

Mathematics Anxiety Among Secondary School Students

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ABSTRACT Mathematics anxiety has emerged as a significant concern in secondary education across the world due to its adverse effects on students' engagement, confidence and academic performance. Given its significance, a cross-sectional descriptive survey was conducted to determine the level of mathematics anxiety among secondary students attending government schools in the Salem district of Tamil Nadu, India, with regard to gender, school locality, and medium of instruction. A convenience sampling technique was used to select 390 students from Class 9 from various government schools. A self-developed mathematics anxiety scale was used to collect data from the students, and the collected data were analysed using descriptive and inferential statistical techniques. The findings showed that most secondary students had moderate to high levels of mathematics anxiety. The study offers some useful recommendations to mathematics teachers and curriculum planners to address students' mathematics anxiety in secondary schools.

INTRODUCTION

In recent years, education and achievement in Science, Technology, Engineering and Mathematics (STEM) subjects have gained growing importance worldwide due to their significance in future economic development and productivity (United Nations Educational, Scientific and Cultural Organisation 2017; Maass et al. 2019). Among the STEM subjects, mathematics holds a pivotal place in the school education system (Suleiman and Hammed 2019), as it serves as the foundation for understanding science and technology. Mathematics learning helps students to develop essential skills, including problem-solving, logical reasoning, critical thinking, and creativity (National Curriculum Framework for School Education 2023). Moreover, mathematics proficiency is necessary for students and society, particularly in light of the growing challenges posed by artificial intelligence, machine learning, data science, and numerous other related scientific issues that India and all countries face today. Therefore, developing students' mathematical proficiency in schools is necessary not only for academic success but also for practical everyday living.

Given the importance of mathematics proficiency, considerable research has focused on identifying and understanding the factors that contribute to students' performance in mathe-

matics. One of the most significant predictors of students' mathematics performance is mathematics anxiety (Chang and Beilock 2016), an affective condition characterised by tension or apprehension when engaging in mathematical tasks (Ashcraft 2002; Sokolowski and Ansari 2017). Ashcraft and Faust (1994) defined mathematics anxiety as unpleasant feelings that weaken one's ability to solve problems or work with numbers. Sheffield and Hunt (2006) described it as tension, nervousness, or fear that hinders performance in mathematics. Luttenberger et al. (2018) state that mathematics anxiety arises when students are engaged in mathematical tasks such as working with numbers, solving mathematical problems, or taking mathematics tests.

Mathematics anxiety can significantly impact mathematics learning and performance (Dowker et al. 2016; Soumen and Susanta 2018), as it disrupts cognitive functions such as working memory and problem-solving skills (Ashcraft and Krause 2007). Previous studies consistently reported a negative correlation between mathematics anxiety and academic performance (Ashcraft 2002; Omar et al. 2022; Zivkovic et al. 2022; Dungdung and Bankira 2023; Yu et al. 2024; Asomah et al. 2025; Balakonda 2025; Baral et al. 2025; Gulsen Turgut and Bakir 2025; Jeffry and Amran 2025; Kumari and Kumar 2025; Muana and Uchang 2025; Williams et al. 2025). Recent meta-analyses have also confirmed this nega-

tive relationship (Namkung et al. 2019; Zhang et al. 2019; Barroso et al. 2021). The findings of previous studies highlight the possible negative consequences of mathematics anxiety on students' performance and emphasise the importance of addressing students' emotional responses to mathematics. Beyond academic performance, mathematics anxiety affects students' self-concept, physiological responses, and attitudes towards learning mathematics (Koner and Das 2025). Furthermore, recent studies by Cudr et al. (2024) and Jeffry and Amran (2025) reported that secondary students with high mathematics anxiety tend to avoid STEM careers.

Previous research suggests that secondary school students have varied levels of mathematics anxiety. Akbayir (2019), Omar et al. (2022), Kiso (2024), Asomah et al. (2025), Balakonda (2025), Kumari and Kumar (2025) and Muana and Uchang (2025) found that secondary school students had a moderate level of mathematics anxiety. Escalera-Chavez and Rojas-Kramer (2019), Estonanto and Dio (2019) and Moyo (2023) reported that the majority of high school students experienced moderate to high levels of mathematics anxiety. Similarly, Rahaman et al. (2023) and Koomson et al. (2024) found that high school students exhibited high levels of mathematics anxiety. Previous studies suggest that moderate to high levels of mathematics anxiety are a common issue among secondary school students across the world.

Previous research has also examined how students' mathematics anxiety varies across demographic variables. Among these demographic variables, gender has received the most attention from researchers worldwide and has yielded varied results. Some studies have reported that boys have a higher level of mathematics anxiety than girls (Mandal and Saha 2019; Nandhini and Subramanian 2021). In contrast, some studies suggest that girls report a higher level of mathematics anxiety than boys (Escalera-Chavez and Rojas-Kramer 2019; Dungdung and Bankira 2023; Rahaman et al. 2023; Asanjarani et al. 2024; Halder and Chatterjee 2024; Koomson et al. 2024; Mohammed et al. 2025; Paudel 2025). However, some previous studies have shown that boys and girls report the same level of mathematics anxiety (Akbayir 2019; Kumar and Srivastava 2021; Kiso 2024; Kumari and Kumar 2025).

Mathematics anxiety of students has also been studied in relation to demographic variables, such as school locality and medium of instruction, but to a lesser extent than gender. Sangral and Kumar (2023) reported that rural school students experienced a higher level of mathematics anxiety than their urban counterparts. In contrast, Halder and Chatterjee (2024) reported that urban school students experienced higher mathematics anxiety than their rural counterparts. However, some previous studies suggest that school locality does not influence the mathematics anxiety of secondary school students (Mandal and Saha 2019; Mahato and Sen 2021). Regarding the medium of instruction, Dungdung and Bankira (2023) reported that students in the English medium experienced higher mathematics anxiety than those in the Odia medium. In contrast, Hait and Mishra (2018) found that the medium of instruction has no significant impact on students' mathematics anxiety.

A review of existing research strongly suggests that mathematics anxiety is a pressing issue that negatively affects students' academic performance. The recent State Level Achievement Survey (2025), conducted by the Planning Commission of the Government of Tamil Nadu, further supports this claim. This survey showed that the average mark of Class 8 students in mathematics was 38 out of 100. In the Salem district, the focus area of this study, it is only 35. Hence, this study is highly relevant in the context of the Salem District, where students' mathematics achievement levels are considerably lower. Although gender differences in students' mathematics anxiety have been studied widely across the world, research on the influence of school locality and medium of instruction remains inadequate and indecisive. This highlights the need for research that incorporates these demographic variables to better understand secondary school students' mathematics anxiety.

Therefore, it was deemed necessary to investigate the mathematics anxiety of secondary school students in government schools in the Salem district of Tamil Nadu in India, with regard to gender, school locality and medium of instruction. The findings of this study provide valuable insights for teachers, curriculum developers, and policymakers in designing effective educational interventions to support the academic

and emotional needs of secondary school students in learning mathematics.

Objectives of the Study

The primary objective of this study was to determine the overall level of mathematics anxiety among secondary students attending government schools in the Salem district of Tamil Nadu in India. This study also aimed to investigate whether there were significant differences in mathematics anxiety among secondary students based on gender, school locality and medium of instruction.

Research Questions/Hypotheses of the Study

This study addressed the following research questions and hypotheses:

1. What is the overall level of mathematics anxiety among secondary students?
2. There is no significant difference in mathematics anxiety of secondary students based on gender.
3. There is no significant difference in mathematics anxiety of secondary students based on the school locality.
4. There is no significant difference in mathematics anxiety of secondary students based on the medium of instruction.

METHODOLOGY

A cross-sectional descriptive survey was employed in this study to investigate mathematics anxiety among secondary students attending government schools in the Salem district of Tamil Nadu, India.

Participants

This study focused on secondary school students and selected 390 Class 9 students from six government schools within the Salem district of Tamil Nadu, India. A convenience sampling technique was used for selecting the participants. Among the 390 students, 202 were boys, and 188 were girls.

Research Instrument

Data for this study were collected using a self-developed five-point Likert-type Mathemat-

ics Anxiety Scale. The scale comprises 28 items and addresses various aspects of mathematics anxiety, primarily focusing on classroom situations. An expert review ensured the content validity of the scale. To establish the scale's reliability using Cronbach's alpha internal consistency method, it was pilot-tested with 31 students from a government high school in Salem District. The scale demonstrated good reliability ($r = 0.82$). Total scale scores can range from 28 to 140, with higher scores indicating a higher level of mathematics anxiety.

Data Collection, Processing and Analysis

To collect data from the sampled students, the researchers visited the selected schools and administered the developed mathematics anxiety scale to them. Data were collected in January 2025 of the academic year 2024-2025. The students were given clear instructions to complete the scale. After collecting the data, the responses of all the students were reviewed and scored as 5 points for always, 4 points for often, 3 points for sometimes, 2 points for rarely, and 1 point for never. The scored data were then subjected to descriptive and inferential statistical analyses using JASP, an open-source statistical analysis software. A significance level of 0.05 was used to test the hypotheses.

Ethical Considerations

This study was approved by the Ethics Committee of the Gandhigram Rural Institute (Approval No.: GRI/EDU/Ethical Committee/2024-25, dated 23.01.2025). Due to the nature of the school setting and practical constraints, the researchers were unable to obtain formal informed consent from parents/guardians. However, the researchers obtained permission from the Chief Education Officer of Salem District, as well as from concerned school heads and teachers, to collect data from the students. Additionally, all students were informed about the study's purpose, the voluntary nature of their participation, and their right to withdraw from participation at any time without penalty. The students were also assured that the collected data would be kept confidential and used only for this study.

RESULTS

Descriptive and inferential statistical analyses were conducted to determine the overall levels of mathematics anxiety of secondary students and to examine group differences across the selected demographic variables.

Descriptive Analysis

The total Mathematics Anxiety Scale scores of all 390 students were analysed using descriptive statistical techniques, including mean, standard deviation, percentiles and percentages, to address the first research question. The results of the descriptive statistical analyses are presented in Tables 1 and 2.

Table 1 reveals that the mean mathematics anxiety score (mean = 69.92) was slightly lower than the midpoint score of 70. This indicates that secondary students studying in government schools in the Salem district experienced a moderate level of mathematics anxiety (neither high nor low).

As shown in Table 2, the mathematics anxiety of secondary students was further categorised into three levels, namely high, moderate and low, based on the percentiles. These findings suggest that 50 percent of students experienced a moderate level of mathematics anxiety, 24 per-

cent experienced a high level of mathematics anxiety, and 26 percent experienced a low level of mathematics anxiety.

Inferential Analysis

Before proceeding to further statistical analysis, the distribution of the total mathematics anxiety scale scores was assessed for normality using the Shapiro-Wilk test. The results of the Shapiro-Wilk normality test are presented in Table 3.

The results of the Shapiro-Wilk normality test, presented in Table 3, demonstrated that the p -value of the total mathematics anxiety scale scores ($W = 0.99$, $p = .190$) was higher than the significance level of 0.05. This shows that the distribution of mathematics anxiety scale scores did not significantly deviate from normality. Therefore, a parametric statistical test was used to compare group differences in students' mathematics anxiety.

An independent-samples t -test was used to investigate significant differences in mathematics anxiety among secondary school students based on gender, school locality, and medium of instruction. The results of the independent samples t -test are presented in Table 4.

Table 4 indicates that there were no statistically significant differences in the mathematics anxiety of secondary students based on gender,

Table 1: Descriptive statistics on the mathematics anxiety of secondary students

Variable	<i>N</i>	Mean	<i>SD</i>	25 th percentile	50 th percentile	75 th percentile
Mathematics Anxiety Scale Total Score	390	69.92	16.18	59	70	81

Table 2: Classification of secondary students by level of mathematics anxiety based on the percentile scores

Variable	Score range	Level of mathematics anxiety	Number of students	Percentage
Mathematics Anxiety Scale Total Score	≤ 59	Low	102	26
	60 to 81	Moderate	195	50
	≥ 82	High	93	24
Total	390	100		

Table 3: Results of the Shapiro-Wilk Test of Normality

Variable	Statistic	<i>df</i>	<i>p</i> -value
Mathematics Anxiety Scale Total Score	0.99	390	.190

Table 4: Results of the independent samples *t*-test on the group differences in the mathematics anxiety of secondary students

<i>Variable</i>	<i>Group</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t-value</i>	<i>p-value</i> (2-tailed)
<i>Gender</i>	Boys	202	68.67	16.59	388	1.58	.110
	Girls	188	71.26	15.66			
<i>School Locality</i>	Rural	329	69.57	16.66	388	0.99	.320
	Urban	61	71.80	13.24			
<i>Medium of Instruction</i>	Tamil	233	71.19	16.67	388	1.91	.060
	English	157	68.02	15.28			

school locality, or the medium of instruction. The subgroups, such as girls, urban school students, and Tamil medium students, had slightly higher mean mathematics anxiety scores than their counterparts. However, none of these differences were statistically significant at the 0.05 significance level. As a result, all three null hypotheses were accepted. Therefore, it can be inferred that gender, school locality, and medium of instruction did not influence the mathematics anxiety of the secondary students in this study.

DISCUSSION

The present study revealed that 50 percent of the secondary school students experienced a moderate level of mathematics anxiety. This finding is consistent with several previous studies conducted among secondary school students in different contexts. Akbayir (2019), Omar et al. (2022), Kiso (2024), Asomah et al. (2025), Bala-konda (2025), Kumari and Kumar (2025), Mohammed et al. (2025), and Muana and Ugang (2025) reported moderate levels of mathematics anxiety among secondary students. The findings also show that almost one-fourth of the students reported a high level of mathematics anxiety. This finding aligns with the results of Escalera-Chavez and Rojas-Kramer (2019), Estonanto and Dio (2019), Moyo (2023), Rahaman et al. (2023) and Koomson et al. (2024), who reported higher levels of mathematics anxiety among secondary school students. The presence of moderate to high levels of mathematics anxiety among students is a cause for concern. It highlights the persistent emotional challenges associated with learning mathematics at the secondary level. Cultural traits, curriculum demands, and parental expectations may explain

these differences in secondary students' mathematics anxiety. Overall, the findings collectively advocate that moderate to high levels of mathematics anxiety are now common among secondary students across diverse contexts, highlighting the need for targeted interventions in secondary schools.

The present study found no significant difference in secondary school students' mathematics anxiety based on gender. This finding aligns with previous studies reporting no significant gender differences in mathematics anxiety among secondary students (Akbayir 2019; Kumar and Srivastava 2021; Kiso 2024; Kumari and Kumar 2025). The insignificant gender difference in students' mathematics anxiety suggests that gender gaps in mathematics anxiety may be narrowing due to increased awareness and more inclusive classroom practices. However, it contrasts with studies such as Escalera-Chavez and Rojas-Kramer (2019), Dungdung and Bankira (2023), Rahaman et al. (2023), Asanjarni et al. (2024), Halder and Chatterjee (2024), Koomson et al. (2024) and Mohammed et al. (2025), which reported higher levels of mathematics anxiety among female students. Similarly, it contrasts with some studies which reported higher levels of mathematics anxiety among male students (Mandal and Saha 2019; Nandhini and Subramanian 2021). These variations across studies indicate that gender differences in mathematics anxiety may be context-specific and evolving.

The present study also found no significant difference in secondary students' mathematics anxiety based on school locality. This finding is consistent with the results of Hait and Mishra (2018), Mandal and Saha (2019), and Mahato and Sen (2021), who also reported no significant

difference in secondary students' mathematics anxiety based on school locality. However, this contrasts with a study by Sangral and Kumar (2023), which reported that secondary school students attending rural schools experienced higher levels of mathematics anxiety than their urban counterparts. Similarly, a recent study by Halder and Chatterjee (2024) found that students attending urban schools experienced higher mathematics anxiety than those in rural schools.

The present study further revealed no significant difference in secondary students' mathematics anxiety based on the medium of instruction. This finding aligns with the results of Hait and Mishra (2018), who also reported no significant difference in secondary students' mathematics anxiety based on the medium of instruction. However, this contrasts with a study by Dungdung and Bankira (2023), which reported that English-medium students had higher levels of mathematics anxiety than those studying in the Odia medium. It is well known that one can learn better in one's mother tongue than in a foreign language.

Overall, the findings suggest that most of the sampled secondary students experienced moderate to high levels of mathematics anxiety. This reflects the absence of a supportive mathematics learning environment in secondary schools. Without appropriate interventions, students with high mathematics anxiety may face significant challenges in performing well in mathematics, which may limit their opportunities in higher education and STEM-related careers. The findings also suggest that secondary students' mathematics anxiety did not differ by gender, school locality, or medium of instruction. This implies that mathematics anxiety is a common issue among different groups of secondary school students; hence, it should be addressed as a common issue rather than targeting specific student subgroups. The present study's findings support the need for pedagogical reforms, student-centred teaching and learning practices, and evaluation procedures that reduce fear and promote positive mathematical learning experiences among secondary school students.

CONCLUSION

Mathematics anxiety is a common problem that can be found from school education through

higher education. Recognising the importance of addressing students' mathematics anxiety to improve academic performance, this study investigated the overall levels of mathematics anxiety among secondary students in government schools in the Salem District of Tamil Nadu, India. The study also examined how students' mathematics anxiety varied by gender, school locality, and medium of instruction. The findings showed that half of the sampled secondary students experienced a moderate level of mathematics anxiety, and almost one-fourth experienced a high level of mathematics anxiety. These findings confirm that mathematics anxiety is a common and persistent issue in secondary education across various contexts.

However, the study found no significant differences in secondary students' mathematics anxiety based on gender, school locality, or medium of instruction. This highlights the fact that mathematics anxiety affects all students, regardless of gender, school locality, or medium of instruction. This study contributes to the growing body of literature on mathematics anxiety by highlighting its prevalence and the group differences. This study will also serve as a foundation for future research aimed at developing effective educational interventions to address mathematics anxiety among secondary school students.

RECOMMENDATIONS

The findings revealed that mathematics anxiety is a common issue, as almost three-fourths of the sampled secondary students experienced moderate to high levels of mathematics anxiety. This demands immediate intervention at the classroom, school, and policy levels. At the classroom level, teachers play a crucial role in addressing students' mathematics anxiety. They should create a safe, supportive, and anxiety-free learning environment in mathematics classrooms, where students feel comfortable making mistakes and viewing them as opportunities for learning.

Mathematics anxiety can also be addressed through student-centred teaching and learning methods that encourage students to find meaning and joy in learning mathematics. Interactive teaching-learning methods, which involve play,

exploration, discovery, discussion, games, and puzzles, may also help alleviate students' mathematics anxiety. Teachers should also connect mathematical concepts to students' lives whenever possible by using real-world examples. Connecting mathematical concepts to students' contextual realities can help reduce mathematics anxiety, at least to some extent.

From a curriculum perspective, it is recommended to reduce mathematics content to its core essentials and shift the focus from a culture of rote learning to conceptual understanding, thereby lessening unnecessary stress among students in learning mathematics. Furthermore, schools should give greater weight to formative assessment, which provides continuous feedback to students on their own learning and reduces mathematics anxiety to some extent. Implementing these recommendations can significantly reduce secondary school students' mathematics anxiety and, in turn, improve their academic performance.

LIMITATIONS

Although this study makes a meaningful contribution to understanding secondary school students' mathematics anxiety, it has some limitations. First, using a convenience sampling technique for participant selection might have led to sampling bias and limited the generalisability of the findings to all secondary school students. Second, this study relied on self-reported mathematics anxiety data from students, which may have been influenced by social desirability bias, misunderstanding of items, and students' moods during data collection. Lastly, this study examined the mathematics anxiety levels of secondary students and the differences in these levels across the selected demographic variables. This study did not identify the possible causes of students' mathematics anxiety, which requires an in-depth qualitative analysis. Future research may address these limitations to acquire a complete understanding of secondary school students' mathematics anxiety and its impact on their learning.

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