NSOU-OPEN JOURNAL **ISSN: 2581-5415**
Vol.2 No.1 (Jan 2019)
A multidisciplinary Online Journal of Netaji Subhas Open University, INDIA

Mathematics anxiety and Prevention Strategies: An attempt to improvement of Mathematics Performance of Secondary School Students in West Bengal

Arup Kumar Mandal
Ph.D. scholar
Department of Education, University of Calcutta
E-mail- madalarup@gmail.com
and
BijoyaSaha, Assistant Professor
Department of Education, Calcutta Girls' College
E-mail- bijoyasona@gmail.com

Abstract
In this 21st century equality of both boys and girls has become a major issue. In this study researcher wanted to find out the differences between on specific independent variables with dependent variables.Additionally, based on the literatures mention, somestrategies to reduce mathematics anxiety were identified for practice. In this study investigator randomly selected government and private schools from Kolkata and South 24 parganas district in the West Bengal. Mathematics anxiety was measured using a standardized instrument whereas, students' mathematics performance was collected from the progressive report of the schools. Results revealed that there are significant differences in mathematics anxiety and performance in mathematics on gender and type of schools but there is no significant difference between habitat in mathematics anxiety and performance in mathematics.

Key words:mathematics anxiety, performance in mathematics, secondary school students.

Introduction
In 1972 Richardson and Suinn explained about mathematics anxiety that 'Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations.'Generally mathematics anxiety means- it is a fear of mathematics.Furthermore that it is a negative emotion that interferes with the solving of mathematical problems and disliking mathematics leads to students avoid taking mathematics classes and avoid situations in which mathematics will be necessary. Various terms like Quant phobia (Goldberg & Waxman,2003), math phobia (Hilton, 1980) and math phobia (Pan & Tang, 2005) has used in many literatures in the same phenomenon but maximum investigators prefer the term mathematics anxiety. Many mathematicians in India and other countries have deeply expressed unhappiness due to the lack of application concepts of mathematics techniques in daily life. According to Hembree (1990) reported that when students avoid the study of mathematics, it erodes the country's resources base in science and technology, since it is a base for science and technological fields, another side of non-technical fields such as education, business, social and behavioral sciences, humanities and the arts mathematical skills are also needed. So it is essential in this competitive, rapidly changing environment, to strengthen students' mathematics achievement in schools.Mathematical skill is most important for all levels of students in education and also for competitive examiners'.

Literature review
Guita and Tan (2018) carried out a research on Mathematics Anxiety and Students' Academic Achievement in a Reciprocal Learning Environment.
The study determined the mathematics anxiety and students' academic achievement in a reciprocal learning environment. It sought to determine the level of achievement of students when exposed to reciprocal learning environment (RLE) and to those exposed to non- reciprocal learning environment (non- RLE). The study utilized a quasi- experimental research design which was conducted at Magpet National High School, Poblacion, Magpet, North

Cotabato. Students in Grade 8 were the research respondents of the study. Results showed that the students who are exposed to RLE have “very low performance” in the pretest and have “moderate performance” in the posttest and retention test while those who were exposed to Non- RLE also have “very low performance” in the pretest and have “moderate performance” in the posttest and retention test. Moreover, for the level of students’ anxiety towards mathematics, they have high anxiety before the treatment and becomes moderate after the intervention for both RLE and Non- RLE groups. The mathematics achievement of the students who were exposed to RLE is comparable to the achievement of those students who were exposed to non- RLE. Also, no significant difference in the mathematics anxiety of students was observed in both groups.

Foley (2017) studied on The Math Anxiety-Performance Link: A Global Phenomenon.
To effectively meet this demand, many governments and private organizations have revamped science, technology, engineering and math(STEM) education and promoted training to enhance math and science skills among students and workers. Education and training programs typically focus on increasing individuals’ math and science knowledge. However, data from laboratory studies and large-scale international assessments suggest that fear or apprehension about math, math anxiety, should also be considered when trying to increase math achievement and, in turn, STEM career success.This article reviews findings that shed light on antecedents of math anxiety, the bidirectional math anxiety-performance relation, underlying mechanisms, and promising routes to mitigating the negative relation between math anxiety and math performance.

Passolunghi et al. (2016) worked on Mathematics Anxiety, Working Memory, and Mathematics Performance in Secondary-School Children.
The present study aimed to analyze the academic achievement and cognitive profiles of students with high math anxiety (HMA) and low math anxiety (LMA). Specifically, 32 students with HMA and 34 with LMA matched for age, gender, generalized anxiety, and vocabulary attending sixth to eighth grades was selected from a larger sample. The two groups were tested on reading decoding, reading comprehension, mathematics achievement, and on verbal short-term memory and WM. Our findings showed that HMA students were weak in several measures of mathematics achievement, but not in reading and writing skills, and that students with HMA reported lower scores on short-term memory and WM performances (with associated difficulties in inhibiting irrelevant information) than children with LMA. In addition, a logistic regression showed that weaknesses in inhibitory control and fact retrieval were the strongest variables for classifying children as having HMA or LMA.

Beilock and Maloney (2015) worked on A qualitative study about mathematics anxiety: a factor in mathematics achievement not to be ignored.
They focused on mathematics anxiety and the implications mathematics anxiety carriers for mathematics success and science, technology, engineering and mathematics (STEM) engagement. They suggested that policymakers to consider affective factors, mathematics anxiety, when designing programs aimed at increasing the size of the STEM workforce. By educating the pre-service and already established teachers— who can, in turn, educate their students and their parents—on the negative role of mathematics anxiety in mathematics achievement as well as how to reduce the negative consequences of mathematics anxiety, and by creating programs designed to encourage highly mathematics-anxious students in mathematics.

Ballado (2014) made a study onMathematics anxiety and academic achievement of junior pre-service teacher education students
The main purpose of the study was to find out the correlation of the level of mathematics anxiety to the academic achievement of junior students taking up Bachelor of Elementary Education. Specifically, the study tried to determine the level of mathematics anxiety and academic achievement in mathematics and ascertain their relationship. It also determined the significant differences between male and female anxiety level and math achievement. The investigator chose a 24-item Mathematics Anxiety Inventory. The outcomes revealed that majority of the respondents have Moderate to High anxiety levels. There was a significant difference in the mathematics anxiety levels of male and female students. A significant negative relationship was found between anxiety level and mathematics achievement.

Shaikh (2013) madea study on Mathematics Anxiety Factors and Their Influence on Performance in

Mathematics in Selected International Schools in Bangkok.

Purpose of the study were- 1) To determine the level of Performance in Mathematics of Grade 4 students in selected international schools in Bangkok in terms of Knowledge skills, Comprehension skills, Application skills, Analysis skills, Synthesis Skills, and Evaluation skills. 2) To determine the level of Mathematics Anxiety of Grade 4 students in terms of Cognitive factors, Psychological factors, Physical factors, and Environmental factors. 3) To investigate the influence of Math Anxiety factors on Performance in Mathematics. The study utilized the descriptive method. The instrument employed for collecting the data was a Math Anxiety Opinionnaire (MARS) developed by Richardson and Suinn (1972). Result revealed that- a) The results showed that the highest level of Performance in Mathematics is in the Comprehension skills and the lowest is Knowledge skills. b) Environmental factors produce the highest level of anxiety among the students. c) Physical factors had the highest influence on Performance in Mathematics.

The gaps identified

From the above studies, investigator has identified the following gaps. The current research work is different from the rest of the studies such as there are little research conducted in West Bengal relating to mathematics anxiety and mathematics performance among secondary school students. So that the current work makes an earnest attempt to review the researches on mathematics anxiety effect on mathematics performance.

Research methodology

Objectives

- To study the difference in the mathematics anxiety of secondary school students on gender basis.
- To study the difference in the performance in mathematics of secondary school students on gender basis.
- To study the difference in the mathematics anxiety of secondary school students with respect to habitat.
- To study the difference in the performance in mathematics of secondary school students with respect to habitat.
- To find out the difference in the mathematics anxiety of secondary school students with respect to type of schools.
- To find out the difference in the performance in mathematics of secondary school students with respect to type of schools.
- To provide suggestions on strategies that can be used by students to reduce or overcome mathematics anxiety.

Hypotheses

In this study objective wise hypotheses are-

Ho_1: There is no significant difference in the mathematics anxiety of secondary school students on gender basis.

Ho_2: There is no significant difference in the performance in mathematics of secondary school students on gender basis.

Ho_3There is no significant difference in mathematics anxiety of secondary school students in respect to habitat.

Ho_4: There is no significant difference in the performance in mathematics of secondary school students in respect to habitat.

Ho_5: There is no significant difference in the mathematics anxiety of secondary school students in respect to type of schools.

Ho_6: There is no significant difference in the performance in mathematics of secondary school students in respect to type of schools.

Definition of the important terms

*Mathematics Anxiety:*In 2011 Vahedi and Farrokhi defined 'mathematics anxiety as negative cognitions, avoidance behaviors and feeling pressured and inadequate in performance that combined interfere with solving math related problems in both general life and academic situations.'

In this study, mathematics anxiety means- apprehensive, tense/stressed, anxious, feeling of fear and avoidance when dealing with any situation relating to mathematics.

Performance in mathematics: Marks obtained in mathematics of annual examination of classes IX and X students are considered as performance in mathematics in this current work.

Secondary school students: In this study secondary school students means class IX and X under the West Bengal Board of Secondary Education and Central Board of Secondary Education.

Variables

Independent variable:

Gender (Boys and Girls)
Habitat (Urban and Rural areas)
Type of School (Government and Private schools)

Dependent variable:

Mathematics anxiety
Performance in mathematics

Instrument

A standardized Mathematics Anxiety Scale by Mahmood and Khatoon (2011) was used in this current work. Progress report register of the school for classes IX and X was used for the performance in mathematics.

Procedure

The procedure of the study which was followed by the researcher is as follows:

Step 1=>at first the questionnaire of mathematics anxiety prepare. Step 2=> Selection of schools as well as selection of students from different schools. Step 3=> Selection and local adaptation of tools for the study. Step 4=> a) Primary data collected from the selected sample groups by the questionnaire. b) Tabulation of test data to meet the requirement of hypothesis testing.

Population

Government and Privatesecondary school students under the West Bengal Board of Secondary Education and Central Board of Secondary Education of classes IX and X of both sexes of urban and rural areas in the West Bengal was selected.

Sample

300 secondary school students of classes IX and X of both sexes of urban and rural areas wereselected as sample.

Sampling techniques

Stratified random sampling technique was followed for the selection of the students and schools.

Delimitation of the study

In this current research work researcher has selected 300 secondary school students, studying in IX and X grade of both sexes (150 boys and 150 girls) from the West Bengal Board of Secondary Educationand Central Board of Secondary Education, schools situated in urban and rural areas of Kolkata and South 24 parganas district in the West Bengal. In this study the independent variables werei) Gender (boys and girls) ii) Habitat (urban and rural areas) and iii) Types of school (government and private) and dependent variables were a) mathematics anxiety and b) performance in mathematics score. Only Mathematics Anxiety Scale was used as instrument to assess the anxiety of secondary school students.

Results

Based on the objectives, the results of the data are demonstrated in the different tables and its interpretation are given below:

Objective 1

To study the difference in the mathematics anxiety of secondary school students on gender basis.

Table 1: Mathematics anxiety of Secondary School students

Variable	**Boys (N=150)**	**Girls (N=150)**	**t-value**	**Sig./not sig.**
Mathematics anxiety	**Mean=45.38 S.D.=7.17**	**Mean=43.08 S.D.= 8.28**	**-2.55**	**Sig. at 0.05**

Table 1 illustrates that the mean, S.D. and 't' scores of the mathematics anxiety of secondary school students of both boys (N= 150) and girls (N= 150). Though the mean score of boys indicates high score (M= 45.38) than the girls (M= 43.08), the 't' score (t= - 2.55) with degrees of freedom is 298 clearly indicate that there is significant difference (table value of 't' at 0.05 level is 1.96) between boys and girls in mathematics anxiety. So the null hypothesis is rejected.Thus, there is significant difference in the mathematics anxiety of secondary school students on gender basis.

Objective 2

To study the difference in the performance in mathematics of secondary school students on gender basis.

Table2:Performance in mathematics of secondary school students

Variable	**Boys (N=150)**	**Girls (N=150)**	**t-value**	**Sig./not sig.**
Performance in mathematics	**Mean = 30.02 S.D.= 10.37**	**Mean=27.65 S.D.= 8.75**	**-2.17**	**Sig. at 0.05**

Table 2 illustrates that the mean, S.D. and 't' scores of the performance in mathematics of secondary school students of both boys (N= 150) and girls (N= 150).Though the mean score of boys indicates high score (M= 30.02) than the girls (M= 27.65) and the 't' score (t= - 2.17) with degrees of freedom is 298 clearly indicate that there is significant difference (table value of 't' at 0.05 level is 1.96) between boys and girls in performance in mathematics. Sothe null hypothesis is rejected. Thus, there is significant difference in the performance in mathematics of secondary school students on gender basis.

Objective 3

To study the difference in the mathematics anxiety of secondary school students in respect to habitat.

Table 3: Mathematics anxiety of secondary school students with respect to habitat

Variable	Urban (N=150)	Rural (N=150)	't' value	Sig./not sig.
Mathematics anxiety	Mean= 23.56 S.D.= 5.62	Mean= 27.38 S.D.= 4.56	1.79	Not sig.

Table 3 illustrates that the habitat wise (urban and rural areas) differences in mean, S.D. and t-value of mathematics anxiety of secondary school students'. Though the mean score is high of rural areas than urban areas but the t-value (t=1.79) with degrees of freedom is 298 showed no significant difference in mathematics anxiety between the two groups (urban and rural areas). So the null hypothesis is accepted. Thus, there is no significant difference in the mathematics anxiety of secondary school students in respect to habitat.

Objective 4

To study the difference in the performance in mathematics of secondary school students with respect to habitat.

Table 4: Performance in mathematics of secondary school students with respect to habitat

Variable	Urban (N=150)	Rural (N=150)	't' value	Sig./not sig.
Performance in mathematics	Mean= 30.46	Mean= 26.30 S.D.=9.06	1.80	Not significant

The mean, S.D. and t-value for all groups of habitat are represented in above table 4.Though the mean score indicated differences among the two groups of habitat (urban and rural areas) but t-value (t= 1.80) with degrees of freedom is 298 showed no significant difference in performance in mathematics between the two groups (urban and rural areas). So the null hypothesis is accepted. Thus, there is no significant difference in the performance in mathematics of secondary school students with respect to habitat.

Objective 5

To find out the difference in the mathematics anxiety of secondary school students with respect to type of schools.

Table 5: Mathematics anxiety of secondary school students with respect to type of schools

Variable	Government schools (N=150)	Private schools (N=150)	t-value	Sig./ Not sig.
Mathematics anxiety	Mean= 30.71 S.D.=6.91	Mean= 27.95 S.D.= 8.36	-2.12	Sig. at 0.05

The Table 5 describes the mean score of mathematics anxiety of government schools is 30.71 with standard deviation (S.D.) is 6.91 and private schools mean is 27.95 with S.D. is 8.36. The t-value has been calculated as -2.12, which is significant at 0.05 level because according the t table at the 95% confidence interval with 298 degrees of freedom i.e. 1.96. So the null hypothesis is rejected. Thus the result clearly indicates that there is a significant difference in the mathematics anxiety of secondary school students with respect to type of schools.

Objective 6

To find out the difference in the performance in mathematics of secondary school students in respect to type of schools.

Table 6: Performance in mathematics of secondary school students with respect to type of schools

Variables	Government schools (N=150)	Private schools (N=150)	t-value	Sig./Not sig.

Performance in mathematics	**Mean= 32.56 S.D.=6.54**	**Mean=46.53 S.D.=3.20**	**2.52**	**Sig. at 0.05**

The Table 6 describes the mean score of performance in mathematics of government schools is 32.56 with S.D. is 6.54 and private schools mean is 46.53 with S.D. is 3.20. The t-value has been calculated as 2.52, which is significant at 0.05 level because according the t table at the 95% confidence interval with 298 degrees of freedom i.e. 1.96. So the null hypothesis is rejected. Thus, the result clearly indicates that there is a significant difference in the performance in mathematics of secondary school students in respect to type of schools.

Objective 7

To provide suggestions on strategies that can be used by students to reduce or overcome mathematics anxiety.

There are various strategies for reducing mathematics anxiety. These are described as below:

Student strategies for reducing mathematics anxiety

a) Practice mathematics every day

'Researchers recommend that students practice mathematics problems daily. They emphasize that repetition is important in mathematics and that with practice; students will develop the confidence needed to solve mathematical problems.

b) Use good study techniques

Students should become acquainted with good study techniques. For example, space out studying time to increase retention; study in a location with few distractions; and don't over-study because it can lead to information overload.

c) Study according to one's own learning style

To reduce mathematics anxiety, students should study according to their individual learning style. For example, visual learners learn by using pictures, diagrams, illustrated textbooks, and videos; auditory learners learn best through verbal lectures, discussions, and talking things through with others; and tactile/kinesthetic learners learn through a hands-on approach and active exploration within their environment.

d) Focus on past successes

Unsuccessful experiences with mathematics may cause students to doubt their ability to do well in mathematics, so researchers suggest that students focus on past successes rather than failures. Students can build their confidence in mathematics through gradual, repeated success.

e) Ask for help

Students should immediately seek assistance when they don't understand a mathematics concept. If a student needs extra help, it is often better to be tutored by someone other than the classroom mathematics teacher because other individuals may have different ways of explaining concepts that are easier for the student to comprehend.

f) Practice relaxation techniques

Students practice relaxation techniques to reduce mathematics anxiety, such as deep breathing, visualization, positive messages, and frustration breaks.

Discussion

The results of the analysis of data have shown the differencegender, habitat and also type of schools with mathematics anxiety and also performance in mathematics. There are significant difference in mathematics anxiety and performance in mathematics between boys and girls. Boys indicate high score than girls in mathematics anxiety and performance in mathematics. There are no significant difference in mathematics anxiety and performance in mathematics between urban and rural areas. Rural areas indicate high score than urban areas in mathematics anxiety also urban areas indicate high score in performance in mathematics.There are significant difference in mathematics anxiety and performance in mathematics between types of schools. Government schools indicate that high score than private schools in mathematics anxiety, also private schools indicate better in mathematics performance than government schools.

References

Aiken, L. R. (1974). Two scale of attitude toward mathematics. *Journal for research in mathematics education, 5,* 67-71.

Akin, A., &Kurbanoglu, (2011). The relationship between mathematics anxiety, mathematics attitudes, and self-efficacy: A structural equation model. *StudiaPsychologica, 53*, 263-273.

Alkan. Vesile (2013). Reduction Mathematics Anxiety: The Ways of Implemented by Teachers at Primary Schools. *International Journal Social Science and Education, 3*(2), pp. - 795-803.

Arem, C. A. (2009). *Conquering Mathematics Anxiety. 3rd Edn.*, Cengage Learning, Belmont. ISBN-10: 0495829404, pp: 215.

Bowed, A. D., & Brady, P. H. (2002). Factorial Structure of the Revised Mathematics Anxiety Rating Scale for Undergraduate Education Majors. *Psychological Reports, 91*, 199-200.

Byrd, P. (1982). *A descriptive study of mathematics anxiety: Its nature and antecedents*. (Doctoral dissertation). Indiana University.

Campbell, K. T., & Evans, C. (1997). Gender issues in the classroom: A comparison of mathematics anxiety. Education, 117, 332-339.

Chiu, L. H., & Henry, L. L. (1990). Developments and Validation of the Mathematics Anxiety Scale for Children. *Measurement and Evaluation in Counselling and Development, 23*, 121-127.

Dew, K. M. H., Galassi, J. P., &Galassi, M. D. (1983). Mathematics anxiety: Some basic issues. *Journal of Counselling Psychology, 30*, 443-446.

citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.523.6618&rep=rep1...

https://core.ac.uk/download/pdf/46946573.pdf

https://www.ispacs.com/journals/metr/2018/metr-00096/article.pdf

https://eujournal.org/index.php/esj/article/viewFile/6891/6610

http://www.academia.edu/35733852/Math_Anxiety_Causes_and_Solutions_A_Literature_Review

https://www.researchgate.net/publication/326543424_Mathematics_Anxiety_and_Students'_Academic_Achievement_in_a_Reciprocal_Learning_Environment

https://journals.sagepub.com/doi/abs/10.1177/0963721416672463

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4735424/

https://journals.sagepub.com/doi/abs/10.1177/2372732215601438

https://www.westeastinstitute.com/wp-content/uploads/2014/06/RONATO-S.-BALLADO.pdf

file:///C:/Users/Admin/Downloads/103-1-103-1-10-20160308.pdf.Ω