

## IMPACT OF MATHEMATICS ANXIETY ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT

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### ABSTRACT

Mathematics knowledge is necessary for secondary school students. Mathematics anxiety is a feeling of tension or fear that affects the performance of students in mathematics. The present investigation has been conducted to study Mathematics anxiety with respect to gender, locality and its relationship with academic achievement. The study employed descriptive survey method. The sample size is 105 secondary school students from Bankura district in West Bengal. The instrument (Effect of Mathematics Anxiety on Academic Performance Scale) used to measure the differences has been developed by the investigators. The data has been analyzed by using 't'-test and Pearson correlation. Analysis of the 't'-test results for gender show that there is no significant differences of anxiety towards mathematics between boys and girls students and 't'-test results for locality show that there is no significant differences of anxiety towards mathematics between rural and urban area students. Though the correlation test shows a significant and positive relationship between student's mathematics achievement and their academic achievement with correlation value  $r = 0.001$ , it indicates almost no effect of mathematics anxiety on their academic achievement.

**Keywords :** Math anxiety, Academic achievement, Pearson correlation, gender, locality

### INTRODUCTION

Geometry teaches logical thinking and natural design, algebra gives the idea of functional dependence and generalization, arithmetic is the language of commercial activity. All these combine to produce very valuable literature of interpretation, progress and control. Mathematics is based on understanding science, engineering, technology and economics. It is essential for participation in the knowledge economy and in public decision making. Mathematics as an expression of the human mind reflects the active will, the desire for aesthetic perfection and the contemplative reason. Its basic elements

are logic and institution, analysis and construction, generality and individuality (Courant & Robbins, 1996, p. 1). Mathematics is a language by which we can carefully defined terms and symbols. It is considered as a tool used by everyone in the course of daily life (Reys, Suyadam & Lindquist, 1995, p. 2). Thus mathematical knowledge contributes to enhancing the workforce, insights and skills in a variety of situations and contexts. Long ago mathematics is considered a difficult subject. One of the attributed reasons for it is anxiety. Mathematics anxiety is distinct from general anxiety. Yee (1987) in his study founded that mathematics anxiety seems to act as a facilitator in their mathematics performance. Mohamed & Tarmizi (2010) in their study mentioned that students' performances are impacted with mathematics anxiety. It describes the states of mind developed through personal experience and individual emotional responses to these experiences. It may lead to poor achievement and avoidance of mathematics.

On the other hand, mathematical thinking is important for every individual of modern society as a habit of mind for its use in the workplace, for personal decision making and business and finance. So mathematics knowledge is necessary for secondary school students; it is very useful for higher education. Mathematics anxiety is one of the psychological barriers. Students encounter that when they are performing a mathematics task. It can negatively impact an individual's initial learning of mathematics. Kumar (2014) in his study examined the psychological stress in relation to achievement among the students. He founded that low stressed students get higher achievement than high stressed students. Math anxiety is described as "feelings of tension and anxiety that interfere with the manipulation of mathematical problems in a wide variety of ordinary life and academic situations". This indifference towards the subject is a serious problem for any school administration (Richardson and Suinn, 1972, as cited in Sherman & Wither (2003). 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. Math anxiety is an intense emotional feeling of anxiety that people who suffer from math anxiety feel that they are incapable of doing activities and mathematics in classes. Mathematics anxiety has consistently been proven to be debilitating on mathematics achievement (Foong, 1987; Hembree, 1990; Ma, 1999; Preston, 2008, as cited in Ng, 2012). Research has found it to be a learned behavior, often arising early in one's educational experience and once it lays roots, its damaging effects will last through the school years. Good (1959) defined achievement in mathematics as "knowledge attained or skills developed in the school subjects usually test scores or by marks assigned by teachers". According to Kulkarni (1970), "Mathematical achievement refers to the understanding of mathematical concepts, application of knowledge to new situations and logical reasoning as involved in interpretation of

data, interpretation of missing link, etc.” (as cited in Kundu & Kar, 2018). Mathematics achievement refers to not only to obtain excellent marks in the final examination but it also refers to the attainment of the mathematical ability and skills. Mathematics achievement is an essential part of the academic achievement in modern society. Traditionally it is believed that girls are weaker in math than boys. Şahin (2008) & Abbasi, Samadzadeh, & Shahbazzadegan (2012) in their study mentioned that no significant difference exists in math achievement with respect to gender. Students’ fear of mathematics and their study habits affects their self-confidence in the subject. Low attitude towards the subject could considerably reduce a student’s willingness to persist with a problem and this may hinder the development of good study habits. As a result of the fear and low attitude towards mathematics, secondary school students may also lose interest in the subject and think not to continue it at a higher level. This indifference towards the subject is a serious problem for any secondary school student and school administration. A limited number of research works mentioned the performance of mathematics due to math anxiety but no investigation till now found whether math anxiety differs with respect to locality and also the correlation between mathematics anxiety and academic achievements. The present investigators conducted this study with the following objectives.

### **Objectives**

O<sub>1</sub>: To find out the effect of mathematics anxiety on the academic performance of secondary school students with respect to gender.

O<sub>2</sub>: To study the effect of mathematics anxiety on the academic performance of secondary school students with respect to a locality.

O<sub>3</sub>: To assess the level of academic performance of secondary school students.

O<sub>4</sub>: To explore the relationship between mathematics anxiety and academic performance of secondary school students.

### **Hypotheses and Research question:**

For Objective 1, one hypothesis is framed;

H<sub>01</sub>: There is no significant difference in the effect of mathematics anxiety on the academic performance of secondary school students with respect to gender.

For Objective 2, one hypothesis is framed;

H<sub>02</sub>: There is no significant difference in the effect of mathematics anxiety on academic performance of secondary school students with respect to a locality.

For Objective 3, one research question is framed;

RQ<sub>1</sub>: What is the level of academic performance of secondary school students.

For Objective 4, one hypothesis is framed;

$H_0$ 4: There is no significant relationship between mathematics anxiety and academic performance of secondary school students.

## Method

The present study is quantitative in nature. Descriptive survey design has been employed for conducting this study. The investigators measure the anxiety in mathematics and the academic achievement of secondary school students.

## Population

Bankura district is situated in the western part of West Bengal. In this district, there are three subdivisions. Among them, the Bishnupur sub-division is selected randomly. Among the blocks of the Bishnupur sub-division Kotalpur block is selected randomly as the population of the study.

## Sample

105 secondary school students from different schools are taken as sample for this study. Two (02) schools from rural areas (Panchayet area) and two (02) schools from an urban area (Block area) are selected from Kotalpur block randomly. According to the requirement of the study, the present researchers have been used the following standardized tool. This tool has been developed by the investigators. With the help of the tool viz.,

- Effect of Mathematics Anxiety on Academic Performance Scale (EMAAPS)

data are collected from each school. Among them, 50.48 % of students are in the urban area and 49.52 % of students were in the rural area. Male and female students' percentages are accordingly 50.48 % and 49.52 %.

## Result

For  $H_0$ 1:

**Table 1: Group statistics of the effect of mathematics anxiety on academic performance of secondary school students with respect to gender**

| Gender | N  | Mean  | Std. Deviation | Std. Error Mean |
|--------|----|-------|----------------|-----------------|
| Female | 52 | 80.48 | 7.54           | 1.05            |
| Male   | 53 | 78.32 | 7.82           | 1.07            |

Table 1 shows that the mean score of girls' mathematics anxiety on academic performance ( $M=80.48$ ,  $S.D.=7.54$ ) is higher than the mean score of boys' mathematics anxiety on academic

performance ( $M=78.32$ ,  $S.D.=7.82$ ) in the secondary section. Parental educational thought, school environment, etc. may be the reason. Girls' attitude towards science group grows since their childhood.

**Table 2: Independent Samples 't'-test of mathematics anxiety on academic performance of secondary school students with respect to gender**

|                                             |                             | Levene's Test for Equality of Variances |          | t-test for Equality of Means |        |                     |                 |
|---------------------------------------------|-----------------------------|-----------------------------------------|----------|------------------------------|--------|---------------------|-----------------|
|                                             |                             | F                                       | Sig. (p) | T                            | df     | Sig. (2-tailed) (p) | Mean Difference |
| mathematics anxiety on academic performance | Equal variances assumed     | 0.35                                    | 0.56     | 1.44                         | 103    | 0.15                | 2.16            |
|                                             | Equal variances not assumed |                                         |          | 1.44                         | 102.97 | 0.15                | 2.16            |

From table 2, it is observed that in case of Levene's Test for Equality of Variances for mathematics anxiety on academic performance of secondary school students with respect to gender calculated F value is 0.35 and p value is 0.56 ( $p>0.05$ ). Hence, equal variances can be assumed between the groups. For testing the significance of difference between the mean score of male and female, the calculated  $t_{(103)} = 1.44$  and  $p = 0.15$  ( $p>0.05$ ). Therefore 't' is not significant at 0.05 level of significance. Hence,  $H_0$  is not rejected. Thus it can be concluded that there is no significant difference in mathematics anxiety on the academic performance of secondary school students with respect to gender.

For  $H_0$ 2:

**Table 3: Group statistics of effect of mathematics anxiety on academic performance of secondary school students with respect to locality**

| Locality | N  | Mean  | Std. Deviation | Std. Error Mean |
|----------|----|-------|----------------|-----------------|
| Rural    | 52 | 78.79 | 8.36           | 1.16            |
| Urban    | 53 | 79.98 | 7.07           | 0.97            |

Table 3 shows that mean score of rural area students' mathematics anxiety on academic performance ( $M=78.79$ ,  $S.D.=8.36$ ) are lower than the mean score of urban area students' mathematics anxiety on academic performance ( $M=79.98$ ,  $S.D.=7.07$ ) in the secondary section. Due to the school environment and also societal context rural area students fall behind urban area students.

Table 4: Independent Samples 't'-test of mathematics anxiety on academic performance of secondary school students with respect to locality

|                                             |                             | Levene's Test for Equality of Variances |          | t-test for Equality of Means |       |                     |                 |
|---------------------------------------------|-----------------------------|-----------------------------------------|----------|------------------------------|-------|---------------------|-----------------|
|                                             |                             | F                                       | Sig. (p) | t                            | df    | Sig. (2-tailed) (p) | Mean Difference |
| mathematics anxiety on academic performance | Equal variances assumed     | 1.63                                    | 0.20     | 0.79                         | 103   | 0.43                | 1.19            |
|                                             | Equal variances not assumed |                                         |          | 0.79                         | 99.59 | 0.43                | 1.19            |

From table 4, it is observed that in the case of Levene's Test for Equality of Variances for mathematics anxiety on academic performance of secondary school students with respect to locality calculated F value is 1.63 and p value is 0.20 ( $p > 0.05$ ). Hence, equal variances can be assumed between the groups. For testing the significance of the difference between the mean score of rural and urban area students, the calculated  $t_{(103)} = 0.79$  and  $p = 0.43$  ( $p > 0.05$ ). Therefore 't' is not significant at 0.05 level of significance. Hence,  $H_0$  is not rejected. Thus it can be concluded that there is no significant difference in mathematics anxiety on the academic performance of secondary school students with respect to the locality.

For  $H_0$ 3:

Table 5: Group statistics of academic performance of secondary school students

|            | Mean  | Std. Deviation | N   |
|------------|-------|----------------|-----|
| Total      | 79.39 | 7.722          | 105 |
| % of marks | 63.33 | 11.026         | 105 |

Table 5 shows that mean of academic performance ( $M=63.33$ ,  $S.D.=11.03$ ) of secondary school students is not excellent. But mean is above 60% which indicates that they are interested to access education irrespective of mathematics anxiety. It indicates that the level of academic performance of secondary school students are good.

For  $H_0$  4:

**Table 6: Correlation matrix between mathematics anxiety and academic performance of secondary school students**

|                                    | Mathematics anxiety | % of marks<br>in final examination |
|------------------------------------|---------------------|------------------------------------|
| Mathematics anxiety                | 1                   | 0.001                              |
| % of marks<br>in final examination | 0.001               | 1                                  |

From table 6 it is clear that coefficient of correlation,  $r = 0.001$ . It indicates that there exist positive correlation but the value is too small. Thus it can be concluded that there is no significant relationship between mathematics anxiety and academic performance of secondary school students.

### Discussion

In the present study, major findings are based on academic performance due to the mathematics anxiety of secondary school students with respect to gender and locality and also the correlation between mathematics anxiety and academic performance.

Results revealed that no significant difference exists in academic performance due to mathematics anxiety with respect to gender and locality. Results also revealed that positive correlation exists between academic performance and mathematics anxiety, but a value of  $r$  is very low which indicates that few backward students dropped out due to low scores in the final examination. The only reason for it is not only the mathematics phobia but also lack of interest in formal education.

Yee (1987), Mohamed & Tarmizi (2010), Kumar (2014) in their study mentioned that high anxiety in mathematics creates low achievements. Lay (2012), Onwuka & Tibi (2014) in their study mentioned that teachers can eradicate the mathematics phobia with proper teaching strategy. Abbasi, Samadzadeh, & Shahbazzadegan (2013) revealed that there was not a significant relationship between the high school students' mathematics anxiety and their educational levels. Halder (2015) revealed that there was a negative significant correlation between mathematics anxiety and socio-economic status with respect to their gender and locality. No viable studies were done on academic performance due to mathematics anxiety but results showed that mathematics performance depends upon mathematics anxiety. Thus the previous studies corroborate the findings of the present study that mathematics anxiety has little bit impact on students' academic achievements. Who are basically backwards, their academic performance deteriorates due to lack of interest in education not only in mathematics. On the other hand, students who scored a comparatively lower percentage in mathematics tend to choose arts stream in the higher secondary section. So mathematics anxiety is not the barrier to success of secondary students. Appropriate teaching strategy, motivation, parental positive thought, etc. may recover this type of anxiety.

## Conclusion

Mathematics provides an effective way of building mental discipline and enhances logical thinking capacity and mental rigor. In addition to this mathematical knowledge plays a vital role in understanding the contents of other school subjects such as science, social studies, and even music, art etc. Academic achievement in students is influenced by several psychological factors. Math anxiety is a problem that can affect children's academic achievement and future employment prospects. Results reveal that gender-related factors and locality related factors do not influence mathematics anxiety. This study also shows that there exists a positive correlation between academic achievement and mathematics anxiety of secondary school students. But the poor value of correlation coefficient signifies that due to anxiety in mathematics few students score comparatively poor marks in mathematics but their attitude towards education does not hamper. From the secondary section they ambitious to continue their higher education in arts or commerce stream. In the case of a certain number of students, mathematics may be a tough subject so that they try to avoid it. But this avoidance due to anxiety of it may be eradicated for their future life. Teachers, parents may play a crucial role to reduce it. They should attempt to understand mathematics anxiety and implement teaching and learning strategies so that secondary students can overcome their anxiety. Removal of mathematics anxiety doesn't mean to score high marks in mathematics but to love mathematics. Thus, this study has implications for teachers, schools and parents. They should encourage them with a vested interest in the success to take into account math anxiety levels before determining effective and appropriate strategies when teaching and learning is carried out. It is hoped that the level of mathematics anxiety can be reduced in this way.

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