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INFLUENCE OF PROBLEM SOLVING ABILITY, LEARNING STYLE AND HOME ENVIRONMENT UPON ACHIEVEMENT IN MATHEMATICS OF HIGH SCHOOL STUDENTS

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Abstract

In this study, an attempt has been made to study the influence of problem solving ability, learning style and home environment upon achievement in Mathematics of high school students. A sample of 434 high school students from Pondicherry region were selected for data collection. Achievement Test in Mathematics, learning style inventory, problem solving ability test constructed and validated by the investigators (2023) and home environment scale constructed and validated by N.O.Nelliyappan (2016) were used as the research instrument to collect the data. The data was subjected to regression analysis for further tabulation and interpretation. Findings of the study revealed that 20.6% of the total variance in achievement in Mathematics is contributed by the independent and demographic variables such as Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school. The remaining percentage of variance 79.4 % (1-R Square) is to be accounted by other factors which are not included in this study. Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school of high school students all make a significant contribution to the achievement in mathematics of high school students.

Key words: achievement in mathematics, problem solving ability, home environment, learning style

Introduction

Achievement in mathematics can be defined as the competency shown by the student. Its measure is the score on an achievement test in mathematics. Problem solving is a process of overcoming difficulties that appears to interfere with the attainment of a goal. Simple problems can be solved by instinctive and habitual behaviors. The more difficult problems require a series of solutions attempts until the successful solution is reached i.e., the problems which are more difficult require a degree of understanding, a perception of the relationships and the significant factors of a problem. Problem solving is one of the five fundamental mathematical process standard along with reasoning and proof, communication, connections, and representation. It is the foundation of all mathematical activity. In order to function in the complex and changing society, people need to be able to solve a wide variety of problems. Problem solving is a process; it requires great precision, accuracy, speed and thorough knowledge in mathematical concepts skills.

Mathematic is essential in the modern world. In the present era of computers memorization of fact and principles is sufficient. Teaching and learning of mathematics play a different role in the present century of automation and cybernetics

marked the beginning of new scientific and industrial revolution. National Policy on Education (NPE, 1986) has envisaged that, "Mathematics should be visualized as the vehicle of communication to train a child to think, to reason, to articulate and to analyses logically. It should be treated as a concomitant to any subject involving analysis and synthesis.

These sentences reinforce the need for students to develop the problem-solving skills to solve a wide variety of complex problems. These different types of problem solving are critical to the discussion of problem solving and student achievement because of the potentially different impact on student achievement. It has been found that persons having higher intelligence and reasoning ability can solve the complex problem quickly.

Review of Literature

Rani and Rani (2024) had studied mathematics achievement of secondary school students is greatly affected by many psychological factors like intelligence, learning habits, mathematical anxiety, motivation, concentration, self-confidence, and academic stress. Out of this, mathematical anxiety is prominent one as it is a feeling of tension and apprehension. In fact, it is the ratio of "tension felt" by a pupil to the "support available." In the present review, we have analyzed all the factors responsible for mathematical anxiety to decide the achievement in mathematics. To overcome the problem of mathematical anxiety and to earn mathematical achievement, students should be taught by the teacher with improved teaching and learning methods so that they may feel encouragement towards mathematics. **Ashwani Kumar (2021)** had studied about the Problem Solving Ability of High School Students in Relation to Their Gender, Area and Type of School. Findings showed that there is no significant difference between the mean groups based on gender and area and type of school. **Nain Singh1, & Yudh Veer (2019)** conducted a study on 600 Scheduled Castes Senior Secondary School Students of Kullu and Mandi Districts of Himachal Pradesh to find out the differences in the problem solving ability of these students in relation to their gender and district they belong to. The results of the study revealed that neither the gender nor the district of the senior secondary scheduled caste school students have any effect on problem solving ability of these students. **Madhumathi and Ahmed (2020)** conducted a study on 'assessing problem- solving abilities based on Polya's approach Osmania (Hyderabaad) university'. The study revealed that almost 80% of the students are below average in their problem solving abilities. It has been also found that in almost all the problem solving abilities, the performance of girl students was found to be relatively better than boys. **Mr. Ashwani Kumar, Dr. P.P. Singhal (2014)** had studied about academic achievement in relation to problem solving ability. In this study a sample of 200 students from classes VI to X was taken from government schools in urban area. A problem solving ability test was administered and academic achievements of only those students were recorded form school records. It was found that those students having better problem solving ability were the better performers.

Need for the Study

Mathematics is a part of science which has four fundamental operations of addition, subtraction, multiplication and division. Understanding mathematics is important because it can help measure the effectiveness of lessons and understand student performance in mathematics. Mathematics provides a great way to develop mental discipline and improve critical thinking and critical reasoning. Mathematics knowledge also plays a key role in understanding concepts in other school subjects, such as science, social studies, and even music and art. For high school student it is one among the other school subjects that every student must learn without option. It is also very important for students to select their optional course in higher secondary education. In Puducherry region, CBSC pattern was introduced in school education from the academic year 2023-24 onwards. Problem solving ability is a heart in the study of mathematics and highest level of learning in the hierarchy proposed by Gagne. It is a deliberate or purposeful act on the part of an individual to realize the set goals by inventing some novel method or symbolically following some planned steps for the removal of interferences or obstacles in the path. Problem solving is the process part of mathematics that has often been overlooked in the past in favour of skills such as addition and solving triangles. But there are other reasons for it to be part of the mathematics curriculum. Problem solving is one of the five fundamental mathematical process standard along with reasoning and proof, communication, connections, and representation. It is the foundation of all mathematical activity. The goal of teaching mathematics to be effective were students able to solve their problem which shows that learning mathematics aimed to develop their cognitive and affective domain that can support problem solving abilities. Learning about students' learning styles is important because it allows teachers to tailor lessons that will work best for each student based on how they learn best, thus improving understanding, retention, and overall student engagement. Educational, explanatory, or practical activities; this leads to better performance, increased motivation and greater confidence. Studying the home environment

of students is important for and teacher and school management because it can help to understand how the home environment affects a student's achievement, development and well-being. Based on the above discussion, three factors, namely problem solving ability, learning style and home environment were identified as the influencing factors of achievement in mathematics. Hence the current research drops the attention to carry out the research in Puducherry region among the high school student studying in government and private schools.

Statement of the Problem

Mathematics is a handmaid of all sciences. It is a well-known fact that a mere possession of knowledge is no guarantee for its wise use. Though the assumption "Knowledge is power", by itself is valid, becomes meaningless when the individual possessing it fails to the maximum benefit of mankind. The primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems. Achievement refers to the successful reaching of a goal. Based on the literature review and personal experience, the researcher intended to find out the relative influence of problem solving ability, learning style and home environment of high school students studying in Pondicherry region upon achievement in Mathematics. Therefore, the investigator was used to find out the ground realities entitled as "Influence of Problem solving ability, Learning style and Home environment upon Achievement in mathematics of High school students".

Method of Study

Normative survey method was used to collect data.

a) **Sample:** The sample of the study consist high school students studying in Pondicherry region.
b) **Sampling Technique:** Random sampling technique was adopted in this study. IX standard students studying in Government and private high schools were randomly selected by lottery method. A sample of 434 high school students were included in this study.
c) **ToolS used:** A sample of 434 high school students were selected for data collection. Achievement Test in Mathematics, learning style inventory, problem solving ability test constructed and validated by the investigators (2023) and home environment scale constructed and validated by N.O.Nelliyappan (2016) were used as the research instrument.
d) **Statistical Techniques:** Multiple regression analysis was used for interpretation of the collected data to arrive at meaningful conclusions.

Objective of the study

1. To find out the influence of the independent variables, problem solving ability, home environment, learning style and demographic variables upon the dependent variable achievement in mathematics of high school students.

Hypothesis of the study

1. The independent variables, such as problem solving ability, home environment, learning style and demographic variables do not influence the dependent variable achievement in mathematics of high school students.

Operational Definition

- **Achievement in Mathematics:** Here it refers to the marks obtained by an individual in the achievement test in Mathematics.
- **Mathematics:** Mathematics is a part of science which has four fundamental operations of addition, subtraction, multiplication and division. Here it refers to ninth standard mathematics subject.
- **Problem Solving Ability:** Here it refers that ability to understand goal of the problem and rules could be applied to represent the key to solving the problem.
- **Learning style**: Learning style refers to the way a student processes and retains information, including how they take in, understand, express, and remember it.
- **Home environment:** The term "home environment" refers to the physical and emotional atmosphere within a student's home. It encompasses a variety of factors that contribute to the overall quality and functionality of living spaces.

Analysis and Interpretation

Achievement in mathematics, problem solving ability scores, home environment and learning style scores were analysed and tabulated for further interpretation.

The regression analysis has been carried out to find out whether there is any significant contribution of learning style, Problem solving ability, home environment and demographic variables of the study upon the dependent variable achievement in mathematics. The results of the analysis are presented in the following tables.

Table 1: contribution of the independent variables and demographic variables of high school students

R	R Square	Adjusted R Square	Std. Error of the Estimate
.454[a]	.206	.187	17.211

a. Predictors: (Constant), Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school

b. Dependent Variable: Achievement in Mathematics

Table –1 shows the R square value, which is found to be (.206) and it is evident that only 20.6% of the total variance in achievement in Mathematics is contributed by the independent and demographic variables such as Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school. The remaining percentage of variance 79.4 % (1-R Square) is to be accounted by other factors which are not included in this study.

Table-2: The categorical regression ANOVA of the independent and demographic variables upon the dependent variable achievement in mathematics

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	32512.353	10	3251.235	10.976	.000[b]
Residual	125301.573	423	296.221		
Total	157813.926	433			

a. Dependent Variable: Achievement in Mathematics

b. Predictors: (Constant), Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school

It is evident from table-2, the F value is found to be 10.976, which is significant at 0.01 level. It indicates that there is a significant of contribution of the independent and demographic variables upon the dependent variable achievement in mathematics. Hence it is inferred that a linear combination of all independent and demographic variables taken in this study predicts the achievement in mathematics of high school students. It suggests that Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school of high school students all make a significant contribution to achievement in mathematics of high school students.

Hence, the framed hypothesis is rejected, and it is concluded that the independent variables, such as problem solving ability, home environment, learning style and demographic variables do influence the dependent variable achievement in mathematics of high school students.

Table-3: the categorical regression coefficients for independent and demographic variables upon the dependent variable achievement in mathematics

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	26.205	14.642		1.790	.074
	Gender (X_1)	3.358	1.800	.086	1.866	.063
	Locality (X_2)	1.438	1.373	.047	1.047	.296
	Type of school (X_3)	6.372	2.501	.143	2.547	.011
	Religion (X_4)	-.858	1.771	-.021	.485	.628

	Community(X_5)	1.346	1.365	.044	.986	.325
	Parental education(X_6)	-1.265	2.139	-.026	.591	.555
	Income(X_7)	4.221	1.515	.139	2.786	.006
	Problem solving(X_8)	1.172	.243	.253	4.817	.000
	Home environment (X_9)	1.048	.239	.156	3.231	.019
	Learning style(X_{10})	.485	.231	.196	2.103	.036
a. Dependent Variable: Achievement in Mathematics						

Table-3 shows the calculated 't' value, which reveals that type of school (t=2.547), parental income (t=2.786), problem solving (t= 4.817), home environment (t=3.231)and learning style (t= 2.103) are being significantly contributed to the dependent variable achievement in Mathematics of high school students. Moreover, gender, locality, religion, community and parental education, are not being significantly contributed to the dependent variable achievement in mathematics of high school students.

A comparison of Beta coefficients in table 3 indicates that problem solving ability is the most significant predictor of achievement in mathematics followed by learning style and home environment. Also income is found to be the least predictor of achievement of high school students.

Regression equation for Achievement in Mathematics

Using the categorical B coefficients (standardized coefficients) given in table 3, the following regression equation is obtained to predict the contribution of the independent variables (Problem solving, Learning style Home environment, Type of school and Income) over the dependent variable (Achievement in mathematics). 26.205

$$Y= .253\ X_8 + .196X_{10} + .156\ X_9 + .435X2 + .143X_3 + .139X_7$$

Where Y is the predicted achievement in mathematics and X1, X2, X3 …….X9 are the independent variables.

Thus, it is concluded that there is significant role of Problem solving, Learning style Home environment, Type of school and Income, towards achievement in mathematics of high school students.

Findings of the study

i. It is evident that only 20.6% of the total variance in achievement in Mathematics is contributed by the independent and demographic variables such as Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school. The remaining percentage of variance 79.4 % (1-R Square) is to be accounted by other factors which are not included in this study.

ii. The independent variables, such as problem solving ability, home environment, learning style and demographic variables do influence the dependent variable achievement in mathematics of high school students.

iii. A linear combination of all the independent variables taken together contribute towards achievement and significantly predicts achievement in mathematics among high school students.

iv. Learning style, Religion, Community, Gender, Parental education, Problem solving, Locality, Home environment, Income, Type of school of high school students all make a significant contribution to the achievement in mathematics of high school students.

v. Type of school, parental income, problem solving, home environment and learning style are being significantly contributed to the dependent variable achievement in Mathematics of high school students.

vi. Gender, locality, religion, community and parental education, are not being significantly contributed to the dependent variable achievement in mathematics of high school students.

Conclusion

Achievement of high school students was focused in this study. It was found that type of school, parental income, problem solving, home environment and learning style are being significantly contributed to the dependent variable achievement in Mathematics of high school students. Based on the findings it is recommended that problem solving should be given due importance for high school students which contributed significantly to achievement in mathematics. In parallel home environment and learning style also plays a significant role to achievement in mathematics of high school students. Parents should be made aware of this finding and let them provide conducive home environment for students to

concentrate and involve in learning at home. It is concluded that achievement in Mathematics of high school students in Puducherry region can be improved by developing their problem solving skills, practice in learning styles and providing conducive home environment.

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