"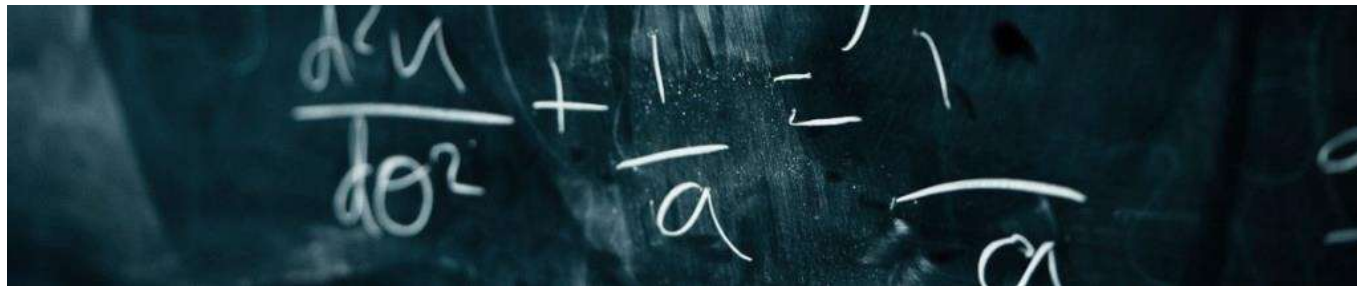A study on teacher's Mathematics Pedagogical Content knowledge and its effect on students' attitude towards Mathematics and their scholastic achievement in Mathematics of secondary level students of kolkata"

Original Research Article

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Citation of the Article

ABSTRACT

Traditionally mathematics classes are grave and solemn and often appear intimidating students and make them reticent about using it. The most important factor impinges students' attitude towards and scholastic achievement in mathematics is teacher's Mathematics Pedagogical Content Knowledge (MPCK) may confidently eradicate students' anxiety (SA) towards mathematics. Mathematics teachers got the soul authority to change the situation in a desirable direction that may confidently eradicate students' anxiety (SA) towards mathematics. The study is fashioned to create a scalable intervention to measure the relationship between teachers' MPCK and students' attitude towards and scholastic achievement in mathematics. To address this issue students of Kolkata (WB) constitute the population. A sample of 200 students was selected from tenth slandered. A25-items self-developed questionnaire ($r = 0.78349$) was used to measure the students' attitude towards mathematics (15-items) and 10 mathematics questions from common syllabus of both the states. The obtained data were analysed and interpreted by using descriptive statistics, t-test, one way ANOVA, and Scheff's Post-hoc test. The result reveals there is significant relationship among and between all the independent variables of attitude towards mathematics except in one case and there is no significant difference and influence of intersection among and between attitude towards mathematics and scholastic achievement in mathematics of secondary level students of Kolkata.

Key Words:

MPCK,
Attitude towards mathematics,
Scholastic achievement in mathematics,
Mathematics anxiety.

I. INTRODUCTION

"Students under achievement in mathematics is just not a concern for particular country but has become a global concern over the years "(Pisa, 2003).

A subject of vicarious and ethereal beauty, mathematics disciplines our mind in a desirable direction that develops power of clear thinking quickness of mind and perseverance. Several studies and researches so far has been undertaken to trace out the factors that influence students' scholastic achievement in mathematics. Among them teachers' MPCK and students' positive attitude towards mathematics are the most important and surely a forceful determinant impinges students scholastic achievement in mathematics. A target is essential for attitude. Attitudes are highly composite and can affect learning comprehensively and influence performance and performance in turn influences attitudes including attitudes. There are three parts of attitudes towards mathematics. Viz: -

1. The emotional part signifies students' feelings confronted with mathematics.
2. The cognitive part depicts students' beliefs about mathematics.
3. The operative part behaviour student exhibit when they have to do mathematics.

There are three factors impinging students' attitude towards and scholastic achievement in mathematics. Viz: -

1. The teacher' MPCK [Mathematics Pedagogical Content Knowledge (MPCK) is an amalgam of SMK in mathematics, PCK & knowledge of blended learning, knowledge of student characteristics & students' acceptance as per their SES and knowledge of creating congenial mathematics learning environment both inside & outside of school premise "].
2. The student characteristics (i.e., mathematical achievement, readiness and educational motivation, confidence, self-efficacy, self-concept, self-judgment, self-reaction, and mathematics phobia and anxiety).
3. The environment of school, home and society (i.e., classroom management, the availability, provision and use of TLMs, SES of the parents, demographic aspects).
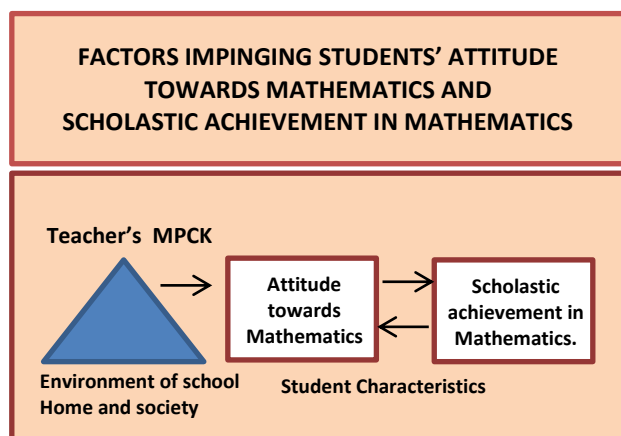

Figure No. 1.1, Represents factors impinging students' attitude towards and scholastic achievement in mathematics.

According to Aiken, (1970), "attitudes affect achievement and achievement in turn affects attitudes". It is therefore an irrefutable fact from the aforesaid discussion that the successfulness of development attitude toward and scholastic achievement in mathematics is contingent on myriad of factors all impinge on the learning of mathematics. Here the most important factor is the teacher; the teachers' MPCK and attitude towards mathematics and amount of confidence and support mobilized for their students accounts the degree of attitude towards mathematics enhanced.

II. MATERIAL AND METHODOLOGY

2.1 population and sample : In the present investigation all the students of Kolkata were the population of this study. Based on random sampling technique the researcher selected 200 students from four schools.

2.2 Tools used in the study : To collect data from sample groups the researcher used self-developed 15-items questionnaire for attitude towards mathematics and 10 questions for scholastic achievement in mathematics. Assessment is made on five points Likert's-format scale.
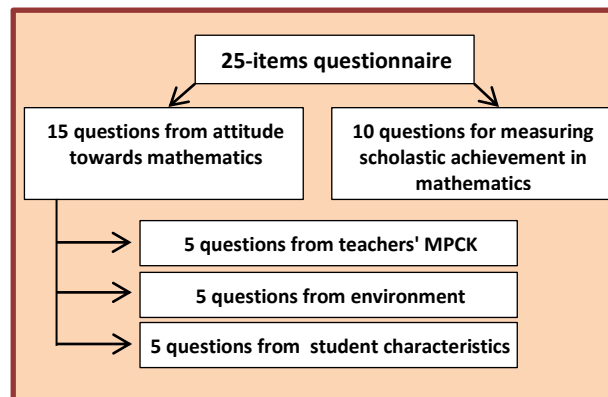

Table No. 2.0: Represents the hierarchy of questionnaire.

2.3 Statistical technique used : The data pertaining to the criterion variables of attitude towards mathematics (i.e., teachers' MPCK, environment of school, home & society, and student characteristics) and scholastic achievement in mathematics(i.e., attitude towards mathematics and teachers' MPCK) have been examined by One-way ANOVA for each variable, and Scheff's Post-hoc test to examine the significant difference among groups.

To determine the relationship among and between the independent variables, Pearson's Product Moment Method of Correlation was used.

2.4 Scope and delimitation

- The study was conducted only for the year August and September 2017.
- The study was conducted only for class-X students of Kolkata.
- The study was conducted only for the subject Mathematics, not for other subjects.
- Attitude towards mathematic scholastic achievement in mathematics were conducted separately.
- Only selected personal and institutional variable has been taken into consideration for the present study.
- The study has been delimited to students' perception about their teachers' MPCK, their attitude towards mathematics and scholastic achievement in mathematics.
- Further the findings have been subjected to limitations of tools and statistical treatment used.

2.5 Objectives of the study

- To determine whether or not there is presence of correlation among and between all the independent variables of attitude towards mathematics i.e., teacher's MPCK, environment of school, society, & home and student characteristics.

- To determine whether or not there is presence of correlation among and between attitude towards mathematics and scholastic achievement in mathematics of secondary level students of Kolkata.

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2.6   *Hypothesis of the study*

H_{01}: There is no significant difference among between all the independent sub-variables of attitude towards mathematics i.e., teachers' MPCK, environment of school, society, & home and student characteristics.

H_{02}: There is no significant difference and influence of intersection among and between attitude towards mathematics and scholastic achievement in mathematics of secondary level students of Kolkata.

III.   STATISTICAL ANALYSIS AND GRAPHICAL REPRESENTATION

Under descriptive statistics mean, and standard deviation against the score of independent variables (i.e., teachers' MPCK, learning environment of school, home & society, and student characteristics) and dependent variables (i.e., attitude towards mathematics and scholastic achievement in mathematics are presented in the below mentioned table.

	MPCK	Environment of school	Student characteristics	Attitude towards mathematics	Achievement in mathematics
N	200	200	200	200	200
Mean	16.065	14.2	14.19	44.46	24.56
SD	2.8953	2.264	2.5151	4.4077	7.4650

Table no. 3.0: Represents size of the sample, mean and SD of different variables.

From the table-3.0, it is revealed that mean score of MPCK of teachers perceived by the students is very much higher than that of environment of school, home, and society (i.e., 16.065>14.02) and it is almost same with knowledge of student characteristics by the teacher (14.20 = 14.19). Though the mean score of students' attitude towards mathematics is high (i.e., 44.46) but their scholastic achievement is comparatively very low (i.e., 24.56).

H0^{1}: There is no significant difference among between all the independent sub-variables of attitude towards mathematics i.e., teachers' MPCK, environment of school, society, & home and student characteristics.

Ind. Variable	Variation	∑of Square	df	Mean Square	F	P
MPCK	Between groups	466.2633	2	233.1317	35.26371	0.00001
Environment	Within groups	3946.935	597	6.611281		
Student characteristics	Total	4413.198	599			

** P<0.05 Table F, df (2,597) = 3.01   *The result is significant at P < 0.05*

Table-3.1: Represents the ANOVA of independent variables under attitude towards mathematics.

The computed value of F-statistics i.e., 35.26371 is much higher than the critical/table value of F, df(2,597) = 3.010815 at 0.05 levels of significance i.e., P= 0.00001<0.05. Hence it should be taken as quite significant. Consequently the null-hypothesis *H_{01}* is rejected means, *there is significant difference among between all the independent variables of attitude towards mathematics*

i.e., teachers' MPCK, environment of school, society, & home and student characteristics. Hence at least one significant difference definitely exists between the group means.
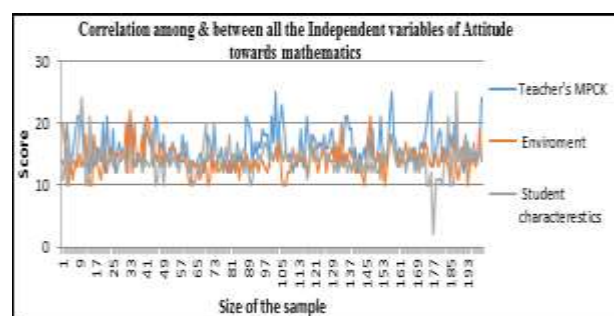
The attitude towards mathematics' independent variable's mean score for MPCK, environment of school, society & home, and Knowledge of Student characteristics are 16.065, 14.20, and 14.19 respectively. To find out which of these paired mean had a significant difference, the Scheffe's post-hoc test was applied.

INDEPENDENT VARIABLES OF MPCK			TS : F_s	Scheffe's Critical value
Teacher's MPCK	Environment of home, school, and society	Student characteristics		
16.065	14.20	xx	52.5423	F-critical x df(n) = 3.010815 x 2 = 6.021630
16.065	xx	14.19	0.0016	
xx	14.20	14.19	53.1073	

** Significant at 0.05 level

Table-3.1.1: Represents Scheffe's Post-hoc test for significance difference of attitude towards mathematics.

The table-3.1.1 shows that the significant paired means difference in attitude towards mathematics between MPCK & environment of home, school and society and environment of home, school and society & student characteristics are 52.5423 and 53.1073 respectively which are more than the Scheffe's critical value of 6.021630 at 0.05 level of confidence and no significant paired mean difference in attitude towards mathematics between MPCK and student characteristics is 0.0016 as it is less than the Scheffe's critical value of 6.021630 at 0.05 level of confidence.
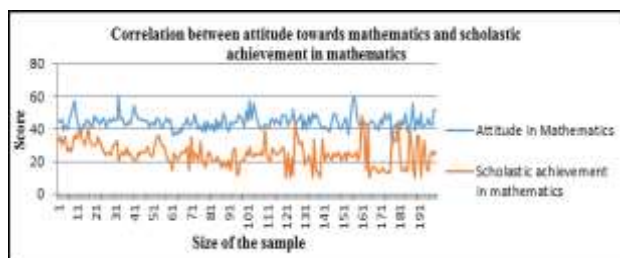

Graph table 1: Representing the correlation among and between the independent variables of attitude towards mathematics.

H_{02}: There is no significant difference and influence of intersection among and between attitude towards mathematics and scholastic achievement in mathematics of secondary level students of Kolkata.

Variables	" t "	Sig	MD	SED	95% CI of Difference
Attitude					18.699<19.9<21.101 (Rejected as not contained "0")
Achievement	32.463	0.00001	19.9	0.613	

Table3.2: Represents the significance of difference between secondary level student's attitude towards mathematics and scholastic achievement in mathematics.

Frome table-3.2, the "t" difference between secondary level students' attitude towards mathematics and scholastic achievement in mathematics is 32.463, which is statically significant as the P-value is less than 0.05 (P=0.00001<0.05 for two tailed) and as 95% CI of difference not containing Zero, there is statistical significance between the means of two variables. Hence the formulated null hypothesis is rejected i.e.; *there is significant difference and influence of intersection among and between attitude towards mathematics and scholastic achievement in mathematics of secondary level students of Kolkata.* The difference between means in the population likely to be between 18.699 and 21.101.

Graph table 2: Representing the correlation among and between attitude towards mathematics and scholastic achievement in mathematics.

Reason: The reasons behind the significant difference between attitude towards mathematics and scholastic achievement in mathematics are,

1. Student may be the first generation learner.
2. Student's level of IQ may not be up to the mark.
3. SES of the parents means their educational qualification, financial condition, and psychosocial construct may be weak.
4. At present students are very smart, many of them are in a tendency to show their mathematical calibre in a final stage of examination, but it is a subject require regular practise.
5. Due to several E-media of entertainment students generally inclined towards those and hardly spent quality time with mathematics books.

IV. RESULTS

There are three factors impinging students' attitude towards and scholastic achievement in mathematics. In the light of the above findings it could be concluded that teacher's MPCK & environment of home, school and society; environment of home, school and society & student characteristics are significantly different. And there is no significant difference between teacher's MPCK & student characteristics. There is significant difference between attitude towards mathematics and scholastic achievement in mathematics.

V. DISCUSSION

Mathematics is a subject which disciplines the mind in a desirable direction and there is three parts of positive attitude towards mathematics (the emotional part, the cognitive part and the operative part) and is the prerequisite of a student in learning mathematics. There is a correlation between students' attitude towards and scholastic achievement in mathematics. Through several studies it is revealed that students with similar abilities differ in scholastic achievement. It is due to positive attitude towards the subject. Therefore developing positive attitude towards mathematics is an important goal of mathematics curriculum. In a general observation students having positive attitude towards mathematics achieve more in comparison with those students who have negative attitude towards mathematics. achieve more in comparison with those students who have negative attitude towards mathematics. It is therefore an

irrefutable fact from the aforesaid discussion that the successfulness of development attitude toward and scholastic achievement in mathematics is contingent on myriad of factors all impinge on the learning of mathematics. Here the most important factor is the teacher; the teacher's MPCK, and amount of confidence and support he/she mobilizes for their student's, besides that environment of home, school and society & knowledge of student characteristics that garner students attitude towards mathematics.

VI. CONCLUSION

Teacher's mathematics pedagogical content knowledge is one of the most important factors that impinges student's attitude towards mathematics and scholastic achievement in mathematics provided the environment of the home, school and society and student characteristics are congenial. But the result reveals there is significant difference between attitude towards mathematics and scholastic achievement in mathematics of the secondary level students of Kolkata.

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