



**EFFECT OF MATHEMATICS ANXIETY AND ATTITUDE TOWARDS  
MATHEMATICS ON THE ACHIEVEMENT OF ADOLESCENTS**

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***Abstract***

The present study examined the influence of mathematics anxiety and attitude towards mathematics on mathematics achievement of adolescents. Random sampling technique was used to collect the data. A sample of 120 secondary school students from District Ambala was thus selected. The findings of the study indicated that significant difference exists between mathematics achievement of boys and girls; but no gender difference was found on the variables mathematics anxiety and attitude towards mathematics. Findings also indicated that students with high mathematics anxiety had low achievement scores. Significant but negative relationship was found between mathematics anxiety and mathematics achievement; attitude towards mathematics with mathematics achievement of adolescents. This implies that teachers should strive to understand mathematics anxiety and attitude of adolescents towards mathematics and implement teaching and learning strategies so that students can overcome their anxiety.

**Keywords:** Mathematics Anxiety, Attitude towards Mathematics, Mathematics Achievement

## **Introduction**

Mathematics is often considered as a difficult subject. Many people think of mathematics as a punishment or something that induces stress (Zaslavsky, 1999). Researches indicate that many students are afraid of mathematics and they do not take interest in this subject which results poor performance in mathematics. Students' under achievement in mathematics is not just a concern for particular countries, but has become a global concern over the years (PISA, 2003). Several factors influence students' under achievement in mathematics. Some of these factors are classroom climate, mathematics anxiety (Lewis & Aiken, 1970), teaching practices and teaching methods (Maat, Zakaria, Nordin&Meerah, 2011), students' beliefs and attitudes towards mathematics (McLeod, 1992). One of the attributed reasons is the anxiety that an individual may have towards mathematics.

Mathematics anxiety is regarded as feelings of fear, avoidance and dread when doing and understanding mathematics. Tobias (1995) defined mathematics anxiety as a feeling of tension and anxiety that appears when someone is engaged in the manipulation of figures to solve mathematical problems in both academic and daily-life situations. Mathematics anxiety is generally defined as a state of discomfort caused by performing mathematical tasks (Ma & Xu, 2004). Tobias and Weissbrod (1980) defined mathematics anxiety as the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem (p 403). Pradeep (2006) defined mathematics anxiety as a state of a sinking feeling, uncertainty and despair at doing and understanding mathematics. It can be manifested as feelings of apprehension, tension, fear, dislike, worry and frustration. It is primarily because some students feel anxious even at the thought of entering into the mathematics class.

Mathematics anxiety could also develop as a result of a student's prior negative experiences of learning mathematics in the classroom or at home (Rensaa, 2006). It is easy to forget math equations and to lose confidence when one is experiencing mathematics anxiety. Mathematics anxiety refers to a person's feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary and academic settings (Khatoon & Mahmood, 2010). Importantly, mathematics anxiety has several negative effects on children's and adult's mathematics education. The individual who experience high level of mathematics anxiety are likely to develop negative attitudes toward tasks involving mathematics, drop out of elective mathematics classes or avoid taking them altogether.

Secondary school students are the worst affected by math anxiety. Studies have shown higher level of mathematics anxiety among secondary school students than others (Aggarwal & Bhalla, 2013). Puteh and Khalin (2016) stated that the early detection of mathematics anxiety among students is important so that it is easy to help students in the control and dealing with the level of mathematics anxiety.

Attitude towards mathematics is another effective factor that has been studied over the years in relation to mathematics achievement. Mathematics anxiety and attitude towards mathematics are two effective variables that have been studied independently and extensively in relation to mathematics learning and achievement (Zakaria & Nordin, 2008). Zan and Di Martino (2007) explored that the phenomenon of 'negative attitude towards mathematics' is related to the learning of the discipline. They further claimed that the negative attitude towards mathematics affects various aspects of the social context: the refusal of many students to enroll in science undergraduate courses due to the presence of exams in mathematics, or an explicit and generalized refusal to apply mathematical rationality, and a tendency to uncritical acceptance of models that are only apparently rational.

Hart (1989) described an individual's attitude towards mathematics as the emotion he or she associates with mathematics, his or her beliefs towards mathematics and how he or she behaves towards mathematics. According to Hannula (2002) student's attitude towards mathematics can be classified under the evaluative processes as: the emotions experienced through activities involving mathematics; emotions evoked by the concept mathematics; evaluations of the consequences of doing mathematics and value of mathematics to one's future goal. Attitude towards mathematics is therefore seen as the pattern of beliefs and emotions associated with mathematics (Daskalogianni & Simpson, 2000). It is the attitude of the student which contributes a lot towards his perception about mathematics. It develops the adaptability and applicability in the learners (Booker, Briggs, Davey & Nisbett, 1992; Schiefele & Csikszentmihaly, 1995). Poor attitude towards mathematics has often been cited as one factor that has contributed to lower participation and success of girls in mathematics (Willis, 1995; Fullarton, 1993).

A perusal of research review indicates that positive attitude towards mathematics leads students towards success in mathematics. Attempt to improve attitude towards mathematics at lower level provides base for higher studies in mathematics. It also effects achievement in mathematics at secondary school level (Ma & Xu, 2004).

## Significance of the Study

One of the most significant contributor duly acknowledged in literature for mathematics achievement or lack of it is mathematics anxiety. Venkatesh and Karimi (2010) found that Mathematics anxiety has significant but negative correlation with Mathematics performances and overall academic performance. They also found significant gender difference in Mathematics anxiety and no significant difference between boys and girls in Mathematics performances. Mahmood and Khatoon (2011) examined the effects of mathematics anxiety on mathematics achievement and found that students with low mathematics anxiety had highest achievement scores. Findings also reveal a significant negative correlation ( $-0.48$ ) between mathematics achievement and mathematics anxiety and males reported more mathematics achievement than females. The findings of Zakaria, Zain, Ahmad and Erlina (2012) documented significant differences in achievement based on the level of mathematics anxiety and the mean difference between mathematics anxiety and gender is not significant. Chaman and Callingham (2013) in their study found significant positive relationship between mathematics anxiety and attitude towards mathematics among secondary school students.

Several studies and researches have been done in many countries to find the factors that influence the students' performance in mathematics. Among these, students' attitude towards mathematics is one important factor that has been consistently studied. Often, the studies on relationship between students' attitude and their academic performance show a positive relationship (Mohd, Mahmood, & Ismail, 2011; Bramlett & Herron, 2009; Nicolaidou & Philippou, 2003; Papanastasiou, 2000; Ma & Kishor, 1997). Hence, student's attitude towards mathematics is a major factor that might influence the performance of the students. Due to this, several studies have been conducted in different countries in order to find out the students attitude towards mathematics (Tahar, Ismail, Zamani & Adnan, 2010; Tezer & Karasel, 2010; Maat & Zakaria, 2010; Bramlett & Herron, 2009) and hence to use these data to suggest to trace out the factors affecting low performance of the students and to provide necessary suggestions. Mohamad and Waheed (2011) explored that despite the lower performance of Maldivian students in mathematics, the attitude of the respondents were fairly positive. It also found no significant difference between male and female students attitude towards mathematics. Most of the studies showed that there is a positive correlation between students' attitude towards mathematics and academic achievement (Mohd et al., 2011; Bramlett & Herron, 2009; Papanastasiou, 2000; Ma & Kishor, 1997). However there are many studies that suggest that

there is no significant difference in the attitude of male and female students towards mathematics (Kögce et al., 2009; Nicolaidou & Philippou, 2003).

On the basis of these studies, it is clear that there is inconsistency and gaps in the knowledge. So, there is a great need to conduct further studies in this area. Keeping in view, this research work was taken up to collect in-depth knowledge about the Mathematics Achievement, Mathematics Anxiety and Attitude towards Mathematics of adolescents.

### **Objectives of the Study**

- To study the mathematics achievement, mathematics anxiety and attitude towards mathematics of adolescents in relation to their gender.
- To study the mathematics achievement of adolescents having different levels of mathematics anxiety.
- To study the mathematics achievement of adolescents based on their attitude towards mathematics.
- To study the relationship between mathematics anxiety, attitude towards mathematics and mathematics achievement of adolescents.

### **Hypotheses of the Study**

- There is no significant difference in the mathematics achievement, mathematics anxiety and attitude towards mathematics of male and female adolescents.
- There is no significant difference in the mathematics achievement of the adolescents having different levels of mathematics anxiety.
- There is no significant difference in the mathematics achievement of adolescents based on their attitude towards mathematics.
- There is no significant relationship between mathematics anxiety, attitude towards mathematics and mathematics achievement of adolescents.

### **Method**

In the present study, descriptive survey method of investigation was employed.

### **Sampling**

The sample of the present study was randomly drawn from secondary schools of Ambala district. The sample comprised 149 students out of which 74 boys and 75 girls from class IX were selected.

## Tools Used

- Mathematics Anxiety Scale (MAS) by Mahmood and Khatoun (2010)
- Attitude towards Mathematics Scale (ATMS) by Gakhar and Rajni (2005)

## Statistical Techniques Employed

Statistical techniques, t-test, ANOVA and Correlation were used. In order to find out the difference between mathematics achievement, mathematics anxiety and attitude towards mathematics of male and female students, t-test was applied. To find out the difference between mathematics achievement of adolescents having high, medium and low mathematics anxiety, one-way ANOVA was applied and to find out the relationship between mathematics anxiety, attitude towards mathematics and mathematics achievement, Pearson Product Moment Correlation technique was employed.

## Analysis and Interpretation of Data

In order to study the significant difference between male and female adolescents on the variable mathematics achievement, mathematics anxiety and attitude towards mathematics, t-test was employed. The result thus obtained is presented vide table 1:

**Table: 1**

### **Significance of Mean Difference between Male and Female Adolescents on Mathematics Achievement, Mathematics Anxiety and Attitude towards Mathematics**

Variable	Mean		SD		t-ratio	Level of Significance
	Male	Female	Male	Female		
Mathematics Achievement	51.30	47.15	9.93	10.04	16.22	Significant at 0.01 level
Mathematics Anxiety	35.15	37.18	7.69	7.48	1.67	Not Significant
Attitude towards Mathematics	164.95	167.05	22.87	18.36	0.61	Not Significant

Table 1 depicts that the t-value of mathematics achievement of male and female adolescents was found to be 16.22 which was significant at 0.01 level of significance. The mean scores of mathematics achievement of male adolescents are better than female adolescents. The t-values of mathematics anxiety and attitude towards mathematics of male and female adolescents were

found to be 1.67 and 0.61 which were not significant at any level of significance. The mean scores of male adolescents are lower in mathematics anxiety and attitude towards mathematics as compared to their female counterparts. The results indicated that the male adolescents were low in attitude towards mathematics, less mathematical anxiety and are high achievers in mathematics compared to their female counterparts.

**Table: 2**

**One-way ANOVA of Mathematics Achievement Scores of Adolescents on the basis of Different Level of Mathematics Anxiety**

Sources of Variance	Sum of Squares	df	Mean Square	F -ratio	Level of Significance
Between Groups	7716.520	2	3858.260	22.571	Significant at 0.01 level
Within Groups	7716.520	147	170.936		
Total	32844.160	149			

**Table: 3**

**Significance of Mean Difference between Mathematics Achievement of High, Medium and Low Mathematics Anxiety Adolescents**

Level of Anxiety	Mean	SD
High Anxiety	53.192	14.536
Medium Anxiety	57.568	17.304
Low Anxiety	54.509	13.208

Table 2 reveals the significant difference between mathematics achievement of high, medium and low anxiety adolescents. The F-value was found to be 22.571 which is significant at 0.01 level of significance. It depicts that there is significant difference between mathematics achievement of high, medium and low anxiety adolescents. Table 3 depicts the mean scores of mathematics achievement of high, medium and low anxiety adolescents. It shows that adolescents with high anxiety achieved low scores in mathematics which shows that more anxious students does not perform well. It also depicts that students of medium level of mathematics anxiety score more marks which indicates that some mathematics anxiety is required to perform well in mathematics.

**Table: 4**

**Significance of Mean Difference between Mathematics Achievement of Adolescents on the basis of Attitude towards Mathematics**

Variable	Mean		SD		t-ratio	Level of Significance
	High	Low	High	Low		
Mathematics Achievement	51.73	47.78	10.287	9.541	2.081	Significant at 0.05 level

Table 4 reveals that t-value of mathematics achievement on the basis of high and low attitude towards mathematics was found to be 2.081 which was significant at 0.05 level of significance. The mean scores of mathematics achievement of high attitude of adolescents towards mathematics are better than adolescents having low attitude towards mathematics. It depicts that the adolescents who have positive attitude towards mathematics scores more marks in mathematics than the adolescents having negative attitude.

**Table: 5**

**Inter-correlation Matrix between Mathematics Anxiety, Mathematics Achievement and Attitude towards Mathematics**

Variable	Mathematics Anxiety	Mathematics Achievement	Attitude towards Mathematics
Mathematics Anxiety	1		
Mathematics Achievement	-.330**	1	
Attitude towards Mathematics	-.816**	.120*	1

\*\* Significant at 0.01 level

\*Significant at 0.05 level

Table 5 depicts the relationship between mathematics anxiety, mathematics achievement and attitude towards mathematics of adolescents. The r-value between mathematics anxiety and mathematics achievement was found to be -0.330 which is significant at 0.01 level of significance. Negative significant relationship was found between these two variables i.e., mathematics anxiety and mathematics achievement which depicts that students who are suffering from mathematics anxiety scores less marks in mathematics while students who have less mathematics anxiety perform good in mathematics.



The r-value between mathematics anxiety and attitude towards mathematics was found to be  $-.816$  which is also significant at 0.01 level of significance. It shows that students who have positive attitude towards mathematics found to have less anxiety in mathematics and those who have negative attitude faced difficulties in mathematics and suffers from mathematics anxiety. The r-value between attitude towards mathematics and mathematics achievement was found to be  $.120$  which is significant at 0.05 level of significance. It implies that students who have positive attitude secure good marks in mathematics while those who have negative attitude towards mathematics perform poor in mathematics.

### **Educational Implications**

The findings of the present study indicated that there is a significant positive relationship between mathematics achievement and attitude towards mathematics. It indicates that students who have positive attitude towards mathematics perform better than those who have negative attitude. Significant but negative relationship was found between mathematics achievement and mathematics anxiety which indicates the adolescents having low mathematics anxiety score higher marks in mathematics as compared to adolescents having high mathematics anxiety. Puteh and Khalin (2016) also found significant but negative relationship between student's achievement and mathematics anxiety. The results is also consistent with previous studies on mathematics achievement and anxiety (Cheema & Sheridan, 2015; Karimi & Venkatesan, 2009; Mutawah, 2015; Woodard, 2004; Yuksel-Sahin, 2008; Zakaria & Nordin, 2007).

Findings also revealed that boys have an edge over girls in the achievement of mathematics. The result is consistent with findings of many empirical studies showing that boys tend to outperform girls in mathematics achievement (Khatoon & Mahmood, 2010; Yuksel-Sahin, 2008). In contrast, Opdenakker et al. (2002), report that proportion of girls was positively related to mathematics achievement. Further, Anderson et al. (2006) reported that relationship between student gender and mathematics achievement was weak and mixed. In the mathematics content domain, males tend to do better than females and in mathematics problem domain females tend to do better than males.

The findings also showed significant differences between students' mathematics achievement based on their mathematics anxiety levels. Students who are high achievers have low level of mathematics anxiety, while low achieving mathematics students have high level of mathematics anxiety. This is because high achievers have a strong understanding of mathematics and have more confidence than low achievers. These findings support the previous findings of Karjanto

and Yong (2015), Woodard (2004) and Karimi and Venkatesan (2009), who determined that students who have high mathematics anxiety level tend to earn lower mathematics scores. Conversely, it was found that medium mathematics anxiety students perform best in mathematics which indicates that some level of mathematics anxiety is required for good performance in mathematics.

The findings of the study recommend that teachers should be positive, supportive and inculcate interest among students through reinforcement so as to reduce their mathematics anxiety. Traditional methods of teaching and classroom practices are a great cause of mathematics anxiety among students. So, teachers should employ teaching methods that empower students to develop positive attitudes towards mathematics and reduce their anxiety and tension. Lessons must be presented in variety of ways which include more discussions, less lecture. Mathematical concepts should be taught through co-operative groups, role playing, visual aids and CAI (Computer Aided Instruction). Teachers and parents should be made aware of the use of technology for learning and doing mathematics and use of various mathematical CD's.

Parents should maintain an active role when encouraging their children to incorporate mathematics into their daily routine. Parents and teachers can also help students realise that myths such as the general feeling that mathematics aptitude is genetic and mathematics is a male domain, is simply not true.

Much of the mathematics anxiety happens in the classroom due to the lack of diversity in learning styles of students. Mathematics must be looked upon with a positive attitude to reduce mathematics anxiety. However, some amount of anxiety is helpful to keep students motivated and energized although anxiety level need to be closely monitored so that it does not interfere with their ability to do well in class.

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