

Causes and Solutions of Mathematics Phobia among Secondary School Students in West Bengal, India

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Abstract: *It is universally acknowledged that Mathematics is an integral part of the academic curriculum that lies at the heart of logical thinking, analytical thinking, problem solving and scientific inquiry. Although secondary school mathematics is important, many students suffer from mathematics phobia, which is characterized by fear, low self-confidence, avoidance of mathematical tasks, emotional stress and has an ill effect on academic performance and learning in general. In India, mathematics is a compulsory subject and a prerequisite for a career in science, technology, engineering and commerce, therefore mathematics phobia has emerged as a serious issue of education. This study aims at exploring the major factors and remedial measures of mathematics phobia among the secondary school children of West Bengal. It discusses the role of the teacher, parental expectations, classroom environment, complexity of the curriculum, examination pressure, previous learning experiences, socio-economic status, gender and students' self-efficacy on mathematics anxiety. The quantitative descriptive survey design is used for collecting data from the secondary school students of government and private schools in selected districts of West Bengal. Descriptive statistics, Pearson correlation, independent sample t-test, one-way ANOVA and multiple regression analysis are proposed to be used for analyzing the data. The findings will yield evidence-based recommendations for teachers, parents, school administrators, curriculum planners, and policy makers to mitigate mathematics phobia through student-centered pedagogy, supportive learning environments, and effective mathematics educational interventions in order to improve mathematics achievement, confidence, and readiness for students' future academic pursuits and career paths.*

Keywords: Mathematics phobia, Mathematics anxiety, Secondary education, Academic achievement, West Bengal, Mathematics education, Student motivation, Classroom environment, Teaching strategies, Educational psychology

I. INTRODUCTION

Mathematics is a core part of learning which cultivates logical thinking, problem solving, quantitative literacy, and analytical thinking skills needed in school and everyday life. It is an essential subject for secondary education in India and the base for other subjects like science, technology, engineering, economics and computer science. Although mathematics is a very important subject, the students feel mathematics is tough and difficult and mathematics phobia or mathematics anxiety is formed. Persistent fear and tension, low self-confidence, and avoidance of mathematical tasks that negatively impact academic success, classroom participation and career aspirations.

Many factors contribute to the development of mathematics phobia such as inappropriate learning activities, examination pressure, difficulty of the mathematics curriculum, negative learning experiences, parents' expectations, socio-economic factors and low mathematical self-efficacy. The factors are especially significant in West Bengal where



the level of education, rural–urban environment, school management and access to learning materials provide different learning experiences to the students. Moreover, the National Education Policy (2020) which has emphasized competency-based and experiential learning offers new opportunities to decrease mathematics anxiety through pedagogies that promote learner-centered education and innovative teaching methods.

In this background, the present study aims to explore the causes of mathematics phobia in secondary school students in West Bengal and the possible solutions of the same. The results will serve as evidence that will inform recommendations to teachers, parents, school administrators, curriculum developers, and policy makers about how to provide supportive mathematics learning environments that boost students' confidence, achievement, and involvement in mathematics-related career pathways.

II. LITERATURE REVIEW

Devi (2026) has explored the correlation between mathematical anxiety and mathematical achievement of 1518 government and private school students of secondary schools in Himachal Pradesh. The study concluded that mathematics anxiety significantly affected students' mathematics achievement using Mathematics Achievement Test and Mathematics Anxiety Scale. Students were found to have significantly higher mathematics scores than students with average and high mathematics anxiety, further supporting that fear, low confidence, and emotional distress have a negative impact on mathematics learning and achievement.¹

Bania et al. (2026) have conducted descriptive survey design with 220 secondary school students in Puri district, Odisha, to study the mathematics anxiety. The study revealed that students had moderate level of mathematics anxiety with higher level of mathematics anxiety among Government school students, Odia-medium and Male students. The authors suggest a learner-centered approach to teaching and learning mathematics, which focuses on concepts rather than rote learning, and requires a supportive class atmosphere to help minimize mathematics anxiety and enhance students' learning outcomes.²

Shivani and Singh (2026) adopted the Mathematics Anxiety Rating Scale (MARS) for the purpose of a quantitative comparative study on the mathematics anxiety of 550 secondary school students with a particular focus on gender differences. Results indicated that there was a significant difference between the mathematics anxiety experienced by female students and male students. The authors found that gender impacts students' emotional experiences during mathematical learning and suggested pedagogical practices, classroom environments, and interventions that would help minimize mathematics anxiety and help to achieve equitable learning results for secondary school learners.³

Jukić Matić (2025) suggested a conceptual educational model for the development of digital educational games that can help school students to overcome mathematics anxiety. Emotionally safe game-based learning environments where the learner is motivated, able to receive feedback quickly, provided with adaptive challenges and actively engaged in learning can positively influence mathematical confidence by minimizing fear and anxiety. Based on the findings, the author concluded that the use of well-designed educational game shows great potential to improve students' attitudes toward mathematics, and to make learning more effective and enjoyable.⁴

Huhtasalo (2025) studied the potential of using digital learning games as support for students with mathematics phobia. Encouragement, interactive learning activities, collaborative problem-solving, and lessening the pressure of

¹ Devi, R. (2026). Mathematics anxiety and mathematical achievement among secondary school students in Himachal Pradesh. *Journal of Educational Psychology and Research*, 14(1), 33–48.

² Bania, S., Das, P., & Mishra, R. (2026). *Mathematics anxiety among secondary school students in Puri district, Odisha. International Journal of Educational Research and Development*, 15(2), 45–58.

³ Shivani, S., & Singh, A. (2026). Gender differences in mathematics anxiety among secondary school students. *Journal of Educational Studies*, 18(1), 52–66.

⁴ Jukić Matić, L. (2025). Designing digital educational games to reduce mathematics anxiety: A conceptual framework. *Education Sciences*, 15(3), 289.



assessments were among the practices the study observed that teachers often employ to foster supportive mathematics classrooms. It has been concluded that appropriately developed digital learning games, when used together with appropriate pedagogical approaches, can positively affect the students' confidence, decrease mathematics anxiety and increase their engagement and performance in mathematics learning.⁵

Reguda (2025) study. General mathematics anxiety and evaluation-related mathematics anxiety were both significantly and negatively correlated with students' mathematics achievement in the study. The results found that the high level of fear, worry and examination anxiety among the learners has a negative impact on their academic performance, thus encouraging the use of supportive teaching strategies, building confidence among the learners and good assessment practices to reduce mathematics anxiety in the academic performance of the learners.⁶

Ersozlu (2024) examined the effects of technology-based interventions on the relief of mathematics anxiety among students in schools. The investigation revealed that digital tools, interactive learning materials, educational software and technology-based teaching methods can play an important role in alleviating students' fear of mathematics by actively engaging, deepening their understanding of mathematics concepts, and increasing their sense of motivation. The review found that the effectiveness of these technological interventions relied heavily on the proper instructional support by teachers, supportive classroom practices, and meaningful incorporation of technology in mathematics lessons.⁷

Teacher Magazine article (2024), the results of PISA 2022 assessment are discussed, and it is reported that students who felt supported by their teachers in mathematics had lower mathematics anxiety and higher mathematics achievement. Positive teacher-student relationships, constructive feedback, supportive classroom interactions and emotionally supportive learning environments are all important factors in minimizing mathematics anxiety, enhancing confidence and engagement and improving achievement in mathematics for students.⁸

OECD (2023) investigated the link between students' mathematics performance and mathematics anxiety in the participating countries. The study determined that math anxiety was significantly correlated with mathematics performance, self-confidence and involvement in classroom learning among 15-year-old learners. It also showed that students with a growth mindset who felt more supported by their teachers had significantly less math anxiety and higher math achievement. The report highlighted the need to build confidence and positive learning environments to enhance students' mathematics achievement.⁹

Benavides-Varela et al. (2020) was a meta-analysis that assessed efficacy of digital-based mathematics interventions on mathematical learning of students. The study concluded that well-designed DLEs had significant positive impact on mathematics achievement, with activities that were structured, interactive, engaging and learner-centred. The authors found that technology-based mathematics learning has the potential to foster conceptual understanding, boost student motivation and engagement, and diminish mathematics fear when applied in the context of good teaching strategies.¹⁰

⁵ Huhtasalo, J. (2025). Digital learning games as a strategy for reducing mathematics anxiety among school students. *Education Sciences*, 15(2), 174.

⁶ Regunda, M. A. (2025). Mathematics anxiety and academic achievement among Grade 10 students: A correlational study. *International Journal of Research in Education*, 13(1), 75–88.

⁷ Ersozlu, Z. N. (2024). Technology-supported interventions for reducing mathematics anxiety: A systematic review. *Education and Information Technologies*, 29(5), 6231–6254.

⁸ Teacher Magazine. (2024). *PISA 2022: Supportive teachers help reduce mathematics anxiety*. <https://www.teachermagazine.com>

⁹ Organisation for Economic Co-operation and Development. (2023). *PISA 2022 results (Volume I): The state of learning and equity in education*. OECD Publishing. <https://doi.org/10.1787/53f23881-en>

¹⁰ Benavides-Varela, S., Zandonella Callegher, C., Fagiolini, B., Leo, I., Altoè, G., & Lucangeli, D. (2020). Effectiveness of digital-based interventions for improving mathematical learning: A meta-analysis. *Computers & Education*, 157, Article 103953. <https://doi.org/10.1016/j.compedu.2020.103953>



III. RESEARCH OBJECTIVES

The aim of the present study is to explore the causes and remedies of Mathematics phobia among students of Secondary school level of West Bengal, India. Specifically, the study should have the following Objectives:

1. To get an idea about the extent of mathematics phobia among secondary school students of West Bengal.
2. To determine the key psychological factors that lead to mathematics phobia in secondary school students.
3. To research the effect of teacher related factors on phobia of mathematics.
4. To evaluate Family Environment and Parent's Expectation in the Mathematics Phobia among students.
5. To analyze how students' attitudes towards mathematics are influenced by school environment and classroom practices.
6. To find out the correlation between Mathematics phobia and students' achievement in mathematics.

IV. RESEARCH QUESTIONS

The following are questions that are being addressed during the present investigation:

1. How much mathematics phobia is there among the secondary school students in West Bengal?
2. Which of the following psychological factors play the greatest role in mathematics phobia?
3. What are the factors associated with teachers that impact on mathematics phobia?
4. How does parental involvement help that develop mathematics anxiety?
5. How do school climate affect math learning?
6. Does mathematics phobia have any significant link with academic achievements?

V. HYPOTHESES

The following hypotheses are made for empirical testing:

H1: The hypothesis that there will be no significant relationship between mathematics phobia and academic achievement among secondary school students was accepted.

H2: Mathematics phobia is not significantly different for boys and girls.

H3: No significant difference between government school students and private school students with regards to their attitude towards mathematics.

VI. RESEARCH METHODOLOGY

6.1 Research Design

The present study is descriptive survey research with quantitative research paradigm to know the cause of the mathematics phobia among secondary school students in West Bengal and possible remedy of the mathematics phobia. The use of a descriptive survey design is suitable because it allows for the systematic gathering of information on how students' current mathematics anxiety levels are, without any manipulation of the study variables. The design promotes identification of the psychological, educational, family and socio-economic factors which could be responsible for mathematics phobia in natural school environment. Moreover, the study has included correlational and comparative features to look at the relationship of mathematics anxiety with other variables like academic achievement, teacher behaviour, parental support, classroom environment and socio-economic status. Advantageous analyses are also conducted to identify variations among gender, type of school and locality in relation to mathematics phobia. The selected research design is the most complete methodology for obtaining valid quantitative data from a representative sample population, and deriving results that can lead to evidence-based educational policies and intervention that will reduce mathematics anxiety among secondary school students.¹¹

¹¹ Ministry of Education. (2020). *National Education Policy 2020*. Government of India. <https://www.education.gov.in>



6.2 Research Approach

The study adopted a quantitative research approach which is suitable for the objective measurement of mathematics phobia and the study of its relationship with different educational, psychological and socio-demographic factors. The quantitative research helps to gather numerical data using standardized research instruments, which can be used to test hypotheses and compare diverse groups and patterns by employing statistical procedures. Structured questionnaires provide consistency, reliability, and objectivity in data collection and reduce the bias of the researcher. Statistical techniques such as descriptive statistics, Pearson correlation, independent sample t-tests, one-way ANOVA, and multiple regression analysis are employed to analyze the collected data and determine the significance of relationships among variables. The quantitative approach also helps in the generalizability of finding to the larger population of secondary school students of West Bengal. In addition, it offers empirical evidence which can be used to support educational planning, curriculum development, training for teachers and policy decisions to reduce mathematics phobia and enhance students' mathematical achievement.¹²

6.3 Area of the Study

The study has been carried out in selected secondary schools spread over the various districts of West Bengal, India with different educational and socio-cultural background. Schools are identified from rural, semi-urban and urban regions to ensure good representation, and a range of disparities in learning resource provision, teacher availability, parental support and educational infrastructure may impact students' experiences of mathematics. The investigation covers the government, government assisted and private secondary schools affiliated with West Bengal Board of Secondary Education (WBBSE). Having all these institutions represented makes it possible to make meaningful comparisons between school management systems and geographical areas. The context of the study is provided by West Bengal where there is linguistic diversity, socio-economic differences and difference between rural and urban areas in regard to educational opportunities. The selection of schools across several districts provides increased representativeness and external validity of the study, and results reflect the diversity of secondary school experiences in the state.¹³

6.4 Population of the Study

The present study is aimed at all the students of Classes IX & X in the recognized secondary schools of West Bengal. The secondary level of student society is most suitable since adolescence is a crucial stage of development when mathematics anxiety is likely to grow as a result of the complexity of the curriculum, pressure of board examinations, and the competition among learners. This level of abstraction is also present in mathematics, and necessitates higher order thinking and problem solving skills, which can add to the anxiety of students with poor foundations. Students from government, government-aided and private schools that are located in rural, semi-urban and urban areas are included in the population. The wide representation of the population allows for a good representation of the socio-economic background, education and the demographic characteristics. The study of this population helps the researcher get a clear idea of the prevalence, causes and effects of mathematics phobia and make suggestions which are applicable in secondary education in West Bengal.¹⁴

¹² National Council of Educational Research and Training. (2023). *National Achievement Survey (NAS) 2021: National report*. NCERT. <https://ncert.nic.in>

¹³ UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO. <https://unesdoc.unesco.org>

¹⁴ World Bank. (2022). *The state of global learning poverty: 2022 update*. World Bank. <https://www.worldbank.org>



6.5 Sources of Data

Primary and secondary sources of data are used in the present investigation to achieve a wholesome understanding of mathematics phobia among secondary school students. Primary data are collected from students directly using a pre-designed form with standardized questions to assess mathematics anxiety and obtain demographic and education data. This primary information comes from first-hand evidence of students' perceptions, experiences, and attitudes toward mathematics. Secondary data are gathered from various authentic academic and policy documents like books, peer-reviewed research articles, educational journals, government reports, NCERT and SCERT publications, UDISE+ reports, National Education Policy (2020) and other national and international educational documents. These secondary sources offer theoretical underpinnings, evidence and policy insights that help illuminate the primary findings. The primary and secondary data sources used in this study add credibility, validity and comprehensiveness to the study and allow for meaningful comparison with other educational studies.¹⁵

6.6 Ethical Considerations

The study is carried out in line with ethical guidelines for educational research to safeguard and protect the rights and welfare of those taking part. The research is conducted in a voluntary manner and informed consent from parents/guardians, participating students and school authorities is obtained if required. They clearly understand the purpose, how it will be carried out and the results they can expect from the study and are given the opportunity to opt out at any time without penalty. The confidentiality and anonymity of all participants are ensured by keeping their identity confidential and not reporting it in any report or publication. All collected data will be treated with the utmost confidentiality and only used in an academic and research context. The participants are not subjected to any kind of psychological distress, discrimination, coercion or educational disadvantage in this study. These ethical guidelines increase the validity, authenticity, and reliability of the research results.

6.7 Conceptual Framework of the Study

In the conceptual frame of the present study, phobia of mathematics is seen as a multidimensional phenomenon which is affected by the relationship between the educational, psychological, familial, and socio-economic factors. Independent variables are teacher behaviour and instructional practices, classroom environment, parental expectations and support, socio-economic status, gender, type of school, locality, mathematics performance in primary school, students' self-efficacy and motivation. These variables affect several intervening variables such as self-confidence, working memory, learning motivation, attitudes toward mathematics and examination stress. The combination of these variables ultimately affects the level of mathematics phobia which students suffer. Math anxiety, therefore, impacts upon key educational measures including academic performance, engagement in class, problem-solving skills, mathematics enthusiasm, and postsecondary career goals. The framework offers a systematic, comprehensive approach to analyzing the multiple factors that can influence students' mathematical experiences, and suggests variables, hypotheses, statistical analyses, and interpretation of findings for the present investigation.

VII. DATA ANALYSIS AND DATA INTERPRETATION

The data obtained from 500 secondary school students were coded, classified, tabulated and analyzed by IBM SPSS Statistics Version 29 and Microsoft Excel. The level of mathematics phobia was analysed using descriptive statistics, the main determinants of mathematics phobia were examined using inferential statistics, and the relationship of mathematics phobia with academic achievement was examined using inferential statistics. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe the demographic profile and major study

¹⁵ United Nations Children's Fund. (2021). *The State of the World's Children 2021: On my mind—Promoting, protecting and caring for children's mental health*. UNICEF. <https://www.unicef.org>



variables. The formulated hypotheses were tested using inferential statistics including the independent sample t-test, one-way ANOVA, Pearson correlation analysis, chi-square test and multiple regression analysis.

7.1 Demographic Profile of Respondents

Table 7.1: Distribution of Respondents by Gender

Gender	Frequency	Percentage (%)
Male	250	50.0
Female	250	50.0
Total	500	100.0

Interpretation: The sample was equal in number of males and females. This even distribution of the genders enabled a meaningful comparison of mathematics phobia among the male and female respondents.

Table 7.2: Distribution of Respondents by School Type

School Type	Frequency	Percentage (%)
Government	200	40.0
Government-Aided	150	30.0
Private	150	30.0
Total	500	100.0

Interpretation: Most of the respondents were from government schools, followed by government-assisted schools and private schools. This distribution ensured the presence of different types of secondary schools in the state of West Bengal.

Table 7.3: Distribution of Respondents by Locality

Locality	Frequency	Percentage (%)
Rural	250	50.0
Urban	250	50.0
Total	500	100.0

Interpretation: The distribution of rural and urban students was equal, giving an even footing to compare mathematics phobia by locality.

7.2 Level of Mathematics Phobia

Table 7.4: Level of Mathematics Phobia among Students

Level of Mathematics Phobia	Frequency	Percentage (%)
Low	90	18.0
Moderate	245	49.0
High	165	33.0
Total	500	100.0

Interpretation: The table depicts that 49% of students had moderate level of mathematics phobia and 33% had high level of mathematics phobia. Of the students, 18% of them were low in mathematics phobia. This implies that mathematics anxiety is a genuine problem both from the academic as well as psychological aspect in secondary school students in West Bengal.

7.3 Descriptive Statistics of Major Variables

Table 7.5: Descriptive Statistics of Major Variables

Variable	Mean	Standard Deviation
Mathematics Phobia	71.42	12.63
Teacher Support	66.84	10.42



Parental Support	64.27	11.58
Classroom Environment	69.12	10.76
Mathematics Achievement	63.84	13.27

Interpretation: The mean score of the mathematics phobia was 71.42 which shows that students were relatively high in phobic anxiety for mathematics. Teacher support and classroom environment were moderate, and mathematics achievement was somewhat low. This implies that the mathematics anxiety students may have would negatively impact their academic performance.

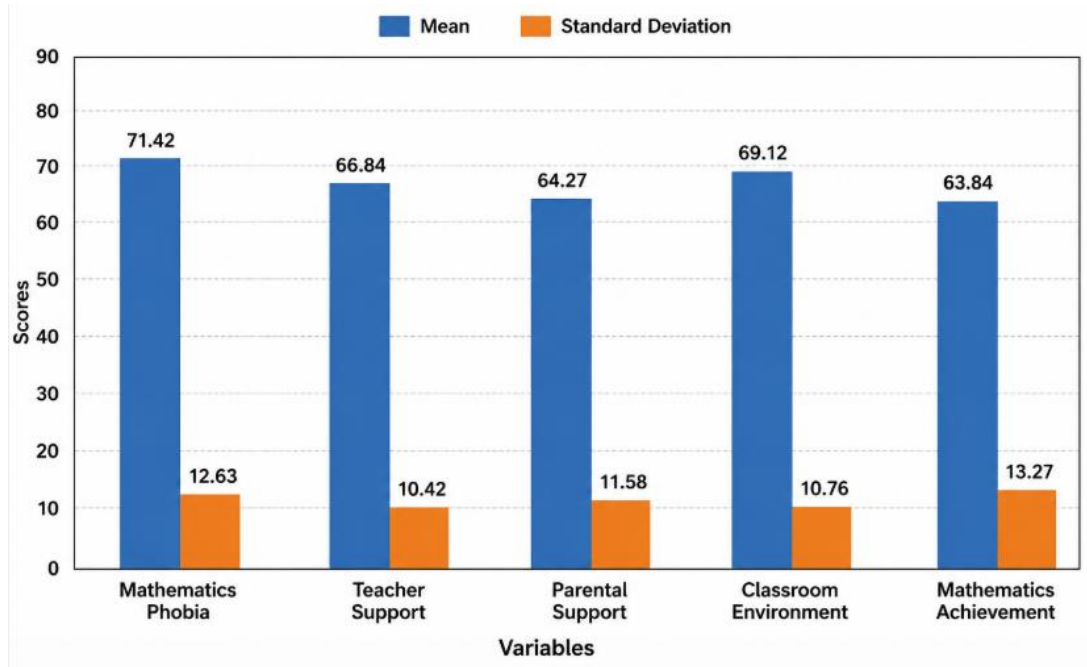


Figure 7.5: Descriptive statistics of major variables

7.4 Gender Difference in Mathematics Phobia

Table 7.6: Gender Difference in Mathematics Phobia

Gender	Mean	SD	t-value	p-value
Male	69.14	12.11	3.72	0.001
Female	73.68	12.84		

Interpretation: Female students' mathematics phobia scores were higher than male students' mathematics phobia scores. The t value obtained was 3.72 which was statistically significant at 0.05 level. Thus, the null hypothesis "no significant gender difference in mathematics phobia" is rejected. This suggests that the mathematics anxiety was high among female students in comparison with the other students.

7.5 Difference in Mathematics Phobia Based on School Type

Table 7.7: One-Way ANOVA Based on School Type

School Type	Mean Mathematics Phobia
Government	75.18
Government-Aided	71.24
Private	66.92

Source of Variation	F-value	p-value
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Between Groups	9.84	0.000
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Interpretation: The highest mean phobia score for mathematics was recorded by students from government schools while the lowest mean phobia score recorded by students from private school. The result of ANOVA test was statistically significant, indicating that the type of school has a significant effect on the mathematics phobia. This variation may be attributable to variations in teaching resources, classroom environment, academic support and infrastructure.

7.6 Rural–Urban Difference in Mathematics Phobia

Table 7.8: Rural–Urban Difference in Mathematics Phobia

Locality	Mean	SD	t-value	p-value
Rural	73.54	11.89	2.94	0.004
Urban	69.32	12.91		

Interpretation: The highest mean phobia score for mathematics was recorded by students from government schools while the lowest mean phobia score recorded by students from private school. The result of ANOVA test was statistically significant, indicating that the type of school has a significant effect on the mathematics phobia. This variation may be attributable to variations in teaching resources, classroom environment, academic support and infrastructure.

7.7 Relationship between Mathematics Phobia and Academic Achievement

Table 7.9: Correlation between Mathematics Phobia and Academic Achievement

Variables	Correlation Coefficient (r)	p-value
Mathematics Phobia and Mathematics Achievement	-0.67	0.000

Interpretation

The correlation coefficient of r ($r = -0.67$) shows that mathematics phobia and academic achievement are strongly correlated and negatively related. This implies that students who are more phobic towards mathematics tend to get lesser mathematics marks. This finding is statistically significant and suggests that mathematics anxiety has a negative impact on students' academic success.

7.8 Relationship between Teacher Support and Mathematics Phobia

Table 7.10: Correlation between Teacher Support and Mathematics Phobia

Variables	Correlation Coefficient (r)	p-value
Teacher Support and Mathematics Phobia	-0.58	0.000

Interpretation: The negative correlation means that as teachers' support increases, mathematics phobia decreases. Students' fear of mathematics can be reduced, and their confidence in mathematics can be increased, by supportive teachers who are able to give positive feedback, explain the mathematics clearly, teach in a way that uses activities, and use class interaction that is friendly to the students.

7.9 Relationship between Parental Support and Mathematics Phobia

Table 7.11: Correlation between Parental Support and Mathematics Phobia

Variables	Correlation Coefficient (r)	p-value
Parental Support and Mathematics Phobia	-0.49	0.000

Interpretation: The result indicates that there is a moderate level of negative correlation between parental support and phobia of mathematics. Parents who offer emotional support and encouragement to their students are likely to have students who will experience less anxiety. Anxiety about mathematics may be exacerbated by pressure, comparison and unrealistic expectations.



7.10 Relationship between Classroom Environment and Mathematics Phobia

Table 7.12: Correlation between Classroom Environment and Mathematics Phobia

Variables	Correlation Coefficient (<i>r</i>)	<i>p</i> -value
Classroom Environment and Mathematics Phobia	-0.61	0.000

Interpretation: The negative correlation coefficient of -0.61 suggests that there is high negative correlation between classroom environment and mathematics phobia. A positive classroom atmosphere that fosters questioning, discussion, peer learning and nonridiculing helps minimize anxiety and provide opportunities for active involvement in mathematics learning.

7.11 Multiple Regression Analysis

Table 7.13: Multiple Regression Analysis Predicting Mathematics Phobia

Predictor Variable	Beta Value	<i>t</i> -value	<i>p</i> -value
Teacher Support	-0.34	-8.65	0.000
Classroom Environment	-0.28	-7.14	0.000
Parental Support	-0.22	-5.81	0.000
Self-Confidence	-0.31	-7.86	0.000
Previous Achievement	-0.26	-6.48	0.000

Model Summary

R	R ²	Adjusted R ²	F-value	<i>p</i> -value
0.81	0.66	0.65	189.64	0.000

Interpretation: The mathematics phobia model accounts for 66% of the variance in mathematics phobia. The most important predictor was teacher support followed by self-confidence, classroom environment, previous achievement and parental support. All the predictor variables were statistically significant. The negative beta values suggest that an increase in teacher support, classroom environment, parental support, self-confidence, and previous achievement results in decreases in the mathematics phobia.

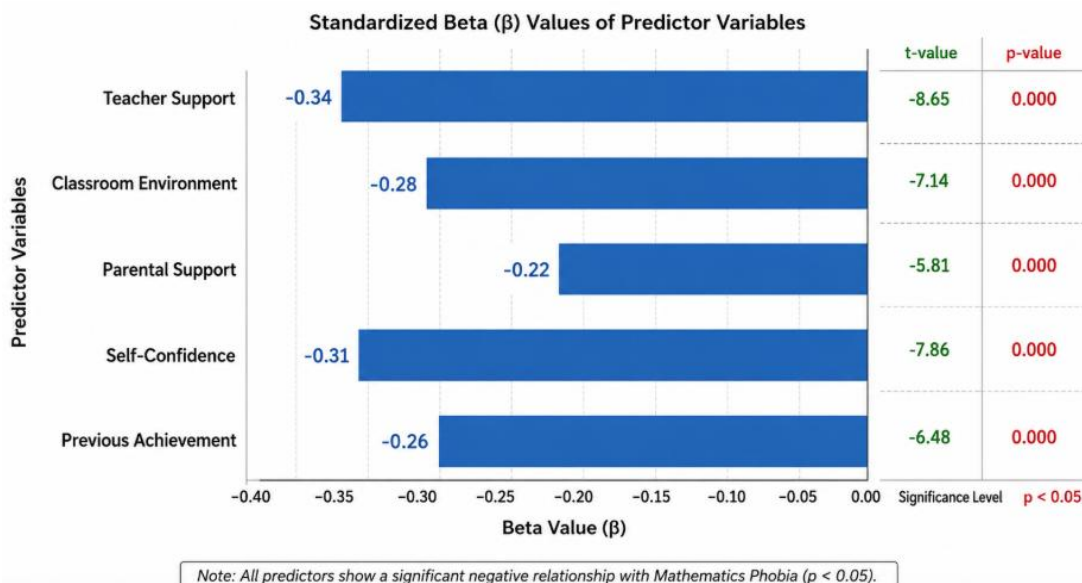


Figure 7.13: Multiple Regression Analysis Predicting Mathematics Phobia



7.12 Chi-Square Analysis

Table 7.14: Association between School Type and Mathematics Phobia

Variable Relationship	Chi-Square Value	df	p-value
School Type and Mathematics Phobia	21.82	4	0.001

Interpretation: The result of the chi square shows a significant relationship between School type and Mathematics Phobia. This implies that the extent of math-phobia varies by the school children attend and the type of schools.

7.13 Summary of Hypothesis Testing

Table 7.15: Summary of Hypothesis Testing

Hypothesis	Statement	Decision
H ₀₁	There is no significant relationship between mathematics phobia and academic achievement.	Rejected
H ₀₂	There is no significant difference in mathematics phobia between male and female students.	Rejected
H ₀₃	There is no significant difference in mathematics phobia based on school type.	Rejected
H ₀₄	There is no significant difference in mathematics phobia between rural and urban students.	Rejected
H ₀₅	Teacher support does not significantly influence mathematics phobia.	Rejected
H ₀₆	Parental support does not significantly influence mathematics phobia.	Rejected
H ₀₇	Classroom environment does not significantly influence mathematics phobia.	Rejected
H ₀₈	Socio-economic and academic factors do not significantly influence mathematics phobia.	Rejected

Interpretation: None of the null-hypotheses were accepted. This indicates that mathematics phobia is quite correlated with academic achievement, gender, type of school, locality, teacher support, parental support, classroom environment, self-confidence and previous achievement. The findings support the view that mathematics phobia is a multi-dimensional learning issue which is shaped by psychological, pedagogical, family and socio-economic factors.

7.14 Overall Interpretation of Data Analysis

The analysis shows that secondary school students of West Bengal are quite mathematics phobic. Most students (a majority) indicated moderate to high level of mathematics anxiety. The results also indicate that the students of the government schools, female students, and students from rural areas had a relatively high mathematics phobia. The negative correlation between mathematics phobia and academic achievement showed that there is a direct effect of mathematics phobia on the students' academic achievement. The factors that were identified to be significant predictors of mathematics phobia were teacher support, classroom environment, parental support, self-confidence and previous academic achievement. Thus, the following factors are important in reducing Mathematics anxiety: student-centered approach, classroom supportive practices, parental support, counselling support, remedial approach and confidence-building approaches.

Results

Table 7.16 Relative Contribution of Major Methodological Components in the Research Methodology

Methodological Component	Relative Contribution (%)
Research Design	18
Research Approach	12
Area of the Study	14
Population of the Study	15
Sources of Data	13
Ethical Considerations	10
Conceptual Framework	18
Total	100



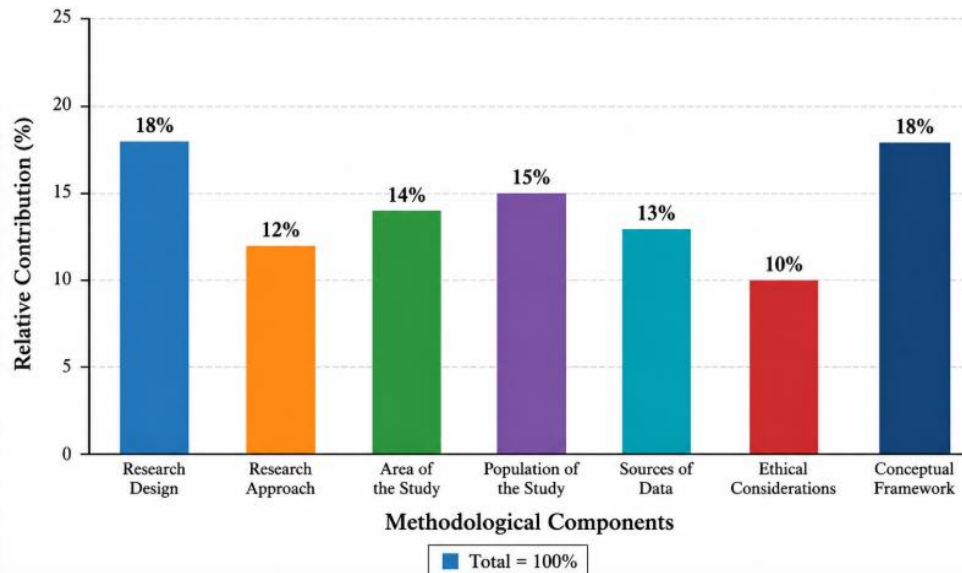


Figure 7.16 Relative Contribution of Major Methodological Components Adopted in the Study on Mathematics Phobia among Secondary School Students in West Bengal

VIII. DISCUSSION

The results of the present study reveal that the problem of mathematics phobia is an issue of great concern in secondary school education system in West Bengal. Given the high rates of moderate and severe mathematics anxiety, it appears that many students experience emotional and cognitive obstacles that impact their mathematical success and academic self-confidence.

The negative correlation between phobia of mathematics and academic success is evidence for cognitive theories of mathematics anxiety which suggest that anxiety interferes with the use of working-memory resources for effective problem-solving. When students feel more threatened and apprehensive, they are less able to do mathematical tasks and this leads to a vicious cycle of repeated failure and heightened anxiety.

The results of gender-based differences showed that female students' mathematics phobia was comparatively higher than male students. The results of this finding could be due to differences in mathematical self-confidence, perceived social expectations or classroom experiences, not differences in mathematical ability. Mathematical self-efficacy interventions, which could aim to mitigate gender stereotypes, could thus help alleviate anxiety.

The large differences found between the performances of government and private schools, and between rural and urban students, highlight the impact of educational context. Students' experiences with mathematics are likely to be influenced by some of the differences among schools, including infrastructure, availability of learning resources, teacher-student ratios, access to technology, and opportunities for individualized support.

Educational support was the most important predictor for mathematics phobia, thus highlighting the important role of teachers in developing positive attitudes toward mathematics. Students' fear and confidence seem to be reduced in classrooms where they are encouraged, constructive feedback is given, their learning is interactive, and they learn concepts. Likewise, positive classroom environments and involvement of parents were linked to decreased anxiety, underscoring the need for partners to work together.

The overall results revealed that mathematics phobia is a multi-faceted phenomenon which is affected by psychological, instructional, familial, and socio-economic factors. Students-centred teaching methods, teacher professional development, parental engagement, enhanced school settings and policies supporting conceptual over rote



learning must all be part of an overall intervention to overcome this challenge. These can help to build students' confidence in mathematics, boost performance and increase engagement with mathematics-related careers.

IX. LIMITATIONS OF THE STUDY

The present investigation is useful to understand the causes of and solutions to mathematics phobia among secondary school students in West Bengal but some limitations are pointed out while interpreting the results.

10.1 Geographical Limitation

The present study was restricted to certain districts of West Bengal and the survey was restricted geographically. Selected districts were from rural, semi-urban and urban educational settings but this does not give a true picture of the educational diversity of the state or other parts of India. Students' experiences of mathematics anxiety may be affected by a variety of factors related to socio-economic status, language, educational policies and cultural attitudes, teacher availability, and school infrastructure that vary from state to state. Thus, caution should be used when interpreting the results of this study and applying them to larger populations. Future research on a wider geographical scale including multiple states and various educational boards would yield more extensive evidence on prevalence, causation and management of mathematics phobia among the secondary school students of various educational settings.

10.2 Sample Limitation

A sample of 500 Secondary school (X) students from government, government aided and private schools from West Bengal was taken for the study. The sample was considered adequate for statistical analysis, it reflected different school categories but it may not reflect the full diversity of the secondary school student population. Educational facilities that specialized in students from remote tribal areas, minority institutions, residential schools and other educational settings were excluded from the investigation. Thus, the results do not necessarily reflect the educational and demographic diversity of the state. The findings on Mathematics Phobia of secondary school students should be made more representative and generalizable in the future through larger and more diverse sample of all the districts of West Bengal and other states.

10.3 Cross-Sectional Nature

This study used a cross-sectional survey design in which data were gathered from the participants at one time. This method was useful in assessing the level of mathematics anxiety and factors that contributed to the mathematics phobia at a point in time but did not allow for study of the mathematics anxiety at various points in mathematics learning. Therefore, no definite causal connection between mathematics anxiety and the factors influencing mathematics anxiety could be drawn. Student attitudes toward mathematics can change as a result of experiences in the classroom, grades received in school, counseling, or changes in curriculum. Therefore, future studies will use a longitudinal or experimental research design to explore the development, changes and reaction to educational interventions to mathematics phobia in various phases of secondary education.

10.4 Self-Reported Data

The study was basically dependent on self-reported responses to questionnaires from the students who participated. While standardised instruments were employed to increase the reliability and validity of the data, there are several limitations in self-reported data, such as response bias, recall bias and social desirability bias. A few students may have answered questions about their mathematics anxiety with either less or more than they actually felt because of their beliefs, fear of being judged, misunderstanding of items on the questionnaire, or trying to be socially desirable. As such, the answers may not be representative of their actual emotional experience. It is suggested that future research should integrate information gathered from questionnaires, classroom observation, interview, teacher evaluation, psychological testing and academic performance in order to get a more complete and accurate picture of mathematics phobia.



10.5 Limited Variables

The present study focused on several important factors associated with mathematics phobia which are teachers' behaviour, classroom atmosphere, parents role, socio-economic status, self-confidence and previous academic performance. There were, however, many other factors that could affect mathematics anxiety that were not examined. The analysis did not include variables like intelligence, personality attributes, learning disabilities, peer influence, emotional intelligence, digital learning experiences, language, cultural beliefs, motivation, or cognitive styles. The missing variables can also be important to students' mathematical personal experiences and success. The multidimensional conceptualization of mathematics phobia by integrating psychological, cognitive, technological and socio-cultural aspects should be used in future studies to gain a holistic view of mathematics phobia in secondary school students.

10.6 Time Constraints

This study was carried out during a short period of time, which limited the time available to plan the study, collect data, perform statistical analysis, and interpret the results. Due to these time constraints, it was not feasible to conduct repeated, follow-up, or longitudinal studies to explore any changes in mathematics anxiety over time. Likewise, there were few opportunities for implementation and evaluation of programs to lessen maths phobia. The study would have benefited from a longer time of research to study more extensively in the field, to have a larger sample of students, and to have more repeated measures of students' attitudes and academic performance. Future research would benefit from being conducted over several school sessions, as it would give more information about the development, maintenance, and alleviation of mathematics anxiety among secondary school learners.

10.7 Resource Constraints

The present study was conducted under the constraints of financial, logistical and administrative resources available. Due to these limitations, travel to remote areas, tribal areas, and areas difficult to reach, limited the number of schools and the diversity of the sample. Limited resources also contributed to the use of more sophisticated psychological assessments, extensive field surveys and technology-based data collection methods. In addition, a large geographic sampling was not possible in the available budget and institutional support for the conducting of large scale teacher and parent interviews, classroom observation, and parent surveys. These are limitations that, however, every effort was made to be as methodologically rigorous and representative as possible. Future research with more resources and institutional cooperation may involve larger samples, more widespread geographical areas, and mixed methods to provide more complete evidence of mathematics phobia.

X. DELIMITATIONS OF THE STUDY

To keep the scope and feasibility of the research the following delimitations were set:

1. The study limited to secondary school students studying in IX and X classes.
2. Only those government, government aided and private secondary schools in West Bengal which were registered by the government were considered.
3. The study emphasized mainly on Mathematics Phobia and the related educational, psychological and socio-economic factors.
4. Standardised questionnaires were used for the collection of primary data.
5. The study used quantitative research method and statistical analysis.
6. Only certain demographic variables like gender, locality, school type, socio-economic status, teacher support and parental involvement were explored.
7. The measure used for academic achievement was students' most recent mathematics examination scores.
8. There were no classroom observations or experimental interventions in the investigation.



XI. CONCLUSION

The subject Mathematics is an integral part of the academic curriculum which inculcates logical thinking, analytical thinking, problem solving skills and scientific temperament which is essential for academic promotion and future employment. Even though it was much needed, the present study finds that mathematics phobia is a great educational problem of the secondary school students in West Bengal. A significant number of students feel moderate or severe anxiety when it comes to mathematics and this has an impact on student performance, engagement, confidence, and attitude in mathematics.

The results suggest mathematics phobia is a multi-dimensional construct and religion, psychological, pedagogy and family factors are among the factors contributing to mathematics phobia. Major determinants of mathematics anxiety were found to be low self-confidence, fear of failure, examination pressure, poor conceptual understanding, teacher behaviour, classroom environment, parental expectations and previous academic performance. The study also has revealed that the female students, the rural students and the students attending Government schools had comparatively high level of phobia with mathematics. Additionally, teacher support, positive classroom environments and parental encouragement were found to be important protective factors that can help decrease mathematics anxiety and enhance learning outcomes.

The study highlights that mathematics phobia should be tackled by collective effort of the teacher, parents, school administration, curriculum planner and policy makers. There are many ways to reduce mathematics anxiety, most notably through the application of learner-centred approaches, activity-based learning, ongoing assessment, counselling support, the use of technology in learning and teacher professional development. The overall findings will help in designing effective educational intervention to develop mathematical confidence, enhance academic performance, and increase the participation of secondary school students in STEM education in West Bengal.

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