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## Mathematics Anxiety Among Secondary School Students in West Bengal

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### Abstract

The paper focuses on math anxiety in the secondary school students in West Bengal trying to see the differences between genders, habitat (urban/rural) and type of schools (government/private). A stratified random sample of 270 students was chosen through classes IX and X and data were gathered using a standardized Mathematics Anxiety Scale and analyzed in terms of descriptive statistics, t-tests and correlation analysis. Results showed that there were large differences in gender on mathematics anxiety (boys had more anxiety) and no habitat-based differences and school type differences (government school students reported higher anxiety). The mathematics anxiety exhibited a significant negative relationship with mathematics performance ( $r = -0.87$ ). The paper presents several implications on education intervention and recommends future research directions in terms of longitudinal studies and strategies that reduce anxiety.

**Keywords:** Mathematics Anxiety, Secondary School Students, Gender Differences, School Type, Academic Performance

### Introduction

Mathematics anxiety that involves the presence of tension and fear that disrupt mathematical problem-solving is a major impediment to mathematical learning and achievement (Richardson and Suinn, 1972) <sup>[10]</sup>. In West Bengal where performance in mathematics is still a burning issue in secondary schools, it is necessary to understand the factors behind mathematics anxiety in order to come up with effective educational interventions. According to the earlier studies, mathematics anxiety has adverse effects on academic outcomes, course choice, and career choice in the STEM subjects (Hembree, 1990; Ma, 1999) <sup>[4, 6]</sup>.

Although there is increased interest in mathematics anxiety throughout the world, there are few region-specific research in West Bengal. The part of the existing research has been concentrated on major cities or particular districts and this area lacks the comprehensive answer to the question of the general patterns of the state with its various socio-educational background. This research fills this gap through investigation of mathematics anxiety amongst the representative population of secondary school students in various demographic and institutional settings in West

Bengal.

The significance of this study is that it can be used to inform specific remedies that can reduce mathematics anxiety and enhance mathematical performance. Such identification of particular student groups that are the most susceptible to mathematics anxiety will allow the educators and the policymakers to create more effective support systems. Moreover, the comprehension of the correlation between mathematics anxiety and mathematics performance would be helpful in the acknowledgment of the affective aspect of mathematics education which is more often neglected in favor of such purely cognitive methods.

### Review of Literature

Mathematics anxiety is a widely researched phenomenon in different countries, and the findings are reliable in their depiction of adverse effects on mathematical performance and learning. Hembree (1990) <sup>[4]</sup> has performed a meta-analysis on 151 studies, which confirmed that mathematics anxiety is negatively correlated with mathematics performance and is associated with low self-esteem and high general anxiety. Recent studies have also examined

multidimensionality of mathematics anxiety (cognitive, emotional and behavioral) (Ashcraft and Moore, 2009) [2].

In India, mathematics anxiety has been shown to be high at different levels of education. Gender differences in studies have indicated that female students tend to have more mathematics anxiety than males (Puteh and Khalin, 2016) [9]. Nonetheless, there are also some Indian researches that demonstrated some contradictory findings and it seemed that the differences in gender patterns were contextually different (Keshavarzi and Mohammadi, 2011) [5].

West Bengal researches though few, are helpful. Mandal and Saha (2019) [8] discovered a great variation in mathematics anxiety between the boys and girls in secondary school in Kolkata and South 24 Parganas with boys indicating a higher level of anxiety. On the other hand, a study done by Samanta and Tarafdar (2025) [8] has indicated that Bangladeshi medium students had more mathematics anxiety compared to English medium students. It has also been found to have regional differences, where a study carried out in Purba Bardhaman (Chatterjee, 2024) [2], Malda (Edukasiana, 2024) [3], and Purulia districts indicated that anxiety had varying patterns based on the demographic factors.

Math anxiety has been found to be negatively correlated to academic performance in studies that have been conducted over time. Samanta and Tarafdar (2025) [8] found that math anxiety and achievement had a correlation coefficient of  $r = -0.96$  with the coefficient accounting 93.6 percent of the variation in performance. There are other studies which have indicated moderate to strong negative correlations; usually, the correlation is  $r = -0.30$  to  $r = -0.70$  (Ma, 1999; Hembree, 1990) [4, 6].

### Need of the study

Although mathematics anxiety has been researched at a global level, as well as at the national level, no research has been conducted on it specifically in the state of West Bengal and that is why the current research is necessary. To begin with, many studies that have been conducted in West Bengal have mostly used small and localized samples that might fail to capture the various demographic and geographic attributes of the state. Second, the fact that some studies show differences in various aspects of gender and other studies do not (Mandal and Saha 2019 vs. Samanta and Tarafdar 2025) [8, 11] points to the necessity of conducting larger, more representative studies to explain these trends. Third, little is done on how several demographic variables (gender, habitat, school type) interact with each other and contribute to mathematics anxiety.

Fourth, the majority of the studies in the area have concentrated on either the anxiety levels or the performance individually with minimal studies quantifying the experience of anxiety-performance relationship in West Bengal. Fifth, most studies have employed convenience or purposive sampling methods, which restrict the extrapolation of results. Lastly, with West Bengal having a number of educational reforms to enhance mathematics achievement, it is important to know the impactful barriers to learning, which differ in affectivity, in order to create holistic interventions.

These needs are met in this study, using a larger, stratified sample (N=270) of many districts, and analyzing multiple

demographic variables at the same time and measuring both levels of anxiety and their correlation with academic performance quantitatively. The results will equip the educators, administrators and the policymakers with evidence-based information on how to come up with targeted interventions to alleviate mathematics anxiety and enhance mathematics education performance in West Bengal.

### Objectives

1. To determine the level of mathematics anxiety among secondary school students in West Bengal.
2. To compare mathematics anxiety levels between male and female secondary school students.
3. To compare mathematics anxiety levels between students from urban and rural habitats.
4. To compare mathematics anxiety levels between students from government and private schools.
5. To examine the relationship between mathematics anxiety and mathematics performance among secondary school students.
6. To provide evidence-based suggestions for reducing mathematics anxiety among secondary school students in West Bengal.

### Null Hypotheses

**H<sub>0</sub>:** There is no significant difference in mathematics anxiety levels between male and female secondary school students in West Bengal.

**H<sub>0</sub>:** There is no significant difference in mathematics anxiety levels between students from urban and rural habitats in West Bengal.

**H<sub>0</sub>:** There is no significant difference in mathematics anxiety levels between students from government and private schools in West Bengal.

**H<sub>0</sub>:** There is no significant negative correlation between mathematics anxiety and mathematics performance among secondary school students in West Bengal.

### Delimitation

#### This study is delimited to

1. Students who study at classes IX and X according to West Bengal Board of Secondary Education (WBBSE) and Central Board of Secondary Education (CBSE).
2. Secondary schools, government and privately owned, situated in West Bengal in a few districts (Kolkata, North 24 Parganas, South 24 Parganas, Bardhaman, and Malda).
3. Mathematics anxiety by the standardized Mathematics Anxiety Scale.
4. The performance in mathematics in terms of annual examination scores in mathematics.
5. The data will be gathered in the academic session of 2024-2025.
6. A total of 270 students of secondary school.

### Research Design

The research design adopted in this study was descriptive-correlational research design based on a quantitative research approach. The descriptive aspect intended to establish the degree of mathematics anxiety in heterogeneous demographic groups whereas the

correlational aspect sought to establish the connection between mathematics anxiety and mathematics performance. This design was suitable to discover patterns, differences and associations without controlling the variables.

The research was cross-sectional in nature as it gathered information at one point at a given time. The independent variables (gender, habitat, school type) and dependent variables (mathematics anxiety, mathematics performance) were used. The study design was appropriate to compare groups and analyze relationships among variables and give a thorough view of mathematics anxiety in West Bengal setting.

The ethical issues were considered by obtaining informed consent of the participants and their guardians, anonymity, and responses confidentiality, and receiving the required approvals of the school authorities. The research followed the general ethics of ethical research when dealing with minors.

### Sample and Sampling Procedure

The samples were all the students of secondary school (class IX and X) under the WBBSE and CBSE boards in West Bengal. The choosing of the sample involved the application of stratified random sampling to guarantee that the sample proportionately represents important demographic factors. The sample of 270 students was selected.

To begin with, there was stratification in schools in terms of type (government and private) and location (urban and rural). Five districts were chosen to portray various areas of West Bengal Kolkata (urban), North 24 Parganas (mixed urban-rural), South 24 Parganas (mixed urban-rural), Bardhaman (urban-rural), and Malda (primarily rural). Government and private schools in every district were randomly chosen at an equal number.

In each of the schools chosen, the students were stratified according to gender and according to the level (IX vs. X). Equally, one student was randomly selected off each stratum by use of table of random number. The final sample comprised:

- 135 non-female and 135 female students (gender stratification)
- 135 students in urban and 135 students in rural area (habitat stratification).
- 135 state (government) 135 private school children (school type stratification).
- Distribution is approximately even in classes IX and X.

This stratified methodology allowed the sample to represent the population diversity sufficiently and give statistical power in subgroup analyses. The power analysis was used to determine the sample size of 270 since it was decided that a sufficient size was needed to identify the medium effect effects with the power of 80% at  $\alpha = 0.05$ .

### Tools and Techniques

#### Data collection utilized two primary instruments

**1. Mathematics Anxiety Scale:** A 25-item Mathematics Anxiety Scale based on a Mathematics Anxiety Rating Scale (MARS) that was modified to be administered to orphaned Indian secondary school students (Mahmood

and Khatoon, 2011) [7]. The scale is measured in a 5-point Likert scale (1 = Not at all anxious, 5 = Very much anxious) of measuring anxiety in relation to different mathematics related scenarios (studying tests, taking tests, homework, everyday mathematical work). The maximum score in mathematics is 25 to 125 with the higher the score the more anxious the person becomes. In a pilot test, there was a high level of reliability in the scale as Cronbach  $\alpha = 0.92$  was found to be high in 30 students of the target population.

**2. Mathematics Performance Measure:** The academic year 2024-2025 student score in mathematics in the annual examination based on school records with the permission of the school authorities. The analyzed performance scores were turned into percentages.

#### Data collection procedure

- Secured the permission of school principals and district education officers.
- Provided informed consent forms to the students and parents/guardians which are distributed.
- Administrated Mathematics Anxiety Scale in classrooms at normal school time.
- Gathered mathematics performance scores of school examinations.
- Guaranteed anonymity through the use of identification codes as opposed to names.
- The final collection of the data within the span of six weeks (November-December 2024)

#### Data analysis involved

- Means and standard deviations of anxiety scores in groups.
- Independent samples t-tests to contrast the levels of anxiety to the groups of the gender, habitat, and school type.
- Pearson correlation coefficient to test the correlation between mathematics anxiety and mathematics performance.
- All the analyses were done with the SPSS version 28.0,  $\alpha = 0.05$  to test significance.

#### Analysis of Data

The analysis of data was carried out to respond to every research objective. First, descriptive statistics were used to describe the generally anxiety of the sample in mathematics. Second, comparisons between independent samples t-tests were done on mean anxiety scores between:

- Male vs. female students
- City vs. country students of habitation.
- The government vs. the students in the private schools.

Third, Pearson correlation test was used to analyze the direction and strength of the correlation between mathematics anxiety scores and mathematics performance percentages. Parametric tests (parametric normality and homogeneity of variance) were assumed before analysis. To determine practical significance as opposed to statistical significance, the effect sizes (Cohen  $d$  of t-tests,  $r$  of correlation) were computed.

**Table 1:** Presents the sample distribution across demographic variables, showing proportional representation as intended through stratified sampling.

Variable	Category	N	Percentage
Gender	Male	135	50.0%
	Female	135	50.0%
Habitat	Urban	135	50.0%
	Rural	135	50.0%
School Type	Government	135	50.0%
	Private	135	50.0%
Class	IX	135	50.0%
	X	135	50.0%
Total		270	100.0%

Table 1 confirms successful stratification with equal representation across all demographic variables.

**Data Interpretation**

The maximum score of Mathematics Anxiety Scale was 32 to 108 and the sample mean was 58.74 (SD = 18.32). The performance score of mathematics was between 35 percent and 92 percent and the mean of the sample was 62.41 percent (SD = 12.87). These variabilities imply high differences in anxiety and performance between the sample. Table 2 indicates t-test results of the group-to-group comparisons. In the case of gender differences, the math anxiety of male students was significantly higher than that

**Table 2:** Show the different Comparison Group

Comparison	Group 1 (M, SD)	Group 2 (M, SD)	t-value	df	p-value	Cohen's d
Gender	Male: 61.28, 17.95	Female: 56.20, 18.22	2.52	268	.012	0.28
Habitat	Urban: 58.91, 18.45	Rural: 58.57, 18.21	0.16	268	.873	0.02
School Type	Government: 64.32, 17.68	Private: 53.16, 16.98	5.84	268	<.001	0.66

**Findings**

1. General mathematics anxiety among the students in West Bengal is moderate to high with the mean of 58.74 out of 25-125.
2. The male students had reported much more mathematics anxiety than the female students (Ho1 rejected) as opposed to some other previous studies in India which had indicated higher mathematics anxiety among females.
3. The level of mathematics anxiety was not significantly different between students in urban and rural habitat (Ho2 retained) implying that level of locality has no significant impact on the level of anxiety in this scenario.
4. The school students of government schools indicated a significantly higher level of mathematics anxiety as compared to the school students of private schools (Ho3 was rejected), which implies that the school type is a powerful factor in mathematics anxiety.
5. There is a high negative correlation between mathematics anxiety and mathematics performance (Ho4 rejected), which proves that the greater the anxiety, the lower the performance.
6. Mathematics anxiety accounts about 75.7 percent of the variance in mathematics performance thus showing that mathematics anxiety has a significant influence on academic performance.

of female students (M = 61.28, SD = 17.95) as compared to the female students (M = 56.20, SD = 18.22),  $t(268) = 2.52$ ,  $p = .012$ ,  $d = 0.28$ . This is a small-to-medium effect size, which suggests that the difference is statistically significant, but the difference in practice is small.

In the case of differences in habitat, the urban students (M = 58.91, SD = 18.45) and the rural students (M = 58.57, SD = 18.21) did not exhibit any significant difference in mathematics anxiety which was  $t(268) = 0.16$ ,  $p = .873$ ,  $d = .02$ . The insignificant effect value proves the absence of a significant difference between the urban and the rural students.

In the case of school type differences, government school students (M = 64.32, SD = 17.68) had a greater maths anxiety level in contrast to that of the student in a private school (M = 53.16, SD = 16.98),  $t(268) = 5.84$ ,  $p < .001$ ,  $d = 0.66$ . The medium-to-large size of the effect demonstrates a significant difference between school types in relation to the level of anxiety.

The r value of Pearson correlation between mathematics anxiety and mathematics performance was  $r = -.87$ ,  $p < .001$  which showed that there was a strong negative correlation between mathematics anxiety and mathematics performance. This correlation is an indication that mathematics anxiety levels can explain a significant proportion of mathematics performance of about 75.7%.

**Discussion according to Objectives**

**Objective 1:** Determine anxiety level - The means of the sample 58.74 will show moderate to high levels of mathematics anxiety which is in agreement with the national and international results that indicated high levels of mathematics anxiety among the secondary students. Such a level implies that a good number of students develop anxiety-like situations that can disrupt their best mathematics performance.

**Objective 2:** Gender comparison - The discovery that male students showed higher anxiety than the female students goes against a number of studies conducted in the Western world and even some studies conducted in India that showed higher levels of anxiety among the females. This turnaround can be explained by the shift of gender relation in the educational context of West Bengal or the discrepancy in the expression or experience of anxiety between genders. This pattern can be contributed by the cultural aspects peculiar to the West Bengal like dissimilarities in societal expectations or in the classroom experiences.

**Objective 3:** Habitat comparison - Lack of differences based on habitat is an indication that mathematics anxiety is widespread within geographical settings of West Bengal. This observation means that anxiety reduction interventions cannot be geographically tailored but instead be expansive in both urban and rural areas.

**Objective 4:** School type comparison - The level of anxiety among the students of the government schools is significantly greater, which correlates with the differences in resources between the state and the non-state schools. The challenges in government schools are usually associated with increased class size, insufficiency of resources and inconsistencies in teacher quality and skills, which could lead to increased student anxiety. The benefits of private schools in terms of resources, smaller classes, and possibly more accommodating learning conditions can be useful in overcoming the anxiety.

**Objective 5:** Anxiety-performance relationship - This is a strong negative correlation ( $r = -.87$ ) stronger than the literature ( $r = -.30$  to  $-.70$ ) would indicate and may indicate a very strong relationship in this sample. This connection helps to believe in the cognitive interference hypothesis of mathematics anxiety, in which the worry appropriates working memory resources required to do mathematics.

**Objective 6:** Suggestions for reduction - On the findings, interventions must consider giving priority to: (a) students in government schools that exhibit the highest levels of anxiety; (b) male students who counter intuitively exhibit the highest levels of anxiety; (c) interventions that focus on the high levels of anxiety-performance association; and (d) interventions that are universally applicable to habitat conditions.

#### Limitations

1. The cross-sectional design makes it impossible to draw causal conclusions regarding the relationship between anxiety and performance.
2. Self-report instruments of anxiety can be affected by the social desirability bias, but anonymity was insisted on.
3. The sample, though being stratified, might not be a complete representation of all the socioeconomic and cultural subgroups of West Bengal.
4. The performance of mathematics was only gauged using annual exams that did not reflect other areas of mathematical performance.
5. The research failed to focus on the possible mediating or moderating factors (e.g., instructional strategies, parental views, past mathematical experiences).
6. The results might not be applicable to other students not included in classes IX-X or to other educational boards other than WBBSE and CBSE.
7. Piloted, the adaptation of the Mathematics Anxiety Scale might have failed to represent culture-specific expression of anxiety in West Bengal.

#### Suggestion for Future Research

1. Longitudinal research of mathematics anxiety and performance in more than one academic year to determine direction associations.
2. Intervention studies the testing of the particular anxiety reduction methods (cognitive-behavioral, mindfulness, growth mindset interventions), in West Bengal secondary schools.
3. Qualitative studies examining the lived experience of mathematics anxiety by students based on interview

and focus groups as a way of corroborating quantitative results.

4. Analysis of other variables including classroom climate, teaching methods, parental involvement and peer factors with regards to mathematics anxiety.
5. Comparison between the various educational boards (WBBSE, CBSE, ICSE) and different educational stages (primary, secondary, higher secondary) in West Bengal.
6. Neuroscientific/ psychophysiological research on physiological correlates of mathematics anxiety among West Bengali students.
7. Establishment and testing of mathematics anxiety assessment instruments with local linguistic and cultural anxiety expressions in West Bengal.

#### Conclusion

This research gives useful information about mathematics anxiety among students of secondary schools in West Bengal. The average to high levels of anxiety measured especially in male students and those in government schools depict a strong affective inhibition to math learning in the area. This negative correlation between math anxiety and performance has been found to be strong and hence the need to consider the emotional aspects in the teaching of mathematics, in addition to the cognitive instruction.

The results conflict with some of the existing gender stereotypes in mathematics anxiety studies and support the negative effect of anxiety on performance. This absence of habitat-related differences may imply that the anxiety is a universal issue that should be addressed at the state level instead of being addressed in the area-specific manner. The large differences in school types indicate systematic inequities which might need to be addressed on a policy level to the aspect of resources allocation and the quality of education.

These findings indicate that a successful reform in mathematics education in West Bengal should be designed to focus not only on the intellectual aspects of the experiences of students in the subject but also on the emotional ones. Focusing on anxiety reduction interventions, especially in governmental schools and subjects among male students, can have a beneficial outcome in terms of student wellbeing and mathematics performance. Future research needs to be done on culturally specific, evidence-based interventions to meet the particular curves of mathematics anxiety in the multicultural education environment of West Bengal.

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