

## **To Investigate the Relationship between Performance in Mathematics and Students' Anxiety towards the Subject**

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**Abstract:** *As revealed in various researches, mathematics anxiety implies psychologically a feeling of nervousness or a negative mind-set towards solving mathematical problems, which impacts on students' learning practices and outcomes. In looking more closely at why a remarkable number of students may be struggling for improvement in mathematics in comparison to other subjects, it is timely to consider, the mathematics anxiety factor. This study intends to investigate how students' anxiety towards this subject affects in their performance. How their anxiety lead them towards inappropriate learning mathematics and consequently poor performance in secondary level students and how to assist in mitigating math anxiety. The study adopted a descriptive survey design and data was largely descriptive by nature. Data were collected using "Math-Anxiety Inventory" for the students of secondary level. These were administered on a sample of 384 students selected from 13 secondary schools of different categories of Guwahati city. The internal reliability and validity were examined. The formulae used for internal reliability were Split-half reliability and Cronbach Alpha. Data collected were coded and subjected to a Statistical Package for Social Science (SPSS) analysis which indicates primarily that the students' anxiety towards mathematics and their performance in that subject are negatively co-related irrespective of gender of the students and category of the schools under the domain of the study.*

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### **I. Introduction**

Mathematics anxiety can be defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving mathematical problems in an open variety of societal life and academic situations. Math anxiety indicates psychologically a feeling of tension<sup>1</sup> which interferes in learning and performances. It was mentioned as a fear and apprehension<sup>2</sup>. Mathematics anxiety, considered a fear or phobia, produces 'a negative response specific to the learning, or doing, of mathematical activities that interferes with performance'<sup>3</sup>. It is defined as low self confidence, a negative mind-set towards mathematics learning<sup>4</sup>, feeling threatened<sup>5</sup>, a factor of failing to reach potential<sup>6</sup> and a temporary reduction in working memory<sup>7</sup>. It was defined math anxiety as panic, helplessness, paralysis and mental disorganization that arises at the time of solving mathematical problems<sup>8</sup>. Tobias described math anxiety as a feeling of sudden death<sup>9</sup>. "In pursuance of these definitions and considerations by the researchers it can be considered to be a factor, which interferes with the manipulation of numbers and the solving of mathematical problems in academic, and social environments<sup>1,10</sup>. Thus, math anxiety as a psychological construct interferes in developing students' thinking skills it can be considered as a significantly important factor of poor performances of school students in mathematics"<sup>11</sup>.

"In our study, for selection of samples, stratified random sampling technique has been adopted. The schools from which students of IX standard are considered as samples, have been stratified into three strata—provincialised schools under SEBA (Board of Secondary Education Assam), private schools under SEBA and private schools under CBSE (Central Board Of Secondary Education) of Guwahati city. The samples from each stratum are taken through simple random sampling technique. The stratification is done to produce a gain in precision in the estimates of characteristics of the whole population. All the students of IX standard from private, govt., provincialised including SEBA and CBSE of the city formed the population of our study. At 95% confidence level with + 5% level of precision, the estimated sample size from a total of 12531 was found to be 384. The samples, 384 students from 13 selected schools are considered to be representative samples"<sup>12</sup>.

Capital city of the state, Guwahati of Kamrup District is a key destination for education for the students of the whole of north-eastern region of India. The city covers large number of schools under SEBA and CBSE with variations of managerial status and socio-economic conditions.

## II. Main objectives

- To investigate the relationship between students' mathematics anxiety and their performance in mathematics
- To investigate the relationship between Sex and mathematics anxiety
- To investigate the difference of mathematics anxiety within the various categories of the schools.

## III. Hypotheses

H<sub>01</sub>: There is no significant relationship between students' mathematics anxiety and their performance in mathematics.

H<sub>02</sub>: There is no significant relationship between Sex and mathematics anxiety.

H<sub>03</sub>: There is no significant difference of mathematics anxiety within the category of the schools.

## IV. Tools used in the study

To carry out research investigation, data must be gathered with the help of which an investigator can test the hypothesis. Various tools and techniques are there to gather information, according to the need of the study. From the available tools, the researcher has to select them which will be used to collect data he or she wants for testing hypothesis.

In the study, 'Mathematics Anxiety Inventory' questionnaire was used to collect the required data from the sample students under the study.

### Mathematics Anxiety Inventory

A set of carefully designed questions are adapted in the inventory to measure the students' mathematics anxiety wherein questions are stratified in terms of positive and negative. The questionnaire deals with identifying mathematics anxiety for the secondary level students. The inventory consists of 20 items on a 5-point Likert scale. Five items are worded positively and the next five are worded negatively. Responses are rated from five possible choices: strongly agree, agree, neutral, disagree and strongly disagree. We assigned the following numeric values to the positively phrased questions: strongly disagree=5, disagree=4, neutral=3, agree=2, and strongly agree=1. We assigned the following numeric values to the negatively phrased questions so that high scores indicate a positive attitude: strongly disagree=1, disagree=2, neutral=3, agree=4, and strongly agree=5. In this way, the Scores range was from 20 to 100.

### Classification of Anxiety Level

The subjects (sample students) were classified into the following three categories in accordance with the raw scores obtained by them through the inventory.

**Table 1:** Classification of subjects according to their anxiety

Anxiety Level	Scores
High	80 and above
Average	50-79
Low	49 and below

To assess their performance in mathematics half yearly examination's marks in the subject were recorded through the questionnaire.

### Reliability of mathematics anxiety scale inventory

In the present study the Cronbach coefficient Alpha of the whole test ( $r_{kk(\alpha)}$ ) is given by the formula -

$$r_{kk(\alpha)} = \frac{k}{k-1} \left[ 1 - \frac{\sum S_i^2}{S_x^2} \right]$$

Where,  $k$  = number of items in the test = 3 (for the data related to our investigation)

$S_x^2$  = variance of the test scores = 41.543 (for the data related to our investigation)

$\sum S_i^2$  = the sum of the variances of the item scores

The Cronbach Alpha for the questionnaire we used for our investigation is found to be 0.78. Thus the alpha value is greater than 0.70, which agrees with the recommendation that for an instrument to be used, its internal co-efficient- Chronbach's alpha must be at least 0.7<sup>13</sup>.

### Estimation of validity

The validity may be measured with the help of index of reliability. The validity of the mathematics anxiety scale questionnaire used for the present study was found with the help of index of reliability.

$$\text{Index of reliability, } r_{1\infty} = \sqrt{r_{11}}$$

In this case, the reliability coefficient (Chronbach's alpha) is 0.78. Therefore, the index of reliability is 0.88. The present index of reliability implies that the test measures true ability of the subjects to the extent of 88%. That means the validity of the questionnaire is 0.88.

### V. Methodology

The methodology adopted for the study consists of-

- A. **Co-relation coefficient:** the linear correlation is used to find the relation between the ATM and PIM.
- B. **t-test:** Independent t-test is used to test the significance difference between ATM of Boys and Girls Students.
- C. **ANOVA:** ANOVA is used to test the significance mean difference among the students of different types of schools.
- D. Linear Regression model is used.

### VI. Analysis and Remarks

Students' responses received from the mathematics anxiety inventory were scored accordingly as designed in the inventory then entered into Statistical Package for Social Science (SPSS). After completion of data entry into the software analysis were run.

#### Correlation

First of all correlation co-efficient was checked which reveals the Table II. In table II it has been seen that the 'r'- value of mathematics anxiety level (MAL) and performance in mathematics (PIM) is -0.698 which indicates a negative co-relation. So, it reveals that the students' mathematics anxiety and their performance in mathematics are significantly negative co-related. In this context the linear regression equation found to be  $y=11.6 - 1.09x$ , Table-III. Thus, it can be considered as having strong evidence to reject the null hypothesis that students' mathematics anxiety and their performance in mathematics have no relationship. Therefore it can be stated that the students' mathematics anxiety and their performance in mathematics are significantly co-related.

**Table II:** 'r'- value of performance in mathematics (PIM) to the students' mathematics anxiety level (MAL)

Variable	r-value	p-value	Comment
PIM-MAL	-0.698	0.0001	Reject

**Table III:** linear Regression

Model	Regression coefficient	Sig
(Constant)	11.6	0.0001
Anxiety	-1.09	0.0000

#### Linear regression line

The trend line which fits well the data has been generated from the software as shown in the figure. Also its equation revealed as  $y=11.6 - 1.09x$ , where y is the dependent variable PIM, and x is independent variable MAL with y-intercept 11.6 and slop -1.09 (Table-III). The equation leads to the conclusion that when x will increase, y will decrease accordingly, i.e. if students' anxiety towards mathematics is higher, then their performance level in the subject will be lower. Therefore, to improve students' performance level in mathematics it is urgently required to mitigate their anxiety level towards the subject.

#### Scatter Plot

We use the scatter plot to identify visually the relationship between students' mathematics anxiety and their performance in the subject. Data related to MAL and PIM plotted on XY-plane anticipating MAL along X-axis and PIM along Y-axis where it was found that the points followed a linear pattern well (Fig. I). Therefore, we can say that there is a higher linear negative co-relation between MAL and PIM. Hence, it can be concluded that students' with lower anxiety level can perform better.

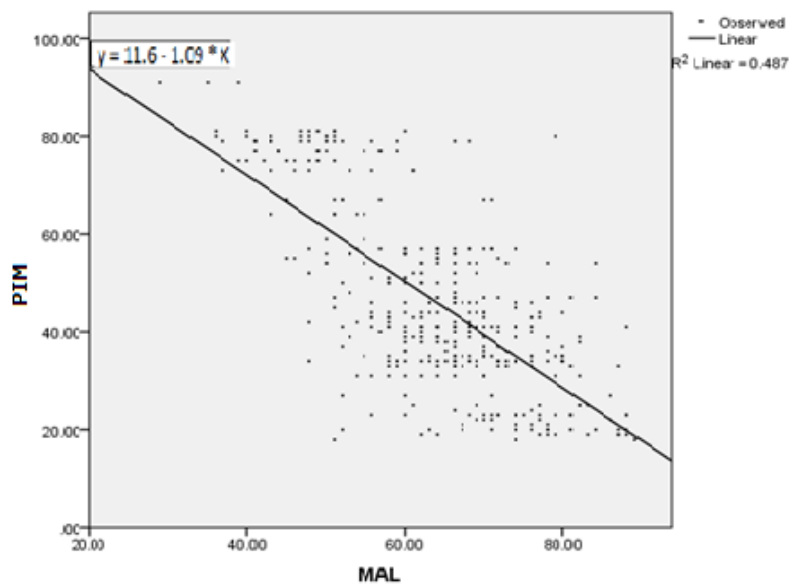


Fig. I: x-y scatter of performance in mathematics and mathematics anxiety level

**Student's t-test**

After finding a negative correlation between students' mathematics anxiety level and their performance in the subject we intended to test how students' mathematics anxiety level differ by sex wise, for which 't'-value was found to be 0.53 with 'p'-value 0.35 which is not less than 0.001 (Table-IV). So, the test is not significant. Therefore, there is no strong evidence to reject the null hypothesis on sex and mathematics anxiety; i.e., no significant difference of anxiety level exists between the boy as well as girl students within the study domain.

Moreover, it has been depicted in the box plot, Fig.-II which also revealed having no significant difference between the MAL of boys and girls.

**Table IV:** 't'-value for MAL of boy and girl students

Sex	N	Mean	S.D	t-value	P-value	Comment
Boys	214	47.68	10.3	0.53	0.35	N.S
Girls	170	49.37	9.7			

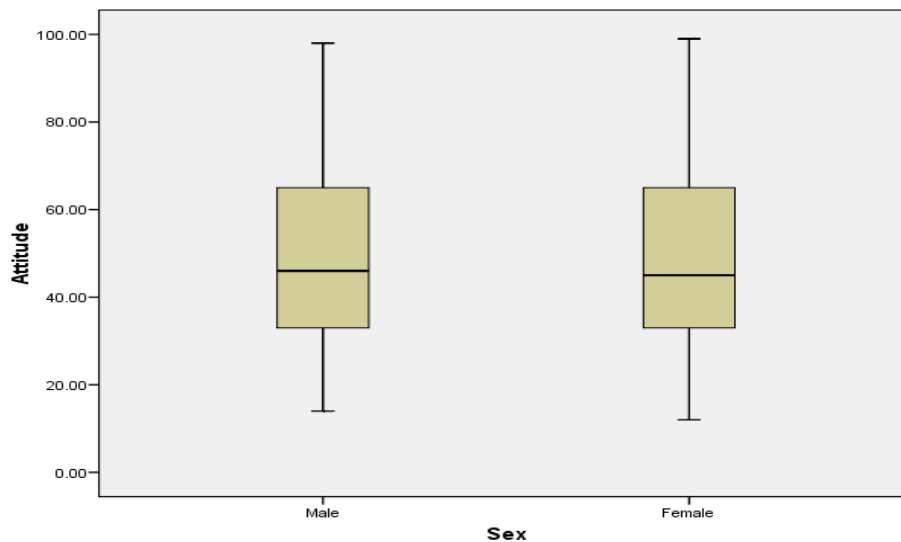


Figure-II: Sex wise box plot of students' MAL

**ANOVA**

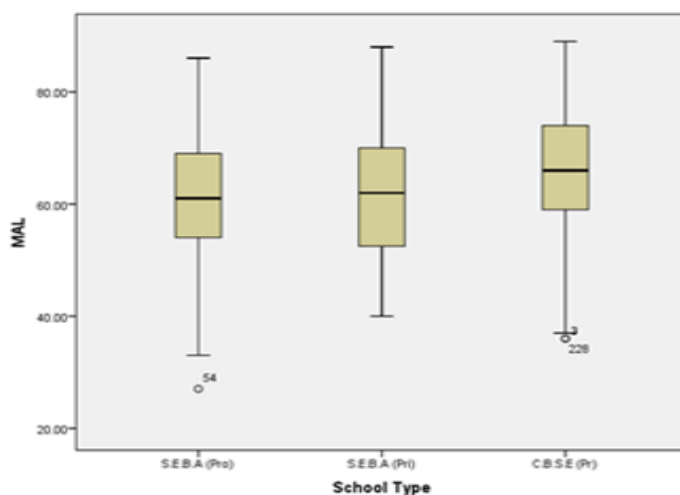
The following table shows *F*-statistic derived from one way ANOVA analysis.

**Table V:** ANOVA of MAL amongst different categories of school

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	441.84	2	220.94	1.64	0.195
Within Groups	51326.02	381	134.71		
Total	51767.87	383			

In this case, the calculated *p*-value is 0.195 which is not less than 0.001(Table-V). Therefore, there is no strong evidence to reject the null hypothesis of having no significant difference in means of students' mathematics anxiety level amongst different categories of schools under the study.

Moreover, it has been depicted in the box plot, Fig.-III which also revealed having no significant difference of students' mathematics anxiety level amongst different categories of schools under the study.



**Fig. III:** School category wise box plot for Mathematics anxiety level

**Bar graph**

A cross tabulation (Table-VI) on students' anxiety level and achievement level has been made category wise of the schools under the study for pictorial representation in Bar Graph. Demographic characteristics on Students' mathematics anxiety level and their achievement level in the subject have been depicted in the figures (Fig. IV, V VI ).

**Table VI :** Anxiety level , achievement level, school category cross tabulation

School Category	Anxiety level	Achievement level					Total
		Excellent	Very good	good	Satisfactory	Unsatis factory	
CBSE(pvt)	High	5	9	11	10	9	44
	Average	10	15	13	13	7	58
	Low	13	21	16	2	3	55
	Total	28	45	40	25	19	157
SEBA(prov)	High	2	8	10	16	12	48
	Average	3	15	11	8	2	39
	Low	5	18	15	1	0	39
	Total	10	41	36	25	14	126
SEBA(Pvt)	High	4	7	8	2	5	26
	Average	10	19	13	3	1	46
	Low	12	14	3	0	0	29
	Total	26	40	24	5	6	101

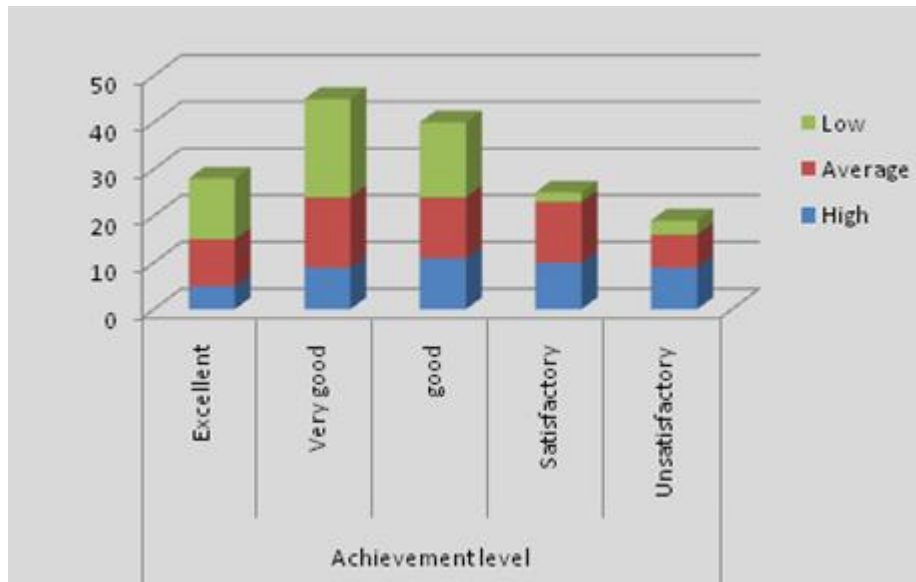


Fig. IV: Demographic characteristics on students' anxiety level and achievement level, (CBSE, Pvt)

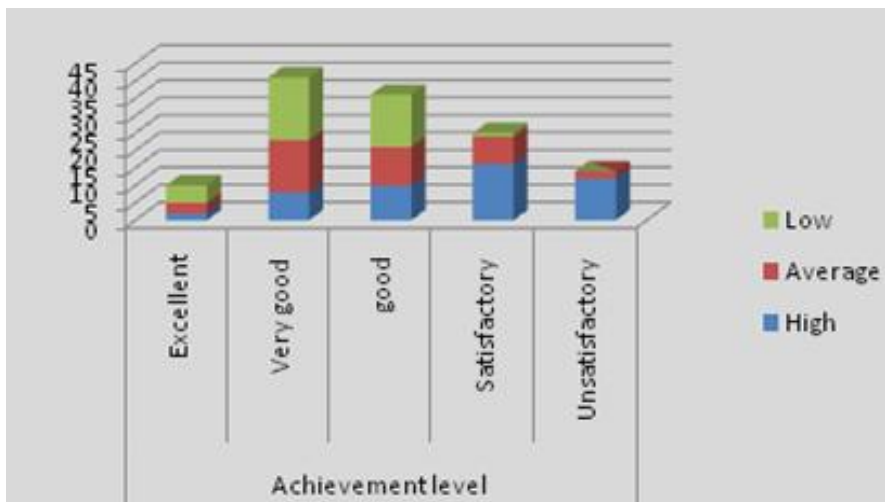


Fig. V: Demographic characteristics on students' anxiety level and achievement level, (SEBA, Prov)

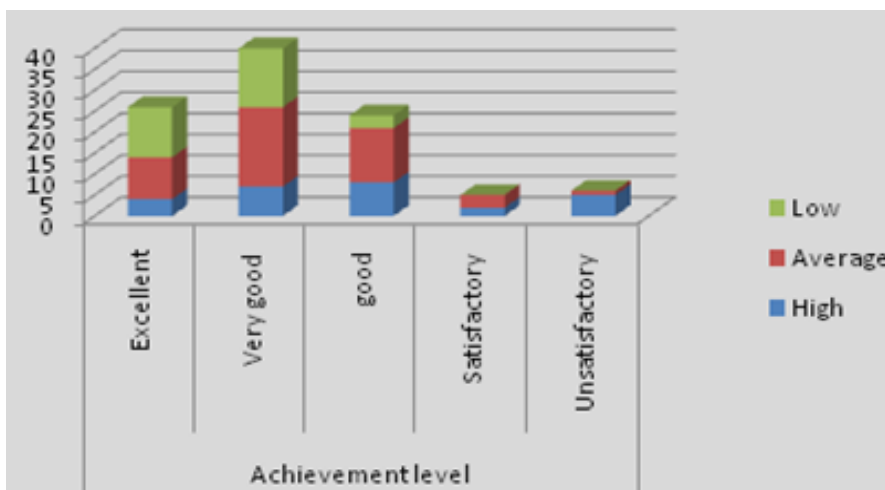


Fig. VI: Demographic characteristics on students' anxiety level and achievement level, (SEBA, Pvt)

## VII. Findings

1. There is a strong negative co relation between students' mathematics anxiety and their performances in the subject.
2. There is no significant difference of students' mathematics anxiety amongst different categories of schools.
3. There is no significant difference between mathematics anxiety of the boy and the girl students.

## References

- [1]. Richardson, F.C., & Suinn, R.M.: 1972, 'The Mathematics Anxiety Rating Scale: Psychometric Data', *Journal of Counseling Psychology* 19, 551-554.
- [2]. D'Ailly, H., & Bergering, A. J. (1992). Mathematics anxiety and mathematics avoidance behaviour: a validation study of two factor. *Educational and Psychological Measurement*, 52(2), 369-378.
- [3]. Whyte, J. M. (2009). *Maths anxiety: The what, where, and how*. Unpublished Masterate research report. Palmerston North: Massey University.
- [4]. Jain, S., & Dowson, M. (2009). Mathematics anxiety as a function of multidimensional selfregulation and self-efficacy. *Contemporary Educational Psychology*, 34(3), 240-249.
- [5]. Zohar, D. (1998) An Additive Model of Test Anxiety: Role of Exam-Specific Expectations. *Journal of Educational Psychology*, 90(2), 330-340.
- [6]. Perry, A. B. (2004): Decreasing math anxiety in college students. *College Student Journal*, 38(2), 321.
- [7]. Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology: General*, 130, 224-237.
- [8]. Tobias, S. & Weissbrod, C. (1980): Anxiety and Mathematics: an update, *Havard Educational review*, 50(1), 63-70
- [9]. Tobias, (1993): *Overcoming Math Anxiety*. New York: w.w. Norton & Company.
- [10]. Suinn, R., Taylor, S., & Edwards, R., (1988): Suinn Mathematics Anxiety Rating Scale For Elementary School Students (MARS-E): Psychometric And Normative Data. *Educational and Psychological Measurement*, 48, 979-986.
- [11]. Das R, Das G C, "Math Anxiety: The Poor Problem Solving Factor in School Mathematics", *International Journal of Scientific and Research Publications*, Volume 3, Issue 4, April 2013 1 ISSN 2250-3153 www.ijsrp.org (Impact factor-1.22).
- [12]. Das G C, Sinha S, "Effect of Socioeconomic status on performance in Mathematics among students of secondary schools of Guwahati city" *IOSR Journal of Mathematics (IOSR-JM) e-ISSN: 2278-5728, p-ISSN: 2319-765X. Volume 13, Issue 1 Ver. I (Jan. - Feb. 2017), PP 26-33 www.iosrjournals.org DOI: 10.9790/5728-1301012633 www.iosrjournals.org 26 | Page*
- [13]. Santos, J.R.A. : Cronbach's Alpha: A Tool For Assessing The Reliability Scales, *Journal Of Extention* 37(2), Retrieved September 14, 2006 (1999), from [http:// www.joe.org/joe/1999 April/ tt3. html](http://www.joe.org/joe/1999_April/tt3.html).

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