An Investigation on the Relationship Between Performance in Mathematics and Students' Attitude Towards the Subject in Secondary Schools of Guwahati

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ABSTRACT *All the stake holders are greatly concerned with the students' performance in mathematics of secondary level students as this standard is considered to be significantly important. This study intends to investigate how students' attitudes towards this subject influence in their performance. How their attitudes towards the subject lead them towards inappropriate learning mathematics and consequently poor performance in secondary level students. The study adopted a descriptive survey design and data was largely descriptive by nature. Data were collected using questionnaires for the students of 9th standard. These were administered on a sample of 384 students selected from 13 secondary and senior secondary schools 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 overall that students' attitude towards mathematics and their performance in that subject are significantly co- related.*

Introduction

Mathematics is accepted compulsorily across the world in school education, as it enhances students' thinking power which is primarily significant for their further studies or field of work. Even during their schooling tenure it helps the children to improve their performance in other subjects as mathematics enhances thinking skill. This subject deals with the fundamentals of any invention as thinking skill is the root source of inventions. From day to day life to research fields its impact lies. In schooling period it is extremely important for the children to develop their interest and attitude towards learning and achievement in mathematics. All stakeholders—parents, teachers, schools' principals, are still worry about the performances of their children in mathematics with the student themselves.

According to oxford dictionary attitude means "a settled way of thinking or feeling about something" and in North America it is truculent or uncooperative behavior. If students settled mathematics subject as a difficult, boring or interesting in their minds then this attitude may reflect their performance. In this study an investigation is carried on how this attitude leads students' performance in mathematics. The results of the investigations on attitude and anxiety in 1970 [1] suggested that the measures of attitude and anxiety might be better predictors of achievement of females than that of males.

It seems that the number of dissertations and published articles dealing with attitude towards mathematics increased geometrically since Feierabend's (1960) report "Review of research on psychological problems in mathematics education" (Aiken, 1970). This shows a growing interest of mathematics education researchers in the area of attitudes toward mathematics. In this context, mathematics educators have considered the connection between students' attitudes toward mathematics, and their achievement in the subject as one of the major concerns (Ma & Kishor, 1997). Ma and Kishor further stated that "the research literature, however, has failed to provide consistent findings regarding the relationship between attitude toward mathematics and achievement in mathematics" (p. 27). This discrepancy of result might have stemmed from differences in research method, context, and other intervening factors (Belbase S., 2013).

In today's high-tech world rapidly developed technology leads to change in the expectation of communities from the individuals. In this regards systems of education across the globe are facing as a challenge. To educate individuals in globalised world information construct, critical thinking, establishing connectivity among phenomena and incidents are very significant for which assessment studies is being important and increased over times which present empirical data about a country. This type of empirical findings may help in quality comparative assessment among the countries creating an opportunity in evaluation and policy making in the field of education. Some of the projects, such as TIMSS (Trends in International Mathematics and Science Studies), PIRLS (Progress in International Reading Literacy Study) and PISA (Programme for International Student Assessment), which were applied for this purpose and organized by OECD and aiming at determining the students' achievements and in school and out-of-school factors that affect their achievements are the main case studies in the field of education (Wu, 2010).

A relationship exists between mathematics self-efficacy beliefs and attitudes toward mathematics subject (Stramel, 2011). In the studies (Dandy & Nettelbeck, 2002; House, 2004; O'Dwyer, 2005; Randhawa, Beamer, & Lundberg, 1993; Shen, 2002) it has been revealed that there is a positive relationship between the mathematic efficacy beliefs of the students and their mathematics achievements. There are various research findings giving contrast results concern to the relationship between attitude and performance across the world. There is a casual relationship between attitude and performance (Lianghuo 2005).

The Third International Mathematics and Science Study

(TIMSS) revealed that despite having negative attitude towards mathematics the Japanese students outperformed students from many other countries. Chilean students like and value mathematics but had inflated their self perception of their mathematical competence, which has been reported using the data from the 1999 Trends in International Mathematics and Science Study (TIMSS) in the study of Ramirez, 2010. The way students' perceive their teachers' in terms of knowledge of mathematics contents, communication ability, teaching methods and classroom management skills has a significant relationship with students' attitude towards mathematics. When the students' perception of their teachers' characteristics is low, students' attitude towards mathematics tends to be negative (Etuk, 2013) cited in Muthulakshmi (2014). Stuart (2000) argued that negative attitudes and performance about mathematics has various causes, traceable to poor or ineffective teaching, shyness, influence of mathematics anxious teachers, siblings, peers, or the lack of confidence when working in mathematical situations .This shows that performance is an outcome of many factors which are interlinked. Hence the need to continuously conduct researches in trying to improve performance is justified as cited in Chagwiza C J (2013). Young people's attitudes towards science, technology, engineering, and mathematics are subject to interpersonal influence of significant persons, defined as those who influence a person's attitudes (Sjaastad, 2013).

Objectives

In the present study our aim is to enquire the students' attitudes towards mathematics in terms of their---

- Views on mathematics
- Confidence on learning mathematics
- Views on usefulness of mathematics
- Views on mathematics teachers

Also to enquire relationship between their achievement in mathematics and attitude towards the subject exist.

Hypothesis

- H_{01}: There is no significant relationship between attitude towards mathematics and performance in mathematics.
- H_{02} : There is no significant relationship between Sex and attitude towards mathematics.

Samples

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 Educatiion) of Guwahati. 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., provincialiseed including SEBA and CBSE of Guwahati formed the population of our study. At 95% confidence level with $\pm$ 5% level of precision, the estimated sample size from a total of 12531 was found to be 384. This sample size of 384 students from 13 selected schools are

considered to be representative of student population of Guwahati. Students were selected from each school by us-

ing Cochran formula at 95% confidence level with $\pm$ 15% margin of error (Table-I).

Table I: The Distribution of Sample Size for Class IX Students of Different Schools of Guwahati

C.S*	S*	P*	S*	Allotted Sample Size		
				B*	G*	Total
SEBA Provincialised	S_1	48	23	12	11	23
	S_2	85	29	15	14	29
	S_3	46	22	10	12	22
	S_4	110	31	20	11	31
	S_5	42	21	10	11	21
SEBA Private	S_6	190	35	20	15	35
	S_7	164	34	21	13	34
	S_8	121	32	17	15	32
CBSE Private	S_9	75	27	12	15	27
	S_{10}	116	31	19	12	31
	S_{11}	118	32	22	10	32
	S_{12}	156	34	17	17	34
	S_{13}	149	33	13	20	33
Total				208	176	384

"*" (C.S. "Category of School" S "Schools" P. "Population Size"

S. "Sample size" B "Boys" G "Girls")

Tools

The following tools were used to collect the data from the students

- A carefully designed questionnaire to measure the students' attitude towards mathematics wherein questions are stratified in terms of views on mathematics subject, confidence on learning mathematics, views on usefulness of mathematics and views on mathematics teachers.
- To assess their performance in mathematics half yearly examination's marks in the subject were recorded through the questionnaire.

The investigator administered directly entire process attending the schools under the study.

Methodology

The methodology adopted for the study is

Co-relation coefficient: the linear correlation is used to find the relation between the ATM and PIM.

t-test: Independent t-test is used to test the significance difference between ATM of Boys and Girls Students.

ANOVA: ANOVA is used to test the significance mean difference among the students of different types of schools.

Linear Regression model is used.
Reliability of attitude towards mathematics (ATM) questionnaire

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 (Santos, 1999).

Estimation of validity of the questionnaire
The validity may be measured with the help of index of re-liability. The validity of the Attitude towards mathematics scale questionnaire used for the present study was found with the help of index of reliability.

Index of reliability, $r_{1\infty} = \sqrt{r_1}$

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 abil-ity of the subjects to the extent of 88%. That means the validity of the questionnaire is 0.88.

Analysis and Remarks
Table II: 'r'- value of performance in mathematics (PIM) to the attitude towards mathematics (ATM)

Variable	r-value	p-value	Comment
PIM-ATM	0.88	0.0001	Reject

In table II it has been seen that the 'r'- value of ATM and PIM is 0.88 which is closed to 1. So, it indicates that the students' attitude towards mathematics and their per-formance in mathematics are significantly related. In this context the linear regression equation found to be *PIM=9.45+0.75 ATM*, (Table-III).

Table III: Linear regression

Model	Regression coefficient	*p*-value
(Constant)	9.451	0.0001
Attitude	0.75	0.0000

Thus, it can be considered as having strong evidence to reject the null hypothesis on ATM and PIM that the stu-dents having highly positive attitude towards mathematics can perform better in the subject

Table IV: 't'-value for attitude towards mathematics

Sex	N	Mean	S.D	*t*- value	*P* -value	Comment
Boys	214	49.68	21.3	0.59	0.55	N.S
Girls	170	48.37	21.8			

In table IV it has been observed that the *'t'*- value is 0.591 with *'p'*- value 0.555 where there is no strong evidence to reject the null hypothesis on sex and attitude; i.e., no sig-nificant difference exists between the boys as well as girls students within the study domain which has been depicted in the box plot, Fig.-2.
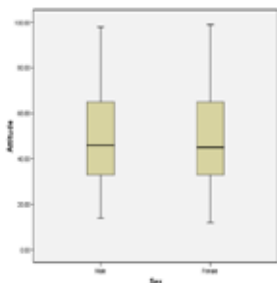


Fig.-2: sex wise box plot

Table V : Descriptive for attitude towards mathematics

Type of School	N	Mean	S.D	S.E
SEBA (Pro)	126	47.36	21.60	1.92
S.E.B.A (Pri)	101	53.84	21.86	2.14
C.B.S.E (Pr)	157	56.57	21.25	1.71
Total	384	49.10	21.51	1.09

If we observe over all ATM within the types of schools i.e., SEBA provincialised, SEBA private and CBSE private then it is noticeable that the students from SEBA provincialised schools are having a bit low attitude level in comparison to other strata, (Table-V) which has been depicted in ATM-PIM bar, (Fig.-3)
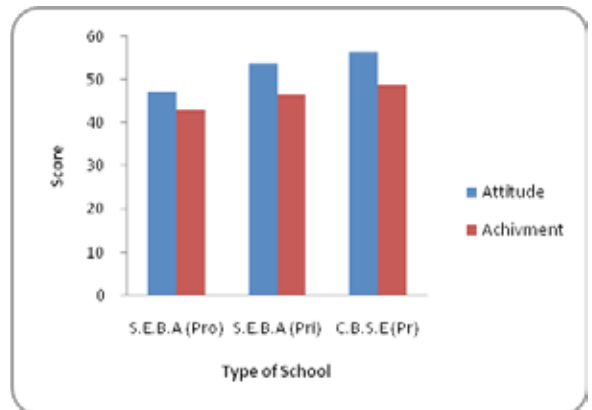
Fig.-3: ATM-PIM bar
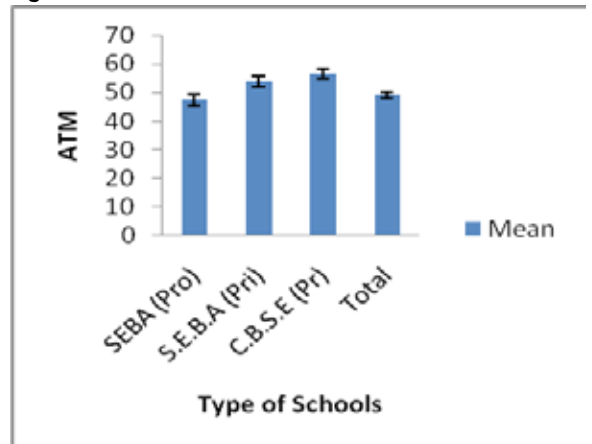
Fig.4: Error bar diagram on types of sc

Table VI: ANOVA for ATM

	Sum of Square	df	Mean Square	F	Sig
Between Groups	2897.334	2	1448.6		
Within Groups	176732.3	381	463.86	3.12	0.04
Total	179629.6	383			

From the table VI, it is observed that there is a significance difference among the students of the schools viz. SEBA Provincialised, SEBA Private and CBSE Private attitude towards mathematics. So accordingly found to be differ-ent performance levels among the students of the schools within the study domain.
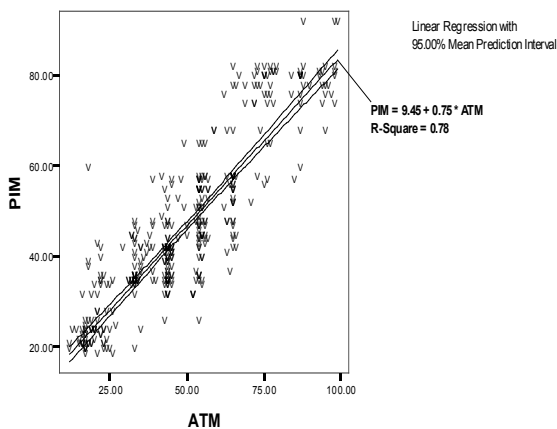
Fig.-I: x-y scatter

However, so many students are there who greatly recognize the usefulness of mathematics despite its abstract nature and problems but all of them could not perform well. So, other emotional factors like anxiety, self efficacy, teachers' pedagogy would be there to be emphasized parallel so that the students become more inquisitive and gain an effective understanding on mathematics.

Conclusion

From the study, it can be said that for better performance in mathematics, to develop a positive attitude towards the subject is significantly important. Students' perceptions on learning this subject settled in their minds have to be changed by the concerned teachers and parents to develop an attitude towards the subject. The study also reveals that the attitude towards mathematics remains indifferent sex wise i.e. , no significance difference was found between the attitude levels of boys as well as girls which leads that any boy or girl can achieve richness in mathematics. In the perspective of school type it can be said that the students from SEBA provincialised have been found to be little bit poor level in terms of both attitude towards mathematics and performance in mathematics in comparison to the other type of schools for which special attention need to be paid by the concern authority and policy makers with co operation of all stake holders.

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