AN INVESTIGATION INTO THE UNDERSTANDING OF ANXIETY ABOUT MATHEMATICS LEARNING IN THE GRADUATING STUDENTS OF KARACHI

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Abstract

Appropriate learning of mathematics is considered to be a critical component for the development of a scientific society. Our curriculum of mathematics courses are well developed and comparable to the curriculum of any other recognized and good university but still the graduating students lack the ability of mathematical understanding. Out of many reasons for the inability of mathematics learning, anxiety has been a neglected topic. The rationale of this research is to dig out the presence of anxiety factors among our students so that in future they can be targeted and confronted properly. For this purpose, a survey based research was conducted for quantitatively finding the mathematics anxiety among the graduating Pakistani students. A sample of 360 students from Electronic Engineering, Business and Media Sciences were taken and data was evaluated using principal component analysis and regression statistics. The research instrument was a questionnaire that was specifically developed for this purpose. Results revealed that two factors are predominantly contributing towards mathematics anxiety in Pakistan ;(1) inability of students to correlate mathematics with practical life and (2) the student's emotional instability towards the subject. These factors successfully explained the total proportion of 54.24%of anxiety for mathematics in the sample. Our qualitative study also showed that remaining can be attributed to the lack of digital tools, boring teaching style, untrusting assessment criteria and non-existence of student's psychological counselling. This article concludes with recommendations for developing effective mathematics learning progressing towards a scientific society in Pakistan and in similar demographics of South Asia.

Keywords: Anxiety, mathematics education, regression, statistical analysis, principal component analysis.

INTRODUCTION

En route to reaching a professional learning community, science, mathematics and technology are indispensible components in the higher education machinery of a country. Mathematics, being the key discipline common in many professional degree programs, has its unrivaled reputation. Significance of having a solid background in mathematics is well recognized, as it serves a gateway to professions in a variety of fields of engineering, computer science, business, medicine, media sciences and arts (Masanja, 2002). Current and future technological advances entail a rock-hard understanding of mathematical concepts underlying them (Khuda, 2019). Therefore schools, higher education institutions and universities must respond with effective teaching and learning of this subject for the prosperous future of the country. Mathematics is taught both as a subject and also as part of other subjects. Therefore students must attain not only empirical but also conceptual understanding of it to understand the problems and devise solutions accordingly (Khuda, 2016). Mathematics anxiety is well recognized as a feeling of tension that comes in the way with the manipulation of numbers and the solving of mathematical problems in ordinary life and academic situations (Lipsey & Wilson,1993). It is also been proved that mathematics anxiety is a major reason of destruction of mathematical achievements of a student (Sherman & Wither, 2003).

In Pakistan, there has been little or no research study available eliciting the mathematical learning problem because of anxiety among the graduating students. With this impact, if required consideration is not given to mathematics anxiety at graduate level, than it can have large and detrimental consequences leading towards the technological and scientific decay of the society. Therefore there is a dire need to measure it among the professional students, so that this factor can be combated competently. Once the components building up the anxiety among the students are known then it will be easier to find proper remedy to eradicate it. This paper is structured in a format that at first a secondary data analysis was carried out in the form of literature survey to specifically identify the present state of understanding on the topic of mathematics anxiety. This developed theoretical foundation and helped in producing the problem definition. This is followed by a discussion on material and methods used in this research and reliability analysis to indicate the validity of the research method used. Results and a discussion on the research conducted are stated afterwards which follows with the conclusions and recommendations.

LITERATURE SURVEY

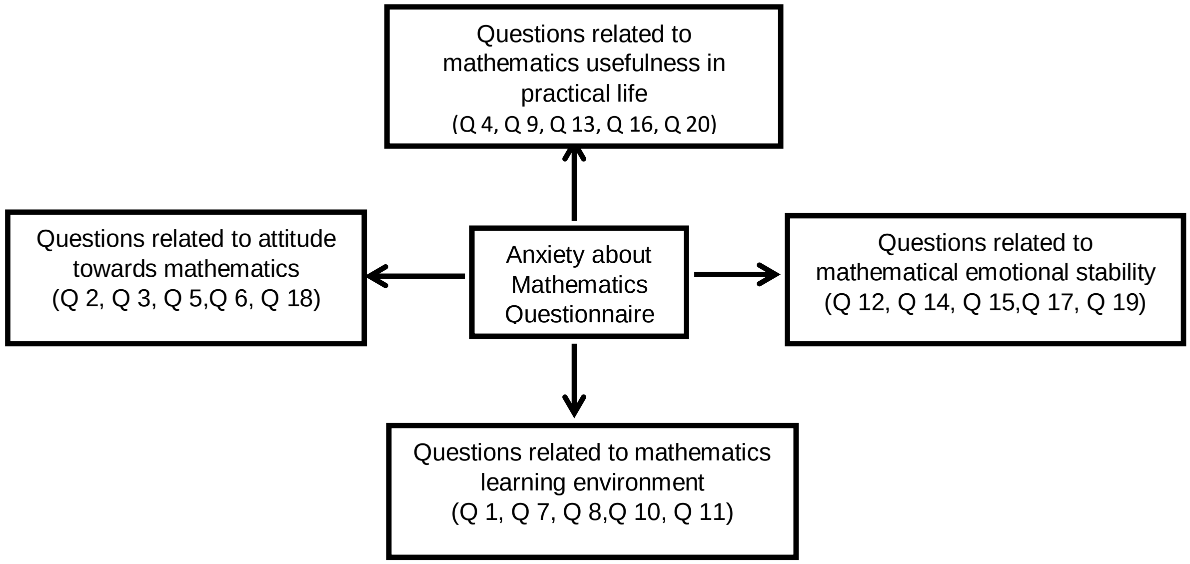
Many studies have been conducted to measure mathematics anxiety in different countries signifying its importance in their domain. Using linear modeling an examination of 26 different countries was conducted to analyze the *inverse*relationship between mathematics anxiety and achievements in mathematics among elementary and secondary students in Canada. An extensive study was made to explore the varaiance of Iranian students mathematics achievements with mathematics anxiety (Kiamanesh, 2004). Approximately 50.8% of mathematics'non-achievents werebecause of anxiety towards the subject.In another study it was found that no significance difference in the problem solving techniques exists between lower and higher class school students. This further indicated that no work was done to confront and improve mathematics anxiety among the students while advancing to higher class (Tarim & Akdeniz, 2008). From Malaysia, researchers explored the aftermath of matriculation students' passiveness and failures in mathematics subject (Zakaria, 2008). It was found that this was narrated by their anxiety in mathematics.

Over the study for the past decade showed that mathematics anxiety may be identified by varying factors broadly ranked as psychographic or demographic in nature. It was found that mathematics self-concept, home background, teaching, and attitude towards mathematics were the most important factors that affected the student's achievement in the subject (Demir, 2009).Most measures for gauging mathematics anxiety implicate questionnaires and rating scales (Thomas & Dowker, 2000; Krinzinger, et al., 2007).In addition to questionnaires, there are also some research studies that have endeavored to measure anxiety using physiological measures when the subject is exposed to mathematical stimuli. These include examples like heart rate and skin conductance, cortisol secretion from salivary glands for measuring mathematics anxiety in the subjects (Pletzer, Wood, Moeller, Nuerk, & Kerschbaum, 2010;Mattarella-Micke, Mateo, Kozak, 2011). LIkewisebrain imaging measures including electroencephalogram (EEG) recordings and functional MRI have also been used to measure mathematics anxiety in the subjects (Van Dillen, Heslenfeld, & Koole, 2009; Paul, 2012;Núñez-Peña & Suárez-Pellicioni, 2015). For a low cost consistent research, reliability of mathematics anxiety questionnaires has generally been found satisfactory and is taken as an established fact (Dowker, 2016).

MATERIALS AND METHODS

There are many factors to measure anxiety about mathematics but in broad categorization there can be four anxiety producing factors, namely; no feeling of usefulness of mathematics, negative attitude towards the subject, emotional factors and environmental factors. To measure these factors, a research instrument was formulated in the form of a questionnaire. This would include both closed ended and open ended questions. The closed ended questions were designed to directly measure the mentioned four factors and open ended questions were designed to get more inside information. Closed ended questions are represented in mixed structure. Therefore respondents do not know that which question belongs to which anxiety producing factor. The questionnaire was constructed containing 20 closed ended questions and 4 open ended questions. Novelty of this research instrument is that the theme of the questions were taken from the issues found in the feedback forms of the students of this region and from the feedback of faculty either involved in teaching mathematics directly or as part of some other subject. The comments which students normally post on social media websites like Facebook® were also considered. The aim of this work was to measure the most recurrent of these anxiety factors about mathematics which are common among students belonging to three different professional disciplines in Pakistan; engineering, business and media sciences graduation programs. Observable variables are questions in the questionnaire, also called as items. This newly developed questionnaire is provided for reference in Appendix I. Mapping of the questions with the anxiety about mathematics producing factors is provided as follows in Figure 1.

Figure 1
Mapping of the questions to different factors producing anxiety about mathematics in the questionnaire



Analysis of the data obtained from the questionnaire was made using SPSS ® throughout this study. The factors constituting mathematics anxiety were extracted and detailed by carrying out *Exploratory Factor Analysis* or *EFA***.** These factors defined the numeric measure of anxiety and were then modelled as regression polynomials in terms of the questions in the questionnaire. Hence regression analysis was conducted to obtain particular linear combination of the variables. The questionnaire was filled by the students of three different study groups; Electronic Engineering, Business and Media Sciences In total 360 students were selected randomly; 120 from each study group; Bachelor of Business Administration (BBA), Bachelor of Electronic Engineering (BE-EE) and Bachelor of Media Science (BMS).This formed the sample under study. Students' selection was made with consideration to a set profile characterized by the randomization and representativeness of the sample. Simple random sampling (SRS) technique of sampling was used so that every student had equal chance of being part of the sample under study. Thus the sample included, average, below average or above average students. Sample frame comprised of equal number of males & females aged 18 & above. So therefore mostly of them were 1st semester students. It is to be noted that it was difficult to have same number of male and female students so some were also taken from the next higher semesters.

INSTRUMENT VALIDATION
Data was prepared before starting with the analysis. Basic descriptive statistics were produced to note any missing/abnormal data entry. Special care was taken that all the variables should measure the construct in the same direction. Items were taken to be in positive direction when they were phrased in such a way that an agreement with the item represented a relatively high level of the attribute being measured. Items were taken to be in the negative direction when they were phrased in such a way that an agreement with the item represented a relatively *low* level of the attribute being measured. The attribute that was measured in this research using the questionnaire was "mathematics anxiety". The questionnaire was designed in such a way that questions/ variables/ items 1,7,8,10,11,12,15,17 and 19 were all in the negative direction. In the process of data preparation all the negatively directed questions were reverse scored on SPSS using the *recode* menu option. This was done to obtain consistency in the dataset, so that high scores on the questionnaire all reflected high levels of anxiety (being) measured.

Data obtained from the research instrument was reduced by the approach called *"data reduction"* or *"dimension reduction"* using correlation operation (Liang, Li, & Kim, 2004). Initially there were 20 questions in the questionnaire. These questions are also called as items or variables. By means of data reduction the initial set of variables, 20, was reduced to a smaller number, 9. Items with low multi-collinearity were taken to be in the final correlation matrix and would give us the factors. To prepare the correlation matrix, criteria that was used was (1) firstly to consider only correlation coefficients which were significant ($p < 0.05$) and (2) secondly the determinant of the correlation matrix was checked to be greater than 0.00001. The obtained correlation matrix is shown in Table 1.

Table 1: Correlation matrix or R-matrix with determinant = 0.080and p value < 0.05.

		Q2	Q4	Q5	Q6	Q9	Q13	Q16	Q18	Q20
Correlation	**Q2**	1.000	.302	.409	.420	.185	.186	.356	.399	.255
	Q4	.302	1.000	.423	.244	.370	.400	.453	.470	.401
	Q5	.409	.423	1.000	.438	.154	.231	.390	.309	.271
	Q6	.420	.244	.438	1.000	.281	.176	.416	.335	.329
	Q9	.185	.370	.154	.281	1.000	.333	.309	.410	.347
	Q13	.186	.400	.231	.176	.333	1.000	.340	.188	.364
	Q16	.356	.453	.390	.416	.309	.340	1.000	.502	.503
	Q18	.399	.470	.309	.335	.410	.188	.502	1.000	.388
	Q20	.255	.401	.271	.329	.347	.364	.503	.388	1.000
Sig. (1-tailed)	**Q2**		.000	.000	.000	.021	.021	.000	.000	.002
	Q4	.000		.000	.004	.000	.000	.000	.000	.000
	Q5	.000	.000		.000	.047	.005	.000	.000	.001
	Q6	.000	.004	.000		.001	.027	.000	.000	.000
	Q9	.021	.000	.047	.001		.000	.000	.000	.000
	Q13	.021	.000	.005	.027	.000		.000	.020	.000
	Q16	.000	.000	.000	.000	.000	.000		.000	.000
	Q18	.000	.000	.000	.000	.000	.020	.000		.000
	Q20	.002	.000	.001	.000	.000	.000	.000	.000	

Correlation matrix or R-matrix obtained in Table 1 prepared the data in the format which was ready to be treated under statistical analysis for factor extraction. The aim was to find factors of anxiety about mathematics learning. For this factor analysis was performed. The purpose of factor analysis was to explore the underlying variance structure in the R-matrix.

STATISTICAL ANALYSIS

After preparing the data, quantitative statistical analysis was performed in the following sequence.

FACTOR EXTRACTION

There are different ways to perform factor extraction. The method used here is Principal Component (Haiming, 2005). Accordingly, it is a technique of scrutinizing the data for determining a linear combination of minimum set of variables that are characterized for displaying maximum variance. Principal Component Analysis was conducted on SPSS and using Kaiser's criterion only those factors were selected whose eigenvalues were greater than 1 (Williams, Brown, & Onsman, 2012). In factor analysis, eigenvalues are used to summarize the variance in a correlation matrix. Factors with the highest eigenvalue have the most variance and so on, down to factors with small or negative eigenvalues that are generally not considered in the solutions. Factor rotation was also performed to obtain factors that are different from each other as possible. Hence orthogonal varimax rotation was used to produce uncorrelated factors. The extracted factors with eigenvalues are shown as the variance in Table 2.

Table 2: Table showing total variance found using the Principal Component Analysis as extraction method showing eigenvalues for the present dataset.

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.765	41.833	41.833	2.517	27.969	27.969
2	1.117	12.407	54.240	2.364	26.272	54.240
3	.823	9.143	63.384			
4	.718	7.979	71.363			
5	.692	7.686	79.050			
6	.604	6.710	85.759			
7	.486	5.401	91.161			
8	.409	4.548	95.709			
9	.386	4.291	100.000			

Rotated component matrix showing the quantitative relationship between obtained components or factors in Table 2 with the testing variables shown in Table 1 are shown in Table 3. The loadings in the columns of *Components* in the Table 2 show the correlations of each of the tests in the study with the factor obtained and thus the variance.

Table 3: Table showing matrix of rotated components using the method of Varimax with Kaiser Normalization.

	Components	
	1	**2**
Q 2		.763
Q 4	.658	
Q 5		.737
Q 6		.736
Q 9	.710	
Q 13	.717	
Q 16	.552	.514
Q 18	.508	.488
Q 20	.662	

FACTOR NAME ATTRIBUTION

Final part of the factor analysis was to propose common themes from the content of the questions that loaded onto the same factor from factor rotations performed earlier. As shown in Table 4two factors were obtained in our principal component analysis. Factor 1 comprised of Q4, Q9, Q13, Q16, Q18 and Q 20. Factor 2 comprised of Q 2, Q5, Q6, Q16 and Q18. Common theme for factor 1 was interpreted as ignorance of math usefulness and theme for factor 2 as emotional instability towards math.

Table 4: Rotated component matrix with factor interpretation information.

Components	1	2
I feel frightened by mathematics problems		.763
I will never use and need mathematics in my future work	.658	
I feel I cannot do good in mathematics tests		.737
I cannot easily concentrate while solving large calculations and often make mistakes.		.736
Learning mathematics is a waste of time	.710	
Mathematics can never help me earn a good living	.717	
I study mathematics just to pass it, I do not know how to use it	.552	.514
I do not enjoy doing calculations	.508	.488
I don't find any practical application of the mathematics that I study	.662	

FACTOR SCORE INTERPRETATION

Factor scores can be modelled in the equation form by using multiple regression technique. These were obtained/ from two pieces of information, 1) the factor score coefficient matrix and 2) the standardised scores for the observed variables. The factor score coefficient matrix was obtained from SPSS as shown in Table 5. These are coefficients used in the modelled regression equation.

Table 5: Score coefficient matrix for regression analysis

	Components	
	1	2
Q2	-.181	.424
Q4	.264	-.005
Q5	-.141	.390
Q6	-.140	.389
Q9	.375	-.176
Q13	.398	-.216
Q16	.149	.134
Q18	.132	.132
Q20	.286	-.043

Standardised scores can also easily obtained in SPSS using the descriptive statistics menu option. Standardized values are also known as z-scores. Theoretically, z-scores for a variable, is equal to variable's mean being subtracted from its value and then divided by the standard deviation. Using the obtained two factors, therefore the two multiple regression equation providing numerical value for the obtained factors, are as follows.

$$Factor_1 = -.181(z_{scoreQ2}) + 0.264(z_{scoreQ4}) - .141(z_{scoreQ5}) - .140(z_{scoreQ6}) + .375(z_{scoreQ9}) + 0.398(z_{scoreQ13}) + 0.149(z_{scoreQ16}) + 0.132(z_{scoreQ18}) + 0.286(z_{scoreQ20}) \quad (1)$$

$$Factor_2 = +0.424(z_{scoreQ2}) - 0.0005(z_{scoreQ4}) + 0.390(z_{scoreQ5}) + 0.389(z_{scoreQ6}) - 0.176(z_{scoreQ9}) - 0.216(z_{scoreQ13}) + 0.134(z_{scoreQ16}) + 0.132(z_{scoreQ18}) - 0.043(z_{scoreQ20}) \quad (2)$$

RELIABILITY ANALYSIS

Reliability refers to the accuracy and precision of a measurement procedure. The most common measure and index of reliability, is called Cronbach's coefficient *alpha* (α). If Cronbach's alpha falls below 0.7, then the relevant questions in the subset are deleted in order to increase the Cronbach's alpha above 0.7. Using SPSS the reliability analysis test results are shown in Table 6 and Table 7for the $Factor_1$and $Factor_2$respectively. As indicated in Table 6 the Chronbach's alpha overall value of 0.745, is a satisfactory result. In Table 6 the values in the column labeled *Alpha if item is deleted* are the values of overall alpha if that item isn't included in the calculation. Results in this column should approximate overall Chronbach's alpha value; which is coherent in our case. Similarly as indicated in Table 7 the Chronbach's alpha overall value of **0.767** and it is also a satisfactory result.

Table 6: Reliability test results for $Factor_1$showing Cronbach's alpha value of 0.746; indicating good reliability.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.746	.745	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q9	9.6000	13.486	.477	.253	.713
Q13	9.0667	14.315	.412	.209	.735
Q16	9.1417	12.644	.583	.386	.673
Q18	9.2667	13.340	.517	.338	.698
Q20	9.1250	12.732	.561	.331	.681

Table 7: Reliability test results for $Factor_2$showing Cronbach's alpha value of 0.767; indicating good reliability.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.767	.767	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q2	10.6167	13.011	.533	.296	.726
Q5	10.9083	13.126	.517	.286	.731
Q6	10.3833	13.314	.544	.309	.723
Q16	11.2000	12.430	.567	.349	.714
Q18	11.3250	12.961	.522	.313	.730

RESULTS AND DISCUSSION ON OPEN ENDED QUESTIONS

Each of the four open ended questions in the research instrument was explored to identify factors contributing to mathematics anxiety among students of electronics engineering, business and media departments. Using a qualitative method of content analysis, text excerpts indicating different ideas were coded. Codes were not predetermined but were rather empirical observations. Each new code marked a distinct idea, which was not previously highlighted in the closed questionnaire. Using SPSS, codes and their associated text passages were linked, building up a data set of codes and their frequency of use.

Codes sharing similar nature were combined and grouped together to give new ideas/themes. Analysis of 120 written responses produced a total of 480 discrete notes across the dataset. Interesting observations detailed deeper and provided well rounded description of the factors which have developed anxiety for mathematics subject among the graduating students. Appendix II can be referred for students' quotes obtained in their responses. The central themes of these responses were extracted and their percentages (of similar replies) are indicated below.

a. Teacher's individual support (35% response)

Students expressed that previously they were not very good in the subject but with individual concentration of the teachers, they were able to overcome their weak areas in mathematics.

b. Ridiculing and Bullying in the Class (32% response)

Students' reply showed problems with the class room environment which has produced negative influence of mathematics.

c. ***Preference of teachers to some students over others' (18 % response)***

Collectively students have expressed their discomfort when teachers start giving priority to some students over others. This has also created negative attitude for mathematics in them.

d. ***Lack of Confidence (15% response)***

Students expressed their lack of confidence to do calculations when either asked to come on the board or orally give the answer. The teacher notifying this normally practiced to ask the same student every time. Similar experiences of students have brought negative influence of mathematics in them and gradually they lost interest in the subject.

e. ***Minor mistakes in the solution of lengthy questions (7% response)***

Students pointed out that in solving lengthy problems a miss of step led to incorrect solution of the problem and loss of marks. This discouraged them from mathematics learning.

f. Pre-determined and formulated questions (7 % response)

Collectively students have criticized the format of question paper used by some teachers of predetermined questions. This has influenced negatively for the subject.

g. Fun learning (5 % response)

Students responded that they had a very pleasing time learning mathematics in school so now they are conceptually much better than others and quickly get the approach to solve a problem.

h. Getting good grades (5 % response)

Students have collectively acknowledged the fact that getting good grades have always acted positively.

CONCLUSIONS AND RECOMMENDATIONS

In this research statistical models were formulated to measure mathematics anxiety in terms of two factors found commonly among Pakistani undergraduate students of Electronic Engineering, Business and Media Sciences. The mathematics anxiety factors that were found deterministically are(1) "ignorance of understanding math usefulness" and (2) "emotional instability". The quantitative analysis has shown that *Factor 1* accounted for 27.969% of the variability in all variables and *Factor 2* has accounted for 26.272% for the variability. Hence the total variability explained by our analysis is 54.240%. It is an interesting finding that students from different study domains showed same factors accounting into the anxiety. The reason is assumed to be same educational standard in secondary and higher secondary levels of education of these students in Pakistan. Segregation into different professional study domains is made at university level (separate professional careers). This further suggests that main cause of mathematics anxiety was already germinated at the school level.Reliability analysis has validated this research instrument positively. From qualitative study it was found that most of the discouragement in learning mathematics is from the very own class room environment and mathematics teacher is the key person to play an effective role in this regards. The results and observations in this study has stemmed out the inclusion of action research programs, student counselling, inclusion of ICT, and regular teacher trainings as suggestions and recommendations for the improvement of mathematics anxiety among the students. No study on mathematics anxiety is available with reference to graduating students of Pakistan at present. This research paper has attempted to fill this gap and provided a foundation to further this research so that benefits could be reaped for developing effective professional learning communities in Pakistan and in other similar countries of South Asia. Because of similar demographics, results and discussions presented here can also be generalized to other developing countries. Contribution is also in the design and development of a research instrument for measuring mathematics anxiety solely considering the problems of students for this region of interest. Reliability analysis has quantitatively shown the validity and trustworthiness of the newly developed questionnaire as an instrument for measuring mathematics anxiety.

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Appendix I

Questionnaire to Measure Anxiety About Mathematics

To the participant

In this survey study you are asked to rate yourself on a number of phrases or statements. After reading each statement, you would mark your answer in the table below. Put a CHECK MARK “X” in one box only that best suits.

Name of Student: ______________________________**Program of Study:** ______________________

Current Semester/Year: _______________________________________

Questions	Strongly Disagree	Disagree	N/A	Agree	Strongl y Agree
1. I am regular in my math tests for the last one year	☐	☐	☐	☐	☐
2. I feel frightened by mathematics problems	☐	☐	☐	☐	☐
3. I need to prepare much more for math tests than for other subjects.	☐	☐	☐	☐	☐
4. I will never use and need mathematics in my future work	☐	☐	☐	☐	☐
5. I feel I cannot do good in mathematics tests	☐	☐	☐	☐	☐
6. I cannot easily concentrate while solving large calculations and seldom make mistakes.	☐	☐	☐	☐	☐
7. I feel normal and confident to work in mathematics in the presence of others.	☐	☐	☐	☐	☐
8. My parents and/or friends helps me and encourage me in my math problems	☐	☐	☐	☐	☐
9. Learning mathematics is a waste of time	☐	☐	☐	☐	☐
10. I have had math teachers whom I felt were really good teachers providing elaborate examples.	☐	☐	☐	☐	☐
11. I have never been punished and embarrassed in math class for not understanding something.	☐	☐	☐	☐	☐
12. I do not get nervous when asking questions in mathematics class.	☐	☐	☐	☐	☐
13. Mathematics can never help me earn a good living	☐	☐	☐	☐	☐
14. I am never dull or unable to think clearly when working math	☐	☐	☐	☐	☐
15. My heart beats are pretty normal while doing math tests.	☐	☐	☐	☐	☐
16. I study mathematics just to pass it, I do not know how to use it	☐	☐	☐	☐	☐
17. I do not approach math with a feeling of hesitation	☐	☐	☐	☐	☐
18. I do not enjoy doing calculations	☐	☐	☐	☐	☐
19. I am never tense during my math tests	☐	☐	☐	☐	☐
20. I don’t find any practical application of the mathematics that I study	☐	☐	☐	☐	☐

Briefly describe one experience which you feel really influenced your attitude towards mathematics (either positive or negative):

____

____

What do you like most about learning mathematics?

____

____

Are you more interested in math theory or math practice? Say which and explain why.

____

____

Appendix- II

Sample of Students' Responses to Open Ended Questions

S.No.	Students' quote
1.	*"Earlier I didn't like mathematics. Never got presentable grades in it. Then when I was in matric (secondary school) one of my teachers taught me how to solve questions easily and quickly. Afterwards I felt in myself a positive change in my attitude towards mathematics".*
2.	*"Though I love math but sometimes in some difficult questions I get stuck and face some difficulty but in 1st year when I got a brilliant teacher who taught me really well from that day I got influenced towards mathematics".*
3.	*"I ask too many questions (some are pretty dumb), so other people just laugh at me. I don't know really what they think of me. But only when the teacher answers me without hesitation then my confidence shoots up and overall I am motivated. These types of things change my attitude towards maths (and other subjects as well)".*
4.	*"Whenever I asked questions in my class every one made fun of that. My brain is slow and in first attempt I cannot get to the logic".*
5.	*"I was embarrassed in class in front of all my friends".*
6.	*"Preference of teachers to appreciate those students only who finish calculations faster has reduced my confidence in the subject. Everyone understands things differently."*
7.	*"In first year in my college, teacher told me to come and solve the problem on white board and explain it to all the students. That was my first time. I lacked confidence to solve problems in front of everybody. This has brought negative attitude for math in me".*
8.	*"When I was in my matriculation, I solved a very length question. The pattern was correct but little mistakes made the whole question wrong. That thing influenced negative attitude in me for the subject".*
9.	*"In doing preparation of math exams, it was boring to understand some formulated questions. So this brought in a negative attitude towards the subject in me".*
10.	*"My math attitude is good because we had fun learning at school level".*
11.	*"Though I love math but sometimes in some difficult questions I get stuck and face difficulty. In my high school luckily I got a brilliant teacher who taught me really well. From that day I got influenced towards mathematics".*
12.	*"Securing A+ in my mathematics paper (high school) influenced in me for math".*