



Correlation Study on Xth Grade Students in Mathematics Achievement with Motivation and Mathematics Anxiety

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Abstract:

This study investigated the effects of mathematics anxiety on Xth grade students in Jangal-Mahal, West-Bengal. as related to motivation and achievement. Here subjects included 94 students who were at the end of their 3rd unit of session. Anxiety and motivation were measured using the self constructed Math Anxiety Scale (MAS) and Effectiveness of Motivation Scale (EMS) and Mathematics Achievement Test (MAT) respectively. The ANOVA results showed that the mean achievement scores and motivation scores of low, moderate and high anxiety groups were significantly different. Findings also revealed a low ($r = -0.29$) but significant ($p < 0.05$) negative correlation between mathematics anxiety and achievement and also a strong ($r = -0.69$) significant ($p < 0.05$) negative correlation between mathematics anxiety and motivation. The study also revealed a significant low positive correlation ($r = 0.31$) between motivation and achievement.

Keywords: *Mathematics Achievement, Mathematics Anxiety, Motivation*

1. Introduction

Mathematics anxiety is most psychological factor among the college students population to get success in mathematics (Betz 1978). Studies by Rahmah (1999) and Ahmad Sukri et al. (1996) found that a majority of Malaysian students have moderate level of mathematics anxiety. Lazarus (1974) expressed that the base of mathematics anxiety are formed in the elementary and secondary grades. Also Jackson and Leffingwell (1999) have linked mathematics anxiety to prior experience with formal instruction in mathematics at the elementary and secondary level. They found that 16% of the students surveyed had their first negative experience with mathematics instruction as early as grades 3 and 4. This is cause for concern, considering that matriculation students may bring these negative feelings to their university studies.

A review of current research suggests that low achievers in mathematics frequently accompany the incidence of mathematics anxiety. Ma (1999) found that the relationship between mathematics anxiety and mathematics achievement is significant. It was also found that once maths anxiety takes shape, its relationship with maths achievement is consistent across grade levels. Satake and Amato (1995) and Hardfield et al. (1992) also reported similar findings. A high level of anxiety is associated with a lower level of achievement (Quilter & Harper, 1988). Other than achievement, Tapia (2004) reported that students having little or no math anxiety scored significantly higher in motivation than students with some or high math anxiety, and students with some math anxiety scored significantly higher than students with high math anxiety. Levine (1995) described math anxiety as involving feelings of anxiety and tension that interfere with doing mathematical operations. Math anxiety existed around a set of circumstances in which students suffered from fears that were based upon years of painful experiences with mathematics (Miller & Mitchell, 1994). Maths anxiety has been defined as the feeling of tension, helplessness, mental disorganisation and dread one has when required to manipulate numbers and shapes and the solving of mathematical problems (Ashcraft & Faust, 1994). Fennema and Sherman (1976) described math anxiety as involving strong feelings of fear and apprehension when faced with

the possibility of dealing with a math problem. Norwood (1994) emphasized that math anxiety did not appear to have single cause, but was, in fact, the result of many different factors such as truancy, poor self image, poor coping skills, teacher attitude and emphasis on learning maths through drill without understanding. However, Greenwood (1984) further stated that the principal cause of mathematics anxiety has been in teaching methodologies. He said math classes did not encouraged reasoning and understanding. The problems with math anxiety would not go away until teachers applied the problem solving process to the teaching of arithmetic's and mathematics (Greenwood, 1984). Butterworth (1999) believes that a lack of understanding is the cause of anxiety and avoidance and that understanding based learning is more effective than drill and practice. A lack of confidence when working in mathematical situations is described by Stuart (2000) as the cause of maths anxiety. Highly maths anxious individuals will be less fluent in computation, less knowledgeable about mathematics, and less likely to have discovered special strategies and relationships within the mathematics domain (Ashcraft Faust, 1994). In order to reduce mathematics anxiety and increase achievement, Miller and Mitchell (1994) suggested that teacher should create a positive learning environment, free from tension and possible causes of embarrassment or humiliation.

2. Rationale of Study

The main objectives of Xth i.e. matriculation education was to further develop students' knowledge, competency and interest in the subject area. In a study by Rokiah and Mazlina (1998) on first year engineering students from matriculation, it was found that students had a negative attitudes towards mathematics. From my own 21 years teaching experience, some students do well during mathematics lesson and assignment yet fail to perform well in examination. Although there are many diverse reasons for the poor performance in mathematics, one prevalent variable worth considering is mathematics anxiety. Since a lot of research has been done locally in the area of mathematics anxiety of matriculation students, this study was undertaken to add to that body of knowledge.

3. Operational Definition

3.1 Academic Achievement

Operationally academic achievement is refers to achievement in subject. This is to the marks obtained in the subject. It also can be defined as excellence in all academic disciplines- scholastic and non scholastic, in class as well as extracurricular activities. It includes excellence in education, sporting, behaviour, confidence, communication skills, Arts, Culture etc. Academic achievement has become an educational touchstone since the passage of the federal No Child Left Behind Act in 2001, requiring all educators - including school counsellors - to formally define how their jobs and programs impact students' academic growth and contribute to overall school success. It may be concluded that "Academic achievement is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals".

3.2 Anxiety

Anxiety is the feelings of tension or fear that interfere in a variety of situation in daily life or in academic affairs. Mathematics anxiety can be defined as the general lack of comfort that someone might experience, along with the feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of life and academic situations (Richardson & Suinn, 1972). This condition may be accompanied by debilitating test stress, low self-confidence, fear of failure and negative attitudes toward mathematics learning.

3.3 Purpose

The objectives of this study was to investigate whether there was a statistical difference between matriculation students' motivation and achievement when they were classified according to the math anxiety levels.

4. Population of this Study

In this research study, the population is the secondary students in Jangal-Mahal of West-Bengal under West-Bengal Board of Secondary Education (WBBSE). The South-Western part of West Bengal mainly a major part of Paschim Medinipur, Bankura and Purulia District (approx. latitude 21045/ N to 23045/ N & 85045/ E to 87030/ E) is now literary marked as 'Jangal-Mahal'. The name says that the major part of this region is covered by forest or jungle and it is one of the socio-economically backward as well as educationally backward regions of West Bengal. Ethnical variation of the region is also remarkable. Almost 25-30% of the total population of the aforesaid districts is tribes. Apparently, the reason behind this is the lack of literacy and historical deprivation of an ethnical group. But it is not the only reason. The various reasons lying behind this also include their demand for cultural identity.

5. The Sample of this Study

The researcher considered only the district of Paschim-Medinipur of Jangal-Mahal of West-Bengal. In Paschim Medinipur these police stations Belpahari, Lalgargh, Jamboni, Binpur, Goaltore, Garbeta, Salboni, Jhargram, Gopiballavpur, Beliabery, Sankrail and Nayagram are mainly marked as Jangal-Mahal by the Government of West-Bengal.

6. Tools Used in this Study

A self constructed achievement test (prepared by the researcher) used for measure of mathematics performance of the secondary students. An adapted questionnaire transformed by the researcher into Bengali version and again standarized to measure motivation towards mathematics of the secondary students (MAS-IAKT by Imam and Khatun, H.P. Bhargav Book House, Agra). An adapted questionnaire transformed by the researcher into Bengali version again standarized to measure anxiety towards mathematics of the secondary students (MAS-MSKT by Mahmood and Khatun, H.P. Bhargav Book House, Agra).

7. Hypothesis of the study: The hypothesis of this study is

- (i) H_{01} : There is no significant correlation between mathematics anxiety and motivation
- (ii) H_{02} : There is no significant correlation between mathematics anxiety and achievement.

8. Methodology

The study involved 94 students (65 females and 29 males). Students were informed that their participations in the study were completely voluntary and would not influence their grade in the course. Three self constructed standarized instruments were used to obtain the data: the Mathematics Anxiety Scale (MAS), Effectiveness of Motivation Scale (EMS) and the Mathematics Achievement Test (MAT). The MAS and the EMS is a 18-item instrument, ten worded positively and nine worded negatively. The instrument uses a Likert scale with a range of strongly agree to strongly disagree. A total score is calculated by assigning a value of 1 (strongly disagree) to 5 (strongly agree) to each item and then adding the values. Possible scores range from 18 to 90. It is important to know that a low score on the MAS indicates a high level of mathematics anxiety, therefore the sign was reversed so that high scores would indicate high mathematics anxiety. Both the Math Anxiety Scale and Effectiveness of Motivation Scale have a split-half reliability of 0.88 and 0.89 respectively. The instrument used for measuring mathematics achievement was the Mathematics Achievement Test (MAT). The MAT is a 15 questions open ended test with a 2 hour time limit.

X^{th} grade students' math anxiety scores were used to assign them into three groups: low math anxiety group, moderate anxiety group and high math anxiety group. The classification of the students was made by using the percentiles of the anxiety scores. Students whose scores fell between 34% and 64% were considered the moderate group. Low and high anxiety groups consisted of the students whose scores were in the lower 33% and in the upper 33% of the distribution, respectively. One way ANOVA tests test were used to compare the mean EMS and MAT scores of the different math anxiety groups.

The Pearson product correlation coefficients of the participants' EMS and MAT scores and math anxiety scores were calculated to explain the possible relationships between these variables.

9. Results

The number of students in each anxiety group and the mean scores for dependent variables are reported in Table 1. The ANOVA results as shown in Table 2, revealed that the mean achievement scores of low, moderate and high anxiety groups were significantly different, $F(2,91)=3.46, p<0.05$. According to this table there is a mean difference in achievement test between the low and high anxiety groups were found to be statistically significant. On the other hand, the comparison of the mean scores of low and moderate anxiety and between moderate and high anxiety groups provided insignificant results at 0.05 significance level.

For motivation, as shown in Table 3, ANOVA results show that the mean motivation scores of low, moderate and high anxiety groups were also significantly different, $F(2,91)= 13.36, p<0.05$. According to this table there is a mean difference between the low and moderate anxiety groups, between the low and high anxiety groups and between moderate and high anxiety groups were found to be statistically significant. Findings also revealed a low ($r=-0.29$) but significant ($p <0.05$) negative correlation between mathematics anxiety and achievement and also a strong ($r=-0.69$) significant ($p<0.05$) negative correlation between mathematics anxiety and motivation. The study also revealed a significant low positive correlation ($r=0.31$) between motivation and achievement.

Table 1: Comparisons of Mean by Level of Math Anxiety

Math Group	Mean (Anxiety)	Mean (Motivation)	Standard Deviation (SD)	No of Students (n)
High	36.73	43.45	7.83	26
Moderate	48.95	47.29	8.29	29
Low	56.34	52.34	7.76	39
Total	48.37	49.00	8.03	94

Table 2: Results of the ANOVA for Mathematics Achievement Scores

Source of Variation	Degree of Freedom	Mean Square	F	Sign
Between Groups	2	2295.15	3.46	0.28
Within Group	91	599.89		

Table 3. Result of the ANOVA for Motivation Scores

Source of Variation	Degree of Freedom	Mean Square	F	Sign
Between Groups	2	593.21	13.36	0.00
Within Group	91	34.15		

10. Discussion

The results indicated that matriculation students with high mathematics anxiety scored significantly lower in achievement. Numerous authors have suggested that higher achieving students are more apt to be less anxious (Betz, 1978; Hembree, 1990; Skiba, 1990). The data analysis also indicated that the effect of math anxiety on motivation was significant. Students with low math anxiety scoring significantly higher than students with moderate or high math anxiety and students with moderate

anxiety scoring significantly higher than students with high math anxiety. These results concurred with the findings of Tapia (2004). The results also indicated that there was a relationship between mathematics anxiety and achievement. This indicates that as math anxiety scores increase, achievement scores decrease. This finding is consistent with the studies of Betz (1978), Ma (1999) and Woodard (2004), which revealed a negative relationship between these two variables. Although the magnitude of the correlations calculated is not very high, teacher should be aware of the needs and the capabilities of the students with different mathematics anxiety levels when designing teaching strategies for them. There could be other variables that have significantly influenced the students achievement that were not identified and explored in this study. A strong correlation between mathematics anxiety and motivation is not surprising. This would indicate that students with high anxiety will be less motivated in doing things related to mathematics. The significant low positive correlation between motivation and achievement showed that all the variables were interrelated with each other. The result of this study provide an evidence that the mathematics anxiety has an important effect in mathematics achievement. Therefore subject teacher should be careful on this matter i.e. how to reduce students' anxiety by finding a better ways to teach mathematics.

11. Implications

Teachers needed to be careful of the effects of mathematics anxiety on students mathematics achievement and motivation. Woodard (2004) suggested the techniques- create such an environment that students do not feel threatened, use co-operative grouping that helps students to understand that others have the have the same problems as they do, teach slow pace that helps students better comprehend and provide extra session so that they are not left behind academically. With all these efforts it is possible to reduce mathematics anxiety.

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