International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979, Impact Factor: RJIF 5.72
www.allsubjectjournal.com
Volume 3; Issue 6; June 2016; Page No. 69-74

The relationship between attitude towards and achievement in mathematics among higher secondary students

[1] Arup Kundu, [2] Aditi Ghose

[1] Assistant Professor of Mathematics (W.B.E.S), Government Training College (CTE), Hooghly, West Bengal, India
[2] Professor (Rtd.), Department of Education, University of Calcutta, Kolkata, West Bengal, India

Abstract
This study is based on a survey of Higher Secondary school students about their attitudes towards mathematics and its possible effect on achievement in the subject. Students of different streams (Science, Arts and Commerce) constituted the population of this study. The sample consisted of 784 students both male and female of Class XI selected from school in southern district of West Bengal. The tool used was the Modified Fennema Sherman Mathematics Attitude Scale (Depaken, Lawsky and Padwa, 1993). Achievement of Mathematics was measured by the scores in mathematics in the Class X Public Examination. A co-relational study showed that the association between Higher Secondary students' attitude towards mathematics and their achievement in mathematics is high. This indicates that a healthy attitude towards mathematics can augur good performance in mathematics examination. This was found to be particularly true for girls and for students in the Arts stream.

Keywords: Attitude, Mathematics, Achievement, Performance, Higher Secondary

1. Introduction
Mathematics is an essential aspect of human Knowledge, and a major contributor to human civilization and development. In the modern world, the indispensability of mathematics in everyday life is more than apparent. Thus mathematics forms not only a compulsory part of the school curriculum up to the secondary stage, it is often necessary in the following tertiary stages. While mathematics is associated with enjoyment and pleasure by a few aficionados of the subject, it is regarded more as a utilitarian tool by others, and regarded with fear and aversion by others.

Students entering the HS stage have to choose between the streams of study. The popular choices are Science, Arts and Commerce. Mathematically able students are usually inducted in to the Science streams, while Arts students' cosy up to the illusion that they are rid of mathematical studies forever. This implies that certain attitudes to mathematics are built up over the school years and contribute to the attainment of mathematical ideas and realization of its beneficial impacts.

1.1 Definition of Attitude
Various studies discuss the definition of attitude. Allport (1935) [1] defined attitude as a "mental and neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (p.810). This definition implies that an attitude is a response to certain experiences formed throughout one's life. Thus one's repertoire of experiences can be regarded as the basic building blocks of his/her attitudes. Allport's view of the function of experience in attitude formation makes his definition immanent for this investigation.

Eagly and Chaiken (1993) [7] defined attitude as "A psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" (p. 155). This definition appears to focus on the manifestation of attitude. Philips (2003) stated that attitude is protean as per situation and based on individuals' beliefs, feelings and values. Thompson (1993) [25] defined attitude as a pattern of perceptions developed through one's reactions with the environment. These definitions thus imply that attitude represents one's feeling and reactions to situations. Several studies deal with learners' attitudes towards mathematics. Choudhury & Das (2012) [3], Kundu & Ghose, (2016) [15] and Mahanta, (2014) [18] shows that attitude to mathematics is affected by various factors like gender role stereotyping, beliefs, perceptions about mathematics, self-efficacy and affect study habits of students.

1.2 Relationship between Attitude and Achievement
Several studies in western countries show a link between positive attitude and achievement (Iben, 1991; Ma & Nand Kishor, 1997; Tocci & Engelhard Jr., 1991) [13, 17, 32]. On the other hand, studies conducted in Asia on Asian students show that positive attitudes are not always present in students with high achievement scores (Leung, 2002; Stevenson, Chen, & Lee, 1993) [16, 30]. While student achievement does not always correlate with a positive attitude, Wilson (2008) recommends that fostering positive attitudes can have long-term beneficial effects. In a study by Reed, Drijvers, & Kirschner (2010) [26], it was concluded that positive attitudes towards mathematics improved learning styles. The study further stated that the attitude of students played an important role in learning mathematics with computer based learning tools.

1.3 Attitude towards Mathematics
Attitude can therefore be simply regarded as a positive or negative degree of sentiment associated with certain experiences. Obviously, it is manifest in a student's outlook on particular subjects of study. Thus attitude towards mathematics may be seen as just a positive or negative emotional predication toward mathematics (Haladyna, Shaughnessy, & Shaughnessy, 1983; McLeod, 1992) [11, 20].

Attitude may not be manifest in overt behaviour. In other

words, behaviour signifying particular attitudes may not be outwardly apparent. Thus, attitude toward mathematics may be a conglomeration of patterns of beliefs and emotions regarding mathematics (Daskalogianni & Simpson, 2000) [4]. Hart (1989) [12] points to the fact that attitude is multidimensional, having three components within it: emotional response, beliefs regarding the subject, and behaviour related to the subject. From this point of view, an individual's attitude toward mathematics is delineated by the emotions that he/she relates with mathematics, his/her beliefs towards mathematics, and by how he/she behaves. Thus attitudes can be positive or negative. Attitudes play a definite role on students' mathematics achievement. These may be manifest in liking, enjoying and exhibiting interest in mathematics, or the opposite reactions. At worst, math phobia (Ernest, 1989) [8] may ensue.

As attitude is associated with academic achievement, it is often considered as a significant variable in educational research (Nkwe, 1985) [23]. Ma and Kishor (1997) [17] stated that there is a general belief that children learn more effectively when they are curious about what they learn and that impels them to achieve better in mathematics. Several studies have researched on the role of attitude in Mathematics learning and achievement. Fogarty, Cretchley, Harman, Ellerton, & Konki, (2001) [9] developed a tool to measure attitudinal factors that play a role in the effective use of technology in mathematics learning. They found that attitudinal factors like intimidation regarding mathematics or technology served to stymie conceptualization of mathematics. Di Martino & Zan, (2010) [5] found that attitude is a multi-dimensional concept and it is never too late to change the student's attitude towards mathematics.

Student attitude thus plays a central role in mathematics learning and achievement (McLeod, 1992) [20]. Several studies indicate a strong relationship between positive attitudes and beliefs about mathematics and academic success in mathematics (Ashcraft & Kirk, 2001; Sandt, 2007; Schenkel, 2009; Sherman & Christian, 1999; Tapia & Marsh II, 2004) [2, 27-29, 31].

The above discussion gives grand to the belief that a student's attitude can be the critical factor behind his or her success or failure in the subject. Attitudes towards mathematics develop from educational experiences. Positive attitudes generate optimism that is, attributing favourable interpretations to actions and events (Gillham, Shatte, Reivich, & Seligman, 2000) [10] and can lead to persistence. In other words, optimistic students are more likely to persist with their learning tasks, thus increasing the possibility of their academic success (Wigfield, 1994) [34]. In contrast, negative attitudes can enhance maths-anxiety (Trujillo & Hadfield, 1999) [33] and contribute to poor achievement in mathematics.

Students in the Higher Secondary classes have completed ten years of schooling, a large part of which includes mathematics education. They can be expected to have formed certain definitive attitudes towards mathematics. This study intended to find out whether attitude to mathematics does have an impact on achievement in mathematics among these students. Culturally, the problems of education do have differentiated repercussions on girls and boys. Thus this study has further examined the impact of attitude to mathematics on achievement in the subject on a gender wise basis. After a broad based basic education, students in Class XI have to choose a stream of study. This selection is often influenced by achievement in mathematics (Kundu & Ghose, 2015) [14]. However, it is also influenced by the attitude to mathematics evolved over the previous ten years of schooling. How far attitude to mathematics has impacted the achievement in the subject is a moot point. Thus study has therefore attempted to uncover and discern between this association among students in the science, Arts and Commerce streams of study in the Higher Secondary classes.

1.4 The objectives of the study were

To examine the relationship between attitude towards and achievement in mathematics of HS students.

The variables of the study are

- Independent variables: Attitude towards mathematics
- Dependent variable: Achievement in mathematics

2. Methodology

2.1 Sample

The population of the study consisted of HS students in Southern district of West Bengal. The sample consisted of 784 Class XI learners from 25 schools in two districts of South West Bengal, viz., Bankura and South 24 Parganas. These were urban schools and drew learners from middle socio-economic communities. Formal approval from the school Head Teachers were obtained in order to conduct this research. The sample is as follows:

Table 1: The sample

Gender	Streams			Total
	Science	Arts	Commerce	
Boys	188	124	95	407
Girls	159	181	37	377
Total	347	305	132	784

2.2 Tools employed

The following instruments were used in the study

- Attitude towards mathematic: measured by "Modified Fennema Sherman Mathematics Attitude Scale" (Depaken, Lawsky and Padwa, 1993) [6] consisting of 47 likert type items translated into Bengali. The Test-retest reliability coefficient of the scale is 0.94.
- Transcript of mathematics scores in the Madhyamik Examination.

3. Findings

After identification of the sample, the participants were administered the Modified Fennema Sherman Mathematics Attitude Scale. The responses were scored and tabulated, and subjected to descriptive statistics.

Table 2: Descriptive statistics of Attitude towards Mathematics

	Mean	Median	Min.	Max.	Skewness	Kurtosis
Attitude	175.83	177	106	228	-.180	-.679

The scores in mathematics in the Madhyamik Examination were acquired from the school records, tabulated and subjected to descriptive statistics.

Table 3: Descriptive statistics of Achievement in *Mathematics*

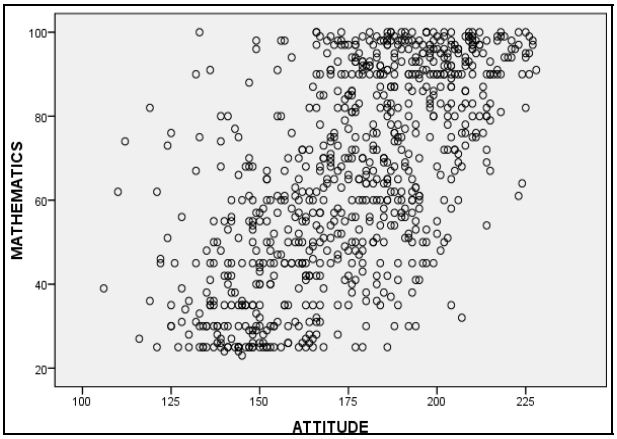
	Mean	Median	Min.	Max.	Skewness	Kurtosis
Achievement of Mathematics	65.67	67	23	100	-.160	-.1.273

Both variables were found to be continuous and nearly normal. To find the relationship between attitude towards mathematics and achievement in mathematics the following null hypothesis was employed:

- **H_0:** There is no relation between attitude and achievement in mathematics.

The Pearson Product Moment Correlation technique was used to test the hypothesis.

Initially, a scatter gram between attitude in mathematics and achievement in mathematics was constructed. This indicated a viable liner correlation between the two variables.



Scatter plot for all student

The Product Moment Correlation yielded the following:

Table 4: Pearson Product-moment correlation between attitude towards mathematics score and Achievement in mathematics score.

		Madhyamik Mathematics	Attitude towards mathematics
Madhyamik Mathematics	Pearson Correlation	1	.621**
	Sig. (2-tailed)		.000
	N	784	784

** Correlation is significant at the 0.01 level (2-tailed)

The correlation was found to be significant thus disproving the null hypothesis H_0.

Therefore the there does exist a strong positive relation between attitude in mathematics and achievement in mathematics. In other words, it may be expected that a good attitude to mathematics may augur good results in the subject.

3.1 Gender wise analysis

The data was further subjected to gender wise analysis

Table 5: Descriptive statistics of Attitude towards Mathematics (Gender wise)

	Mean	Median	Min.	Max.	Skewness	Kurtosis
Boys	175.71	177	112	227	-.258	-.330
Girls	175.97	178	106	228	-.129	-.965

The data was subjected to compromise according to gender.

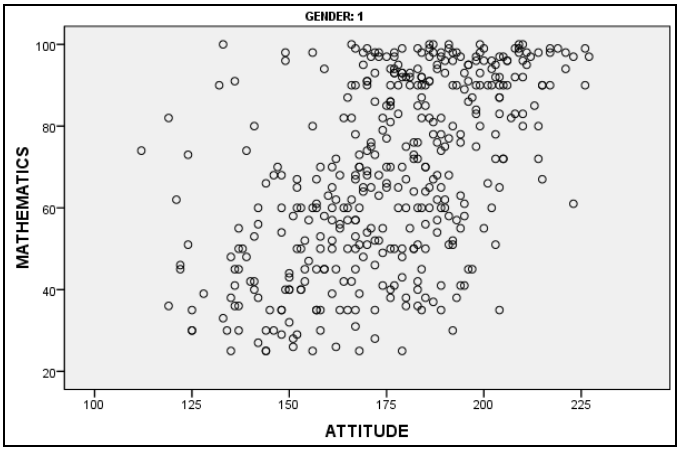
Table 6: Descriptive statistics of Achievement in Mathematics (Gender wise)

	Mean	Median	Min.	Max.	Skewness	Kurtosis
Boys	68.16	68.00	25	100	-.176	-1.252
Girls	62.98	64	23	100	-.085	-1.362

The relevant null hypotheses to find attitude towards mathematics and achievement in mathematics on a gender wise basis were as follows:

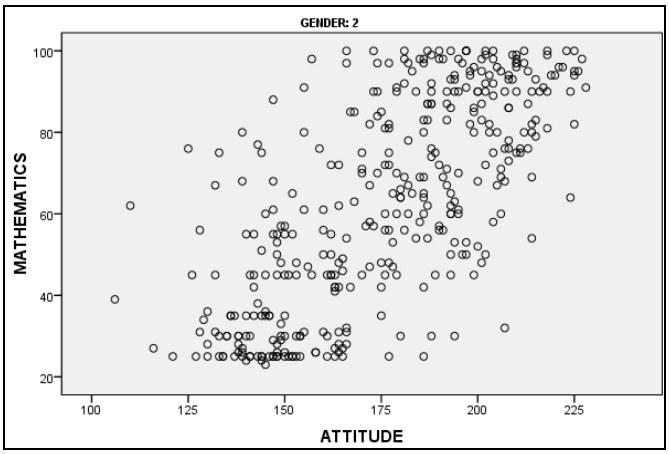
- **H_{0B}:** There is no relation between attitude towards and achievement in mathematics of boys.
- **H_{0G}:** There is no relation between attitude towards and achievement in mathematics of girls.

The Pearson Product Moment Correlation technique was used to test the H_{0B} and H_{0G}: Scatter plot for Boys.



Scatter plot for Boys Student

Scatter grams showing the relationship between attitude towards mathematics and achievement in mathematics for boys and girls were constructed. They indicated viable linear correlations between the two variables for both genders. Scatter plot of Girls



Scatter plot of Girls Student

The Product Moment Correlation yielded the following:

Table 7: Gender wise Pearson Product-moment correlation between attitude towards mathematics score and achievement in mathematics

Gender wise	Achievement in Mathematics	Attitude towards mathematics
Ach. in Mathematics (Boys)		
Pearson Correlation	1	.531**
Sig. (2-tailed)		.000
N	407	407
Ach. in Mathematics (Girls)		
Pearson Correlation	1	.702**
Sig. (2-tailed)		.000
N	377	377

** Correlation is significant at the 0.01 level (2-tailed)

Table 7 shows that attitude to mathematics and achievement in mathematics is highly significantly positively correlated, both for girls and for boys. Thus H_{0B} and H_{0H} are to be rejected. Thus both for boys and girls, better attitude to mathematics can augur better results in the subject. The correlation in the case of girls is perceptibly higher than that of boys. This shows that the influence of attitude to mathematics on mathematics achievement is greater for girls than it is for boys.

3.2 Stream wise analysis

The data was subjected to stream wise analysis.

Table 8: Descriptive statistics of Attitude towards Mathematics (Stream wise)

	Mean	Median	Min.	Max.	Skewness	Kurtosis
Science	191.50	192.0	119	228	-.609	.740
Arts	157.85	154.0	106	225	.484	.140
Commerce	176.11	177.5	124	215	-.253	.011

Table 9: Descriptive statistics of Achievement in Mathematics (Stream wise)

	Mean	Median	Min.	Max.	Skewness	Kurtosis
Science	86.86	90	39	100	-1.202	1.085
Arts	45.30	44	23	97	.626	-.398
Commerce	57.05	57	25	91	0.128	.000

The relevant null hypotheses to find attitude towards mathematics and achievement in mathematics on a stream wise basis are as follows.

- **H_{0S}:** There is no relation between attitude towards and achievement in mathematics of Science students.
- **H_{0A}:** There is no relation between attitude towards and achievement in mathematics of Arts students.
- **H_{0C}:** There is no relation between attitude towards and achievement in mathematics of Commerce students.

The Pearson Product Moment Correlation technique was used to test H_{0S}, H_{0A} and $H_{0C.}$

Scatter grams showing the relationship between attitude towards mathematics and achievement in mathematics for Science, Arts and Commerce were constructed. They indicated viable correlations between the two variables for the three streams. The Product Moment Correlation yielded the following:

Table 10: For Science Pearson Product-moment correlation between attitude towards mathematics score and achievement in mathematics

Stream wise	Madhyamik Mathematics	Attitude towards mathematics
Ach. in Mathematics (Science)		
Pearson Correlation	1	.206**
Sig. (2-tailed)		.000
N	347	347
Ach. in Mathematics (Arts)		
Pearson Correlation	1	.421**
Sig. (2-tailed)		.000
N	305	305
Ach. in Mathematics (Commerce)		
Pearson Correlation	1	.078**
Sig. (2-tailed)		.000
N	132	132

** Correlation is significant at the 0.01 level (2-tailed)

Table 10 shows that Attitude towards Mathematics and Achievement in Mathematics are highly significantly positively correlated for student in all three streams of study. Thus H_{0S}, H_{0A} and H_{0C} are to be rejected. Thus for students of all three streams, better attitude to mathematics may augur better results in the subject.

Table 10 shows that the correlation is greatest for Arts students, followed by science students, followed by commerce students. This shows that Arts students' achievement in mathematics is most affected by their attitude to mathematics.

4. Discussion

This study shows that attitude towards mathematics and achievements in mathematics are significantly and positively correlated, both for boys and girls, and for students in the different streams of study. Thus it indicates that attitude to mathematics has a definite impact on mathematics achievement. The results of this study may be corroborated by some other studies in India and abroad. Mahanta (2014) [18] found a positive correlation between attitude to mathematics and achievement in the subject among Class X students in Nagaon district of Assam. Choudhury and Das (2012) [3] also found that positive attitude to mathematics had a beneficial effect on mathematics achievement in Assam. Mohd and Mahmood (2011) [21] in Kuala Lumpur in Malaysia found that students in higher education programs demonstrated that attitude to problem solving contributed significantly to mathematics achievement. In contrast, Mubeen *et al.* (2013) [22] in Pakistan surveyed 500 students of Class IX and X. They found that the correlation between attitude to mathematics and achievement in mathematics was not significant.

The present study shows that the correlation between attitude to mathematics and mathematics achievement is greater for girls than for boys. This implies that the greater positive attitude of girls to the subject increases the likelihood of their success in the examination. In other words, girls require that their confidence and self-efficacy in the subject be boosted for their achievement in the subject to be improved. Unfortunately, mathematics is often regarded as a boys' subject, thus dissuading girls from forming positive attitudes towards it. Mahanta and Islam (n.d) have shown in their study that boys attitude to mathematics is higher than that of girls. This prevents girls from achieving as well as boys in mathematics. Hence the confidence and general attitude to mathematics

among girls needs to be uplifted, so that more and more girls enter the portals of mathematics and mathematical subjects of study.

This study also shows that the correlation between attitude to mathematics and achievement in mathematics is strongest in the case of Arts students and least for Commerce students. For Arts students this possibly indicates that they are the most influenced by their attitude to mathematics as compared to students in other streams of study. It is common to hear about fear and phobia about mathematics among Arts students. It could be possible that Arts students often shun mathematical thinking because of their poor attitude to the subject. The remedy for this is to devise ways to improve attitude to mathematics among students in Elementary and High School so that their aversion and intimidation mathematical ideas may be averted and so that they may feel more confident and able in mathematical studies.

Commerce students appear to be the least influenced by attitude to mathematics. This may be explained by their focus on the utilitarian aspect of mathematics rather than any affinity to it. Science students not demonstrate as much dependability on their attitude to mathematics for their mathematics achievement. Mathematics to them in class XI, involves not only commitment to mathematics but the embracing of science, and particularly physical science. Thus the association between their attitudes towards mathematics and their mathematics achievement is not as apparent as it is for Arts students.

This study, therefore, stresses on the impact of attitude to mathematics for mathematics achievement. This implies that instead of burdening students with mathematical concepts and haranguing them about practising mathematics problems, the key to furthering mathematics achievement lies in ways to improve mathematics attitude among students.

5. Reference

1. Allport G. Attitudes. In The Hand book of Social Psychology. Worcester, MA: Clark University Press. 1935; 2:798-844
2. Ashcraft MH, Kirk EP. The relationship among working memory, math anxity, and performance. Journal of Experimental Psychology General. 2001; 130:224-237.
3. Choudhury R, Das DK. Influence of Attitude towards Mathematics and Study Habit on the Achievement in Mathematics at the Secondary Stage. International Journal of Engineering Research and Applications. 2012; 2(6): 192-196.
4. Daskalogianni K, Simpson A. Towards a defination of attitude: the relationship between the affective and the cognitive in pre-university students. In Procedia of PME, Hiroshima, Japan, 2000; 2:217-224.
5. Di Martino P, Zan R. "Me and maths": Towards a defination of attitude grounded on students' narratives. Journal of Mathematics Teacher Education. 2010; 13:27-48.
6. Doepaken D, Lawsky E, Padwa L. Modified Fennema Sherman Mathematics attitude scales, 1993. Retrive from http:/ woodrow.org/teachers/math/gender/oscale.html.
7. Eagly AH, Chaiken S. The psychology of attitudes (p. 794). Harcourt Brace Jovanovich College Publishers, 1993. Retrive from http:/ books.google.co.in/books/about/Thepsychologyofattitudes .html?id=oPYMAQAAMAAJ&pgis=1.
8. Ernest P. The knowledge, belief and attitudes of the mathematics teacher: A model. Journal of Education for Teaching. 1989; 15(1):13-33.
9. Fogarty G, Cretchley P, Harman C, Ellerton N, Konki N. Validation of a questionnaire to measure mathematics confidence, computerconfidence, and attitudes towards the use of technology for learning mathematics. Mathematics Education Research Journal, 2001. doi. 10.1007/BF03217104.
10. Gillham JE, Shatte AJ, Reivich KJ, Seligman MEP. Optimism, Pessimism, and Explanatory Style. In Optimism & Pessimism: Implication for Theory, Research, and Practice, 2000, 53-75). doi: 10.1037/10385-003.
11. Haladyna T, Shaughnessy J, Shaughnessy JM. A casual Analysis of Attitude towards Mathematics. Journal for Research in Mathematics Education. 1983; 14:19-29.
12. Hart L. Describing the Affective Domain: Saying what we mean. In D.B. McLeod & V. M. Adams (Eds.), Affecting and Mathematical Problem Solving. New York, NY: Springer New York, 1989. doi: 10.1007/978-1-4612-3614-6.
13. Iben MF. Attitude and Mathematics. Comprative Education. 1991; 27(2):135-151.
14. Kundu A, Ghose A. Van Hiele Level of Geometry thinking among H.S. students from different streams of study. 'Sikshachintan' a Journal of Education. 2015; 9:119-124.
15. Kundu A, Ghose A. The Relationship between Attitude and Self efficacy In Mathematics among Higher Secondary Students. IOSR Journal of Humanities and Social Science. 2016; 21(4):25-31.
16. Leung FKS. Behind the high achievement of East Asian students. Educational Research and Evalution. 2002; 8:87-108.
17. Ma X, Kishor N. Assessing the relationship between attitude towards mathematics and achievement in mathematics: A meta-analysis. Journal for Research in Mathematics Education. 1997; 28(1):26-47.
18. Mahanta D. Impact of Attitude and Self-Concept of the Students towards Mathematics upon their achievement in Mathematics. International Journal of Theoretical & Applied Science. 2014; 6(1):20-35.
19. Mahanta S, Islam M. (n.d). Attitude of Secondary Students towards Mathematics and its Relationship to Achhievement in Mathematics. International Journal of Computer Technology and Applications. 3(2):713-715.
20. McLeod D. Research on affact in mathematics education: A reconceptuatization. In Hand book of research on mathematics teaching and learning. doi: New York, 1992, 575-596.
21. Mohd N, Mahmood TFPT. The Effect of Attitude towards Problem solving in Mathematics Achievements. Australian Journal of Basic and Applied Sciences. 2011; 5(12):1857-1862.
22. Mubeen S, Saeed S, Arif MH. Attitude towards Mathematics Achievement in Mathematics among Secondary Level Boys and Girls. IOSR Journal of Humanities and Social Science. 2013; 6(4):38-41.
23. Nkwe DT. Teacher's attitude, with special reference to mathematics teaching. Unpublished master's thesis,

University of Witwatersrand, Johannesburg, South Africa, 1985.
24. Phillips S. Contributiong factors to music attitude in sixth, seventh-, and eighth-grade students, PhD dissertation, University of Iowa, Iowa City. Retrived October 15, 2010, from ProQuest Dissertations & Theses database. (Publication No. AAT 3097568), 2003.
25. Thompson KM. Geometry students' attitude towards mathematics: an emerical investigation of two specific curricular approches. Unpublished master's thesis California state University Dominguez Hills, USA, 1993.
26. Reed HC, Drijvers P, Kirschner PA. Effect of attitude and behavoiurs on learning mathematics with computer tools. Computer and Education, 2010; 55:1-15.
27. Sandt S, Van Der. Research Framework on Mathematics Teacher Behaviour: Koehler and Grouwns' Framework. Eurasia Journal of Mathematics, Science andTechnology Education. 2007; 3:343-350.
28. Schenkel BD. The Impact of an Attitude towards Mathematics on Mathematics Performance, 2009. Retrived from https://etd.ohiolink.edu/ap/10?0::No.:10:P10_ETD_SUBID:55523.
29. Sherman HJ, Christian M. Mathematics attitudes and globel self-concept: An investigation of the relationship. College Student Journal. 1999; 33:95-101. Retrieved from http://eserv.uum.edu.my/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=1999-10984-009&site+ehost-live&scope=site
30. Stevenson HW, Chen C, Lee SY. Mathematics achievement of Chinese, Japanese, and American children: ten years later. Science (New York, N.Y.), 1993; 259:53-58.
31. Tapiia M, Marsh II GE. An Instrument to Measure Mathematics Attitudes. Academic Exchange Quarterly, 2004; 8(2). Retrieved from http:// www.rapidintellect.com/AEQweb/cho25344.html
32. Tocci CM, Engelhard Jr G. Achievement, Parential Support, and Gender Difference in Attitude towards Mathematics. The Journal of Educational Research. 1991; 84(5), 280-286. Retrieved from http://www.jstor.org/stable/40539696
33. Trujillo KM, Hadfield OD. Tracing the Roots of Mathematics Anxiety through In-Depth Interviews with Pre-service Elementary Teachers. College Students Journal, 1999. Retrieved from http://www.questia.com/library/journal/1G1-62839422.tracing-the-roots-of.mathematics-anxiety-through-in-depth
34. Wigfield A. The role of children's achievement values in the self-regulation of their learning outcomes. In D. Schunk & B. Zimmerman (Eds.), Self-Regulation of Learning and Performance: Issues and Educational Application, 1994, 101-124). Hillsdale, NJ: Lawrence Erlbaum Associates.
35. Wilson P. Promoting Positive Attitudes. Mathematics Teaching Incorporating Micromath, 2008. Retrieved from http://eric.ed.gov/?q=promoting+positive+attitudes&id+EJ815090.