

MATHEMATICS ANXIETY AMONG STUDENTS: CAUSES AND REMEDIES

Naseek P.

Assistant Professor

Govt.Brennen college of teacher education, Thalassery

Malappuram, Kerala

ABSTRACT

Mathematics is one of the most important subjects in our school curriculum. A thorough knowledge in mathematics is often necessary to learn other science subjects. Bacon had once emphasised the importance of mathematics stating that mathematics is the gateway and key to all sciences. However, maths anxiety is a major issue faced by a majority of the students in Indian schools. Mathematics anxiety is a feeling of tension, apprehension, or fear that interferes with the performance of students while learning mathematics. This has been the subject of various studies among psychologists and mathematics subject experts. This paper is a deep look in to this issue.

Keywords: mathematics anxiety, academic achievement, mathematics interest, education, school students

OBJECTIVES

This paper attempts to highlight mathematics anxiety, a major issue faced by Indian students. It aims to pin point the symptoms and causes of mathematics anxiety. Also, this paper also intends to direct the teachers and students towards the solutions to curb this anxiety, so that it helps in the improvement of their academic as well as overall performance.

METHODOLOGY

In order to achieve the above mentioned objectives, this paper analyses the various instructional methods suggested in the teacher education curricula and adopted in the Indian schools. It also takes into account the various studies on mathematics anxiety in the field of psychology. The findings and conclusions drawn in this paper are also based on interviews with the subject-experts.

FINDINGS AND CONCLUSION

Mathematics anxiety among school students has various causes. One of the most important causes is the lack of proper guidance for the students, parents and the teachers. The teaching methods adopted in schools are not favorable in reducing the anxiety. This has eventually lead to a negative attitude and disinterest towards the subject, making the students demotivated.

This paper also suggests a few changes in the teaching methods so that the teachers and students find mathematics equally interesting. A shift to the constructive method of teaching, using real-life examples and activities would help in understanding mathematics at an application level. Also, abstract concepts can be taught using inductive cum deductive method. The use of modern technologies is appreciated.

The paper concludes that a change is required in the teaching methods. And this change must come from the teachers first, and then spread to the students of mathematics.

SIGNIFICANCE

Mathematics is one of the core subjects in school education and it has great importance in higher education. It is very useful in daily life and it has vocational value. Mathematics anxiety has been a problem of decades. This study would help to create awareness among teachers as well as students about the problem of

anxiety. Understanding a problem is necessary to solve the issue. Hence, this paper would enlighten us on the causes of mathematical anxiety among students. The remedies suggested in the paper would, hopefully, help to bring about a change in the attitude of students towards mathematics, thereby improving their academic performances.

Mathematics is one of the most important subjects in our school curriculum. A thorough knowledge in mathematics is often necessary to learn other science subjects. Bacon had once emphasised the importance of mathematics stating that it is the gateway and key to all sciences. However, maths anxiety, a subject of research among psychologists and mathematics subject experts, is a major issue faced by a majority of the students in Indian schools. Mark H. Ashcraft defines math anxiety as "a feeling of tension, apprehension, or fear that interferes with math performance" (2002).

Since the early 1950s, maths anxiety has been studied from an academic perspective. The dislike or fear associated with mathematics was what called "mathemaphobia" by the Irish-American mathematician Mary Fides Gough. Later studies on the subject proved that maths anxiety is related to certain negative attitudes, or rather biases, that people have towards maths. This eventually leads to poor performance in achievement tests held in schools. Hembree, in his article "The nature, effects, and relief of mathematics anxiety" (1990), argues that math anxiety is directly connected with math avoidance, where students try to avoid situations involving mathematical calculations.

So, maths anxiety can result in a lack of competency among students, which reflects in various aspects of their life. An individual with math anxiety does not necessarily lack ability in mathematics, rather, they cannot perform to their full potential due to the interfering symptoms of their anxiety. Math anxiety manifests itself in a variety of ways, including physical, psychological, and behavioral symptoms which can disrupt a student's mathematical performance. Studies show that relieving maths anxiety can eventually lead to a better performance among students.

This paper is intended to create awareness among teachers, parents and students about the problem of anxiety. Understanding a problem is necessary to solve the issue. Hence, this paper aims to enlighten us on the symptoms and causes of mathematical anxiety among students. Further, the paper also suggests a few remedies for curbing this issue. The study of maths anxiety is like a travel, where you learn to recognize what it is, then you find the causes of it and then you go in search of a solution for your problem.

SYMPTOMS OF MATHS ANXIETY

Identifying the disease accurately is the most important step in a treatment. Likewise, we must learn to recognize maths anxiety. Understanding the symptoms is necessary. Poor grades, consistently, in a subject is a matter of concern, and this is when we, as teachers and parents, have to be concerned. Researches show that maths anxiety is identified initially at a psychological level as well as at a physiological level. Research published in *Psychology Research and Behavior Management* (2018) found students with symptoms of math anxiety can get unusually nervous, clammy hands, an increased heart rate, upset stomach, and light headedness.

The student would usually show an unusual nervousness when thinking about maths or doing anything related to mathematical calculations. The stress that is evident, perhaps on the face of the student, is a red signal for the teacher. Dr Ros McLellan of Cambridge University, who led a research on maths anxiety, opined that it is an emotional reaction and usually children refuse to go to maths classes out of the stress that they experience. This leads to a passive behavior among kids. They are too afraid of failure. Their minds are filled with too much of negative emotions that they do not even attempt to do anything related to maths. Thus, there will be a high lack of response from the students.

Researchers have also found that maths anxiety leads children to lose their confidence in the subject, leaving the student isolated. Isolation and alienation often results in negative self-talk, where the students claim that they hate maths or are bad at it naturally. Also, the student becomes incapable of finding solutions to their problems. Naturally, they would expect others to help with their problems, rather than doing it themselves. And if this continues for a long time, it leads to a depressed state where the students themselves believe to be poor in maths and would not try to improve their performance. This symptom can become what sociologist Robert K.

Merton coined as the “self-fulfilling prophecy” which is, “in the beginning, a false definition of the situation evoking a new behavior, which makes the originally false conception come true.”

Another major symptom of maths anxiety is the panic they show when asked to answer a question in classroom or during achievement tests. This panic is an indicator of the stress that they are experiencing at the moment. It is possible that the student has maths anxiety. However, one must keep in mind that the panic is deeply rooted in the assumption that a good student would answer quickly and correctly.

CAUSES OF MATHS ANXIETY

Once the symptoms are noted, we must be able to analyze the causes of maths anxiety.

1. Influence of teachers:

Studies often show that one of the major sources of maths anxiety are the teachers themselves. This makes the matter a serious one. If the teachers themselves are anxious about their mathematical abilities, it can easily be transferred to the students. The students in the classroom could easily detect the discomfort of the teacher, and may interpret it as the difficulty of the subject as a whole, making them anxious. According to John Taylor Gatto, in the late 19th century, western schools were particularly designed to foster fear and anxiety, which resulted in the prevention or delaying of proper learning.

2. The wrong method of teaching:

Teachers, especially if they are not competent enough, tend to restrict their students to one single approach of finding the solution to a problem in mathematics. Mathematics is usually understood as that which has only one single right answer, unlike other subjects which have the possibility of multiple right answers. Rather than emphasizing on the concept, teachers have a method of giving more importance to the method to be followed for achieving the correct answer. Unfortunately, most teachers do not encourage students to try or experiment with other methods, thereby curbing their imagination as well as interest in the subject. As Joseph M. Furner says in “Math anxiety: Overcoming a major obstacle to the improvement of student math performance” (2003), by emphasizing more on the process and the students thinking process, rather than on the right and wrong answer, teachers can help alleviate students’ anxiety about mathematics.

3. Preference for rote memorization approach:

Recently, there have been many experiments regarding the various teaching approaches. Although the most favored teaching approach is the constructivist approach, mathematics still continues to follow the age old rote memorization behaviorist approach. In the maths classes of our schools, the students are introduced to a set of problems, then they are introduced to the problem-solving method and are made to practice this methods repeatedly until they achieve a mastery over it.

4. The pressure caused by time limits on tests:

We hear students often complaining that they could not answer a question, which they have performed well at home, while in the examination hall. The examination hall, with a upper-imposing teacher to inspect upon them and its dead line time-limits, becomes a pressure cooker for the students who are already quite anxious regarding their mathematics abilities. It’s critical, according to Boaler, to address “the ways in which it transforms children’s brains, leading to an inevitable path of math anxiety and low math achievement.”

We can sum up the above causes as what Megan Smith found in her thesis, “Math Anxiety: Causes, Effects, and Preventative Measures” (2008), in which she states that giving written work every day, insisting there is only one correct way to complete a problem, and assigning mathematics problems as punishment for misbehavior can cause students to dislike mathematics.

5. Fear of being wrong

Public embarrassment can have many psychological effects upon a growing mind. The fear of being wrong and embarrassed before others makes a child introvert and unwilling to try new things. If a student is scolded or laughed at when answered wrongly, the feeling of embarrassment might remain with him/her for a very long

time. This can easily lead to development of anxiety when it comes to mathematics. Jo Boaler, author and professor of mathematics at Stanford University, highlights the fact “that early anxiety snowballs can lead to math difficulties and avoidance that only get worse as children get older.”

6. Parents’ negative predispositions

An NPR article titled “How to Make Sure Your Math Anxiety Doesn’t Make Your Kids Hate Math” (2018) pointed out the parents’ feelings about maths as one reason for kids’ math anxiety. Once a parent claims themselves to be weak in mathematics, it can send a signal to the child that he need not perform well in the subject. They may not find the need of maths as they find their parents quite successful without maths.

7. Lack of previous knowledge or pre-requisites

It is a fact that most of the students with maths anxiety are very poor in basic mathematical operations like addition, subtraction, division and multiplication. This lack of basic knowledge in primary classes does not allow them to proceed with mathematics in secondary level leads to maths anxiety.

8. Inability to accept the change of content from concrete to abstract

Students only learn mathematical operations of addition, subtraction, division and multiplication of natural numbers in lower primary classes. But in upper primary and secondary classes some abstract concepts are included in the syllabi. The study of mathematical operations with fractions, negative numbers and irrational numbers becomes difficult for the students. Also, the arrival of algebra with unknown variables and fundamental operations of variable makes it more complicated, and eventually leads to maths anxiety.

9. Dyscalculia

Dyscalculia is a mathematical learning disorder where the mathematical ability is far below the expected level for a person’s age, intelligence and education. It can manifest itself as a person’s inability to understand basic number concepts and number relationships, recognise symbols, and comprehend qualitative and spatial information. This inability leads to anxiety.

REMEDIES FOR MATHS ANXIETY

Experts on the subject agree that maths anxiety, which has developed from a very young age, can grow along with the individual. This can reflect not only in mathematical performances but also in every other aspect of an individual’s life. Lack of confidence and inability to take up new challenges can make one withdrawn from their social life. So, maths anxiety is not to be ignored, but solved.

1. Introduce recreational activities

Recreational mathematics has a vital role in making mathematics an interesting one. Experience shows that the basic principles of learning mathematics can be made easier through mathematical fun, activities and games. If mathematics can be turned in to a game it can become child’s play. Classroom experience indicate clearly that mathematical puzzles, riddles etc encourage an open minded attitude in youngsters and help them to develop their clear thinking. By making mathematics teaching-learning enjoyable and pleasurable students should get relief from anxiety and tension. So we have to introduce recreational activities like games, riddles, puzzles and quiz. This will change the negative attitude of students towards mathematics.

The treatment for maths anxiety must first and foremost begin from the classrooms. Students must be made to feel that maths is not difficult, but is fun. This can be achieved once their creative abilities are given a chance to bloom. With the modern technologies, now we have many games that are related to maths. It will be quite helpful for students if they are introduced to such games. We are all familiar with sudoku which frequently appears in the newspapers. This game requires basic mathematical calculation skills, with a bit of planning and foresight. It also encourages children to take up challenges. There are other board games, online and offline computer games, which can easily catch the interest of

children. Studies have shown that such maths related games have increased the interest of students in mathematics. Besides these, there are apps like Bedtime Math, in which parents can read to their children and then children are given chances to answer questions related to maths. These increase the potential of the students in mathematical calculation abilities. According to [Educause](#), gameful learning can “reinforce the fact that failure is neither a setback nor an outcome but rather an indication that more work is needed to master the skill or knowledge at hand.” This results in lasting effects in the children’s academic achievements.

2. Shift to the constructivist method of teaching:

What we need is a change in the approach towards mathematics teaching method. Since this is the subject that generates the highest amount of fear in children, it should be handled tactfully. Research has shown that it is high time teachers in schools drop the rote memorization behaviour approach towards mathematics teaching. In Boaler’s [op-ed](#) for *The Hechinger Report*, she wrote: “we continue to value the faster memorizers over those who think slowly, deeply and creatively — the students we need for our scientific and technological future... Memorization is valuable, but pushing it as the only way to do math is problematic. This growth-stunting mindset will eventually produce a generation of students who are procedurally competent but cannot think their way out of a box.”

A constructivist approach is what we need in this time. This would truly be an effective teaching. Also, it is important that teacher take care to group students based on mixed abilities. Rather than grouping the high performing students with high performing students and the low performing students with the low performing students alone, let the low performing and high performing students sit together. Allow them to discuss and explore their ideas and approaches together. This brings in more confidence to the anxious students, helping them to recognize their achievements and improve their overall performance.

3. Encouragement through words and gestures

Since maths anxiety is an issue closely related to the mind of the child, a psychological approach is very much necessary. A few words of encouragement is what the anxious child need. A study in the *Journal of Emerging Investigators*(2017) explored the effects positive and negative reinforcement had on mathematical performance for students in 6th grade. After receiving a negative, positive, or neutral form of reinforcement, students had to do mental math to calculate fraction problems while holding a heart rate monitor. Overall, the results suggest reinforcement — positive or negative — may yield higher grades. However, researchers found that students who received positive reinforcement had significantly lower heart rates when calculating fractions. So, instead of punishments, parents and teachers may want to motivate kids through reward to help improve student learning and academic success. A change in the attitude of teachers as well as parents must be evident.

A major cause of anxiety is when the students feel the pressure to answer question quickly and correctly. Studies have shown that the time teachers allow the students to answer is less than one second, when the students really need more time to process the calculations. Robert J. Stahl, a professor in the Division of Curriculum and Instruction at Arizona State University, highlighted that before teachers move on or allow students to respond, the average time they wait is an alarming 0.7 to 1.4 seconds after asking a question. Considering that students usually take up to 10 seconds to process questions and formulate answers, teachers who offer minimal response time are failing to foster an environment for critical thinking and success.

4. One-on-one tutoring:

Students usually like it when the teacher gives them special attention. A teacher must be able to pick out the anxious students in his/her class, make them at ease and explain the concepts to them especially. This would help the students to concentrate more on the subject, giving it more energy and attempts. Parents can also hire a personal tutor for their child. Researchers have also found that one-on-one tutoring sessions can help remedy highly math-anxious kids.

5. Create the stuck-unstuck situation

This was an experiment performed by Kate Mills, a 4th grade teacher in New Jersey. She gave the students a few problems which she knew was very difficult that the students would be stuck with it. However, rather than directly giving them the instruction to solve the problem, she asked her students to note down their emotional responses, like anger, fear, frustration and the like, while they attempted to solve the mathematical problem. Being aware of their emotional state, the students found it easy to “unstuck” from their problems.

A teacher is said to be a friend as well as mentor. Mills assisted her students in overcoming the emotional anxiety that they feel when confronted with a mathematical problem. This boosted the confidence of the students. The experiment eventually became a source of encouragement for the students.

This method can be applied in Indian schools as well. It would be helpful if students are able to maintain a chart to track their improvement levels.

6. The Breathing Exercise

Taking deep breaths always helps to reduce the tension. In 2013, cognitive psychologist Tad T. Brunyé published a study in *Learning and Individual Differences* focusing on the role of breathing in reducing maths anxiety. When highly math-anxious students practiced mind-ful breathing practices, they reported feeling much calmer and performing better on timed tests. Brunyé proposed that mind-ful breathing exercise would help students move past distractions that would otherwise occupy working memory. Working memory, in which a large portion is dedicated to mathematical problem solving, can be occupied by anxiety. This would only result in low performance of the student.

It will be informative to mention the suggestions put forward by the National Council of Teachers of Mathematics (NCTM) (1989, 1995b) for teachers seeking to prevent math anxiety. These include:

- Accommodating for different learning styles
- Creating a variety of testing environments
- Designing positive experiences in math classes
- Refraining from tying self-esteem to success with math
- Emphasizing that everyone makes mistakes in mathematics
- Making math relevant
- Letting students have some input into their own evaluations
- Allowing for different social approaches to learning mathematics
- Emphasizing the importance of original, quality thinking rather than rote manipulation of formulas.

7. Utilize audio visual aids and ICT in teaching

Using real equipments inside classroom will generate students' interest, and allowing them to explore and entertain with it will surely leave a positive mark in their minds forever. Utilization of audio visual aids and ICT (information and communication technologies) is very essential to explain some complex mathematical concepts easily and effectively. Geometrical representations like pictures, graphs and diagrams helps to teach some algebraic equations and results. This makes learning easy and leaves anxiety.

8. Teach by correlating mathematics with real life situations

Students should understand the needs and significance of the subject mathematics and also know its applications in daily life situations. So teacher should impart the content matter by correlating real life situations and experiences. This approach provides motivation and interest in learning mathematics which causes to relieve maths anxiety.

CONCLUSION

Children are curious by nature. They like to experiment and learn through that experience. This is what we should make use of as a maths teacher in our school. It is time that we drop our traditional methods of teaching, and adopt certain experiments in our classroom. Maths anxiety is a serious issue which must be approached with utmost care. As teachers and responsible adults, we must learn to identify the elements of maths anxiety within a student. The knowledge of the causes of maths anxiety would give us valuable insights into how to tackle the problem. Applying the remedies for maths anxiety would make the students as well as the teachers active learners. Active learning is what any discipline require. This leads them to explore more in the subject, resulting in a very productive student and adult.

BIBLIOGRAPHY

- Arjunan, M.K..psychological bases of education: personality dynamics of education.palakkad:Yuga publications, (1999)
- Ashcraft, M.H.. "Math anxiety: Personal, educational, and cognitive consequences", *Current Directions in Psychological Science*, **11** (5): 181–185, (2002)
- Aster, Michael von, Karin kucian. "Relation between mathematical performance, maths anxiety and affective priming in children."Frontiers in psychology. www.ncbi.nlm.nih.gov.2018
- Furner, Joseph M.. "Math anxiety: Overcoming a major obstacle to the improvement of student math performance". *Childhood Education*.www.questia.com, (2003)
- Gough, Mary. "Why Failures in Mathematics? Mathemaphobia: Causes and Treatments". *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*. pp 290-294, 2015.
- Hembree, R.. "The nature, effects, and relief of mathematics anxiety", *Journal for Research in Mathematics Education*, **21** (1): 33–46, (2002)
- James, Anice. *Methods of Teaching Mathematics*. New Delhi: Neelkamal Publications, 2012
- McLellan, Ros. "Understanding Maths Anxiety: Investigating the Experience of UK Primary and Secondary School Students". Diss. University of Cambridge, 2019
- National Council of Teachers of Mathematics. Curriculum and evaluation standards for school mathematics. Reston, VA: National Council of Teachers of Mathematics, 1989
- Schwartz, A. E.. Axing math anxiety. *Education Digest*, 65(5), 62-65. *Math Anxiety* 32, 1999
- Steele, D F., & Alfred A A . Lowering anxiety in the math curriculum. *Education Digest*, 63(7), 18-24, (1998)
- Tobias, S.. *Overcoming math anxiety*. Boston: Houghton Mifflin, 1986
- "Maths Anxiety". www.prodigygame.com. 2015
- "What is Math Anxiety?". www.oxfordlearning.com. 2017