language and memory (Hannell, 2005).

Learning arithmetic and reading skills are likely to be related to their rapid recall of abstract information from long-term memory. It has been estimated that forty percent of youngsters who are dyslexic may also struggle to understand mathematics (Pollock & Waller, 1994). A special Educator and dyscalculia specialist Judy Hornigold (2015) mainly highlights symptoms in their report regarding dyscalculia that is called “The Dyscalculia Toolkit” – which include the use of finger counting math solutions long after classmates have stopped using this method, Problems in remembering fundamental math facts/concepts, Difficulties to connecting the numbers and symbols in right directions or amounts, unable to tell time on an analogy clock, Difficulties sorting right from left right away, Problems with patterns and number sequencing types mathematical tasks.

Related review

Moreover, Albina (2019) found in his study there are no significant differences in their awareness level towards dyscalculia (Ramanathapuram and Sivagangai District) concerning the gender and seniority level of the primary school teachers. Only 26 % and 64.66% of school teachers have a low level and moderate level of awareness of dyscalculia, and 9.33% of teachers have a high level of awareness of dyscalculia.

Chacko and Vidhukumar (2020) found the prevalence rate of specific learning disabilities and their determinants among school-going students (4 to 7 grade) in Ernakulam district, Kerala. The result revealed that the prevalence rate of Specific Learning Disabilities was 16.49%, out of which the prevalence of dyscalculia disorder was 9.93% of school-going students.

Kauts and Dadwal (2022) conducted a survey study on private and government schools for dyscalculia students in Amritsar District. The study employed the survey method. The findings showed that, depending on the type of school, there is very little difference between teachers' awareness of dyscalculia and type of school.

Early diagnosis and identification of specific learning disability are crucial for ensuring timely interventions or support are helpful for individuals enabling them to reach their full potential. The early stage of identification is applicable for getting decent experience on a particular part and developing their disablement skills and equitable access to mathematics must be established by helping them develop strong mathematical identities and employing strategies based on research (MS et al. 2023, Kenneth 2023).

Herwegen, Outhwaite, and Herbert (2024) examined the understanding and willingness to accept neuromyths regarding dyscalculia and dyspraxia among 229 UK educators. finding of the study presented that the teachers accepted more neuromyths about dyslexia than dyscalculia, even though they were better knowledgeable about dyslexia.

A number of research studies showed that numerical deficiency of students with dyscalculia (Mogasale et al., 2011; Jovanović et al., 2013; Osisanya, Lazarus & Adewunmi, 2013; Zygouris et al., 2017; Morsanyi et al., 2018; Adaikala & Albina 2019; Chacko & Vidhukumar, 2020; Pournesaei, Pirkhaefi & Fard, 2020). Furthermore, the majority of school students face arithmetic language skills problems, and reading and writing disorders (Manor et al., 2005; Saeidei & Pirkhaefi, 2020; Sarma, 2021; Luoni et al., 2023). Moreover, there were no significant gender differences found in students with dyscalculia. But the majority of male students were more affected than females by basic numerical deficiencies (Reigosa et al., 2012; Nojabae et al., 2014; Hudson, 2016; Uket, 2023). Furthermore, a significant difference was found in students with dyscalculia across locale (Osisanya, Lazarus, and Adewunmi (2013) Fu & Chin, 2017; Yoong et al., 2022; Herwegen, Outhwaite & Herbert, 2024).

The identification of elementary school students with dyscalculia disorder was the main theme of this paper. Even though there are many types of learning disability, dyscalculia is the one that has received the least attention in studies (Yoong et al., 2022). Rather the problem is very often identified as a mathematical learning difficulty instead of mathematical learning disability (dyscalculia). Dyscalculia is a genetic disorder and incurable, if not identified earlier, its condition can be worsened. However, a prompt solution is needed to interfere from the starting stage (Uket, 2023). A teacher might have suspicions about a dyscalculic student in the class who struggles with basic numeracy operations and uses finger counting to complete arithmetic operations while his peers have advanced to more effective methods. The teacher can be unsure of how to support the student and systematically organize activities so that the student can participate.

Objectives of the study

- To study the prevalence of dyscalculia among elementary school students.
- To study the gender differences in prevalence of dyscalculia elementary school students.

Hypothesis

- There exist no significant gender differences in prevalence of dyscalculia elementary school students.

Research method

The present study was conducted through descriptive qualitative research to identify elementary school students with dyscalculia. Qualitative research is especially effective in obtaining culturally specific information about a particular population's values, opinions, behaviours, and social context.

This research was conducted at a government smart School, Patiala. A cluster sampling technique was used for data collection, which includes an academic performance of the student's previous two years i.e., 5th and 6th grade in their final examination, Teacher Referral Form (prepared by a researcher), non-verbal intelligence test Raven et al. (2004) Standard Progressive Matrices, Learning Disabilities Battery (part – I) by Bhargava and Bhardwaj (2014) and also observing, and then conducting direct interviews with teachers and students of class seventh elementary school students. The population in this study were students in class seventh-class students and ten teachers who teach seventh-class students at a government smart school, Patiala.

Survey of identification of elementary school students with dyscalculia

The 351 elementary school students were surveyed by the researcher from a government smart school Patiala, affiliated with PSEB. The researcher consulted with 7th-grade math teachers about the performance of students in mathematics subjects and checked the previous record of marks in mathematics in the last two years' examinations obtained by them. The students who obtained less than 35 percentage marks in math were called low achievers in mathematics subject. Out of 351 elementary school students, the researcher found 189 students as low achievers in mathematics subjects based on previous records.

Then to know the intelligence level of the students, the researcher administered the non-verbal intelligence test of Raven et al. (2004) standard Progressive Matrices scale consists of 60 problems divided into five sets of 12 each, and the right answer receives one mark in Raven's Standard Progressive Matrices, while the incorrect or no response receives no mark. The highest attainable score is 60. The Researcher found that the majority of the 89 elementary school students were lying between the 25th and 75th percentile belonging to average intelligence.

Furthermore, a teacher referral form prepared by research was given to math teachers to identify who suffers more in mathematics subjects. Out of 89 students, only 72 elementary school students were identified as having a mathematics disability (dyscalculia).

To confirm these 72 elementary school students, have dyscalculia disorder, the researcher administered a standardized test of 20 items of different arithmetic problems namely multiplication, division, place value, face value, decimals, algebra, and geometry of learning disability battery (Part -1) by Bhargava and Bhardwaj (2014), and 72 elementary school students were confirmed by the test.

Results and Discussion

The table 1 shows the prevalence of dyscalculia distribution of elementary school students on the basis of their Intelligence grades based on Raven's (SPM, 2004).

Grades of Intelligence		frequency	Percentage
Grade I (Intellectually superior)	I (at or above the 95th percentile)	262	74.61
Grade II (above-average intelligence)	II+ III+ (above the 50th percentile) III- (below the 50th percentile) II (at or above the 75th percentile)	9	2.5
Grade III (intelligence average)	III+ (above the 50th percentile) III- (below the 50th percentile)	45	12.82
Grade IV (below average intelligence)	IV (at or below the 25th percentile) IV- (at or below the 10th percentile)	35	9.97
Grade V (impaired)	V (at or below the 5th percentile)	—	—
Total		351	100

The table 1 showed that 2.5 % of students have an above-intelligence level, 12.82 % of students have an average intelligence level, and 9.97% of students have below below-average level of intelligence.

The table 2 shows the distribution of elementary school students in terms of the extent of dyscalculia.

Dyscalculia	Frequency	Percentage
Without dyscalculia	279	79.50
>60(No Dyscalculia)	_____	_____
40-59(Mild Dyscalculia)	56	15.95
5-39(Severe Dyscalculia)	16	4.55
Total	351	100

The result in Table 2 showed that 15.95 % of students have mild dyscalculia and 4.55% of students suffer from severe dyscalculia.

The following description clearly shows the survey identification of elementary school students with Dyscalculia. Many teachers and parents are aware of this term of dyscalculia. The researcher also conducted interviews with teachers during the survey procedure to obtain information on those students not perform well in mathematics subjects. There are many reasons behind it such as the lack of interest of students in mathematics subject viz., socioeconomic status of the students, lack of motivation or interest, students' intelligence level, inability to adopt new knowledge, slow in doing calculation process, old teaching learning material, method or technique, lack of using learning media platform, etc.

Gender differences in the Learning Disability of dyscalculia (Bhargava and Bhardwaj, 2014) among elementary school students.

The table 3 shows the gender differences in dyscalculia among elementary school students.

Gender	Mean	Median	Mode	SD	t-test	Significant
Male	38.25	42	40	13.18	0.98	Non-Significant
Female	38.31	41	41	11.93		

Not significant at 0.05 level.

The table 3 revealed that there are no significant gender differences in elementary school students with dyscalculia.

Conclusion

Based on the survey and identification of the study, it was found that there were no significant gender differences in elementary school students with dyscalculia. Furthermore, the results of the study indicated that between 3 and 6% of children suffer from a particular type of numerical understanding deficit that is called developmental dyscalculia (Kucian and Von

Aster 2015; Zygouris et. al 2017; Morsanyi et al. 2018). The finding of this study revealed that math learning difficulties occur in students with low IQ. A student mostly suffers mathematics difficulties (or dyscalculia), with no impairment of abstract mathematical reasoning abilities. Furthermore, learning difficulties in mathematics mainly result from their self-learning challenges, specifically a lack of self-awareness to learn mathematics because they have wrong perceptions (beliefs) of mathematics subject like as it is a very tough subject. Furthermore, the findings of the results also stated that most of the students have insufficient numeracy skills, contributing to their arithmetic difficulties.

Educational Implications

- Students with dyscalculia mainly affect self-esteem and lead to anxiety. Schools must provide counseling and create a supportive environment to help students cope with these challenges.
- NEP 2020 must ensure comprehensive teacher training programs that equip educators with the skills to identify and support students with learning disabilities. Training must include inclusive pedagogical practices and differentiated instruction strategies.
- NEP 2020 mandates the establishment of support centers in schools that play an essential role in assistance and counseling to students with learning difficulties. These centers must offer remedial instruction and emotional support to help students succeed.
- NEP 2020 must achieve universal foundational literacy and numeracy in primary schools by 2025, ensuring that all students, including those with dyscalculia, have access to need-based support for developing basic reading, writing, and arithmetic skills.
- The NCF must ensure the curriculum is designed to be inclusive and flexible, accommodating the needs of students with dyscalculia.

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