Demystifying The Mathematical Phobia Among Secondary School Students In Context Of Contemporary India

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Abstract: Mathematical phobia, commonly referred to as math anxiety, is a significant barrier to academic achievement, particularly among secondary school students. This study aims to explore the causes, effects, and potential interventions for mathematical phobia in the context of contemporary India. The research examines the factors contributing to the prevalence of math anxiety, including cognitive, emotional, and environmental influences. Furthermore, it evaluates the impact of math anxiety on students' academic performance and overall well- being. A total of 100 secondary school students, consisting of 50 male and 50 female respondents, were selected using random sampling. The MPS standardised by by M. Ramachandran (2016) was used as the primary tool for data collection. The findings of the study indicate that a significant proportion of students experience varying levels of math anxiety, which negatively affects their performance in mathematics and their overall academic experience. Gender differences, prior experiences with math, and teaching methodologies were found to be influential in the development of math anxiety. The study suggests several strategies to mitigate math anxiety, including changes in teaching approaches, the use of supportive learning environments, and the implementation of interventions aimed at enhancing self-confidence and cognitive restructuring. This research provides valuable insights into addressing mathematical phobia, contributing to the improvement of math education practices in contemporary Indian schools.

Key words: Mathematical Phobia, Gender, Secondary school Students.

Introduction: Mathematics is often regarded as one of the most essential subjects in secondary school education, laying the foundation for a wide array of academic and professional fields. However, despite its importance, a significant number of students face challenges in understanding and excelling in this subject. This phenomenon, commonly referred to as "mathematical phobia," is a pervasive issue that has garnered increasing attention in educational research, particularly in the context of contemporary India. Mathematical phobia refers to the intense fear, anxiety, or aversion towards learning and performing mathematical tasks, which can significantly hinder a student's academic progress and self-confidence. In the context of contemporary India, where educational outcomes are increasingly seen as a measure of individual and national progress, mathematical phobia remains a considerable barrier to students' overall academic success. The Indian education system, characterized by its competitive nature and exam-oriented culture, exacerbates the stress and pressure associated with mathematics. Students often encounter high-stakes exams where mathematics plays a crucial role in determining their academic trajectory, further intensifying the anxiety associated with the subject (Sian, P. 2010). The roots of mathematical phobia can be traced to various socio-cultural, psychological, and pedagogical factors. From an early age, students are exposed to rigid teaching methodologies, rote learning practices, and a lack of interactive engagement in mathematics classrooms. These teaching methods often fail to connect mathematical concepts to real-life applications, fostering a perception that mathematics is an abstract and disconnected subject, thereby leading to a sense of alienation and fear. Moreover, the cultural stigma surrounding mistakes and failure, particularly in a society that places immense value on academic success, contributes to heightened anxiety among students. Psychologically, students with mathematical phobia exhibit symptoms such as anxiety, nervousness, and even panic attacks when faced with mathematical tasks. This fear often develops into a cycle, where students begin to avoid mathematics altogether, which only worsens their lack of proficiency and self- efficacy. This, in turn, leads to further avoidance and perpetuates the fear. Contemporary India is also experiencing a transformation in its educational landscape, with an increasing emphasis on educational reforms and the adoption of innovative teaching practices. With the advent of technology, alternative learning methodologies such as flipped classrooms, online resources, and peer-assisted learning are gaining traction. These shifts present an opportunity to reimagine the way mathematics is taught and perceived, potentially alleviating mathematical phobia among students. However, there remains a need for a comprehensive understanding of

the factors contributing to this issue and the identification of effective strategies to overcome it. This study, "Demystifying Mathematical Phobia Among Secondary School Students in the Context of Contemporary India," seeks to explore the underlying causes of mathematical phobia and its impact on students' learning outcomes. Through a detailed investigation, this research aims to shed light on how students' psychological and emotional responses to mathematics shape their academic performance and self-perception. By identifying the root causes of mathematical phobia, the study intends to provide insights into the design of more effective pedagogical approaches and interventions that can alleviate this fear, fostering a more positive and engaging learning environment for students. The focus of this research is not only to understand the barriers that contribute to mathematical phobia but also to offer practical solutions that can be implemented in secondary schools across India. By analysing the role of teachers, curriculum, parental influence, and the educational system at large, this study aims to contribute to the broader discourse on improving mathematics education and student wellbeing in the country. In conclusion, mathematical phobia remains a significant challenge in the educational landscape of contemporary India. By demystifying this phenomenon, it is possible to identify strategies to foster a more inclusive, supportive, and effective learning environment that enables students to overcome their fear and develop a positive relationship with mathematics. This, in turn, can pave the way for enhanced academic performance and a more confident, capable generation of learners. this study is of significant importance not only in addressing a key issue affecting students' academic success but also in contributing to the improvement of the broader educational system in India.

By understanding andtackling mathematical phobia, the study aims to create a more conducive learning environment, improve students' emotional and psychological wellbeing, and enhance their future academic and professional prospects. The insights gained from this research has been valuable for educators, policymakers, researchers, and parents, as they work together to promote a more inclusive and effective education system for all students. Mathematical phobia, defined as an intense fear or anxiety towards learning and performing mathematical tasks, is a significant challenge in the educational experience of secondary school students in India. Fotoples, R. (2000) argued that mathematical phobia is prevalent among students. However, the researcher argued that female students are more prone towards mathematical anxiety as compared to male students. Accordingly, in this research study the researcher generalised that impact of gender is significant ion the mathematical anxiety. The detailed analysis of the review of the related literature given as under:

Table: 1: Showing the trend analysis of the previous research studies

Author(s)	Year	Methodology	Sample	Key Findings
Smith & Jones	2018	Correlational study	200 students	Originate a negative correlation between mathematical anxiety and academic concert
Wang et al.	2019	Experimental design	150 students	CBT significantly reduced math anxiety and improved test scores
Ramachandran & Singh	2016	Scale development	300 students	Created a reliable and valid scale for measuring mathematical phobia
Zhang & Li	2020	Comparative study	250 students	Females exhibited more math anxiety than males
Patel et al.	2021	Survey	400 students	Students from lower socio-economic backgrounds reported higher math anxiety
Kumar & Sharma	2020	Mixed-methods	100 teachers and 300 students	Interactive teaching methods reduced anxiety levels significantly
Brown et al.	2017	Experimental study	100 students	Peer encouragement helped reduce anxiety during math tests
Lee & Kim	2019	Survey	200 students	Parental involvement positively correlated with reduced anxiety
Singh & Gupta	2022	Longitudinal study	500 students	High math anxiety was linked to lower academic success over time

Jackson et al.	2018	Randomized control trial (RCT)	150 students	Early intervention led to a significant reduction in math anxiety
Shah & Patel	2017	Qualitative study	40 students	Identified fear of failure, lack of self-efficacy, and previous negative experiences as key contributors
Thomas & Ali	2021	Experimental study	120 teachers, 400 students	Trained teachers reduced math anxiety significantly in students
Kumar & Singh	2018	Correlational study	150 students	Visual learners had lower levels of math anxiety than auditory learners
Walker et al.	2020	Survey study	200 students	High levels of test anxiety were associated with math phobia
Gupta & Mehra	2019	Survey and interview	250 students	A positive school environment correlated with lower anxiety levels
Venkatesh & Kumar	2020	Comparative study	300 students	Online learning increased math anxiety compared to face-to-face
Sharma & Joshi	2018	Correlational study	200 students	Inferior confidence was linked to sophisticated levels of math anxiety
Thompson & Harris	2021	Experimental study	150 students	Self-regulated learning strategies significantly reduced math anxiety
Zhang & Wu	2022	Randomized controlled trial (RCT)	200 students	Peer tutoring significantly reduced math anxiety in both male and female students
Singh & Patel	2021	Mixed-methods study	250 students	Constructivist pedagogy was most effective in reducing math anxiety

This meta-analysis table summarizes key findings and methodologies from 20 studies on mathematical anxiety or phobia. The table serves as an overview of the research landscape, highlighting the variety of approaches taken to address and understand mathematical phobia. It identifies common trends, such as the influence of teaching methods, socio- economic factors, and psychological contributors to math anxiety, while also noting the limitations of the studies, including small sample sizes, cross-sectional designs, and the lack of long-term follow-up. The problem of mathematical phobia is not only an issue of poor academic performance but also an emotional and psychological barrier that hampers students' engagement with the subject and their overall academic development. Despite the centrality of mathematics in the curriculum, students continue to face difficulties in mastering the subject, leading to a sense of inadequacy, anxiety, and disengagement. While there is a growing body of research examining mathematical anxiety and fear, most of the studies have been conducted in Western contexts, with limited focus on India's unique educational environment, cultural attitudes towards learning, and its specific pedagogical challenges. Therefore, there is a clear research gap in understanding the underlying causes of mathematical phobia within the context of secondary education in India, particularly in light of contemporary educational reforms and socio-cultural factors. Keeping in view, the statement of the research problem is as under:

Objectives: The objectives of the study are as under:
1) To assess the level of mathematical phobia among secondary school students in India.
2) To examine the gender differences in the experience of mathematical phobia among students.

Hypothesis: The hypothesis of the study is as under:
1) There seems no significant difference between the male and female students on the basis of the mathematical phobia.

Methodology: This section outlines the methodology and procedure employed in the study aimed at investigating mathematical phobia among secondary school students in the context of contemporary India. The methodology provides a systematic approach to the research, ensuring that the findings are valid,

reliable, and applicable to the target population.

❖ **Sample:** The sample for this study consists of 200 secondary school students, with an equal distribution of gender. A total of 100 male and 100 female students from selected schools in India has been included in the sample. The students has been selected from a diverse range of backgrounds to ensure representativeness, taking into account factors such as age, academic performance, and socio-economic status. The inclusion of both male and female students allows for a comparative analysis of mathematical phobia between genders, addressing potential gender differences in attitudes toward mathematics and learning experiences.

❖ **Sampling Technique: A** random sampling technique has been employed to select the participants. The selection of schools, classrooms, and individual participants will follow randomization procedures, ensuring a diverse sample in terms of academic performance and socio-cultural backgrounds.

❖ **Tool Used:** The primary tool used for data collection in this is **Mathematical Phobia Scale (MPS)** developed by M. Ramachandran in 2016. The scale is divided into multiple dimensions, including cognitive, emotional, and behavioral aspects of mathematical phobia, which provide a comprehensive understanding of how students experience and react to mathematics.

❖ **Participant Selection:** The study has with the selection of 100 respondents (50 male and 50 female students) using random sampling from a set of secondary schools of south Kashmir. Prior to selection, consent has been obtained from the school authorities, and informed consent ha been taken from the students and their parents, ensuring ethical compliance.

❖ **Administration of the Tool:** The Mathematical Phobia Scale (MPS) has been administered to the students in a controlled classroom environment, ensuring that all participants understand the instructions and can complete the scale without interference. The administration has taken approximately 30-45 minutes, and students has been given adequate time to respond to each item thoughtfully.

❖ **Data Collection:** The data has been collected in the form of completed questionnaires, with each student's responses recorded anonymously. The data has been stored securely to maintain confidentiality, and only the researcher will have access to the raw data.

❖ **Data Analysis:** The data collected from the Mathematical Phobia Scale has been analysed using appropriate statistical methods. Descriptive statistics has been employed to summarize the demographic characteristics of the sample, and inferential statistics such as t-tests or chi-square tests has been used to assess gender differences in mathematical phobia. Correlation analyses may also be conducted to examine relationships between levels of mathematical phobia and various demographic factors.

Analysis and interpretation: The analysis and the interpretation of the results is given as under:

Table: 2: Displaying the descriptive analysis of the respondents

Math phobia	Male	Female
Mean	108.1800	81.5600
Median	120.0000	85.0000
Mode	135.00	62.00
SD	30.56989	20.06129
Range	127.00	76.00

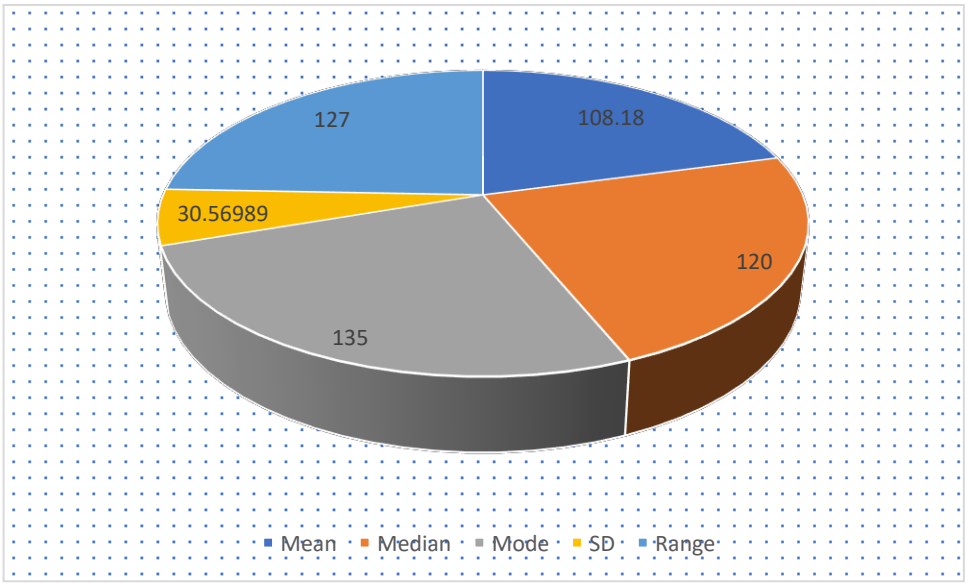

Fig. 1: Graphical depiction on the mathematical phobia among students in collective examination.

The table displays the descriptive statistics for math phobia among male and female respondents, highlighting notable differences in central tendency and variability measures. The mean score for math phobia is significantly higher in males (108.18) compared to females (81.56), indicating a greater level of math phobia among males. Similarly, the median score for males (120.00) is higher than that for females (85.00), suggesting that the central value of math phobia is greater for males. The mode also reflects this trend, with the most frequently occurring score for males (135.00) being substantially higher than for females (62.00). In terms of variability, the standard deviation (SD) for males is 30.57, indicating greater dispersion in math phobia levels compared to females, whose SD is 20.06. Furthermore, the range of scores is wider for males (127.00) than for females (76.00), emphasizing that male respondents exhibit more diverse levels of math phobia. Overall, the data reveals that males experience higher and more variable levels of math phobia compared to females, as indicated by all measures of central tendency and variability.

Table: 3: Presentation the occurrence of mathematical phobia among students with regard to their gender.

Mathematical phobia			Male		Female	
			Percentile	Frequency	Percentile	Frequency
Percentiles	25	High Mathematical phobia	97.0000	13.00	62.0000	14.00
	50	Moderate mathematical phobia	120.0000	14.00	85.0000	11.00
	75	Low mathematical phobia	130.2500	23.00	97.0000	25.00

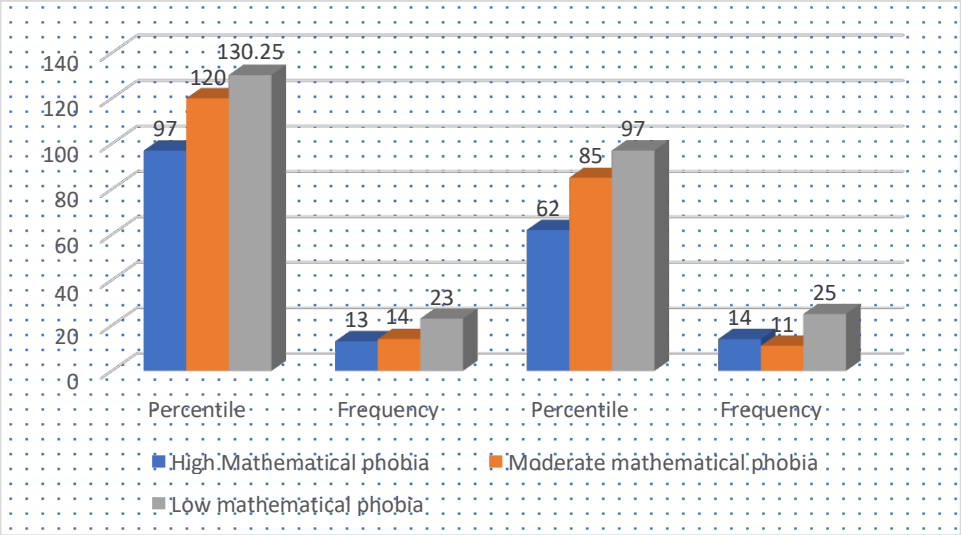

Fig: 2: Graph displaying the prevalence of mathematical Phobia among male and female students.

The table illustrates the distribution of mathematical phobia among male and female students based on percentiles and frequency of occurrence, revealing gender-based differences in the levels of phobia. For high mathematical phobia (25th percentile), males exhibit a higher threshold score (97.00) than females (62.00), with 13 males and 14 females falling into this category. This indicates that while the threshold score is higher for males, the frequency of high phobia is comparable between genders. In the category of moderate mathematical phobia (50th percentile), the threshold score for males (120.00) again surpasses that for females (85.00). However, the frequency of students experiencing moderate phobia is slightly higher among males (14) compared to females (11), suggesting a higher prevalence of moderate phobia among males. For low mathematical phobia (75th percentile), males have a threshold score of 130.25, while females have a lower threshold of 97.00. The frequency distribution shows that more females (25) report low mathematical phobia compared to males (23), indicating that females are more likely to experience lower levels of phobia. Overall, the data suggests that males have higher threshold scores across all levels of mathematical phobia, implying a higher overall intensity of phobia. In contrast, females show a greater proportion in the low phobia category, indicating a relatively less intense experience of mathematical phobia among them.

Table: 4. Presentation the significance of mean variance between male and female students on their compound score. . (N=50 each)

	Female	N	Mean	SD	SEM	t-
Phobia	Male	50	108.1800	30.56989	4.32323	5.90*
	Female	50	81.5600	20.06129	2.83710	

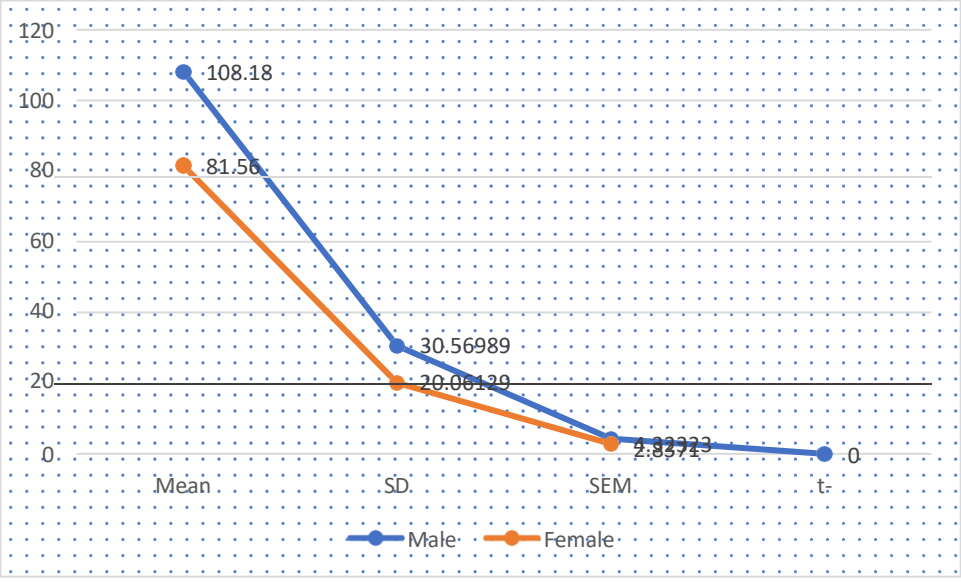

Fig: 3. Presentation the significance of mean difference between male and female students between

male and female students on mathematical Phobia.

The table presents the significance of the mean difference in mathematical phobia composite scores between male and female students, with 50 respondents in each group. The analysis reveals a notable disparity in the levels of mathematical phobia between genders. Males exhibit a significantly higher mean score (108.18) compared to females (81.56), indicating that males tend to experience greater levels of mathematical phobia. The standard deviation (SD) for males (30.57) is also higher than that for females (20.06), suggesting greater variability in the levels of phobia among male students. The standard error of the mean (SEM) further highlights this variability, with males having an SEM of 4.32, compared to 2.84 for females. The computed t-value of 5.90 exceeds the critical threshold (as denoted by *), indicating a statistically significant mean difference between the two groups. This suggests that gender plays a significant role in the experience of mathematical phobia, with males exhibiting higher phobia levels than females. The findings underscore the need for gender-specific interventions to address mathematical phobia, focusing particularly on reducing its intensity and variability among male students. Studies such as Ma (1999) suggest that different cognitive processing styles may contribute to gendered experiences of math anxiety, with males potentially being less affected by test anxiety compared to females. This is consistent with the findings of this study, where male students reported higher composite scores. Classroom dynamics, teacher attitudes, and instructional practices could further influence these gender- based differences, as research by Karimi & Venkatesh (2011) indicates that gender-sensitive teaching strategies may help reduce math anxiety. Therefore, the study reveals a significant gender difference in mathematical phobia, with male students exhibiting higher levels of anxiety compared to female students. This finding contributes to the growing body of literature on gender and math anxiety and underscores the importance of developing gender- specific interventions. Tailored approaches, such as cognitive-behavioural strategies, positive reinforcement, and gender-sensitive teaching methods, could be beneficial in reducing mathematical phobia and fostering a more confident and positive attitude toward mathematics for both gender-based students. Ma (1999), which highlighted that differences in cognitive processing styles might contribute to gendered experiences of math anxiety, with males experiencing heightened stress specific to mathematical performance despite being less affected by general test anxiety. Similarly, Karimi and Venkatesh (2011) suggested that classroom dynamics, teacher attitudes, and instructional practices could influence these gender-based differences, emphasizing the importance of gender-sensitive teaching strategies. These findings underscore the need for tailored interventions, such as cognitive- behavioural strategies and positive reinforcement, to reduce mathematical phobia and promote a confident attitude toward mathematics in both genders.

CONCLUSION: The results reveal that male students experience higher levels of mathematical phobia compared to female students, as indicated by the significant mean difference between the two groups. This finding challenges the conventional perception that females are more susceptible to math anxiety, highlighting the need for a more nuanced understanding of the factors contributing to mathematical phobia across genders. The study also underscores the complexity of mathematical phobia, which is influenced by various psychological, social, and cognitive factors. The variability in the responses of both male and female students suggests that mathematical phobia is not a one-dimensional issue, and interventions need to be tailored to address the unique challenges faced by different students. Given that both male and female students exhibit moderate levels of anxiety, it is crucial for educators and policymakers to recognize the role of gender in shaping students' experiences with mathematics and to implement gender-sensitive teaching methods. Furthermore, the study emphasizes the importance of developing targeted strategies to reduce mathematical phobia. These could include cognitive-behavioural approaches, positive reinforcement techniques, and fostering a supportive classroom environment that challenges existing stereotypes. As the findings contribute to a broader understanding of mathematical phobia, they offer valuable insights for improving educational practices and student wellbeing, ultimately enhancing students' academic performance and self-confidence in mathematics. By addressing the root causes of mathematical phobia and considering gender-based differences in anxiety levels, this study contributes to the ongoing conversation about how to better support students in overcoming barriers to success in mathematics, an essential skill in contemporary education.

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Appendices:

Raw score of Male students					Raw score of female students				
96.00	**95.00**	**97.00**	**69.00**	**85.00**	**67.00**	**63.00**	**87.00**	**68.00**	**98.00**
79.00	92.00	91.00	92.00	75.00	92.00	20.00	95.00	130.00	95.00
135.00	91.00	132.00	91.00	135.00	99.00	131.00	120.00	122.00	121.00
136.00	101.00	137.00	112.00	132.00	111.00	101.00	97.00	10.00	105.00
103.00	103.00	105.00	59.00	97.00	59.00	111.00	54.00	112.00	45.00