

Full Length Research Paper

A Study on Mathematics Anxiety and Mathematics Achievement of Secondary School Students

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Abstract

Purpose of this study was to find out the relationship between achievement in Mathematics and Mathematics anxiety among secondary school students. Mathematics achievement as a cause for Mathematics anxiety and vice-versa was studied to find out the reciprocal relationship between Mathematics achievement and Mathematics anxiety. The effect of gender on Mathematics anxiety was also studied. Randomly selected sample consisted of 374 students (302 male and 72 female students) was used. Self-constructed tools, Mathematics anxiety scale and Mathematics Performance Test, were applied to collect data. It was found that the relationship between achievement in Mathematics and Mathematics anxiety is negative and significant at 0.05 level of significance. Mathematics anxiety of high and low achievers was significantly different at 0.05 level of significance, similarly a significant difference was observed between Mathematics achievements of high and low anxious students. It was also noted that difference in Mathematics anxiety of male and female students was not significant at 0.05 level of significance.

Keywords: Anxiety, Mathematics anxiety Mathematics achievement, Gender, Secondary schools, Students.

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Introduction

Mathematics is essentially needed in every walk of life in many ways. It has always held a key position in the school curriculum. It has occupied its important role not only in mathematical areas but in non mathematical areas also. It's knowledge is essential in home, business industry, sale and purchase, banking, agriculture, communication, transport, defense, science and technology, etc. "Mathematics is a compulsory subject at secondary stage. Access to quality mathematics education is the right of every child. Mathematics engages children to use abstraction to establish precise relationships to see structures, to reason out things to find truth or falsity of statements" (NCF-2005)¹. The knowledge of mathematics merely not meant for computational arithmetic and geometrical measurements but also played an important role in the education of all people. Secondary school mathematics teachers' are trying to develop essential skills, thinking and problem solving abilities among their students related and important to this subject. In Indian education system, Mathematics is a core subject at secondary level. Learning of Mathematics at secondary level is supposed to establish fundamental base for the next level of mathematics education and for all education also. It has the significance to affect the future life of the students. Development in other fields may also be influenced by the understanding of mathematical concepts and their uses. Realizing the importance of Mathematics, Washington, et al. (1967)² remarked 'One of the basic reasons for the tremendous development of certain fields of knowledge is that it has been possible to describe phenomenon in these mathematically'. Mathematics students' at secondary level would join engineering, polytechnic, graduation, post graduation and researches after the completion of their secondary education.

In India due to its diversity, classrooms have different background students. Localities, parents education, teachers anxiety, teachers self efficacy, students mathematics anxiety and gender are some of the aspects of diversity among students. These aspects are prevalent among students and would divide the students in different categories. Mathematics anxiety is one of the important factors among all the other psychological and social factors which may affect the students' achievement in Mathematics. Zakaria et al.

(2012)³ have found that mathematics anxiety have impact on Mathematics achievement and there is a difference in Mathematics achievements of students based on the level of their Mathematics anxiety. Many other researchers (Wither 2003⁴; Khatoon and Mahmood 2010⁵; Hembree 1990⁶; Ma 1999⁷; Pourmoslemi, Erfani and firoozfar 2013⁸) have found the negative impact of mathematics anxiety on mathematics achievement. If a student fears to take any mathematical task with a feeling of anticipated fear and humiliation in future by his teachers and classmates for failure at that task, it is a symptom of mathematics anxiety. Gender was also found a significant factor in mathematics anxiety and achievement. Gender is an important factor for Mathematics anxiety (Aiken, 1970)⁹. Female students have higher Mathematics anxiety than male students (Abbasi et al. , 2013¹⁰; Karimi and Venkates ,2009¹¹;2008¹² ; Penner & Paret, 2008¹³ ; Anglin, Pirson & Langer 2008¹⁴). But in some studies it was also reported that gender is not related to mathematics anxiety among students.

Due to rapid growth in the available resources and varieties of exposure for mathematics learning to the students especially to the female students it is possible that status of mathematics anxiety might have gone down. Hence it was essential to explore the current status of the relationship between mathematics anxiety and mathematics achievement. Results of the previous researches are of mixed opinions about the effect of gender differences on mathematics anxiety. Therefore, efforts were made by the researcher to unveil the real situation of the present time about the relationship between mathematics anxiety and mathematics achievement with another objective to find gender differences in mathematics anxiety. This study was done to find out the effect of gender on mathematics anxiety. Mathematics anxiety and mathematics achievement relationship was also explored to experience a precise insight about this relationship. This study aimed at determining the level of mathematics achievement and mathematics anxiety. To find effect of mathematics anxiety on mathematics achievement was also one of the objectives of this study. Finally gender difference was also explored in mathematics anxiety.

Mathematics Anxiety

Mathematics anxiety is an adverse emotional reaction to Mathematics or the prospect of doing Mathematics (Hembree, 1990)⁶. This is one of the most prevalent problems to many students regarding mathematics. Richardson and Suinn (1972, p. 551)¹⁵ have defined Mathematics anxiety as “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 situation”. Generally high level of mathematics anxiety is more closely associated with lower performance among low ability students (Sena et al., 2009)¹⁶.

Ashcraft and Moore (2009)¹⁷ have defined “Mathematics anxiety as feeling of tension apprehension and fear of situations involving mathematics and is associated with poor mathematics performance”. It is prevalent in our society and students especially among female students. Students, parents and teachers who are not from mathematics background may be affected by Mathematics anxiety up to some extent. The influence of Mathematics anxiety may not be easily removed from the affective domain of the student once affected by it. Effect of Mathematics anxiety for an individual can go beyond the school life and the place of work also.

Mathematics anxiety and gender

Numerous studies have been conducted to explore the difference between mathematics anxiety of male and female students. Results of these studies are not consistent. Aiken (1970)⁹, while studying the effect of gender on mathematics anxiety reported gender as an important factor. Result of some other studies have shown that female students have higher Mathematics anxiety than male students (Baloglu & Kocak, 2006¹⁸; Abbasi et al. , 2013¹⁰; Karimi and Venkates ,2009¹¹; Khatoon and Mahmood ,2008¹⁹ ; Penner & Paret, 2008²⁰ ; Anglin, Pirson & Langer 2008¹⁴). Some studies found that there is no gender difference in Mathematics anxiety. Both the genders performed equally on Mathematics achievement test. Studies which have reported about no gender difference in Mathematics anxiety are of the opinion that increased confidence has lowered the level of anxiety among these female students (Ma 1999⁷; Marsh & Tapia 2002²¹; Mohamed & Tarmizi 2010²²; Pourmoslemi, Erfani and Firoozfar, 2013⁷; and Preston, 1986²³).

Mathematics Achievement and Anxiety

Mathematics as an academic discipline includes numbers, principles, abstract manipulations and varieties of formulas. Most people have a stereo type thinking about Mathematics that it is a tough subject and initiate negative thinking about it. This feeling may create anxiety among individuals and others who are in contact with these individuals. Individuals, who are anxious about mathematics in general and at performance task in specific, would underperform at mathematics task. In spite of gender, mathematics anxiety can be the result of low performance at previous task related to it. Experience of an activity develops some positive and negative feelings for the related future activities. Individuals having negative experience about previous Mathematics task may feel high anxiety at the related new task. This feeling may undermine his future performance. Moderate level of anxiety is good for the performance in Mathematics but if it is too high it will lower the future performance. Previous researches on the relationship between Mathematics anxiety and Mathematics achievement have shown similar results. Some studies have found a negative significant correlation between the scores of Mathematics anxiety and Mathematics achievement (Wither 2003⁴; Khatoon and Mahmood 2010⁵; Hembree 1990⁶; Ma 1999⁷; Pourmoslemi, Erfani and firoozfar 2013⁸).. Same result was also observed by Tocci & Engelhard(1991)²⁴. Zakaria et al. (2012)³ in their study of Mathematics anxiety and achievement among secondary school students found that there is Mathematics

anxiety among secondary school students. They also found significant difference in achievement based on the level of Mathematics anxiety.

Hypotheses

Following null hypotheses were framed and tested in this study.

- 1-There is no significant relationship between mathematics anxiety and mathematics achievement scores of the Students.
- 2-There is no significant difference between scores of mathematics anxiety of high and low achievers in Mathematics.
- 3-There is no significant difference between mathematics achievement scores of high and low anxious students.
- 4-There is no significant difference between the mathematics anxiety of male and female Students.

Materials and Methods

Study area

This study was related to achievements in Mathematics. To find out the effect of Mathematics anxiety on Mathematics achievement this study was done. Effect of gender on mathematics anxiety was also observed so the area of this study is Mathematics achievement and some factors affecting it

Sample and Population

Sample was selected randomly from five central government schools affiliated to Central Board of Secondary Education, New Delhi in the Varanasi city of Uttar Pradesh. All the students of these five schools were selected in the sample. All Government secondary schools in Varanasi district of Uttar Pradesh will constitute the population of this study.

Sample size

Sample of the present study consisted of 374 class XI students (302 male and 72 female).

Data collection methods

Data was collected at students' level. A self made, 5 point likert types Mathematics Anxiety Scale was administered to collect the information regarding Mathematics anxiety of students. This Scale was constructed by following the standard psychometric procedure for the development of a psychological tool. Maximum and minimum score on this scale maybe, 192 and 0 respectively. Mathematics achievement was measured by a self constructed achievement test, named as Mathematics Performance Test. It was developed by following the standard psychometric procedures. It consisted of 42 multiple choice items based on class XI CBSE prescribed syllabus. Scoring of the test was completed by assigning 0 for incorrect response and 1 mark for correct response. The reliability index of mathematics performance test was found to be 0.86. Analysis of the data was carried out by the use of mean, standard deviation, t- test and coefficient of correlations.

Data analysis method

For the purpose of data analysis Statistical Methods like Mean, SD, coefficient of correlation and t-test were used.

Results

Table 1: Mean and S.D. of total sample for data variable

SN	Variables	Means	SD	N
1	Mathematics anxiety	60.37	31.01	374
2	Mathematics achievement	18.18	7.55	374

The results showed that the overall mean of Mathematics anxiety scores was 60.37 with standard deviation 31.01. The obtained mean score for Mathematics achievement was 18.18 on Mathematics Performance Test.

Table 2(hypothesis 1): Coefficient of correlation between Mathematics Anxiety and Mathematics Achievement

SN	Variables	Coefficient of correlation	S
1	Mathematics anxiety	-0.244	p<.05
2	Mathematics achievement		

A coefficient of correlation was calculated to find out the relationship between the scores of Mathematics anxiety and the scores of Mathematics achievement. The obtained coefficient of correlation was -0.244. This coefficient of correlation was low, negative and significant at 0.5 level of significance. Therefore, the null hypothesis that there is no significant correlation between mathematics anxiety and mathematics achievement scores is rejected at 0.05 level of significance.

Table 3(hypothesis 2): Effect of Mathematics achievement on Mathematics anxiety: Significance of the difference between Mathematics anxiety scores for low and high achieving students

SN	Students	Means	SD	N	t	s
1	High achievers	51.72	29.50	101	3.704	P<0.05
2	Low achievers	66.99	29.07	101		

Result in the above table showed the difference in Mathematics anxiety scores of high and low achieving students. From the perusal of the table it is clear that obtained t-value is 3.704 which is significant at 0.05 level of significance. It shows that difference in Mathematics anxiety of high and low achievers is significant at 0.05 level of significance. Therefore, the null hypothesis that there is no significant difference between the mean scores on Mathematics anxiety scale of low and high achieving students is rejected at 0.05 level of significance.

Table 4(hypothesis 3): Effect of Mathematics anxiety on Mathematics achievement: Significance of the difference between the mean scores of Mathematics achievement of high and low anxious students.

SN	Students	Means	SD	N	t	s
1	High anxiety	21.9	8.89	101	4.964	P<0.05
2	Low anxiety	16.28	7.07	101		

Result in the above table showed the difference in Mathematics achievement of low and high anxious students. From the perusal of the table it is clear that obtained t-value is 4.964 which is significant at 0.05 level of significance. It shows that Mathematics achievement of low and high anxious students is significantly different at 0.05 level of significance. Therefore, the null hypothesis that there is no significant difference between Mathematics achievements of high and low anxious students is rejected.

Table 5 (hypothesis 4): Effect of gender on Mathematics anxiety: Significance of the difference between the mean scores of Mathematics anxiety of male and female students.

SN	Gender	Means	SD	N	t	s
1	Male	59.96	32.95	302	0.693	p>0.05
2	Female	62.125	21.06	72		

Above table showed the difference in mathematics anxiety scores of male and female students. From the perusal of the table it is clear that obtained t-value is 0.693 which is not significant at 0.05 level of significance. It shows that gender difference in Mathematics anxiety is not significant. Therefore, the null hypothesis that there is no significant difference between mathematics anxiety of male and female students is not rejected. Hence it is not creating any new knowledge.

Discussion

Analysis of the data was conducted by rearranging the data and keeping in view the objectives and hypotheses of the study. It essentially involved the application of the statistical methods. It may be stated that a number of analysis may be performed with the data, yet only those, which were essential to meet the objectives of the study were included. On the basis of analysis done in previous sections, one may conclude that Mathematics anxiety and mathematics achievement are negatively significantly correlated which is supported by the results of the studies of Hembree (1990), Ma (1999), Wither (2003), Khatoon and Mahmood (2010) and Pourmoslemi et al. (2013). One may also conclude that there is effect of Mathematics achievement on mathematics anxiety. Means if students

performance is continuously at lower level it will create anxiety among them which was supported by the result of the study of Zakaria et al.(2012). It was also observed that high level of anxiety will lower the achievement of students in the subject of Mathematics. Significant gender difference was not observed and this result is in consistent with the results of the studies of Ma (1999), Marsh and Tapia (2002), Mohamed & Tarmizi (2010), Pourmoslemi, Erfani and Firoozfar(2013) and Preston (1986). Obtained result of no gender differences in Mathematics was not supported by the findings of Baloglu & Kocak (2006), Iossi(2008), Abbasi et al.(2013), Chin(2008), Karimi and Venkates (2009), Khatoon and Mahmood (2008), Penner & Paret (2008) and Anglin, Pirson & Langer (2008).

Conclusion

Result of this study reveals that achievement in Mathematics and Mathematics anxiety has inverse relationship. High achievers in Mathematics have low level of Mathematics anxiety. It can also be understood that high anxious students underperform at Mathematics task. To bring down mathematics anxiety at moderate level among secondary school students it is essential to provide support for mathematics learning and problem solving to the students. It is expected from the parents, teachers and educationists that they will motivate students to confront the situation related to mathematics in a confident manner. Teaching of mathematics should be start through simple and easy examples related to the concept and thence-forth complex problems should be discussed. While going through complex situations teachers should be diagnostic in their approach. It would help teachers to identify the students who are facing difficulties. As a result teachers can provide proper remedial to the anxiety affected students. Guidance and counseling services should be arranged specially for those students who are more anxious. Under achievement in Mathematics is also a cause for developing anxiety among students. Mathematics teachers at school, in the class or at the problem solving situation should have to be conscious to understand the symptoms of Mathematics anxiety among students.

It is also concluded that female students opting Mathematics in class XI are less in numbers in comparison to the male students. This structure is not satisfactory from the perspectives of female students. It shows that they are not getting the maximum essential required support from their family & teachers'. In recent time female students are showing some more self confidence in the learning of Mathematics. Therefore it would be judicious to provide them essential support for Mathematics learning. This kind of support and the deposits of self belief among female students towards Mathematics may lower their Mathematics anxiety together with increase in Mathematics achievement.

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