Conceptual Article

Why students find Mathematics difficult?

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Abstract

This paper explores the reasons why students often find mathematics difficult at the school level, with a focus on primary education where foundational attitudes toward the subject are formed. The study identifies two core issues: the widespread misunderstanding of mathematics among teachers, and the inappropriate pedagogical methods used in classrooms. Mathematics is frequently misinterpreted as a subject of rote memorization rather than a way of understanding patterns, relationships, and abstract concepts. Teachers' inability to convey conceptual clarity, combined with linguistic and pedagogical limitations, contributes to students' difficulties in learning. Additional challenges include inadequate understanding of children's cognitive development, overemphasis on writing, and limited use of activities and visualization. The paper suggests classroom strategies such as relating concepts to students' experiences, employing concrete-to-abstract progression, encouraging peer interactions, using activity-based methods, reducing reliance on rote memorization, and promoting meaningful practice over mechanical drills. These approaches aim to make mathematics learning accessible, enjoyable, and conceptually rich.

Keywords: *Mathematics Learning Difficulties; Primary Education; Misunderstanding of Mathematics; Inappropriate Pedagogy; Conceptual Understanding; Activity-Based Learning; Student Engagement.*

There are two reasons why students find learning of Mathematics difficult at school level. The initial likes and dislikes for a subject are sown in the Primary school. Hence in this article we will restrict ourselves to the issues mainly dominant in Primary School. In the course of the article we will also see why the emotional impact of a subject in Primary School is more important in mathematics than in other subjects.

The first reason is the misunderstanding of Mathematics as a subject, among teachers themselves. Teachers themselves have been victims of an edu-cation system which has always misunderstood Mathematics. Further, teach- ers do not read anything in Mathematics apart from their textbooks. Hence they are totally ignorant of the true nature and beauty of Mathematics.

The second reason flows from the first. Because of a lack of under- standing of the true nature and beauty of mathematics, teachers teach the subject in class in very inappropriate ways. As a result the students are. unable to understand the subject and they start disliking it. Naturally they find it very difficult. This entire process perpetuates the myth that Math- ematics is a naturally difficult subject, given to only a few gifted individuals to comprehend. This myth has become so much a part of our social lore that the only subject people feel proud of publicly announcing their ignorance in is Mathematics. It is almost like badge of honour.

Hence the root cause is the misunderstanding of Mathematics by the society in general and teachers in particular.

Misunderstanding Mathematics

Firstly Mathematics is not a subject as the word is understood in school. A subject, as understood in school, is full of content which the student has to master and this mostly implies memorizing: Mathematics has very little con- tent to memorise.

Mathematics is a way of looking at the world around us, discovering the patterns and relationships that we see, and evolving a language to express these patterns and relationships. The final language in which these relationships & patterns are expressed, which is numbers and figures & symbols, will not make much sense unless the underlying thought processes have been experienced at least to some extent.

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Teachers consider the numbers and symbols as the content to be re- membered and fail to enable students to see the real concepts behind them.

A simple example will make this point clear. In teaching 2 digit numbers like 57, teachers teach that 5 is in the ten's place and 7 is in the one's place. Students also repeat these

sentences mechanically and teachers are convinced that the students have understood Place Value. But, when probed a little further, most teachers are unable to answer the following questions.

a. What is the meaning of ten's place? Why ten's and not nine's place?
b. Can there be a six's place similar to a ten's place?
c. Why is ten important?
d. Why are there only ten numerical symbols 0,1,2,3,4,5,6, 7,8,9?
e. Why is ten written with a 1 and a zero and not with a different symbol?
f. What is the difference in the meaning of ten and ten's place?
g. Can you draw a picture to explain what you really mean?
h. Do students of class 1, where Place Value is normally taught, really understand the difference between all these words (ten, one, ten's, one's, place) that are used by the teacher?

Hence Mathematics is full of concepts hidden behind numbers and symbols. Teachers tend to focus on these symbols without clarifying the concepts underlying them.

Secondly all these concepts are organized in a hierarchical manner. Understanding of more complex concepts depends on understanding the underlying simpler concepts. Hence Mathematics is like a house of cards with a broad base and a pyramid like structure which narrows as it goes upwards. If any of the lower cards are shaky, the entire structure will wobble. Most of these basic concepts are abstracted from real life situations. But as they become more and more complex, a stage comes where the relation to physical reality becomes more and more tenuous.

Let us take numbers as an example. Numbers start with Natural numbers which are used for counting any collection of discrete objects. Then we add Zero to it. Most teachers do not even realize that our ancestors argued for thousands of years to decide whether Zero is a number or not? Then fractions were added to the collection of numbers.

Do we even realize that an apparently simple fraction like ½ is totally different from a number like 2? We can directly see 2 in real life in terms of our legs or hands or legs of a bird or a pair of birds. But we cannot see ½ directly. No physical thing is ½ in isolation. It is ½ only in relation to some- thing else. It has no independent existence in the real world. But the

conceptual world of Mathematics, accepts½ as a number equal in status to 2. Hence 2 and ½ are different in their real world status but accorded the same status in mathematics.

This fundamental fact is one of the reasons children find it difficult to understand the concept of a fraction. Instead of taking time to allow them to absorb this new idea, teachers are in a hurry to make them write fractions in their notebooks and memorise words like Numerator, Denominator, Proper, Improper etc etc thus confounding the confusion.

Inappropriate Pedagogy

The problem of misunderstood Mathematics is compounded by inappropriate pedagogy. First is the language through which Mathematics is taught. In most other school subjects, like social studies or science, some day-to-day language like English or Hindi is used to convey the content of the subject. But languages are inadequate to completely convey the meaning of Mathematical concepts. The problem becomes severe in Primary School since the language skills of students themselves are not fully developed. Hence they struggle to understand and express mathematical concepts through language.

Please try the following experiment even with experienced Mathematics teachers. Draw a very simple geometrical figure like a Circle and Square intersecting each other on the board. Ask one of the teachers to describe the figure and make another teacher draw it only by hearing the oral instructions, without seeing the drawing. Invariably they will get it all wrong thus exposing the inadequacy of language to express mathematical concepts be- yond a point. This points to the necessity of developing a precise mathematical vocabulary and understanding its meaning correctly.

Another related problem is that many words used in school mathematics have different meanings in day-to-day life. Examples are problem, rest, left, balance, proper, improper, principal, interest etc etc. When these words are used in the mathematics class without adequately bringing out the difference in the meaning, children find it difficult to understand them. There also are many words in Mathematics, which are never used in day-to-day life. Examples are words like Numerator, Denominator, Dividend, Divisor, Quotient etc. When students are expected to remember these words at too young an age, without using them many times in the classroom, they find it very difficult.

Another issue is the role of writing in school education in general and mathematics in particular. Our school system demands demonstration of understanding only though written

means; written examinations, reports etc etc. This is acceptable to a certain extent in high school where students are expected to have mastery over the skill of language and the skill of writing. But in Primary School, students are still struggling to master the skill of writing. They take a long time to write any piece of text. Hence a major portion of time in a class is spent in writing thus leaving very little time for understanding the concept.

For example, if a teacher is teaching word problems in addition, and expects students to write each problem in full, with all the steps, then only 2 or 3 problems can be done in a class. To understand word problems to figure out the process to be used (say addition or subtraction) students need to do many more problems. Ideally many problems should be discussed orally in class so that students get a hang of the concept. Students are never given this opportunity when teachers expect them to present each and every answer in writing with all the steps.

Inadequate Understanding of the Child

Teachers have very little understanding children's capacity for abstraction and the way they form concepts of mathematics. There is a considerable body of literature on this issue but it remains in the ivory tower of psychologists & universities. It never reaches teachers. Hence most teachers understand learn- ing as memorizing. There is very little understanding of what Understanding is. This ignorance affects Mathematics teaching to the maximum since Mathematics mostly consists of concepts which need understanding.

Suggestions for the Classroom

In the light of the above discussions, we give below some strategies to be adopted in the Mathematics classroom in Primary School to make learning accessible and enjoyable.

1. Relate concepts to learners' experience and previous knowledge Concepts are understood by relating them to our existing knowledge and experience.
2. Enable formation of mental images and patterns of concepts
   Concepts are stored in our mind in the form of images and patterns. Pro- vide opportunities for this.
3. Plan activities, if necessary, with 'designed' activity materials
   Many mathematical concepts may be related to experiences that a child may not have had. Design activities & materials which will help them internalize the related concepts.

4. Proper use of a Mathematics Lab

   The Math Lab has to be used like an Activity Centre rather than a mathematics museum.

5. Less emphasis on verbal explanations

   With activity materials, provide non-verbal means of learning and demonstrating

6. Move from the concrete to semi-concrete to abstract

   Children should be helped to construct concepts in their minds by starting with concrete experiences and then move on to semi concrete images and then to abstract ideas.

7. Encourage peer group interactions

   Concepts are also formed by discussing, defending and modifying our ideas. This has to be facilitated in a non-threatening and non-combative atmosphere.

8. Less emphasis on writing while trying to understand concepts
9. Learn information related to concepts only after understanding the concepts

   Introduce names and definitions after understanding.

10. Remember information by repeated use and not by memorizing

    Most mathematical concepts need not be memorized. Most mathematical facts can also be derived logically. Hence they need not be memorized. If they are used a number of times, remembering them will become easier.

11. Practice is different from drill.

    Drill is drudgery. Practice is doing a variety of problems to master all
    aspects of a problem. Drill is doing the same thing a number of times. Much of the drill-work given in schools is very boring.

12. Practice skills through exploration and interesting happy drills Mathematics has many areas where students can conduct open-ended explorations with surprise patterns and endings. These will make learning Mathematics 'fun' for children and at the same time provide them a lot of practice in skills.

Suggestions for Structural Changes

We also suggest the following changes at the policy level for any long term change in the school mathematics scenario.

1. Teacher Training

The content of the Teacher Education courses in Mathematics needs to be drastically revised. The unique character of Mathematics which sets it apart from other 'school subjects' has to be recognized .

2. Curriculum Transaction

   Since Mathematics is hierarchical in nature, it has to be constructed like a building where the work proceeds level by level from the lower to the higher. All the different kinds of work needed to complete a level have to be completed before moving to the next level.

A spiral coverage of curriculum is better than a linear coverage.

3. Refocus Mathematics Curriculum on processes

   Mathematics curriculum should be centred around mathematical processes like addition, subtraction, multiplication, division, comparison, tabulation etc. Numbers and shapes should form the medium through which the processes are understood.

   Concentrating on processes will also enable students to understand that Mathematics is also a language for expressing the processes

4. Design of Textbooks

   Present design of text books forces a linear coverage of the curriculum. The design has to be changed to facilitate a spiral coverage. In the lower classes, there is no need of a textbook since students do not have the ability to read and understand mathematical prose. In the Primary School we should shift to a system of a loose-leaf type Teachers' Handbook and Workbooks for students.