

Research

## **A Study on Mathematics Learning Difficulties Among High School Students**

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**Abstract:** Mathematics is important for a person to live a better life. Mathematics holds a special position in the educational curriculum. However, it is well known that most students find mathematics challenging. This study examined the high school students' struggles and challenges in learning mathematics. This study examines the mathematics learning difficulties faced by high school students through a quantitative research approach. Data were collected from 200 students across various schools using standardised 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 54% of students struggle with basic arithmetic and algebraic concepts, while 46% exhibit moderate to high levels of math anxiety. From this study, algebra was found to be more difficult than arithmetic and geometry. Around 71% of students were below the 50% criterion in the area of algebra. Among the specific difficulties, around 72% of students faced difficulty in basic mathematical calculations, around 83% of students were having difficulties in converting word problems into mathematical expressions and solving them accordingly, and around 69% of students were having difficulties in understanding the applications of the volume of solids. The findings of the study have great implications for schoolteachers and students, and also for teacher education programs to gain a better understanding and in-depth knowledge about the difficulties in mathematics and accordingly develop their capabilities to neutralise these difficulties. The study underscores the need for targeted interventions, including focused skill-building activities and personalised teaching strategies, to enhance student learning outcomes in mathematics.

**Keywords:** Mathematics Learning Difficulties, High School Students, Quantitative Research, Academic Achievement, Gender Differences.

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## **Introduction**

Mathematics is very important not just in the school curriculum but also in our daily lives. In everything we do, there's an integration of mathematics. However, we can't deny the fact that most of the students nowadays dislike mathematics, although its significance is evident in our lives every day. According to Gafoor and Krugman (2015), students dislike mathematics, as they perceive it as a difficult subject. Their negative perception about mathematics affects their self-efficacy and their approach towards the subject, which leads to a lot of struggles and challenges in learning mathematics. Students have difficulties in learning and understanding the subject, solving equations, and remembering formulas and ways to solve problems.

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 high 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 complications 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 Hilly (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 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 reorganized 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. Heinrich & Jordan (2000), Gear yet 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 Radian (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 Allah & 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 (Ja been 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 Shaheed 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 (Ba tool, 2019).

In the context of higher 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 high 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 high 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.

### **Meaning of Learning Difficulties in Mathematics**

Learning difficulties in mathematics, often called dyscalculia, stem from brain-based differences affecting number sense, calculation, and reasoning, making concepts abstract or hard to grasp, unlike just being "bad at math." Key signs include trouble with basic facts, mental math, understanding quantities, memory, and using fingers to count, leading to anxiety and poor performance despite effort, with effective support involving multisensory teaching, specialized instruction, and strategies to build conceptual understanding rather than just rote memorization.

### **Identifying Mathematical Learning Difficulties**

Mathematical learning difficulties can arise at nearly any stage of a child's learning development. Dyscalculia is a condition that affects the ability to acquire mathematical skills.

Learners with dyscalculia face difficulty understanding simple number concepts, lack an intuitive grasp of numbers, and have problems recalling basic number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically (without a deep understanding of the concept) or without confidence. Dyscalculia and dyslexia may occur both independently of each other and/or together. Here are some signs to look out for when identifying mathematics difficulties:

#### **1. Incomplete Mastery of Number Facts**

Number facts are the basic computations that children are expected to pick up early on, such as knowing that  $5 + 5 = 10$  or that  $2 \times 3 = 6$ . When a child cannot recall these facts efficiently, they may struggle to keep up with more advanced mathematical concepts.

For example, during homework, a child might spend several minutes working out  $7 + 8$  by counting on their fingers each time instead of remembering it instantly. This can make problem-solving slow and frustrating, and may reflect underlying mathematical learning difficulties that warrant further investigation.

## **2. Computational Weaknesses**

Some children may understand mathematical concepts but still struggle when it comes to carrying out calculations. They might make frequent mistakes, such as adding instead of subtracting because they misread the sign, or writing the numbers in the wrong column during long multiplication.

For example, a child who knows how subtraction works may solve  $54 - 29$  as  $54 + 29$ , or when adding 236 and 47, they might accidentally place the “47” under the wrong digits, leading to an incorrect answer. At home, this may look like a child spending extra time redoing sums or feeling frustrated because their answers are not correct, even though they “know” the method.

## **3. Difficulties with Spatial and Directional Understanding**

Children who experience difficulties with spatial and directional understanding may find it hard to judge the relative size of objects.

For example, when given three cups of different sizes, a child might struggle to tell which is the tallest or which holds the most water. Because of this, they often rely on rote memorisation of mathematical facts without truly understanding the concepts. These challenges can become more obvious in school when tasks require both higher-order thinking and visual-spatial skills, such as trying to imagine what a 3D block structure will look like if it is rotated or figuring out how shapes fit together in a puzzle.

## **4. Difficulties with Making Meaningful Connections with Mathematics**

Some children struggle to see how numbers relate to real-life quantities. For example, they may be able to say the number “5” but not immediately connect it to the idea of “five apples” on the table. Without this link, mathematics can feel abstract, and skills that they have learned may not “stick” or carry over to new situations.

A child might, for instance, know that  $10 - 3 = 7$  on a worksheet, but when asked, “If you had 10 sweets and ate 3, how many are left?” They may not realise that it is actually the same problem. This makes mathematics hard to recall and apply beyond rote memorisation.

## **5. Issues with Sequencing Steps and Staying Focused**

Some children struggle when mathematical tasks involve several steps. For example, in a word problem like “John has 12 marbles, gives 3 to his friend, and then buys 5 more. How many does he have now?” The child may lose track of the sequence, only doing one part of the problem or mixing up the order. They may also overlook key details, such as whether they are supposed to add or subtract.

In learning settings, this might look like a child becoming easily distracted, tapping their pencil, or fidgeting whenever mathematics homework is involved. Some may even appear unusually tired or mentally drained after working on just a few questions, as compared to other schoolwork.

### **Why is it difficult to learn mathematics?**

There are at least six different overarching sources of difficulty to the learning of mathematics. The first source is the very nature of mathematics as a discipline. Coming to grips with mathematical concepts, with the specific nature of mathematical statements, with the modes of justification and reasoning in mathematics, with the role and forms of symbols and formalisms in mathematical processes and theoretical edifices, and with the notion and characteristics of abstraction, abstractness, and generalization in the development of mathematics all of which typically deviate from the state of affairs in other disciplines are known to generate learning difficulties, in some cases of a severe nature. Whilst this source of difficulty is primarily internal to mathematics, the second source, the relationships between mathematics and the rest of the world, goes beyond mathematics in itself. Making sense and meaning in real-world terms of mathematical ideas and entities is a necessity for most learners, and the fact that this is sometimes hard to achieve, as is also true of the linking of mathematical results and theory with extra-mathematical experience, is a significant source of difficulty in the learning of mathematics. The same holds for that subtle connection between extra-mathematical domains and mathematical domains that forms the essence of mathematical modelling. For example, many learners find it hard to understand why the indisputable logical rigour of mathematical considerations within a given mathematical domain does not automatically give rise to indisputable results within extra-mathematical domains.

The third source of difficulty is uncertainty about what it means and takes to learn mathematics. Much of this uncertainty is related to learners’ beliefs about mathematics.

Beliefs are long-term and stable convictions about something that an individual holds to be true, no matter whether these convictions are in fact true or are considered to be true by the relevant community of professionals (Phillip 2007). By being long-term and stable, beliefs are very difficult to change. Much more than manifest evidence is needed for an individual to change his or her beliefs about something. As to mathematics beliefs, they concern one or more of the following (Panelist 2015): beliefs about mathematics as a discipline, beliefs about mathematics teaching and learning, beliefs about the role of mathematics in society and culture, and beliefs about the individual's relationship with mathematics as a discipline, as an educational subject, and as a field situated in culture and society. As beliefs further concern one or more of the links between these four elements, beliefs concerning mathematics can be perceived as a tetrahedron with four vertices and six edges. It is important to understand that beliefs about what it means and takes to learn mathematics are not only shaped by experiences and beliefs concerning mathematics teaching and learning but also by beliefs concerning the other vertices and edges in the tetrahedron. This source of difficulty also deals with notions about the way(s) in which the learning of mathematics takes place (is perceived to take place), notions that are largely shaped by the learner's experiences from his or her current and previous mathematical education. Another factor at play here is whether, in the mind or the environment of the learner, mathematics is perceived as something everyone can learn if proper assistance is provided, or whether mathematics learning is seen as being reserved for just a few people in possession of an appropriate background and appropriate intellectual (perhaps even biological) prerequisites. The experiences that students have gained from their life spheres, i.e., their everyday life with family and friends, life in the local community and in the surrounding society, schooling at large, and the world including nature in general, also constitute a (fourth) source of difficulty to the learning of mathematics. This is mainly because the vast majority of experiences gained from those spheres are not immediately conducive to the learning of mathematics. The fact that mathematics does indeed permeate a multitude of aspects in society and culture is only rarely recognized by people, since mathematics largely remains hidden and invisible on the surface of things, except for matters related to basic arithmetic (numbers, money, weight, and measure) and elementary geometry (seldom going beyond names of standard 2D figures and 3D solids). As Richard Loss once put it in a panel debate, the purpose of digital technology is to hide the role and significance of mathematics in

friendly disguises that do not remind users of the presence of mathematics, whereas one of the tasks for mathematics educators is to uncover and reveal the role and significance of mathematics in ICT. Since everyday life for most people only offers few opportunities for non-elementary encounters with mathematics, mathematics easily becomes relegated to an isolated world of its own, which includes the mathematics classroom, governed by its own issues and rules, having no links with or bearing on “the real world.”

The fifth source of difficulty to mathematical learning consists of students’ experiences from mathematics classrooms. This may seem rather surprising, since we have just seen that the mathematics classroom is the primary environment from which students can acquire experiences with mathematics. However, this also implies that negative, limiting, distorted, or misinterpreted experiences about mathematics from the classroom can generate learning difficulties. First, as the classroom sets the scene for the mathematical learning experiences, it also frames the opportunities to learn mathematics in terms of teachers’ backgrounds, competencies, and behavior; in terms of the material and immaterial resources and conditions available for teaching and learning e.g., textbooks, technology, equipment, control of the level of noise, climate, or time and in terms of the backgrounds and conduct of peers. Two classroom-specific factors have a marked impact on students’ classroom experiences. One is the didactical contract (Rousseau 1997), which established tacitly during several years in mathematics classrooms defines the division of labor and the ensuing expectations between the teacher and the students. What can the students expect that the teacher will/will not do inside and outside the mathematics classroom: what is the teacher’s role in presenting and explaining subject, what kinds of questions will the teacher pose to students, what is the nature and extent of the tasks students are expected to undertake, what sorts of help will the teacher provide to students, what modes of assessment will the teacher employ and when, what kind of feedback will the teacher give to the students, and so on and so forth? Conversely, what can the teacher expect the students to do inside and outside the classroom, individually, in small groups, or in whole-class settings? What kinds of learning activities are students supposed to engage in, and how independently are they expected to work, and for how long? What sorts of homework are students expected to accept and undertake, and under what time frames? What kinds of assessment tasks and tests will students be asked to attend to? The didactical contract greatly contributes to shaping students’ mathematics classroom experiences and

hence possible learning difficulties arising from these experiences. The other factor that plays out in the individual mathematics classroom is the set of socio-mathematical norms (tacitly) established in any given mathematics classroom (Baker & Cobb 1996). The social-mathematical norms of a given classroom combine general social norms for acceptable and encouraged behavior in any classroom with the mathematical norms (tacitly) set for mathematical work at large. The socio-mathematical norms frame what is considered a valuable and novel contribution to the mathematical discourse in the classroom, for example, a good question, a novel and effective idea for solving a problem, an interesting observation of a pattern or phenomenon, or an innovative line of reasoning. Both the didactical contract and the socio-mathematical norms are highly significant factors in students' learning of mathematics and hence are, depending on their actual content, potential sources of mathematical learning difficulties as well.

The sixth and final source of difficulty is of a more general nature, namely the genesis, structure, organization, and functioning of human cognition at large. It would go far beyond the limits of this article to offer a thorough or detailed treatment of this topic. Suffice it to be mentioned that the fact that human cognition is rooted in and fundamentally governed by experiences gained from the material and social worlds of human beings gives rise to serious challenges to the coming to grips with the abstracted and abstract concepts of mathematics and with general mathematical claims covering an actual infinity of cases, all of which display relationships with the experiential world that are, at best, highly indirect. This, in and of itself, is a source of difficulty to the learning of mathematics.

### **Learning Difficulties in Mathematics**

Mathematics and Mathematical Structure Mathematics deals with structures and relationships between structures, rather than so-called 'mathematical objects.' In other words, mathematicians have become aware that the 'objects' of their science are particular mental constructs to which they apply their mental dynamism in order to make explicit the content involved in them by virtue of the embedded structures (Attard, 1963). Views of eminent mathematics education & the evidence revealed by different researchers relevant to this study will be discussed in brief. Mathematics: a conceptual study and Mathematics: a relational study, whereas modern methodologies to enlighten mathematics refer to the learning features of math underachievers: mental expressive approach: mental problems occur with math difficulties. The error analysis approach emphasizes the types of errors

made by scholars. The neuropsychological approach links math difficulties to the neurological disorder dyscalculia. The information-processing approach associates vocal, memory, and perceptual processing with math problems.

The mentioned approaches emphasize learners in exclusion instead of students in terms of students-teachers' collaborations in their previous and current learning scenarios" (Munro, 2016). Usually, mathematical problems are composed of controlled and basic activity, but later these are identified with the help of other methods and techniques like changing the state's data, analogy, etc.

Formalize investigational statements, with as much numerical verification as possible; In geometry, make the auxiliary structures that are erased after construction of problem statements; Initiating with a problem (theorem), produce another problem (theorem) using mathematical logic; Beginning from a problem (theorem), make a new problem (theorem) using generalizations and analogies, etc. Founding of acquaintances within unlike domains (mixtures); Resolving a known problem, using an additional technique" (Berea, 2008). "Spatial knowledge consists of two aspects: one is shaped like the number of sides and angles, and the second is position or location in space. The types of spatial problems displayed by the underachievers are problems dealing with directional concepts such as up and down and right and left. Problems with the elementary spatial ideas such as 'inside,' 'above,' and 'under.' A spatial idea is related to unsuitable criteria. The child cannot 'act mentally' on a shape or imagine it being altered or converted. The idea of angle and the degree of rotation causes trouble. The child uses unsuitable perceptual features to categorize the shapes. Child has trouble demonstrating 3-dimensional substances in 2 dimensions" (Mulligan, 2011).

The findings of a study about mathematics learning difficulties in early primary school years are as follows. The acute analysis of the construct, its inferences for children, and the tools for recognizing the precise learning difficulty; empirical reports of children's theoretical knowledge of the basic principles that motivate single-digit addition; and prove pertinent to theoretical models

Of the association between procedural and conceptual knowledge in the subject of mathematics (Ismail, 2007).

### **Learning Difficulties in Geometry**

Geometry means the pure mathematics of points, lines, curves, and surfaces. It is categorized as either straight-line geometrics, such as rectangles, triangles, trapezoids, octagons, pentagons, etc., or radius geometrics, which comprise half-rounds, quarter-rounds, full-rounds, sectors, ellipses, etc. It is as clear as crystal that geometry is the base and essential part of mathematics. The learners usually feel difficulties in drawing the different objects and also calculating their sides and other aspects.

### **Learning Difficulties in Arithmetic**

Mathematics of the numbers under the processes of addition, multiplication, subtraction, and division, rising to authorities an idea of origins, is also known as arithmetic. Some students have difficulties in discriminating between the rational and irrational numbers. And mostly the students face the difficulties in the operation of divisions, especially by using the tables (Teresina, 2014).

### **Learning Difficulties in Algebra**

Algebra is the language used to direct mathematical relationships. Students need to comprehend how quantities are connected to one another and how algebra can be used to exactly express and examine the relationship. Some students experience difficulties converting verbal expressions into mathematical form without understanding them. “Students experienced difficulties such as (1) deficiency of understanding of the problem posed, (2) deficiency of policy knowledge, and (3) incapability to interpret the problem into a mathematical form” (Yes, 2009).

Many studies have exposed that students’ consideration of symbols in algebra is not appropriate because some of the problems faced by the students are specific to algebraic terms (Kuhlmann, 1981). The misunderstandings about the equal sign are mutual among the students of algebra. The concept of equality is an important idea for developing algebraic concepts among algebra students. NCTM (2009) showed the significance of the idea of the equal sign (=) and recommended that more importance should be placed on students’ understanding of the equal sign to ensure a basis for learning algebra.

The results of the study, including students' observations of symbols, letters, and marks and the effect of their observations on learning algebra, are as follows: “The study revealed that students have many misunderstandings about the use of symbols in algebra, which affects their algebraic knowledge. It is crucial for students to understand that the symbols used to represent an unknown measure or variable have changed in context.

### **Need of Mathematics in high School Curriculum**

Mathematics is considered the gateway and key to science. Neglecting mathematics creates injury to all knowledge since those who ignore it cannot know the other sciences or the things of the world. The study of mathematics is a constituent of a full life. It is quite necessary for the all-round development of the child. Modern science and technology stress the importance of mathematics in the school curriculum. Mathematics is the mother of all sciences. In the absence of mathematics, science cannot progress. It is due to the contribution of mathematics that man has moved even to the moon. Mathematics does not mean merely a sum total of addition, subtraction, division, and multiplication. It is a mother discipline that forms a major part of human life. It is quite essential even for a layman and a shopkeeper. Hence, it occupies a strategic position in the school curriculum. The place of mathematics in high schools cannot be underestimated. It must play its own role in shaping the future generation of the country. India, after independence, is striving hard to improve itself in all its commitments, whatever the sphere may be. Only individual and technological advancements will help India become a developed country. To achieve this development, the knowledge of mathematics is essential. Proficiency in mathematics complements proficiency in science knowledge. India's future is being shaped only in Indian classrooms. He further said that to make Indian students better citizens, the high school curriculum should be designed in a way that gives due importance to mathematics.

### **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 high 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, emphasizing the need for basic literacy and numeracy, supports a shift in teaching towards experiential and learner-centered approaches to address subject-specific challenges. It is crucial to fulfil the NEP's vision of preparing students for a future driven by mathematics, innovation, science, and digital literacy, which underpin many interdisciplinary and technical fields. 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 high 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.

### **Statement of the Problem**

Many high 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.

In this context, the study seeks to investigate “A Study on Mathematics Learning Difficulties among High 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.

### **Objectives of the Study**

1. To identify the specific areas of learning difficulties in mathematics among secondary school students
2. To investigating differences learning difficulties in mathematics in relation to gender , type of school, and locality at high school students
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.

### **Hypothesis of the study**

1. There is a significant difference in the learning difficulties faced by high school students across different areas of mathematics, such as algebra, geometry, and arithmetic, with respect to gender.
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 variation in the achievement levels of students in mathematics based on their learning difficulties.
4. There is a significant relationship between students' learning difficulties in mathematics and their academic achievement.

### **Method of the Study**

The present study employed a quantitative research design aimed at exploring the various factors contributing to mathematics learning difficulties among high school students.

The investigation was carried out utilizing a methodology that was based on surveys. After the analysis was finished, the results were analyzed, and then conclusions were drawn from them.

### **Research Design**

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

### **Population of the Study**

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

### **Sample of the Study**

A total of 200 high school students 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.

### 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.).

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 questionnaires.

Analysis and interpretation of data Hypothesis

Hypothesis 1: There is a significant difference in the specific areas of learning difficulties in mathematics among high 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	Significance
Algebra	Male	<b>32.26</b>	<b>3.63</b>	<b>1.51</b>	Not Significant
	Female	<b>30.98</b>	<b>4.77</b>		
Geometry	Male	<b>56.4</b>	<b>7.1</b>	<b>2.17</b>	Significant
	Female	<b>53.2</b>	<b>7.3</b>		
Arithmetic	Male	<b>50.7</b>	<b>8.2</b>	<b>3.85</b>	Significant
	Female	<b>54.1</b>	<b>7.8</b>		

The analysis revealed that male students outperformed female students in algebra, with a mean score of 32.26 (SD = 3.63) compared to 30.98 (SD = 4.77). The t-value of 1.51 and the t-value of 0.05 levels demonstrate no 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 (56.4, SD = 7.1) than female students, who had a mean score of 53.2 (SD = 7.3). The calculated t-value of 2.17 and t-value of 0.05 levels confirm a significant gender-based difference. These results suggest that male students found geometry concepts and applications less challenging compared to female students, indicating that female students may need targeted support to bridge the gap in this area.

For arithmetic, male students scored a mean of 50.7 (SD = 8.2), surpassing the mean score of 54.1 (SD = 7.8) obtained by female students. The t-value of 3.85 and a t-value of 0.05 levels 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, the stated hypothesis that there is a significant difference in the learning difficulties faced by high 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, especially in areas such as geometry and arithmetic, math teachers can help reduce gender gaps in math achievement.

Hypothesis 2: There is a significant difference in the learning difficulties faced by high 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	Gender	Mean	D	t-value	Significance
Algebra	Government school	<b>32.26</b>	<b>3.63</b>	<b>1.51</b>	Not Significant
	Private school	<b>30.98</b>	<b>4.77</b>		
Geometry	Government school	<b>56.4</b>	<b>7.1</b>	<b>2.17</b>	Significant
	Private school	<b>53.2</b>	<b>7.3</b>		

Arithmetic	Government school	50.7	8.2	3.85	Significant
	Private school	54.1	7.8		

The analysis revealed that government school students demonstrated higher scores (mean = 106.40, SD = 10.32) compared to private school students (mean = 103.20, SD = 9.23). The t-value of 0.887 at 0.05 levels confirms a statistically insignificant 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 = 106.40, SD = 10.37) compared to government school students (mean = 103.20, SD = 9.10). The significant t-value is 2.17. Significant at 0.05 levels 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 = 103.97, SD = 9.97) compared to private school students (mean = 105.60, SD = 10.15). The t-value is 1.11 and is not significant at the 0.05 level. 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 at 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 variation in the achievement levels of students in mathematics based on their learning difficulties. Please provide data table and interpret.

Table 3: Achievement Levels of Students in Mathematics Based on Learning Difficulties

Learning Difficulty Level	Mean Achievement Score	SD	t-value	Significance
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Low	<b>62.41</b>	<b>7.96</b>	<b>4.05</b>	Signif icant at 0.01 level
Moderate	<b>33.11</b>	<b>4.60</b>		
High	<b>30.27</b>	<b>4.32</b>		

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 = 62.41, SD = 7.965). 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 33.11 (SD = 4.60), which is significantly lower than the low-difficulty group. Students with high learning difficulties scored the lowest (Mean = 30.27, SD = 4.32), demonstrating a clear negative impact of severe learning difficulties on mathematical achievement.

Hypothesis 4: There is a significant relationship between students' learning difficulties in mathematics and their academic achievement please provide data table and interpret

*Table 4: Relationship between Students' Learning Difficulties in Mathematics and Academic Achievement*

Variables	Correlation Coefficient (r)	Significance
Learning Difficulties vs Academic Achievement	<b>0.588</b>	Significant (Correlation at 0.01 level)

The R-value of 0.588 (R-value < 0.001) indicates 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 reduce the impact of learning difficulties on academic performance.

Higher Students Facing 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.

These data illustrate that there is a significant negative correlation 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.

#### Educational Implications

The aforementioned study appears to have important implications for understanding the difficulties faced by students, which are briefly described below.

Due to the aforementioned difficulties, students' mathematics learning may not take place with a deep understanding in the classroom. After understanding these difficulties, the school administration should plan and prepare a well-equipped classroom with the necessary mathematical tools to avoid these problems and conduct teaching activities accordingly.

Teachers are deeply concerned about their students' in-depth learning. The findings of this study will inform teachers about the challenging areas and specific difficulties that students face. Accordingly, teachers should develop their subject knowledge and pedagogical content knowledge to address these difficulties during the teaching-learning process.

Like the teachers, the findings are also useful for students. It will help the students to gain in-depth knowledge in the concerned area.

#### **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: This research showed that there are significant differences in the specific areas of learning difficulties that students face in mathematics,

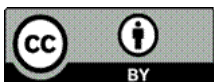
geometry, and arithmetic. These differences are influenced by factors such as gender and the type of school. Male and female students exhibited distinct difficulties in various mathematical areas; gender differences were particularly observed in areas such as algebra and geometry. Furthermore, government school students faced greater challenges in certain topics compared to private school students. This highlights the need for personalized teaching strategies in different school environments. 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.

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