

Influence of Cognitive, Affective and Behavioral Attitude towards Learning Mathematics on Achievement in Mathematics among Secondary School Students

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Abstract:

This study Focus on Influence of Cognitive, Affective and Behavioral Attitude towards Learning Mathematics on Achievement among the students of Government and Private Secondary Schools in Mysore District, Karnataka State. A random sample of Four Hundred and Ninety-Five Students (N=495) Studying in IX Standard from Mysore, K R Nagara and Nanjanagudu taluks of Mysore District. The Descriptive Survey Method was applied in the present study. The plan adopted in the study is Correlation Method. The total contribution of all the independent variables on Achievement in Mathematics of Secondary School students was found to be 77.4%, in which the contribution of Intrinsic motivation(X1) =10.41%, Perceived usefulness(X2)=14.62, Self-Confidence in Learning Mathematics (X3)=44.57 and Mathematics Anxiety(X4)=7.99%.The Self-Confidence in Learning Mathematics (X3) is the First Contributor/predictor followed by Perceived usefulness(X2), Intrinsic motivation(X1) and Mathematics Anxiety(X4) on Achievement in Mathematica of Secondary School students.

Introduction:

In India, mathematics is one of the core mandatory subjects to all students in primary and secondary schools. For example, in secondary school curricula, there are three core subjects, notably, Mathematics, General Science and Social Science. Yet, mathematics is seen as the most difficult subject in many parts of the world (Ignacio, Nieto & Barona, 2006) and India is not exceptional. Ngussa and Mbuti (2017) point out that, high failure rates in mathematics are due to several reasons which eventually disorient students' learning. The continued trend of poor performance in mathematics raises concerns to the public on whether or not the education system can supply graduates who possess the essential skills to enable them to cope with the ever-evolving technological society (Hamilton, Mahera, Mateng'e & Machumu, 2010). These results provide an avenue for further research that seeks to characterize and understand the various factors that may influence students' performance in mathematics. This will help to devise plausible strategies for future action so as to bring about an improvement in the pass rates in mathematics.

Learning mathematics does not only involve thinking and reasoning, it is dependent on the attitudes of the learners towards learning and mathematics (Anthony & Walshaw, 2007; Grootenboer, Lomas, & Ingram, 2008; Kele & Sharma, 2014). Han and Carpenter (2014) state that attitudes consist of cognitive, affective and behavioural reactions that individuals display towards an object or the surrounding based on their feelings or interest.

Attitude refers to a learned tendency of a person to respond positively or negatively towards an object, situation, a concept, or a person. It is also regarded as a belief held by individuals that reflects their opinions and feelings and can be sometimes manifested in behaviour (Joseph, 2013). Attitudes, behaviour, and feelings are interrelated in such a way that people's attitudes determine their behaviour towards objects, situations, and

people. They also influence the relationships that exist among these variables with themselves (Joseph, 2013).

Attitude is a hypothetical construct that cannot be observed directly, but can be inferred from measurable reactions to the attitude object (Ajzen, 1993), as it is the case in our study, learning math. In accordance with Syyeda (2016), attitude is multidimensional. It takes into account three components: affect, cognition, and behaviour. Affect is composed of emotions, beliefs, and vision of the subject. Emotions are the feelings of enjoyment or pleasure in learning the subject or seeing it as boring, difficult, and dull. Beliefs are related to students' confidence in their abilities to learn the subject. Vision represents students' perception regarding mathematics. Cognition represents the students' perceived usefulness of the subject. Conversely, behaviour is connected to students' motivation to learn that is reflected with student's actions, commitment, and performance in class.

Using these components to understand the students' attitude towards mathematics, we measure the following aspects:

- **Self-Confidence, Anxiety, Enjoyment (Affect)**
- **Intrinsic Motivation (Behaviour)**
- **Perceived Usefulness (Cognition)**

Researchers have concluded that students' attitudes play a vital role in the learning of mathematics (Ingram, 2015; Kele& Sharma, 2014) However, only a few studies have investigated the effects of teaching mathematics in a sporting context on students' attitudes towards learning mathematics. Most of the research investigated the effects of sports on academic outcomes (Robinson, 2012). The purpose of this study was to investigate if teaching in a sporting context would have an impact on students' attitudes towards learning mathematics. The data reported in this paper comes from a larger study (Sanchal, 2016).

This study aims at exploring the attitude of students toward mathematics in general and analyzes student attitude difference by demographics of students in secondary schools. The results of this study will reveal the

effect, if any, of the initial and exiting attitude toward mathematics. Thus, it will contribute to the current knowledge regarding students' attitude, learning and achievement concerning mathematics at school level and reveal the ways of creating positive attitude towards mathematics. Moreover, it will be useful for school teachers of mathematics for planning their lessons with differentiable learning approaches and strategies. Creating positive attitudes towards mathematics in students is one of the important goals of this research. It also helps to implement innovative methods in teaching mathematics and find out the condition of professional development of school level mathematics teachers and the implications of the results of the study.

SIGNIFICANCE/RATIONALE OF THE STUDY:

The study is also expected to contribute to the advancement of knowledge about the factors affecting performance of mathematics among secondary school students. The study would also have practical significance because it would lead to the improvement of strategies aimed at improving the performance in mathematics by fostering students' attitude in mathematics in secondary schools. The study would be of immediate help to curriculum implementers in the formulation of strategies aimed at enhancing students' attitude in mathematics. The study forms a base on which others would develop their studies.

This is precisely the reason why the present study is undertaken.

- This Study will provide some insights about the relationship between Associated factors of attitude towards learning mathematics with Academic Achievement in Mathematics of the secondary School students.
- The results of the study will have far- reaching consequences as they are very helpful for teachers in general and guidance/educational counselors in particular.

- The results of the study will also enable them to know the factors that affect their academic achievement in Mathematics or help the Academic Achievement of students.
- The recommendations of the study may be helpful to the policy makers in the direction of evolving new policies, this would assist education planners and curriculum developers to map out strategies by which performance can be improved
- The study would be of immediate help to curriculum implementers in the formulation of strategies aimed at enhancing students' attitude in mathematics. The study forms a base on which others would develop their studies.

Even though there are many factors which may influence an individual's academic achievement, in this study it is decided to find out relationship of four factors, namely Self-Confidence towards Learning Mathematics, Mathematics Anxiety, Intrinsic motivation and Perceived usefulness of students of Secondary Schools with their Achievement in Mathematics.

SCOPE/DELIMITATION OF THE STUDY:

This study centers on relationship between Achievement in Mathematics with Self-Confidence towards Learning Mathematics, Mathematics Anxiety, Intrinsic motivation and Perceived usefulness of the students of Government and Private Secondary Schools in Mysore District, Karnataka State. It is aimed at all Government and Private Secondary schools' students in Karnataka State, but due to time, money and other factors study was limited to only Twenty Four Secondary schools in Mysore District. The content scope covered Cognition, Affect and Behavioral Aspects of Attitude towards Learning Mathematics such as Self-Confidence towards Learning Mathematics, Mathematics Anxiety, Intrinsic motivation and Perceived usefulness which Correlates/affect Achievement in Mathematics of IX Standard Students in Mysore District.

STATEMENT OF THE PROBLEM:

The statement of the problem of the present survey is, “Influence of Cognitive, Affective and Behavioral Attitude towards Learning Mathematics on Achievement in Mathematics among Secondary School Students”

VARIABLES:

- Achievement in Mathematics
- Self-Confidence in Learning Mathematics **(Affective)**
- Mathematics Anxiety **(Affective)**
- Intrinsic Motivation **(Behavioral)**
- Perceived Usefulness **(Cognitive)**

OBJECTIVE OF THE STUDY:

- To study the Significant contribution of predictor variables (Self-Confidence in Learning Mathematics, Mathematics Anxiety, Intrinsic motivation, Perceived usefulness) in predicating the criterion variable (Achievement in Mathematics) of Secondary School Students.

HYPOTHESES:

- There is no Significant difference in the contribution of predictor variables (Self-Confidence in Learning Mathematics, Mathematics Anxiety, Intrinsic motivation, Perceived usefulness) in predicating the criterion variable (Achievement in Mathematics) of Secondary School Students.

RESEARCH METHODOLOGY:

The study employs descriptive research of survey type, to investigate the Associated factors with attitude of students towards the Learning Mathematics in Secondary Schools on Achievement in Mathematics in

Mysore District of Karnataka State. The Descriptive Survey Method was applied in the present study. It identifies the current status of the research study. The plan adopted in the study is Correlation Method. The plan did not entail any experiment or the manipulation of any independent variable.

POPULATION OF THE STUDY:

The students studying in various secondary schools in the academic year 2022–2023 of standard IX in Mysuru District were considered as a population of this study. According to the Department of Public Instruction of Karnataka, there are altogether 270558 Students were Studying in 768 Secondary Schools in Seven Taluks of Mysuru District. Out of 768 Secondary Schools, 231 schools are run by Department of Education, 134 schools are run by Aided Management, 348 schools are run by private Management, 46 schools are run by Social Welfare Department and 8 schools under by Central Government. 46686 Students are Studying in IX Standard out of 270558 student population. Researcher Selected Randomly three taluks out of seven for conducting research namely, Mysore, K R Nagara and Nanjanagudu taluks.

SAMPLING:

In the present study Random Sampling Technique was adopted by the researcher. The Sample for the present study consists of the students of IX standard studying in Secondary Schools in Mysore District.

Selection of Schools and Students:

A random sample of Four Hundred and Ninety-Five Students (N=495) Studying in IX Standard from Mysore, K R Nagara and Nanjanagudu taluks of Mysore District. Researcher was selected 202 students from 9 Government Secondary Schools, 129 students from 6 Aided Secondary Schools and 164 students from 9 Private Schools Randomly in Mysore District. out of 495 students 202 were boys and 292 were girls.

TOOLS USED FOR THE STUDY:

Investigator constructs his own tools for Achievement in Mathematics, Attitude towards Learning Mathematics such as Self-Confidence in Learning Mathematics, Mathematics Anxiety, Intrinsic Motivation, Perceived usefulness; the investigator made a careful selection of the available standardized tools which could be validly applied to the sample of students selected for study. All the tools selected were those that were developed for the use with pupils of secondary classes. Care was taken to assure that the tools had accepted levels of validity and reliability.

DATA COLLECTION PROCESS

The study was planned to be conducted with a total of 495 ninth-grade students in 24 Secondary schools of in the Mysore District of Karnataka State at the end of 2022-2023 Academic year. Student engagement in the research was voluntary. Permission was granted from the Deputy Director of public Instruction in order to conduct the study. Later researcher conducted the data collection processes and visited all the 24 schools and distributed the all the tools to the students in each school. After receiving the filled tools answers, some of the forms were eliminated because some of the students who participated in the study left some items blank while filling out the forms, and some of the students' answers were found to be inconsistent during the control of the tools. Following the elimination, a total of 495 student forms were found to be valid.

STATISTICAL TECHNIQUES:

The hypotheses may be tested by analyzing data by applying appropriate descriptive and inferential statistics.

- **Co-efficient of Correlation:** This statistical technique is employed to verify hypotheses pertaining to correlation studies. It is used to estimate the significance of the relationship between the two variables.
- **Regression:** A statistical procedure in which more than one predictor variable is correlated with a target variable as well as with the other

predictor variables in order to form a linear model using a weighted sum of the predictor variables to predict values of the target variable.

Analysis and Interpretation of the Data:

Table 1: Regression co-efficient of secondary school students (Model Summary)

R	R Square	Adjusted R Square	Std. Error of the Estimate	F-Value	Sig.
0.881a	0.776	0.774	4.04357	424.308	0.000

The coefficient of multiple determination of R^2 is 0.774. It can be therefore, be said that nearly 77.4 percent of the variation in Achievement in Mathematics of secondary school students accounted for whatever is measured by Intrinsic motivation(X1), Perceived usefulness(X2), Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4) taken together. The SEest for the regression equation is 4.04357. This means that each time the regression equation for the sample is used to predict a Academic Achievement; the chances are predicted Achievement in Mathematics will not miss the actual Academic Achievement of secondary school students by more than ± 4.04357 .

The effect of Intrinsic motivation(X1), Perceived usefulness(X2) Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4), was found to be significant (F=424.308, $p < 0.01$) on Achievement in Mathematics of Secondary School students at 0.01 level of significance. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, Intrinsic motivation(X1), Perceived usefulness(X2), Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4) are the significant Predictors of Achievement in Mathematics of secondary school Students.

Table 3: Multiple linear regressions School Environment, Anxiety, Adjustment and Study Habits on Academic Achievement of secondary school students

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-1.097	2.323		-0.472	0.637
Intrinsic motivation(X ₁),	0.093	0.016	0.163	5.991	0.000
Perceived usefulness(X ₂)	0.147	0.021	0.207	7.018	0.000
Self-Confidence in Learning Mathematics (X ₃)	0.284	0.017	0.533	16.769	0.000
Mathematics Anxiety(X ₄)	-0.071	0.014	-0.136	-5.193	0.000

From the results of above table 3, we observed that the followings:

The effect of Intrinsic motivation(X₁), Perceived usefulness(X₂) Self-Confidence in Learning Mathematics (X₃) and Mathematics Anxiety(X₄) was found to be significant on Achievement in Mathematica of secondary school students at 0.01 level of significance. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, Intrinsic motivation(X₁), Perceived usefulness(X₂), Self-Confidence in Learning Mathematics (X₃) and Mathematics Anxiety(X₄) are significant predictors of Achievement in Mathematics of secondary school students.

The relative contribution of Intrinsic motivation(X₁), Perceived usefulness(X₂) Self-Confidence in Learning Mathematics (X₃) and Mathematics Anxiety(X₄) on Achievement in Mathematics of secondary school students are presented in the following table.

Table 4: Relative contributions of predictor variables on criterion variable (Academic Achievement) of secondary school students.

Independent Variable	β	r	$\beta \times r$	% of contribution
Intrinsic motivation(X ₁),	0.163	0.441	0.104143	10.41427
Perceived usefulness(X ₂)	0.207	0.674	0.146157	14.61569
Self-Confidence in Learning Mathematics (X ₃)	0.533	0.748	0.445685	44.56851
Mathematics Anxiety(X ₄)	-0.136	-0.531	0.079876	7.987642
Total			0.774	77.4%

The total contribution of all the independent variables on Achievement in Mathematics of Secondary School students was found to be 77.4%, in which the contribution of Intrinsic motivation(X₁) =10.41%, Perceived usefulness(X₂)=14.62, Self-Confidence in Learning Mathematics (X₃)=44.57 and Mathematics Anxiety(X₄)=7.99%. Therefore we conclude that, The Self-Confidence in Learning Mathematics (X₃) is the First Contributor/predictor followed by Perceived usefulness(X₂), Intrinsic motivation(X₁) and Mathematics Anxiety(X₄) on Achievement in Mathematica of Secondary School students.

The regression equation developed for the contribution of predictor variables (Intrinsic motivation(X₁), Perceived usefulness(X₂), Self-Confidence in Learning Mathematics (X₃) and Mathematics Anxiety(X₄)) in predicating the criterion variable (Achievement in Mathematics) among Secondary School Students(N=495).

$$\text{i.e., } Y = -1.097 + 0.163 (X_1) + 0.207 (X_2) + 0.533 (X_3) - 0.136 (X_4)$$

Major Findings of the Study:

- Intrinsic motivation(X1), Perceived usefulness(X2), Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4) are the significant Predictors of Achievement in Mathematics of secondary school Students.
- The total contribution of all the independent variables on Achievement in Mathematics of Secondary School students was found to be 77.4%, in which the contribution of Intrinsic motivation(X1) =10.41%, Perceived usefulness(X2) =14.62, Self-Confidence in Learning Mathematics (X3)=44.57 and Mathematics Anxiety(X4)=7.99%. Therefore, we conclude that, The Self-Confidence in Learning Mathematics (X3) is the First Contributor/predictor followed by Perceived usefulness(X2), Intrinsic motivation(X1) and Mathematics Anxiety(X4) on Achievement in Mathematica of Secondary School students.
- The regression equation developed for the contribution of predictor variables (Intrinsic motivation(X1), Perceived usefulness(X2), Self-Confidence in Learning Mathematics (X3) and Mathematics Anxiety(X4)) in predicating the criterion variable (Achievement in Mathematics) among Secondary School Students(N=495).

$$\text{i.e., } Y = -1.097 + 0.163 (X1) + 0.207 (X2) + 0.533 (X3) - 0.136 (X4)$$

CONCLUSION:

In light of the research's findings, we may suggest some recommendations to help secondary school students boost their confidence in learning mathematics, decrease their arithmetic anxiety to a tolerable level, and make sure they take a positive attitude on math lessons. Rather than only learning how to solve problems, students should have the chance to embrace the problem-solving process. By using innovative teaching and learning techniques

that will interest the students' interest in studying math concepts and theories, teachers can assist the learners in developing their high self-confidence to perform in mathematics. Parents can encourage and help their children as they struggle with math, which will inspire parents to learn more about the reasons behind their children' unfavourable views towards math. The mathematics program of a school may be improved through plans put forth by the administration that are specific to the interests, and issues of the students. This might be required to encourage students to reach higher levels of effort and motivation, which could lead to better math performance.

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