



A Comparative Study of Mathematics Anxiety among Secondary School Students with Reference to Gender Differences, Causes, and Remedial Strategies

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Abstract

Mathematics anxiety has emerged as a significant psychological construct that adversely affects students' academic achievement and their overall disposition toward mathematics. It constitutes a complex emotional response characterised by feelings of tension, apprehension, and fear that interfere with the manipulation of numbers and the solving of mathematical problems in academic settings. Such anxiety has been consistently associated with diminished academic performance and negative attitudes toward the subject. The present study investigates the level of mathematics anxiety among secondary school students, with particular reference to gender differences. It seeks to examine the extent to which mathematics anxiety varies between male and female students and to analyse its underlying causes and potential remedial measures. The study adopts a comprehensive approach by identifying pedagogical, psychological, and socio-cultural determinants contributing to mathematics anxiety.

Keywords: *Mathematics Anxiety, Gender Difference, Academic Achievement, Secondary Education.*

1. Introduction

"Mathematics is the most beautiful and powerful creation of human spirit." – Banach
Mathematics plays a vital role in the development of logical reasoning, analytical thinking, and problem-solving abilities. However, for many students, mathematics is associated with feelings of tension, fear, and apprehension. This emotional reaction, commonly termed mathematics anxiety, negatively affects cognitive processing and academic performance. "Focusing only on content knowledge is insufficient. Interventions should include techniques to reduce anxiety, such as expressive writing or mindfulness, to help students manage their emotional responses to math" Beilock, & Maloney (2015)[4]. Mathematics anxiety is defined as a feeling of tension and fear that interferes with the manipulation of numbers and the solving of mathematical problems in academic and everyday situations. At the secondary school level, where mathematical concepts become increasingly abstract, anxiety levels tend to rise, thereby affecting students' achievement and confidence. Many students who suffer from mathematics anxiety have little confidence in their ability to do mathematics and tend to take the minimum number of required mathematics courses, which has greatly limited their career choice options (Garry 2005)[7]

Gender-based differences in mathematics anxiety have been widely debated. While some studies report higher anxiety levels among female students, others suggest that social expectations and classroom dynamics play a crucial role in shaping such differences. Therefore, examining mathematics anxiety with respect to gender is both relevant and necessary. The correlation between mathematics anxiety and academic performance is negatively significant. (Ashcraft, M. H.,2001)[1]

Mathematics anxiety is understood as a persistent feeling of tension and fear that interferes with a student's ability to work with numbers and navigate mathematical problems — whether in a classroom or in the routines of everyday life. This experience becomes particularly pronounced at the secondary school level, where the content shifts toward abstraction and the stakes of performance grow higher. As concepts become less tangible and more symbolic, anxiety tends to intensify, quietly eroding both achievement and the confidence students need to persist.

One dimension of this anxiety that continues to generate scholarly debate is the role of gender. Some studies have found that female students report higher levels of mathematics anxiety than their male peers — yet the picture is rarely that simple. A growing body of evidence points to social expectations, teacher interactions, and classroom culture as powerful forces that shape how anxiety is experienced and expressed across gender lines. It is not enough, therefore, to simply



observe that a difference exists; understanding *why* it exists — and what sustains it — is both a relevant and necessary pursuit.

2. Need and Importance of the Study

Anxiety is a natural psychological phenomenon experienced by individuals at various stages of life. While a moderate level of anxiety may function as a motivating factor, excessive and persistent anxiety may develop into a phobic condition that warrants systematic investigation. In the educational context, such heightened anxiety can significantly influence students' academic performance and overall well-being.

The secondary stage of education constitutes a foundational phase in an individual's academic and career development. At this level, students are required to engage comprehensively with a wide range of subjects, each contributing to their cognitive and intellectual growth. Among these subjects, mathematics occupies a prominent and indispensable position due to its logical structure, analytical demands, and practical applications in higher education and professional domains. Proficiency in mathematics is often regarded as essential for the successful completion of formal education.

However, for a considerable number of secondary school students, mathematics emerges as a source of fear and apprehension rather than intellectual engagement. This phenomenon, commonly referred to as mathematics anxiety, manifests as feelings of tension, nervousness, and fear that interfere with mathematical performance. Various pedagogical, psychological, and socio-cultural factors may contribute to the development of such anxiety.

In this context, the present study, entitled "A Comparative Study of Mathematics Anxiety Among Secondary School Students with Reference to Gender Differences, Causes, and Remedial Strategies"* assumes significant importance. The study seeks to examine the prevalence and nature of mathematics anxiety among secondary school students, analyse gender-based differences, identify underlying causes, and propose appropriate remedial strategies to mitigate its adverse effects.

Hembree(1990)[8] has mentioned in "The Nature, Effects, and Relief of Mathematics Anxiety" that math anxiety is a distinct, treatable construct characterised by negative, often paralyzing, emotions regarding maths. It has a significant negative correlation with performance, primarily stemming from working memory disruption.

3. Review of Related Literature

Several studies, both national and international, have explored various aspects of mathematics education at the secondary level. The present investigator has reviewed relevant literature on mathematics education across regional, national, and international contexts, as outlined below. Previous research indicates that mathematics anxiety is negatively correlated with academic achievement in mathematics. Studies suggest that high anxiety reduces working memory capacity, thereby impairing problem-solving performance. Research also indicates that female students often report higher levels of mathematics anxiety compared to male students, possibly due to socio-cultural stereotypes and lower self-efficacy beliefs.

Furthermore, instructional methods, teacher attitudes, parental expectations, and repeated failure experiences are identified as key determinants of mathematics anxiety.

Phaneendrudu (2004)[12] has mentioned in his study "A Study On Mathematics Performance In Relation To Intelligence Creativity, Attitude Towards Mathematics, Mathematics Anxiety And Socio Economic Status Among Xi Standard Students In Higher Secondary Schools" that attitude towards mathematics is a very important contributing factor with a significant influence on mathematics performance. Mathematics anxiety has a reverse relation with mathematics performance. Being in a very competitive society, students are pushed hard by parents on one side and the pressure of school on the other side.

Sathishkumar N (2023)[13] has studied on attitude and performance on mathematics in "A study on mathematics performance in relation to attitude towards mathematics interest in mathematics and mathematics anxiety" The mathematics performance and mathematics anxiety of higher secondary school students are at an average level, with a high favourable attitude, and 166 students have a high interest in mathematics. It is established that there is a positive relationship between mathematics performance, interest in mathematics and a negative relationship between mathematics performance and mathematics anxiety.



Arup Kr Mandal (2023) [14] has mentioned in his study Impact of Mathematics anxiety on performance and classroom participation of secondary school students in Mathematics that there is no significant difference in the mathematics anxiety of secondary school students among the Government, Government Sponsored and Private schools and location. Different types of schools, managed by different authority have different 125 types of influences on the mathematics anxiety of their students.

4. Significance of the Study

Studying Mathematics Anxiety (MA) is important because mathematics is not just a school subject; it shapes students' confidence, academic progress, and future opportunities. When students develop fear or tension toward mathematics, it affects not only their marks but also their willingness to participate, ask questions, or pursue careers in mathematics. Understanding MA helps us see that poor performance in mathematics is often not due to a lack of ability but to emotional barriers.

Mathematics anxiety interferes with students' thinking processes. When a child feels nervous during a mathematics class or examination, their concentration decreases, memory becomes less effective, and even simple problems may appear difficult. Over time, this fear can lead to avoidance, reduced self-belief, and a negative attitude toward learning. Studying MA, therefore, enables educators to recognise the emotional dimension of learning mathematics.

The study of MA is also significant in addressing gender concerns. Research often shows that female students report higher levels of mathematics anxiety, which may influence their academic choices and career aspirations. By examining these patterns, educators and policymakers can work toward creating more equitable and supportive learning environments.

Most importantly, understanding Mathematics Anxiety has practical value. It guides teachers in adopting more encouraging teaching practices, helps schools introduce counselling and emotional support systems, and promotes assessment methods that reduce excessive pressure. By studying MA, we move toward building classrooms where students feel safe to make mistakes, learn confidently, and develop a positive relationship with mathematics.

In essence, the study of Mathematics Anxiety is significant because it links academic achievement to emotional well-being, helping ensure that mathematics education becomes more humane, inclusive, and empowering for all learners.

5. Area and Delimitation of the Study

The present study is strictly delimited to secondary schools of Assam, India. It specifically focuses on Mathematics Anxiety experienced by students at the secondary level. The scope of the investigation is confined to anxiety related to mathematics and does not extend to emotional, psychological, or academic difficulties associated with other school subjects.

6. Objectives of the Study

The present study seeks to examine Mathematics Anxiety (MA) among secondary school students of Assam, India, with specific reference:

1. To measure the level of mathematics anxiety among secondary school students.
2. To compare mathematics anxiety between male and female students.
3. To measure a correlation between anxiety and academic achievement.
4. To identify the major causes of mathematics anxiety.
5. To suggest remedial measures to reduce mathematics anxiety.

7. Hypotheses of the Study

H₀1: There is no significant difference in mathematics anxiety between male and female secondary school students.

H₀2: There is no significant relationship between mathematics anxiety and academic achievement in mathematics.

8. Methodology

8.1 Research Design



The study adopted a descriptive survey method.

8.2 Sample

The sample consisted of 200 secondary school students from Assam, India, selected using random sampling. The sample included both male and female students.

8.3 Tool Used

A self-constructed Mathematics Anxiety Scale was developed by the researcher and used as the main tool for collecting data in the present study. The items on the scale were carefully crafted after an in-depth review of related literature and discussions with subject experts to ensure they adequately reflected the concept of mathematics anxiety and were relevant to the objectives of the study. Special attention was given to making the statements clear, meaningful, and appropriate for secondary school students.

Before final administration, the scale was pilot-tested on a representative group of students in Assam, India, to assess its reliability and overall suitability. The internal consistency of the instrument was determined using Cronbach's alpha coefficient, and the reliability value was found to be 0.70. This indicates an acceptable level of internal consistency for research purposes and suggests that the items of the scale are reasonably consistent in measuring the construct. Based on the feedback and statistical analysis from the pilot study, necessary revisions were made to improve the clarity and effectiveness of certain items.

The scale was developed in the regional language to ensure better understanding, cultural appropriateness, and accurate responses from the secondary school students of the concerned state. There remained 10 items in the final tool. Items are like –

1. I feel anxious in Mathematics class
2. I always find learning Mathematics unpleasant.
3. I feel confident while learning Mathematics. (reverse score), etc.

8.4 Statistical Techniques Used

- Mean
- Standard Deviation
- Independent Samples t-test
- Pearson's Correlation Coefficient

8.5 Operational Definition

MA – Mathematics Anxiety

9. Data Analysis and Interpretation

9.1 Introduction

The present chapter examines mathematics anxiety among secondary school students with respect to gender through statistical analysis and interpretation of data collected from secondary school students. Statistical techniques such as Mean, Standard Deviation, Independent Samples *t*-test, and Pearson's Correlation were used.

9.2 Objective 1

To measure the level of mathematics anxiety among secondary school students. For objective 1, the students were given a questionnaire to test their mathematics anxiety level.

9.2.1 Descriptive Statistics of Mathematics Anxiety



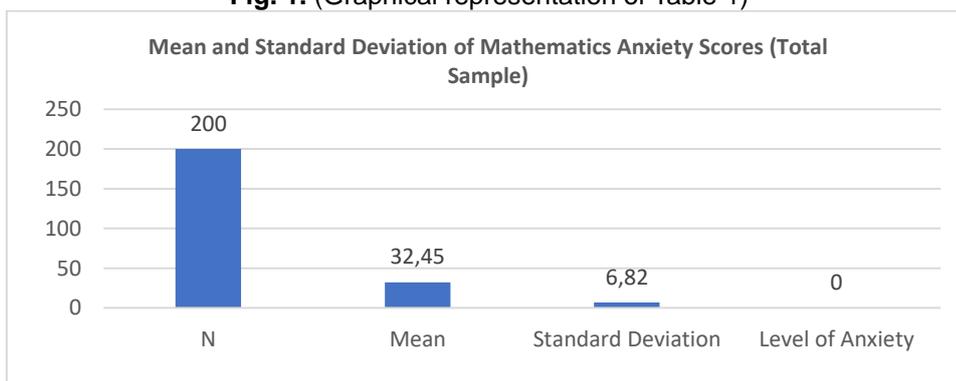
Table 1. [Mean and Standard Deviation of Mathematics Anxiety Scores (Total Sample)]

N	Mean	Standard Deviation	Level of Anxiety
200	32.45	6.82	Moderate

9.2.2 Interpretation

The mean score (M = 32.45) indicates that secondary school students experience a **moderate level of mathematics anxiety**. The standard deviation (SD = 6.82) suggests moderate variability in anxiety levels among students.

Fig. 1. (Graphical representation of Table 1)



9.3 Objective 2

To compare mathematics anxiety between male and female students

9.3.1 Gender-wise Comparison of Mathematics Anxiety

Table 2. (Mean, SD and t-value for Mathematics Anxiety with Respect to Gender)

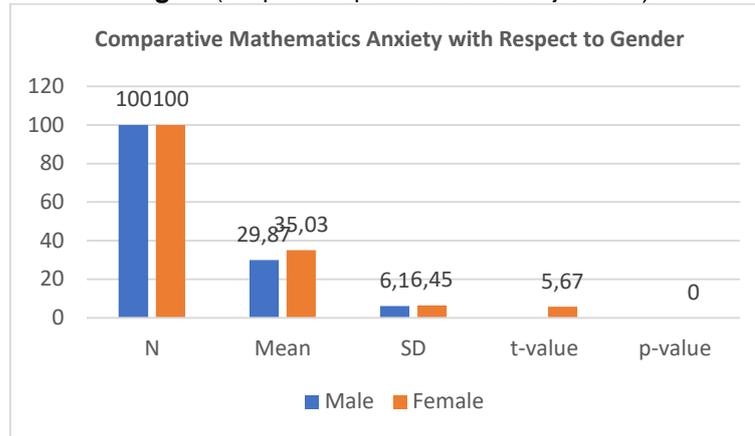
Gender	N	Mean	SD	t-value	p-value
Male	100	29.87	6.10	5.67	p < 0.001
Female	100	35.03	6.45		

9.3.2 Interpretation

The obtained *t*-value (5.67) is significant at the 0.05 level ($p < 0.05$). Therefore, the null hypothesis H_0 stating that there is no significant difference between male and female students is rejected. It is evident that **female students (M = 35.03)** exhibit significantly higher mathematics anxiety compared to **male students (M = 29.87)**.



Fig. 2. (Graphical representation of Objective 2)



The bar diagram shows that the mean anxiety score of female students is visibly higher than that of male students. The height difference between bars confirms a statistically significant gender disparity in mathematics anxiety

9.4 Objective 3

To measure a correlation between anxiety and academic achievement

9.4.1 Correlation between Mathematics Anxiety and Academic Achievement

Table 4.3 (Correlation Between Mathematics Anxiety and Achievement)

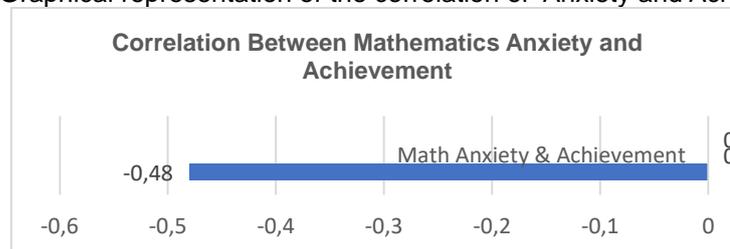
Variables	r-value	p-value	Interpretation
Math Anxiety & Achievement	-0.48	$p < 0.001$	Moderate Negative Correlation

9.4.2 Interpretation

The correlation coefficient ($r = -0.48$) indicates a negative relationship between mathematics anxiety and academic achievement. This suggests that higher anxiety is associated with lower academic performance. Therefore, the null hypothesis H_02 , which states that there is no significant relationship between mathematics anxiety and mathematics achievement, is rejected.

There exists a moderate, statistically significant negative correlation between mathematics anxiety and academic achievement ($r = -0.48$, $p < 0.001$), indicating that **higher levels of mathematics anxiety are associated with lower levels of academic performance.**

Fig. 3. (Graphical representation of the correlation of Anxiety and Achievement)



10 Results and Discussion

The analysis revealed that:

- A considerable proportion of students experienced moderate to high levels of mathematics anxiety.
- Female students showed comparatively higher mean anxiety scores than male students.
- The calculated t-value indicated a statistically significant difference between genders ($p < 0.05$).



- A negative correlation was found between mathematics anxiety and academic achievement, indicating that higher anxiety is associated with lower performance. The findings suggest that gender differences in mathematics anxiety may stem from social conditioning, classroom participation patterns, and self-perception of mathematical competence.

11 Causes of Mathematics Anxiety

Based on data analysis and literature review, the following causes were identified by the researcher:

11.1 Fear of failure and negative evaluation: Fear of failure and anticipation of negative evaluation significantly contribute to the development of mathematics anxiety, as students become apprehensive about making mistakes and being judged, which increases psychological tension during mathematical learning and performance.

11.2 Poor foundational knowledge in earlier classes: Poor foundational knowledge acquired in earlier classes significantly contributes to the development of mathematics anxiety, as inadequate conceptual understanding increases cognitive difficulty, reduces self-confidence, and heightens apprehension toward subsequent mathematical tasks.

11.3 Traditional lecture-based teaching methods: Traditional lecture-based teaching methods may contribute to the development of Mathematics Anxiety (MA), as limited student interaction, minimal conceptual engagement, and an overemphasis on procedural learning can increase apprehension and reduce learners' confidence in mathematical contexts.

11.4 Lack of encouragement and supportive environment: Lack of encouragement and a supportive learning environment significantly contributes to the development of mathematics anxiety, as insufficient emotional reinforcement and academic support may diminish students' self-efficacy, motivation, and confidence in engaging with mathematical tasks.

11.5 Parental and societal pressure: Parental and societal pressure significantly contribute to the development of Mathematics Anxiety (MA), as heightened expectations and performance-oriented comparisons may intensify students' fear of failure and psychological distress in mathematical learning situations.

11.6 Stereotypes regarding gender and mathematical ability: Stereotypes regarding gender and mathematical ability significantly contribute to the development of Mathematics Anxiety (MA), as internalised beliefs about limited competence may undermine self-efficacy, increase performance pressure, and heighten emotional distress in mathematical contexts.

11.7 Examination-oriented educational system: An examination-oriented educational system significantly contributes to the development of Mathematics Anxiety (MA), as excessive emphasis on high-stakes testing and performance outcomes may intensify stress, fear of failure, and avoidance behaviours in mathematical learning contexts.

12 Remedies and Educational Implications

To reduce mathematics anxiety, the following measures are recommended by the researcher:

12.1 Adoption of activity-based and student-centred teaching methods: The adoption of activity-based and student-centred teaching methods serves as an effective remedial strategy for Mathematics Anxiety (MA), as these approaches actively engage learners in meaningful problem-solving experiences, foster conceptual understanding, and create a supportive classroom environment that reduces fear, enhances self-efficacy, and promotes positive attitudes toward mathematics.

12.2 Encouraging cooperative learning and peer tutoring: Encouraging cooperative learning and peer tutoring helps reduce Mathematics Anxiety (MA) by allowing students to learn with and from their peers in a supportive and non-threatening environment. When students solve problems together, discuss their doubts openly, and receive guidance from classmates, mathematics becomes less intimidating and more approachable. This shared learning experience builds confidence, reduces fear



of judgment, and gradually transforms anxiety into a sense of capability and belonging in the mathematics classroom.

12.3 Providing remedial instruction for students with weak foundational skills: Providing remedial instruction for students with weak foundational skills serves as a meaningful remedy for Mathematics Anxiety (MA), as targeted academic support helps learners rebuild essential concepts at their own pace, reduces feelings of inadequacy and frustration, and gradually restores confidence by enabling them to experience success in mathematics.

12.4 Creating a supportive and non-threatening classroom environment: Creating a supportive and non-threatening classroom environment acts as a vital remedial measure for Mathematics Anxiety (MA), as a climate characterised by encouragement, patience, and acceptance of mistakes reduces fear of embarrassment, fosters emotional security, and enables students to engage with mathematical tasks with greater confidence and willingness.

12.5 Conducting counselling sessions to enhance mathematical self-efficacy and emotional support: Conducting counselling sessions to enhance mathematical self-efficacy and provide emotional support serves as a constructive remedy for Mathematics Anxiety (MA), as guided reflection, reassurance, and coping strategies help students reframe negative beliefs about their abilities, manage stress more effectively, and gradually develop a stronger sense of confidence and control in mathematical learning situations.

12.6 Training teachers to identify and address anxiety symptoms: Training teachers to identify and address symptoms of Mathematics Anxiety (MA) functions as a crucial remedial strategy, as informed and sensitive educators are better equipped to recognize early signs of distress, respond with empathy, adapt instructional practices accordingly, and create learning experiences that reduce anxiety while strengthening students' confidence and engagement in mathematics.

12.7 Reducing excessive emphasis on high-stakes examinations: Reducing excessive emphasis on high-stakes examinations serves as an important remedial approach to Mathematics Anxiety (MA), as shifting the focus from performance pressure to continuous learning and formative assessment helps alleviate fear of failure, encourages conceptual understanding, and allows students to engage with mathematics in a more confident and less stressful manner.

12.8 Growth mindset training: Growth mindset training serves as a meaningful remedial strategy for Mathematics Anxiety (MA), as it helps students understand that mathematical ability is not fixed but can develop through effort, practice, and persistence, thereby reducing fear of failure, reshaping negative self-beliefs, and fostering greater confidence and resilience in mathematical learning.

12.9 Continuous formative assessment: Continuous formative assessment functions as an effective remedial strategy for Mathematics Anxiety (MA), as regular, low-pressure feedback enables students to identify learning gaps without fear of judgment, experience incremental progress, and build confidence through steady improvement rather than high-stakes evaluation.

12.10 Teacher sensitisation programs: Teacher sensitisation programs serve as a vital remedial intervention for Mathematics Anxiety (MA), as they cultivate educators' awareness of students' emotional experiences in mathematics, encourage empathetic and inclusive classroom practices, and promote instructional approaches that reduce fear while nurturing confidence and positive engagement with the subject.

12.11 Schools should integrate psychological support systems and promote positive attitudes toward mathematics from early stages of education.

13 Discussion

The findings of the present study are consistent with prior empirical investigations which have demonstrated that mathematics anxiety adversely affects students' working memory capacity and overall academic performance. Elevated levels of anxiety are known to interfere with cognitive processing, thereby reducing efficiency in problem-solving and mathematical reasoning tasks.



Furthermore, the observed gender differences may be attributed to socio-cultural stereotypes, differential expectations, and classroom interaction patterns that shape students' attitudes and confidence toward mathematics. Such factors potentially contribute to variations in anxiety levels and academic outcomes across gender groups.

14 Conclusion

The findings of the present study reveal that mathematics anxiety constitutes a significant psychological barrier affecting secondary school students' academic performance and overall confidence in mathematics. The analysis indicates the presence of statistically observable gender differences, with female students demonstrating comparatively higher levels of mathematics anxiety than their male counterparts.

Furthermore, mathematics anxiety was found to exert a negative influence on academic achievement, thereby impeding the development of mathematical competence and self-efficacy. These results underscore the need for systematic and strategic interventions at both pedagogical and psychological levels.

It is therefore concluded that the reduction of mathematics anxiety requires comprehensive pedagogical reforms, learner-centred instructional practices, and the provision of structured psychological support mechanisms. Addressing the underlying cognitive, emotional, and socio-cultural factors contributing to mathematics anxiety can substantially enhance students' mathematical proficiency, academic performance, and emotional well-being.

Mathematics anxiety significantly affects secondary school students, particularly females. Strategic interventions at pedagogical and psychological levels are essential to enhance mathematical competence and reduce anxiety. The study concludes that mathematics anxiety is a significant factor affecting secondary school students, with observable gender differences. Female students tend to report higher levels of anxiety compared to their male counterparts. Mathematics anxiety negatively influences academic achievement and overall confidence. Addressing the root causes through pedagogical reforms and psychological support can significantly enhance students' mathematical competence and emotional well-being.

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