Attitude Towards Mathematics as Correlate of Achievement in Mathematics

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Abstract

Attitude towards mathematics has its bearing on mathematical creativity, achievement in mathematics. Favourable attitude influences achievement, personality, perception and success. In the present study the researchers have tried to establish a relationship between attitude towards mathematics and achievement in mathematics. In the present study 500 higher secondary school students of Patna district have been selected randomly as sample of the study. For the measurement of attitude towards mathematic, the scale developed and standardised by Lalit Kumar has been employed. Achievement of students in maths in their secondary board examination has been taken as their achievement in mathematics. For testing the hypotheses percentage, mean, standard deviation, t-value, coefficient of correlation have been calculated. The study has major findings as — (i) More than 50 per cent higher secondary school students possess favourable attitude towards mathematics, (ii) Attitude towards mathematics is significantly correlated with achievement in mathematics and (iii) Higher group on attitude towards mathematics is significantly superior in their achievement in mathematics in compariosn to lower group on attitude towards mathematics.

Attitude is one of the most important concept in Psychology. Many studies have been conducted on attitude in Education and Psychology. Attitude has its bearing on different aspects of learning. Focusing on the need of Attitudinal Learning essential for social welfare has clearly mentioned the importance of attitude, "Inculcation of scientific temper, scientific attitude, feeling of dedication and social harmony is possible only when our education system focuses on attitudinal learning. Creating favourable attitude towards social welfare and social service is one of the vital aims of education and it becomes even more important in this age of crisis where individuals are growing and systems are collapsing." Attitude measurement is a central concern in social psychology and also in education. In fact, attitude plays a prominent and significant role in shaping the behaviour and so its measurement is a very important concept of study in Psychology and Education. A complete

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picture of man's attitude towards various aspects of his social world yields highly reliable predictions about his behaviour in various social situations and that is why study of attitude is the major concern of Psychology and Education.

Mathematics is considered as one of the important subject of study and that is why its study has been made compulsory upto secondary level. The faculty theory of Psychology and the theory of mental discipline of Transfer of Training tell about the importance of Mathematics for training the mind and behaviour. Napolean said that the development of a society is related to the development of the mathematics in the society concerned. Due to its utilitarian, disciplinary, vocational, intellectual and other values, it has become even more important in this scientific age.

From a lay man to a scientist – every one is making use of mathematics in their daily life. Besides being an independent subject of study, it has application in almost all other subjects. We may say that mathematics is a mental tool for training and exercise of intellectual functions. Due to its unique role in solving every day problems of human life, it has occupied a prominent position in school curriculum all over the world.

The key to man's success is the process of being aware. Awareness is an innate potential of man. It is a process essential to life. The human knows and does he continue to survive. Thus, we find that it is the acquisition of knowledge and skills that allow a man to survive. In other words, it is the achievement in various fields that produces an effective individual in the society. Morgan and King define achievement as an accomplishment on a test of knowledge or skill.

For the proper development of mathematics education the attitude of students towards mathematics and their achievement in mathematics must be taken into account. Attitude is a condition of readiness for a certain type of activity. Achievement is the status of level of a person's learning and his ability to apply what he has learned. The effectiveness of any educational system is judged by the extent how pupils are involved in the system and achieve in the cognitive, affective and psychomotor domain.

It has been indicated by researches that a number of variables such as personality, attitude, socio-economic status, the organisational climate of the school and curriculum affect the achievement. Lalit Kumar has rightly explained the importance of attitude in the teaching and evaluation, "Attitude is an important psychological concept and affects the individual's behaviour. Favourable attitude has its bearing on all the aspects of human behaviour. It influences an individual's choice of action, achievement and personality. Unfavourable attitude towards the subject and its evaluation affects the teaching and learning process. Therefore, it should be the prime concern of teacher educators and policy makers to make the learner's attitude favourable towards the subject and also towards its evaluation." These variables are generally referred the as correlates of achievement. In schools, great emphasis is placed on achievement right from the beginning. The student is trained to accept a hierarchy based on achievement.

Several works have been done to know the relationship between two or more than two traits of human personality such as relationship between intelligence and achievement, motivation and achievement, etc. Here, the researcher is trying to know the relationship between "Attitude Towards Mathematics" and "Achievement in Mathematics". Since both the traits, i.e. Attitude Towards Mathematics and Achievement in Mathematics have greater importance in mathematics education and so to examine the relationship between these two traits of human personality is a relevant and much needed study. Sahu, L P and Sood R. have established relationship between attitude, perception and academic achievement, "(1) A significant relationship was found between students' perception of teachers attitude towards them and their academic achievement (2) A relationship was found between students perception of teachers attitude towards them and their self perceptions (3) A significant relationship was found between the academic achievement of students and their self perception."

Various studies reflect that favourable attitude towards mathematics predict about the success of the students in mathematics, few studies convey that attitude towards mathematics is related to the achievement in mathematics and so the researchers have undertaken the study to find a relationship between attitude towards mathematics and achievement in mathematics with the objectives that the finding will direct and help the mathematics teachers, researchers, teacher-educators, policy-makers to serve mathematics teaching and learning more properly and scientifically.

Lalit Kumar and Sudhir Kumar while writing on status of attitude researches have concluded that maximum work has been done to survey the opinions of teachers and students related to academic and Psycho-social phenomena. He writes, "Attitude researchers started with the explorations of the nature and structure of attitudes, development of the methods of attitude measurement, and identification of the correlates of attitudes. Influence of attitudes on such psychological processes as learning and remembering, perception and thinking and reasoning has also been investigated in some detail. Maximum work has been done in connection with the survey of attitudes and opinions of various groups of people towards all kinds of social, political, cultural and economic issues that the country is facing. A major bulk of research has been done in area of education – on attitudes of teachers and students towards various academic and psycho-social phenomenon."

Many researchers are of the opinion that attitude towards science is a significant predicator of academic achievement for some level of science students. Academic achievement in mathematics is thus functionally dependent on attitude of the students towards learning mathematics. Pal observed that better attitude towards mathematics ensures better achievement of the students in mathematics at secondary level. Jayraman, V found a significant relation between attitude towards learning mathematics and achievement in mathematics. Lalit Kumar found that attitude towards

mathematics plays a significant role in the development of mathematical creativity. He found insignificant difference between the attitude of male and female students towards mathematics. He concluded that a few primary school teachers possess high favourable attitude towards mathematics.

Lalit Kumar found that attitude towards mathematics is positively and significantly correlated with achievement in mathematics. He also found that high attitude towards mathematics group is significantly superior in achievement in mathematics in comparison to the low attitude towards mathematics group. S. Saha conducted a research study to indicate that the component attitude, in favourable direction of learning mathematics, is a significant contributor to the success in the mathematical achievements of both boys and girls. It explains that predisposition to learn mathematics and psychological readiness to carry the stress of solving problems seem essential for achieving success. In the light of above mentioned studies and some other related studies the researchers have undertaken the study to examine relationship between attitude towards mathematics and achievement in mathematics.

Objectives

(1) To find out whether the Higher Secondary School students possess favourable Attitude towards Mathematics.
(2) To establish the relationship between Attitude towards Mathematics and Achievement in Mathematics.
(3) To compare the Mathematics Achievement Scores of High and Low Attitude Towards Mathematics groups.

Hypotheses

(1) The Higher Secondary School students do not possess favourable Attitude towards Mathematics.
(2) There is no significant relationship between Attitude Towards Mathematics and Achievement in Mathematics.
(3) There is no significant difference in the Mathematics Achievement of High and Low Attitude Towards Mathematics groups.

Methodology

In the present study the researchers have employed Descriptive Survey Method to study the relationship between Attitude Towards Mathematics and Achievement in Mathematics.

Sample

In the present study five hundred (500) Higher Secondary School students of Patna district (Class XIth students only) have been selected randomly as sample of the study.

Tool Used

To measure the Achievement in Mathematics the marks obtained in Mathematics by the students in the Secondary Board Examination has been considered.

Attitude Towards Mathematics Scale developed and standardised by Kumar, Lalit has been used to measure Attitude of students towards mathematics. It is a bilingual scale (English and Hindi)

and contains twenty four (24) items related to mathematics. This Likert type attitude scale has five alternatives as Strongly Disagree, Disagree, Undecided, Agree and Strongly Agree. The scale has separate response sheet coded as 1, 2, 3, 4 and 5 before each item for Strongly Disagree, Disagree, Undecided, Agree and Strongly Agree respectively. For each individual item coded on the answer sheet, the students have to respond by encircling the alternative that looks to him/her the appropriate one.

The inventory has four dimensions – Utilitarian value, Social value, Aesthetic value and Intellectual value. There are three positively worded and three negatively worded items for each dimension. In this way, out of twenty four items – twelve items are positively worded whereas twelve items are negatively worded. Items 1, 5, 9, 13, 17 and 21 are from Utilitarian value dimension, whereas items 2, 6, 10, 14, 18 and 22 are from Social value dimension. Items – 3, 7, 11, 15, 19 and 23 are from Aesthetic value dimension and items 4, 8, 12, 16, 20 and 24 are from Intellectual value dimension.

Scoring of the response is as 0, 1, 2, 3 and 4 in the direction from Strongly Disagree for a positively worded item and for negatively worded item as 4, 3, 2, 1 and 0. Items – 1, 3, 6, 8, 10, 12, 13, 15, 17, 19, 22 and 24 are positively worded. Items – 2, 4, 5, 7, 9, 11, 14, 16, 18, 20, 21, 23 are negatively worded. Score consisting of sum of scores of all the four dimensions is the total score, i.e., score of an individual as Attitude Towards Mathematics. The dimension scores range from 0 to 24 whereas total score on Attitude inventory ranges from 0 to 96. The scale and its dimensions have high positive reliability coefficient ranging from 0.64 to 0.86. The scale also has optimum face and content validity. For this purpose opinion and suggestions of experts, teachers and teacher educators have been taken. The construct validity, a matrix of coefficient of correlation between the scores on four dimensions of Attitude Towards Mathematics scale and the total score on the scale, ranges from 0.43 to 0.87.

The selection of dimensions have been made on the basis of different values of mathematics teaching reflected and discussed in different mathematics teaching books. Utilitarian value is related to utility of mathematics as a subject while social value deals with social importance of the subject and its effect on social, civilisational and cultural development. Aesthetic dimension is all about beauty and enjoyment of subjects and Intellectual dimension is related to intellectual importance that mathematics possesses and helps to sharpen the intellect.

Definitions of the terms used in the study

(A) Attitude Towards Mathematics

Gagne and Briggs (1974) describe the attitude as an internal state which affects an individual's choice of action towards some object, person or event.

Keeping this definition into account, attitude towards mathematics may be defined as "Attitude towards mathematics is an internal state which affects an individual choice of action towards mathematical objects,

mathematical events or persons related to mathematics." More precisely, Attitude towards mathematics is a delimited totality of one's behaviour with respect to mathematics.

(B) Achievement in Mathematics

Achievement is a measure of performance or accomplishment to data (Wideman, 2002).

Achievement refers to the scholastic or academic success of the student at the end of an educational programme.

In the study mathematics score obtained by the students in their Secondary Board Examination has been considered as their achievement in mathematics.

(C) Favourable Attitude

The product of the number of statements and the numerical values assigned to the statement "Agree (for positively worded statement) or Disagree (for negatively worded statement)" has been considered as the minimum score for the consideration of favourable attitude. All the score below this score has been treated as unfavourable attitude score of an individual.

In this study product of 3 (value on statement) and 24 (number of statements) has been considered as the minimum score, i.e., 3x24 = 72. An individual bearing 18 and above on each dimension and 72 and above on composite score has been included in the group of students bearing favourable attitude.

Statistical Treatment of the Data

After scoring the responses for each student and about every statement, the score was tabulated and analysed for different dimensions separately. It was analysed for different individual item and also at composite score (sum of all the dimensions scores). It was decided that the favourable attitude score against an item is 03 and above, against a dimension is 18 and above and against the composite score is 72 and above.

Mean, Standard deviation, Percentage, Correlation coefficient (r) and t-value were calculated to verify the hypotheses.

20 per cent high scorers have been considered as Higher group and 20 per cent Low scorers have been considered as Lower group.

Analysis and Interpretation

TABLE I
Number and Percentage of Students Bearing Favourable Attitude Towards Mathematics

Attitude Dimensions	*Number*	*Percentage*
Utilitarian Value	259	51.80 %
Social Value	237	47.40 %
Intellectual Value	364	72.80 %
Aesthetic Value	251	50.20 %
Composite Attitude	261	52.20 %

Table – I reveals that 51.80 per cent, 72.80 per cent, 50.20 per cent and 52.20 per cent of the students have favourable attitude towards Utilitarian, Intellectual, Aesthetic and Composite dimensions of attitude towards mathematics respectively. It indicates that more than half of the students taken in the sample bear favourable attitude towards the aforesaid dimensions of attitude towards mathematics. However, only 47.40 per cent students show favourable attitude towards social dimension of attitude towards mathematics.

TABLE II
Product Moment Correlation (r) between Attitude Towards Mathematics and Achievement in Mathematics

Attitude Dimensions	*Achievement in Maths*	*N*	*Level of significance*
Utilitarian Value	0.20	500	0.01
Social Value	0.03	500	NS
Intellectual Value	0.30	500	0.01
Aesthetic Value	0.20	500	0.01
Composite Attitude	0.21	500	0.01

Table – II reveals that the correlation coefficient (r) between achievement in mathematics and attitude towards mathematics is 0.21. The correlation coefficient between achievement in mathematics and attitude dimensions – Utilitarian value, Social value, Intellectual value and Aesthetic value are 0.20, 0.03, 0.30 and 0.20 respectively. All these values are significant (except with Social value dimension) at 0.01 (df = 998) level of significance.

It indicates that Utilitarian value, Intellectual value and Aesthetic value of Attitude Towards Mathematics are positively correlated with achievement in mathematics, whereas Social value of Attitude Towards Mathematics is not correlated with achievement in mathematics positively and significantly. It further indicates that Attitude towards mathematics is positively and significantly correlated with the achievement in mathematics.

Table – III reveals that the obtained t-value between achievement of Higher and Lower groups on Utilitarian, Intellectual and Aesthetic values are 5.31, 7.01 and 7.47 respectively. The obtained t-value between achievement of Higher and Lower groups on composite attitude is 4.55. All these four t-values

TABLE III
Mean, SD and t-value between Achievement in Mathematics of Higher and Lower groups on different dimensions of Attitude towards Mathematics

Attitude Dimensions	*Groups*	*Mean*	*SD*	*N*	*t-value*	*Level of significance*
Utilitarian value	Higher	71.45	16.03	100	5.31	0.01
	Lower	58.75	17.71	100		
Social value	Higher	64.85	18.56	100	0.35	NS
	Lower	63.95	18.08	100		
Intellectual value	Higher	75.25	15.16	100	7.01	0.01
	Lower	58.70	18.13	100		
Aesthetic value	Higher	80.65	15.13	100	7.47	0.01
	Lower	62.80	18.53	100		
Composite Attitude	Higher	73.15	16.73	100	4.55	0.01
	Lower	60.55	22.12	100		

are significant at 0.01 (df = 198) level of significance. The obtained t-value between achievement of Higher and Lower groups on Social value dimension of attitude towards mathematics is 0.35, which is not significant.

The higher group is superior in their achievement in mathematics against Utilitarian, Intellectual & Aesthetic value dimensions of attitude towards mathematics and also against composite attitude (UM1 = 71.45, IM1 = 75.25, AM1 = 80.65 and CM1 = 73.15) in comparison to the Lower group (UM2 = 58.75, IM2 = 58.70, AM2 = 62.80 and CM2 = 60.55).

It indicates that the higher group on attitude dimensions and also on composite attitude (Except on Social value dimension) is significantly superior in their achievement in mathematics in comparison to Lower group on attitude dimensions and also on composite attitude (Except on Social value dimensions).

Findings of the study

(i) 51.80 per cent, 72.80 per cent, 50.20 per cent and 52.20 per cent of the students have favourable attitude towards Utilitarian, Intellectual, Aesthetic and Composite dimensions of attitude towards mathematics respectively. It indicates that more than half of the students taken in the sample bear favourable attitude towards the different dimensions of attitude towards mathematics and also on composite attitude. On Social value dimension of attitude towards mathematics it is slightly short to the 50 per cent mark (i.e. 47.40 per cent).

Lalit Kumar 1996 has found in his study conducted on primary school teachers that, "A few primary school teachers possess high favourable attitude towards mathematics."

Lalit Kumar and Sudhir Kumar 2010 has found that very few higher education students have favourable attitude towards privatisation of Higher Education.

Through various studies it has been reflected that to make favourable attitude is essential for achievement, success and proper training and the education system should take care of it. Jain, Rachna Jain 2007 has rightly concluded, "The present study further reveals the significant relationship between the attitudes and the teaching effectiveness of the teachers. It gives a strong message to those involved in training of teachers that it is not only important to empower the prospective teachers with knowledge and skills required for teaching but training should enable them to develop favourable attitude towards teaching profession and its allied aspects."

(ii) Utilitarian value, Intellectual value and Aesthetic value of attitude towards mathematics are positively and significantly correlated with achievement in mathematics, whereas Social value of attitude towards mathematics is not correlated with achievement in mathematics positively and significantly.

Attitude towards mathematics is positively and significantly correlated with the achievement in mathematics.

Lalit Kumar 1998 has the similar

findings in his study conducted on 300 Higher Secondary students of Budaun (UP) district, "Attitude towards mathematics is positively and significantly correlated with achievement in mathematics." Lalit Kumar 1994 has found that attitude towards mathematics plays a significant role in the development of mathematical creativity. He found significant relationship between attitude towards mathematics and mathematical creativity.

S. Saha 2007 found the component attitude in favourable direction of learning mathematics is a significant contributor to the success in the mathematical achievement of both boys and girls.

(iii) Higher group on attitude dimensions and also on composite attitude (Except on Social value dimension) is significantly superior in their achievement in mathematics in comparison to Lower group on attitude dimensions and also on composite attitude (Except on Social value dimension)

[Kumar, Lalit Kumar 1998 found in his study that, "High attitude towards mathematics group is significantly superior in his achievement in mathematics in comparison to the low attitude towards mathematics group". Kumar, Lalit Kumar 1994 found in one of his study the group higher on attitude towards mathematics superior in mathematical creativity than the group lower on attitude towards mathematics.

General Conclusions

Findings of the study and hypotheses of the study yield following general conclusions :-

(1) More than 50 per cent Higher Secondary School students possess favourable Attitude Towards Mathematics except on Social value dimension (47.40 per cent).

(2) Attitude Towards Mathematics (except Social value dimension of attitude towards mathematics) is significantly correlated with Achievement in Mathematics.

(3) Higher group on attitude dimensions and also on composite attitude (except on Social value dimension) is significantly superior in their achievement in mathematics in comparison to Lower group on attitude dimensions and also on composite attitude (except on Social value dimension).

Educational Implications

National Curriculum Framework for School Education 2005 while specifying the general objectives have clearly mentioned that the inculcation of positive attitudes is one of the vital objectives of education, "Education liberates human beings from the shackles of ignorance, privation and misery. It must also lead to a non-violent and non-exploitative social system. School curriculum, therefore, has to aim at enabling learners to acquire knowledge, develop understanding and inculcate skills, positive attitudes, values and habits conducive to the all-round development of their personality." The above statement clearly defines the role of positive attitude for personality development of students. Attitude has its bearing on Achievement. National Curriculum Framework. 2005 has also highlighted the role of positive attitude in mathematics education and has adviced to make the learner's attitude

favourable by making mathematics teaching activity based, "Having children develop a positive attitude towards, and a liking for, mathematics at the primary stage is an important, if not more than the cognitive skills and concepts that they acquire. Mathematical games, puzzles and stories help in developing positive attitude and in making connections between mathematics and everyday thinking." What NCF, 2005 has concluded with respect to primary stage is also true to the other levels of education. NCF (2000, 2005), present study and other related studies laid emphasis on development of favourable attitude as it has its bearing on achievement, development of creative ability and inculcation of scientific temperament.

The present study reveals that students with favourable attitude towards mathematics may perform better in achievement test in mathematics as compared to the students with unfavourable attitude. Students are the torch bearers of one's country. Hence, in order to be developed in science and technology, it is the foremost duty of the nation to develop positive attitude towards mathematics among the learners for their better achievement in mathematics, science and technology.

As founded in the study, achievement in mathematics is positively and significantly correlated with the attitude towards mathematics. Also, there exists a significant difference in the achievement in mathematics of Higher and Lower groups of students. This study has implications for teachers, parents, administrators and curriculum planner. The study must be utilised while framing the curriculum and making educational policies. The attitude towards mathematics must be taken into account and must be improved in order to have a sound creative mathematical ability of the nation. The teaching of mathematics should enhance the child's resource to think and reason, to visualise and handle abstractions to formulate and solve problems. For effective instruction and learning, there is need to create learning setting in the classroom that will enable the learners to actively participate in the process of instruction, rather than be passive listeners.

In brief, the findings of the study suggest that the attitude of learners be taken care of. It further suggests to make favourable attitude of learners towards mathematics to enhance their achievement in mathematics. The study also reflects the need of such studies with respect to other school subjects.

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