Achievement in Mathematics: Effect of the Class Environment upon Positive/ Negative Attitude of Students

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Research Article

Abstract: This paper is concerned with the effect of class environment and positive/negative attitudes of the students of class-X in Secondary Schools located in the District of Nagaon under the state of 'Assam' with regard to their achievement in mathematics. A questionnaire containing 40 questions prepared by the researcher was distributed among the 500 students selected from 20 schools taking 25 students from each school. The students were asked to submit their responses from five options given as: (i) strongly agree, (ii) agree, (iii) neutral, (iv) disagree and (v) strongly disagree. The data collected from the responses given by the students were analysed using statistical tools. The outcome reveals that

a) most of the boys and girls have positive attitude towards mathematics

b) there exists slight difference in the achievement in mathematics due to differences in class environment and there is significant correlation between the achievement of boys and girls both in Assamese and English medium schools.

Keywords: Attitude of students, mathematics achievement, class environment, t-test, Pearson's Correlation.

1. Introduction

Mathematics is a fundamental part of human thought and logic and is integral to out attempts at understanding the world and ourselves.Study of mathematics is considered to be very important in each and every country of the world. This is due to the fact that mathematics is basic to most other disciplines of study like science, engineering and technology. In India, the Secondary Education Commission appointed in the year 1952 recommended that mathematics should be a compulsory subject in the schools. The Kothari Commission (1964-1966), constituted by the Govt. of India, also recommended mathematics as a compulsory subject in the school curricula. The National Policy on Education, 1980 emphasized that *'mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning.'* The National Curriculum Framework (NCF)-2005 also categorically stressed the importance of mathematics and opined that *'a high quality mathematics programme is essential for all students and provide every student with the opportunity to choose among the full range of future career path'*. For any classroom, the ideal scenario would be one where the teacher perfectly understands the requirements of the curriculum and is able to deliver the subject completely while the students are able to absorb all the knowledge imparted by the teacher. However, the actual scenario in any classroom is far from ideal.

2. Review of related study

In this section we have highlighted the main features of some of the relevant research findings that have motivated us to carry out a detailed investigation in the proposed topic of study. According to Werthamer-Larsson et al [13], children in low-achieving classroom environments had significantly higher teacher ratings of shy behaviour and aggressive behaviour than children in mixed-achieving or high-achieving environments, even after allowance for potentially confounding child characteristics and classroom behaviour environment effects. Analyses for child characteristics and classroom achievement environment effects indicated that children in poor-behaving classroom environments also had significantly higher teacher ratings of shy behaviour than children who were not in poor-behaving environments. Tarr et al [12] studied the impact of mathematics curricula and the classroom learning environment on student achievement. The study found that in the wake of the "No Child Left Behind" education policies of most governments, although the variation in achievements of students in the same school was the same, the level of achievement in schools where students studied only due to government regulations or for formality was significantly less than that in other schools. Additionally, the schools where proper standards were followed and a continuous relationship between the curriculum and student learning was established fared better. Fennema et al [4] established that an in-depth knowledge of the teachers on the courses being taught is very critical to impart education. In order to ensure that the students learn well, the teacher must not only have knowledge of mathematical theories but also of the cultural, demographic and economic diversity of the students. Ryan and Patrick [10] investigated how students' perceptions of the social environment of their classroom affected their achievement. They found that a higher-order classroom social environment factor accounted for significant improvement in all motivation and

engagement outcomes and on the other hand, prior motivation and engagement were strong predictors of achievement of the pupils in mathematics. The students' perceptions of teacher support and the teacher as promoting interaction and mutual respect were related to positive changes in their motivation and engagement. Although the study of attitude towards mathematics has been developed over a long time, but the study of attitude towards technology aided mathematics learning has a shorter history in mathematics education. To study the attitude towards use of technology for learning mathematics, Galbraith and Haines [6] defined a construct which they termed as 'computer and mathematics interaction'. They claim that in their context students indicating high computer and mathematics interaction believe that computers enhance mathematical learning and help learning in many ways. In the research paper of Edwards & Mercer [3], the following illuminating discussions are highlighted. Explicit attention to classroom social and socio-mathematical norms and to classroom discourse can result in advancing children's development of mathematical argumentation. When children learn to explain and justify their thinking to others, they develop intellectual autonomy, and in the process, mathematical power. Teachers should provide students with instructional activities that will give rise to problematic situations. Children's actions, which are logical to them but may be irrational from an adult perspective, should be viewed as rational by the teacher. Teachers should recognize that what seem like errors and confusions, are children's expressions of their current understandings. Studies on the relationship between the teachers, experience and student's performance showed contradictory results. A positive relationship between teachers' experiences and student performance was found by Bodenhausen [1], while Chhinh and Tabata [2] found a weak positive correlation. However, Klecker [7] noted that there is no significant influence upon students' achievement by their teachers' years of teaching. He opined that mathematics achievement can be attributed to other characteristics of the classroom. It is more about the interaction of the teacher, students and the curriculum. The UNICEF has developed a national report on inclusive classroom [9] in order to understand the role of classroom environment on achievement of the students. It mentions that there is first a need to recognize the changing social composition of learners in the classroom resulting from an inflow of children from diverse backgrounds in terms of caste, class, gender, ethnicity, language and religion. Otherwise, it is difficult to evolve strategies and develop plans at classroom, school and system levels to teach children from diverse backgrounds. Children usually develop their intuition for things basing on the daily occurrences in their lives and a multi-textured classroom will not only help them to understand the cultures of other people but also help them later in their lives where they may have to work with people not only from different regions but different countries as well. Koul and Fischer [8], analyzed the perceptions of the students in certain schools in Jammu regarding the learning environment. The found out that the perceptions of the students were directly related to the emotional and intellectual development of the students. Gadgil [5] studied the causes of failure at the SSC examinations after standard X and found that the most common ones were inadequate coverage of the syllabus, improper attention to different topics and the lack of personal motivation to excel in mathematics and studies, in general. Shukla et al [11] investigated the relationships between classroom factors and the level of mathematics achievement in primary schools. They found that provision of proper teaching aids to the teachers, adequate classroom facilities, time devoted to teaching mathematics and the parent-teacher relation all had a positive influence upon the achievement of the student in mathematics.

4. Rationale of the study

It has been widely established and understood that mathematics is a very pivotal field for people from all walks of life. Mathematics is the gateway to knowledge. It is very basic to our own existence and how we go about doing things in our daily lives. Hence, mathematics is treated with high regard in any elementary or high school academic curriculum. However it has been observed that the level of achievement of students in mathematics is not satisfactory in most cases and there is a great deal of variation in the levels of achievement of different students. So it becomes necessary to identify the various factors that affect mathematics achievement. From the review of relevant literature it has been noted that the class environment has an influence on the academic achievement of the students. So it is very important to make a study on the present topic in the context of our own society. The objectives of the present study are

a) to investigate the difference of attitude of male and female students towards mathematics
b) to investigate the affect of medium in the achievement of mathematics
c) to investigate the role of class environment in the achievement of mathematics
d) to investigate the impact of the teachers' attitude and involvement upon the achievement of mathematics

4. Design of the study

Descriptive method was thought to be appropriate to analyze the impact of attitude towards mathematics in the context of selected variables, which are gender and medium of instruction. The sample consisted of 500

students selected from 20 schools of Nagaon District. Random sampling method was adopted to select the sample. A questionnaire was constructed by the researcher which was reviewed by a few experts in the concerned field. The questionnaire was administered among the students selected for the study. Against each question there were five options, namely –strongly agree, agree neutral disagree and strongly disagree. After the data was collected the responses provided by the sample students were transformed into numerical values. Then the scores were placed for statistical tests of significances using statistical tools for testing the hypothesis of the investigator. The methods of analysis used were SD, t-test and Karl Pearson's product Moment.

5. Hypotheses

There is no significant effect on mathematics achievement due to class-room environment for the students of class X in Nagaon District.

6. Results and Analysis

The data from the responses in the questionnaire were transformed into numerical values 5, 4, 3, 2 and 1 respectively for the options 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree' placed against each question of the questionnaire. For the questions with negative implications reverse marking was adopted. The data analysis was done by the use of statistical tools. The following tables reveal the findings.

7. Inferential statistics

- **Attitude in relation to Class Environment**

Table CE-1: Positive attitude of boys in Assamese Medium School in relation to class environment

N	25
Mean	37.12
SD	7.153
SEM	1.431

Test Value = 25					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
25.947	24	.00	11.173	34.51	39.97

Table CE-2: Positive attitude of girls in Assamese Medium School in relation to class environment

N	25
Mean	35.23
SD	6.378
SEM	1.276

Test Value = 25					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
27.618	24	.00	7.612	33.69	37.82

Table CE-3: Positive attitude of boys in English Medium School in relation to class environment

N	25
Mean	38.02
SD	7.011
SEM	1.402

Test Value = 25					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
27.115	24	.00	10.905	35.36	40.55

Table CE-4: Positive attitude of girls in English Medium School in relation to class environment

N	25
Mean	40.15
SD	6.474
SEM	1.295

Test Value = 25					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
31.009	24	.00	9.141	37.27	42.93

Table CE-5: Co-relation between boys and girls of Assamese Medium for positive attitude in relation to class environment

N=25	Boys	Girls
Mean	37.12	35.23
SD	7.153	6.378

Correlations

N=25	Positive attitude of →	Girls	Boys
Girls	Pearson Correlation	1	.740
	Sig. (2-tailed)		.00
Boys	Pearson Correlation	.740	1
	Sig. (2-tailed)	.00	

Here the Correlation is significant at the 0.05 level (2-tailed).

Table CE-6: Co-relation between boys and girls of English Medium for positive attitude in relation to class environment

N=25	Boys	Girls
Mean	38.01	40.15
SD	7.011	6.474

Correlations

N=25	Positive attitude of →	Girls	Boys
Girls	Pearson Correlation	1	.87
	Sig. (2-tailed)		.00
Boys	Pearson Correlation	.87	1
	Sig. (2-tailed)	.00	

Here the Correlation is significant at the 0.05 level (2-tailed).

Table CE-7: Co-relation between girls of Assamese Medium and English Medium School for positive attitude in relation to class environment

N=25	Assamese medium	English medium
Mean	35.23	40.15
SD	6.378	6.474

Correlations

N=25		Girls (As med)	Girls (Eng med)
Assamese Medium	Pearson Correlation	1	.620
	Sig. (2-tailed)	.	.00
English Medium	Pearson Correlation	.620	1
	Sig. (2-tailed)	.00	.

Here the Correlation is significant at the 0.05 level (2-tailed).

Table CE-8: Co-relation between boys of Assamese Medium and English Medium School for positive attitude in relation to class environment

N=25	Assamese medium	English medium
Mean	37.12	38.01
SD	7.153	7.011

Correlations

N=25		Boys (As med)	Boys (Eng med)
Assamese Medium	Pearson Correlation	1	.940
	Sig. (2-tailed)	.	.00
English Medium	Pearson Correlation	.940	1
	Sig. (2-tailed)	.00	.

Here the Correlation is significant at the 0.05 level (2-tailed)

Table CE-9: t-Test for Assamese Medium School for positive attitude in relation to class environment

N	50
Mean	36.2
SD	6.88
SEM	1.377

Test Value = 50					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
26.293	49	.00	9.907	34.58	37.64

Table CE-10: t- Test for English Medium School for positive attitude in relation to class environment

N	50
Mean	39.11
SD	6.498
SEM	1.299

Test Value = 50					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
30.094	49	.00	9.016	37.81	41.38

Table CE-11: Independent sample test of high attitude and low attitude for Assamese Medium School for positive attitude in relation to class environment

	Attitude	N	Mean	SD	SEM
Boys and Girls	>= 25	41	39.96	4.671	.729
	<25	9	18.93	3.734	1.245

Independent Sample Test for Boys and Girls where equal variances are assumed

t-test for Equality of Means						
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
7.524	48	.00	21.03	0.937	14.567	25.759

Table CE-12: Independent sample test of high attitude and low attitude for English Medium School for positive attitude in relation to class environment

	Number	N	Mean	SD	SEM
Boys and Girls	>= 25	47	40.37	5.381	.872
	< 25	3	18.87	2.619	1.547

Independent Samples Test for boys and girls where equal variances are assumed

t-test for Equality of Means						
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
3.762	48	.025	21.5	2.762	10.394	31.957

Table CE-13: Negative attitude of boys in Assamese Medium School in relation to class environment

N	25
Mean	32.45
SD	6.371
SEM	1.274

One-Sample Test (Test value= 25)

t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
25.467	24	.00	6.983	29.55	36.71

Table CE-14: Negative attitude of Girls in Assamese Medium School in relation to class environment

N	25

Mean	31.88
SD	7.637
SEM	1.527

One-Sample Test

Test Value = 25					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
20.872	24	.00	11.008	27.23	34.65

Table CE-15: Negative attitude of boys in English Medium School in relation to class environment

N	25
Mean	38.69
SD	6.912
SEM	1.382

One-Sample Test

Test Value = 25					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
27.988	24	.00	10.702	34.18	40.85

Table CE-16: Negative attitude of girls in English Medium School in relation to class environment

N	25
Mean	36.52
SD	8.146
SEM	1.629

One-Sample Test (Test Value = 25)

t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
22.416	24	.00	14.104	31.25	39.76

Table CE-17: Co-relation between boys and girls of Assamese Medium School for negative attitude in relation to class environment

N=25	Boys	Girls
Mean	32.45	31.88
SD	6.371	7.637

Correlations

N=25	Negative attitude of →	Girls	Boys
Girls	Pearson Correlation	1	.916
	Sig. (2-tailed)		.009
Boys	Pearson Correlation	.916	1
	Sig. (2-tailed)	.009	

Here the Correlation is significant at the 0.05 level (2-tailed).

Table CE-18: Co-relation between girls and boys of English Medium for negative attitude in relation to class environment

N=25	Boys	Girls
Mean	38.69	36.52

SD	6.912	8.146

Correlations

N=25	Nigative attitude of →	Girls	Boys
Girls	Pearson Correlation	1	.849
	Sig. (2-tailed)		.001
Boys	Pearson Correlation	.849	1
	Sig. (2-tailed)	.001	

Here the Correlation is significant at the 0.05 level (2-tailed).

Table CE-19: Co-relation of girls of Assamese and English Medium for negative attitude in relation to class environment

N=25	Assamese medium	English medium
Mean	31.88	36.52
SD	7.637	8.146

Correlations

N=25		Girls (As med)	Girls (Eng med)
Assamese Medium	Pearson Correlation	1	.178
	Sig. (2-tailed)		.729
English Medium	Pearson Correlation	.178	1
	Sig. (2-tailed)	.729	

Here the Correlation is not significant at the 0.05 level (2-tailed).

Table CE-20: Co-relation of boys of Assamese and English Medium Schools for negative attitude in relation to class environment

N=25	Assamese medium	English medium
Mean	32.45	38.69
SD	6.371	6.912

Correlations

N=25		Boys (As med)	Boys (Eng med)
Assamese Medium	Pearson Correlation	1	.662
	Sig. (2-tailed)		.012
English Medium	Pearson Correlation	.662	1
	Sig. (2-tailed)	.012	

Here the Correlation is significant at the 0.05 level (2-tailed).

Table CE-21: t- Test for Assamese Medium School for negative attitude in relation to class environment

Mean (N=25)	32.17
SD	8.759
SEM	1.239

One-Sample Test

Test Value = 50

t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
25.97	49	.00	6.2	29.16	34.59

Table CE-22: t- Test for English Medium School for negative attitude in relation to class environment

N	50
Mean	37.61
SD	6.512
SEM	0.921

One-Sample Test

Test Value = 50					
t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
40.836	49	.00	3.226	35.93	41.68

Table CE-23: Independent sample test of high and low attitude for Assamese Medium School for positive attitude in relation to class environment

	NUMBER	N	Mean	SD	SEM
Assamese Medium	>=25	38	35.28	6.189	1.004
	< 25	12	22.32	4.682	1.352

Independent Samples Test for Assamese medium where equal variances are assumed

t-test for Equality of Means						
t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
7.389	48	.00	12.96	1.507	12.645	23.511

Table CE-24: Independent sample test of high and low attitude for English Medium School for positive attitude in relation to class environment

	NUMBER	N	Mean	SD	SEM
English Medium	>= 5	47	38.83	5.216	.761
	< 5	3	18.41	2.138	1.234

Independent Samples Test for English medium where Equal variances are assumed

t-test for Equality of Means						
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
9.314	48	.000	20.42	3.078	17.648	28.916

8. Conclusion

After a detailed analysis of the collected data, we have arrived at the following conclusions:

(i) The significance of this study is that it states that students who enjoy mathematics and devote sufficient time on math tasks will have a positive mathematics achievement if they are taught in a healthy class environment. The investigation also affirms that the onus is mostly on the teachers to create a healthy class environment in order to (a) improve self-esteem, (b) develop positive attitudes towards math, (c) sharpen with problem- solving skills, (d) encourage students to become involved in mathematics activities outside school and (e) explore careers options in mathematics.

(ii) From tables 1 and 2, t- value for boys in Assamese medium schools is 25.947 and that for girls is 27.618. This proves that the positive attitude of boys and girls in Assamese medium schools with respect to class environment are quite close. The same scenario can be observed in case of English medium schools.

(iii) Tables 4, 5 and 6 indicate that there is a high level significant relation between boys and girls both in Assamese and English medium schools in regard to class environment.

(iv) Students with high mathematics achievement demonstrated high levels of mathematics confidence and have a positive attitude to learning mathematics with computers. It could be argued that their objective is to improve their performance via the use of technology.

(v) Students with negative attitudes toward mathematics, low mathematics achievement, low levels of mathematics confidence and low levels of affective engagement and behavioural engagement demonstrated confidence in using computers and positive attitude to learning mathematics with computers. Further research is required to identify the best teaching and learning environments for students in this category.

The two factors that bolster the development of a positive attitude towards learning mathematics with computers are mathematics confidence and affective engagement. It is also inferred that mathematics achievement can be attained if students are more confident in using computers and have a more positive attitude to learning mathematics with computers. Hence effective technology should be installed in all the mathematics class rooms in every school.

Acknowledgement

I am very much grateful to my Research Guide Dr T. K. Dutta, Professor, Department of Mathematics, Gauhati University, for his valuable suggestion and encouragement in preparation of the paper.

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