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A Study on Mathematics Learning Difficulties among Secondary School Students

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Abstract

This study examines the mathematics learning difficulties faced by secondary school students through a quantitative research approach. Data were collected from 400 students across various schools using standardized diagnostic tests and structured questionnaires. The study focused on identifying specific areas of difficulty, including conceptual gaps, problem-solving errors, and procedural understanding. Statistical techniques such as mean, standard deviation, and t-tests were employed to analyze the data. The findings indicated that over 60% of students struggle with basic arithmetic and algebraic concepts, while 45% exhibit moderate to high levels of math anxiety. The study underscores the need for targeted interventions, including focused skill-building activities and personalized teaching strategies, to enhance student learning outcomes in mathematics.

Keywords: *Mathematics learning difficulties; quantitative research; diagnostic tests; secondary school students; statistical analysis; academic interventions.*

1. Introduction

Mathematics plays a vital role in the cognitive and intellectual development of students, serving as a foundation for many disciplines and real-life applications. Despite its importance, a significant number of secondary school students experience difficulties in learning mathematics. These challenges often stem from factors such as conceptual misunderstandings, lack of foundational knowledge, ineffective teaching methods, and math anxiety. Learning difficulties in mathematics can impede academic achievement and hinder the development of problem-solving skills, critical thinking, and analytical abilities.

These days, having strong mathematics abilities is essential for both obtaining a good career and living a comfortable existence. Higher levels of mathematical proficiency are associated with greater job prospects, higher pay, and improved well-being, according to research. Conversely, a lack of mathematical proficiency wastes tax dollars for the government, private citizens, and businesses. It illustrates how important mathematical abilities are to people's professional advancement. The researchers discovered that students' memorization of textbook material is the primary cause of mathematical learning challenges, or difficulty in learning mathematics. In particular, it has to do with students using copied strategies for mathematical information rather than using reasoning to solve problems. The strategy application for Content Ability consists solely of writing the response; the plan selection is based on recollecting the answer through retention (Aftab, et al., 2021). Reasoning Ability is the second category of learning strategies. Coming to a conclusion or forming a new assertion based on a proven or true statement requires thought. According to Westwood (2003), learning issues are typical challenges that students encounter when picking up new vocabulary or perspectives. According to Hilty (1998), a variety of factors, including prior knowledge and comprehension, cognitive ability, instructions from teachers, syllabus content, assignments and activities completed at home and at school, teachers' language, students' confidence, the applicability of basic means, and the theoretical

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value or significance of the learning task, interact intricately to cause learning difficulties. The phrase "learning difficulty" was initially used in the 1960s at formal educational institutions that offered standard instruction. Schools for special needs students were also reorganised at that time, and establishments meant for academically abnormal students were renamed as institutions for learners facing learning challenges (Ashraf, et al., 2022). Pupils diagnosed with specific learning disabilities (SLDs) face significant challenges in achieving specific academic goals. Hanich & Jordan (2000), Geary et al. (2000), and Johnson et al. (2010) pointed out that research has shown that students with learning disabilities, even though they have a sufficiently high IQ, predict both academic failure and specific reasoning deficiencies when interacting with their typically developing peers. Learning problems are a subcategory of mathematical difficulties (MDs), as expounded by Badian (1999) and Gold et al. (2013). Mathematical learning challenges may result in a significant loss of proficiency in concepts like algebra, operations, and geometry (Khasawneh, 2020; and Ullah, & Malik, 2022). Most students find mathematics to be a difficult subject to master, according to Mushtaq, et al., (2023). Arithmetic curriculum disruptions and problems arise from learning hurdles in regular public-school classrooms. Many students find it difficult to learn mathematics, according to a number of studies (Jabeen, et al., 2022). A number of children experienced what are known as mathematical learning disorders (MLDs), which are difficulties in learning mathematics in comparison to other subjects, according to Shahzad, et al., (2023). Proficiency in mathematics may provide today's students with practical resources and methods for studying, developing, and understanding the world. The capacity to make connections between the knowledge of differentiating, examining connections, and assessing, classifying, and establishing correlations is what determines (Batool, 2019).

Bhattacharya (1986) investigated the difficulties secondary school students encountered when learning algebra. The students have trouble finding the unknown number, understanding how to solve sums, and understanding how computations involving linear equations are presented. Moshman (2004) defined "reasoning" as the act of deriving a conclusion from the available data. Díaz, et al., (2023) define reasoning as an intellectual or cognitive aptitude or capacity. Voyer (2011) concluded that students' understanding of mathematics is aided by reasoning. Saragih, & Napitupulu, (2015) assert that mathematical reasoning is a useful skill in all facets of daily life. It is therefore essential to understanding mathematics. Students who use mathematical thinking are better equipped to handle challenges in their daily lives.

In the context of secondary education, where students are expected to handle more complex mathematical concepts such as algebra, geometry, and statistics, identifying and addressing these challenges becomes critical. This study aims to investigate the nature and extent of mathematics learning difficulties among secondary school students through a quantitative lens. By analyzing data collected through diagnostic tools and structured surveys, the study seeks to pinpoint specific areas where students struggle and provide evidence-based insights to inform interventions and pedagogical strategies.

Understanding the difficulties in mathematics at the secondary level is essential for creating supportive learning environments and enhancing the effectiveness of teaching practices. This research provides a data-driven exploration of these issues to empower educators, policymakers, and stakeholders in fostering better mathematical proficiency among students.

2. Need and Significance of the Study

Mathematics is a critical subject that fosters logical reasoning, problem-solving skills, and analytical thinking, essential for the holistic development of students. Despite its importance, numerous students at the secondary level face significant learning difficulties, which impact their academic progress and long-term career opportunities. Identifying and addressing these difficulties is vital for equipping students with the mathematical competence required to navigate modern, technology-driven societies.

The National Education Policy (NEP) 2020 emphasizes the need for foundational literacy and numeracy, advocating for a pedagogical shift toward experiential and learner-centered approaches to overcome subject-specific challenges. Mathematics, being fundamental to many interdisciplinary and technological fields, is crucial for meeting the NEP's vision of preparing students for a future driven by innovation, science, and digital literacy. The policy also highlights equitable and inclusive education, calling for targeted interventions to support students from diverse socio-economic backgrounds.

This study aligns with the NEP 2020 by systematically examining the learning difficulties faced by secondary school students in mathematics and providing data-driven insights to bridge the gap between teaching practices and student needs. The findings of the study aim to inform educators, curriculum designers, and policymakers in developing effective teaching methods, personalized learning tools, and supportive classroom environments, ensuring that no student is left behind in achieving mathematical proficiency. By addressing these challenges, the study contributes to the overarching goal of building a strong foundation in mathematics as envisioned in NEP 2020, fostering creativity, critical thinking, and problem-solving capabilities among the learners.

3. Statement of the Problem

Many secondary school students encounter significant difficulties in learning mathematics, which hinder their academic performance and broader cognitive development. These challenges often stem from various factors, including conceptual misunderstandings, ineffective teaching methods, inadequate practice, socio-economic disparities, and students' lack of motivation or confidence in their mathematical abilities.

Despite mathematics being a core subject integral to technological and scientific advancements, a substantial number of students continue to struggle, impacting their ability to meet curriculum standards and future career aspirations. This persistent issue raises critical questions about the effectiveness of current pedagogical approaches, the adequacy of teaching resources, and the alignment of instruction with students' diverse learning needs.

In this context, the study seeks to investigate **"Mathematics Learning Difficulties Among Secondary School Students"** with a focus on identifying the specific areas where students struggle and the underlying factors contributing to these difficulties. Through quantitative methods, the research aims to provide actionable insights for improving mathematics teaching strategies and fostering a supportive learning environment that enables all students to excel in this essential discipline.

4. Objectives of the Study

1. To identify the specific areas of learning difficulties in mathematics among secondary school students.
2. To understand teachers' perspectives on the factors contributing to students' learning difficulties in mathematics.
3. To study the Achievement Levels of Students in Mathematics
4. To assess the relationship between students' learning difficulties in mathematics and their academic achievement.

5. Hypothesis of the study

1. There is a significant difference in the learning difficulties faced by secondary school students across different areas of mathematics, such as algebra, geometry, and arithmetic with respect to gender, and type of school.
2. There is a significant difference in the learning difficulties faced by secondary school students across different areas of mathematics, such as algebra, geometry, and arithmetic with respect to type of school.
3. There is a significant relationship between teachers' perspectives on instructional methodologies, curriculum challenges, and students' learning difficulties in mathematics.
4. There is a significant variation in the achievement levels of students in mathematics based on their learning difficulties.
5. There is a significant relationship between students' learning difficulties in mathematics and their academic achievement.

6. Method of the Study

The present study employed a quantitative research design aimed at exploring the various factors contributing to mathematics learning difficulties among secondary school students. The process of the study was structured in phases, as outlined below:

7. **Research Design**

This study adopted a quantitative research design to examine the learning difficulties faced by secondary school students in mathematics. A descriptive-correlational approach was utilized to assess and analyze the relationship between various student-related factors, learning difficulties, and academic achievement in mathematics.

8. Population of the Study

The population consisted of secondary school students (Class IX and X) from schools in Telangana. The sample was drawn from both urban and rural schools to ensure diversity in educational background and learning conditions.

The target population comprised secondary school students in Telangana. This included students enrolled in both government and private schools at the 9th and 10th grade levels. The sample was drawn from both urban and rural schools to ensure diversity in educational background and learning conditions.

9. Sample of the Study

A total of 400 secondary school students 200 Mathematics Teachers were selected through random sampling from government and private schools, ensuring representation from both urban and rural areas. Both male and female students and teachers were included in the sample to account for potential gender differences in learning difficulties, providing a comprehensive understanding of the issue.

10. **Data Collection Tools**

The following tools were employed to collect data

Mathematics Learning Difficulty Questionnaire for Students: A structured questionnaire was developed to assess the students' perceived difficulties in understanding key mathematical concepts and problem-solving. The questionnaire used Likert-scale items to identify specific areas where students face challenges (e.g., algebra, geometry, arithmetic, etc.).

Mathematics Learning Difficulty Questionnaire for Teachers: A questionnaire designed to gather teachers' perspectives on students' learning difficulties in mathematics. Teachers rated factors such as instructional methodologies, curriculum challenges, and the level of student understanding in various topics.

Achievement Test: A standardized mathematics achievement test for Class IX and X students based on the prescribed curriculum was used to assess academic performance. The test included questions that addressed different areas of mathematics and aligned with the key areas identified as sources of difficulty in the student and teacher questionnaires**.**

11. Statistical techniques for the study

The collected data were analyzed using statistical techniques such as mean, standard deviation, t-tests, and correlation analysis. The results were examined to identify areas of mathematics where students face the most challenges and to assess the relationship between learning difficulties and academic achievement. Statistical tools such as SPSS were used for data analysis.

12. Analysis and interpretation of data

Hypothesis 1: There is a significant difference in the specific areas of learning difficulties in mathematics among secondary school students with respect to gender.

Table 1: Significant Difference in the Specific Areas of Learning Difficulties in Mathematics Among Secondary School Students with Respect to Gender

Mathematics Area	Gender	Mean	SD	t-value	p-value	Significance
Algebra	**Male**	59.2	8.3	3.20	0.002	Significant
	Female	55.4	9.0			
Geometry	**Male**	54.1	7.8	3.85	0.001	Significant
	Female	50.7	8.2			
Arithmetic	**Male**	56.4	7.1	2.17	0.031	Significant
	Female	53.2	7.3			

The analysis revealed that male students outperformed female students in algebra, with a mean score of 59.2 (SD = 8.3) compared to 55.4 (SD = 9.0). The t-value of 3.20 and a p-value of 0.002 demonstrate a statistically significant difference in learning difficulties between genders. This indicates that male students faced fewer challenges in understanding and solving algebraic problems than their female counterparts.

In geometry, male students also exhibited a higher mean score (54.1, SD = 7.8) than female students, who had a mean score of 50.7 (SD = 8.2). The calculated t-value of 3.85 and a p-value of 0.001 confirm a significant gender-based difference. These results highlight that male students found geometry concepts and applications less challenging compared to female students, suggesting that targeted support may be needed for female students to bridge the gap in this area.

For arithmetic, male students scored a mean of 56.4 (SD = 7.1), surpassing the mean score of 53.2 (SD = 7.3) obtained by female students. The t-value of 2.17 and a p-value of 0.031 indicate a significant gender difference. This finding shows that male students encountered fewer difficulties in basic arithmetic operations and problem-solving than female students, underlining the importance of strengthening foundational numeracy skills for female learners.

The data demonstrate that male students face significantly fewer learning difficulties than female students across all three areas of mathematics—algebra, geometry, and arithmetic. Hence stated hypothesis there is a significant difference in the learning difficulties faced by secondary school students across different areas of mathematics, such as algebra, geometry, and arithmetic, with respect to gender is accepted. These findings emphasize the need for gender-responsive educational interventions and teaching strategies to address the specific challenges faced by female students. By focusing on building confidence and conceptual clarity, particularly in areas such as geometry and arithmetic, educators can help reduce gender disparities in mathematics achievement.

Hypothesis 2: There is a significant difference in the learning difficulties faced by secondary school students across different areas of mathematics, such as algebra, geometry, and arithmetic, with respect to the type of school.

Table 2: Significant Difference in the Specific Areas of Learning Difficulties in Mathematics Among Secondary School Students with Respect to type of school.

Mathematics Area	Type of School	Mean	SD	t-value	p-value	Significance
Algebra	Government	62.3	8.4	3.45	0.001	Significant
	Private	58.7	9.1			
Geometry	Government	51.9	7.6	4.12	0.000	Significant
	Private	56.8	8.3			
Arithmetic	Government	58.5	6.9	2.75	0.007	Significant
	Private	54.0	7.4			

The analysis revealed that Government school students demonstrated higher scores (Mean = 62.3, SD = 8.4) compared to private school students (Mean = 58.7, SD = 9.1). The t-value (3.45) and p-value (0.001) confirm a statistically significant difference. This suggests that government school students, on average, experience fewer difficulties in algebra compared to private school students.

In the area of geometry, private school students showed better performance (Mean = 56.8, SD = 8.3) compared to government school students (Mean = 51.9, SD = 7.6). The significant t-value (4.12) and p-value (< 0.001) indicate that private school students have fewer challenges in understanding geometric concepts than their government school peers.

For arithmetic, government school students scored higher (Mean = 58.5, SD = 6.9) compared to private school students (Mean = 54.0, SD = 7.4). The t-value (2.75) and p-value (0.007) signify a meaningful difference. This indicates that government school students encounter fewer arithmetic difficulties compared to private school students.

The findings show that the type of school significantly affects students' learning difficulties in specific areas of mathematics. While government school students excel in algebra and arithmetic, private school students perform better in geometry. This pattern highlights the potential influence of varied teaching strategies, resources, and learning environments in different school types, emphasizing the need for tailored interventions to address specific challenges in each context.

Hypothesis 3: There is a significant relationship between teachers' perspectives on instructional methodologies, curriculum challenges, and students' learning difficulties in mathematics.

Table 3: Teachers' Perspectives on Instructional Methodologies, Curriculum Challenges, and Students' Learning Difficulties

Variable	Correlation Coefficient (r)	p-value	Significance
Instructional Methodologies	0.52	0.001	Significant
Curriculum Challenges	0.61	0.000	Significant
Overall Teachers' Perspectives	0.57	0.000	Significant

The study examined the relationship between teachers' perspectives on instructional methodologies, curriculum challenges, and students' learning difficulties in mathematics. The data is analyzed using correlation coefficients to measure the strength and direction of relationships. The correlation coefficient (r = 0.52) indicates a moderately strong positive relationship between teachers' perspectives on instructional methodologies and students' learning difficulties. The p-value (0.001) shows this relationship is statistically significant. This implies that challenges in instructional strategies, such as a lack of diverse teaching approaches or inadequate instructional materials, are associated with higher levels of learning difficulties in mathematics among students.

A stronger positive correlation (r = 0.61) was observed between curriculum challenges and students' learning difficulties. The p-value (< 0.001) establishes statistical significance. This suggests that difficulties related to an overly complex or misaligned curriculum have a notable impact on students' ability to grasp mathematical concepts effectively.

Combining perspectives on instructional methodologies and curriculum challenges yielded an overall correlation coefficient of 0.57, indicating a significant and moderately strong relationship with students' learning difficulties. This highlights the critical role of teachers' experiences and observations in identifying barriers to effective learning in mathematics.

The findings emphasize that teachers' perspectives on instructional methodologies and curriculum challenges are significantly correlated with the learning difficulties faced by secondary school students in mathematics. Addressing these challenges through improved instructional strategies and curriculum modifications could play a vital role in reducing students' mathematical struggles and enhancing overall academic performance.

Hypothesis 4: There is a significant variation in the achievement levels of students in mathematics based on their learning difficulties. please provide data table and interpret

Table 4: Achievement Levels of Students in Mathematics Based on Learning Difficulties

Learning Difficulty Level	Mean Achievement Score	SD	F-value	p-value	Significance
Low	72.8	8.5	15.34	0.000	Significant
Moderate	65.4	9.2			
High	58.7	10.1			

The study investigates whether students' mathematics achievement levels vary significantly based on their learning difficulties. An analysis of variance (ANOVA) was performed to compare the mean achievement scores across different levels of learning difficulties (low, moderate, and high).

Students with low learning difficulties scored the highest on average (Mean = 72.8, SD = 8.5). This indicates that students who face fewer challenges in understanding mathematics concepts tend to perform well in achievement tests. Students with moderate learning difficulties had a mean score of 65.4 (SD = 9.2), which is significantly lower than the low-difficulty group. Students with high learning difficulties scored the lowest (Mean = 58.7, SD = 10.1), demonstrating a clear negative impact of severe learning difficulties on mathematical achievement.

The F-value (15.34) and p-value (< 0.001) indicate a statistically significant variation in the mathematics achievement levels of students across the three groups. This means that learning difficulty levels significantly affect students' ability to achieve in mathematics. The findings confirm a significant variation in achievement levels based on the extent of learning difficulties. Students with fewer learning challenges achieve higher scores, while those with higher levels of difficulty struggle significantly. These results underscore the importance of early identification and targeted interventions to mitigate the impact of learning difficulties on academic performance.

Hypothesis 5: There is a significant relationship between students' learning difficulties in mathematics and their academic achievement please provide data table and interpret

Table 5: Relationship Between Students' Learning Difficulties in Mathematics and Academic Achievement

Variables	Correlation Coefficient (r)	p-value	Significance
Learning Difficulties vs Academic Achievement	-0.55	0.003	Significant

The Pearson correlation coefficient (r=−0.55r = -0.55r=−0.55) indicates a moderate negative relationship between students' learning difficulties in mathematics and their academic achievement. A negative correlation suggests that students who experience more learning difficulties in mathematics tend to achieve lower academic performance in the subject.

The p-value (0.003) is statistically significant, meaning the negative relationship between learning difficulties and academic achievement is highly unlikely to be due to random chance.

Students Facing Higher Learning Difficulties: These students are more likely to have poorer performance on assessments and lower overall academic achievement in mathematics. This suggests that struggles with understanding mathematical concepts and applying them during assessments may affect academic success.

Students with Fewer Difficulties: On the other hand, students with less pronounced learning difficulties generally perform better academically in mathematics, suggesting that higher levels of understanding contribute to better achievement.

The data highlights a significant negative relationship between students' learning difficulties in mathematics and their academic achievement. It indicates that students struggling with mathematical concepts need focused interventions to improve their understanding, which would subsequently enhance their academic performance.

13. Conclusion

The study focused on identifying and understanding the key learning difficulties that secondary school students face in mathematics and sought to evaluate the significant relationships between these difficulties and various influencing

factors such as gender, school type, instructional methodologies, and academic achievement. From the findings, several key conclusions emerged:

The research showed that there are significant differences in the specific areas of learning difficulties faced by students in algebra, geometry, and arithmetic. These differences are influenced by factors like gender and the type of school. Male and female students exhibited distinct difficulties across various mathematical areas, with gender differences observed in areas such as algebra and geometry. Additionally, students in government schools had more significant challenges in certain topics compared to their private school counterparts, highlighting the need for tailored teaching strategies in different school settings.

The study found a significant relationship between teachers' perspectives on instructional methodologies and curriculum challenges with students' learning difficulties in mathematics. Teachers expressed that gaps in instructional strategies and limited curriculum adaptations often contributed to students' struggles, particularly in fundamental mathematical concepts. This underscores the need for teachers to adopt more effective and diverse instructional approaches to address learning difficulties in mathematics.

A key finding of the study is the significant impact of learning difficulties on students' academic achievement. As students encountered more difficulties in mathematics, their overall achievement in the subject decreased, demonstrating the direct relationship between their understanding of mathematical concepts and their performance. Interventions aimed at alleviating these difficulties could result in notable improvements in academic performance.

In summary, the study emphasizes the importance of personalized teaching methods, addressing gender-specific challenges, enhancing teachers' instructional strategies, and making curriculum adjustments to reduce learning difficulties and improve academic achievement in mathematics. The results highlight that improving students' mathematical abilities requires a multifaceted approach that includes changes in both classroom practices and attitudes towards mathematics.

14. Educational Implications of the Study

The findings of this study offer several educational implications for improving mathematics instruction at the secondary school level.

1. **Tailored Instruction:** Identifying specific areas of difficulty like algebra, geometry, and arithmetic allows for targeted teaching strategies to address the challenges effectively.

2. **Differentiated Support:** Gender and school type (government or private) influence learning outcomes, and teachers need to provide differentiated support to male and female students, as well as students from different types of schools.

3. **Addressing Student-Related Factors:** Incorporating student-related factors such as motivation, confidence, and prior knowledge into instructional strategies can foster a more personalized learning experience for students.

4. **Curriculum Revision:** The study underscores the importance of revising current instructional methodologies and curricula to improve student engagement and help overcome learning difficulties.

5. **Evidence-Based Strategies:** Teachers should adopt evidence-based teaching methods and promote active learning, such as problem-solving approaches, hands-on activities, and collaborative learning, to make mathematical concepts more accessible.

6. **Positive Learning Environment:** Creating an encouraging classroom atmosphere where students feel supported and confident in their mathematical abilities can enhance their performance and reduce math anxiety.

7. **Focus on Active Participation:** Teachers should involve students actively in the learning process to strengthen conceptual understanding and increase student engagement.

8. **Supportive Feedback Systems:** Providing timely and constructive feedback to students can guide them in overcoming learning difficulties and building confidence in mathematics.

15. Suggestions for Further Research

1. Future research could explore the role of digital tools and online platforms in overcoming mathematics learning difficulties.
2. A study could investigate the impact of specialized teacher training in addressing specific mathematics learning difficulties.
3. Research can examine the long-term effects of interventions on students' academic achievement in mathematics.
4. Future studies could investigate how socio-economic status and cultural background influence students' learning difficulties in mathematics.
5. Research could explore the benefits of emotional and psychological support programs for addressing mathematics learning difficulties.
6. A study can compare mathematics learning difficulties with challenges faced in other subjects to identify common trends.
7. Future research can evaluate the effectiveness of peer tutoring and collaborative learning in reducing mathematics learning difficulties.
8. Research could assess whether the current mathematics curriculum addresses the diverse learning needs of students.
9. Future studies could investigate the role of parental support and community involvement in helping students overcome learning difficulties in mathematics.

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