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Effect of Problem Solving Ability on the Achievement in Mathematics of High School Students

KEYWORDS: Problem Solving Ability; Achievement in Mathematics, High School Students

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ABSTRACT *This paper attempt to analysis the effect of problem solving ability on the achievement in mathematics at high school level. A total of (598) Grade 10th students were randomly selected as sample of this study, selected from different institutions of South Kashmir. In order to assess the problem solving ability L.N. Dubey's Problem solving ability test adapt by the investigator was used. The achievement of mathematics was taken from the school records obtained by the students in previous class. The findings of the study revealed that 79% variance contributed by the predicted variable (problem solving ability) to the criterion variable (achievement in mathematics) amoung high school students. The study also depicted that 78.3% in case of (boys) and 78.2% in case (girls) variance contributed by the predicted variable to the criterion variable*

Introduction

Education is a basic part of human life. It is the base for the growth of the 'whole man' and an essential instrument for accelerating the well-being and success of all in every direction. Without education man would still be living just like a beast.

Mathematics is the foundation in today's systematic life. Without numerical and mathematical proof one cannot decide many issues in day to day life. Mathematics plays a very important role in the economic and social development of a country because it is the foundation for all science and technology. Mathematics is the queen of all sciences and the backbone of civilization. Doing any profession one cannot survive without the knowledge of mathematics.

Mathematics is an indispensable tool of exactness to measure quality and time. The ultimate concept of space travel, the harnessing of hidden sources of energy from space, new and greater use of atomic energy, atomization and electronic devices and such other developments demands the greater use scientific and mathematical advent.

The NPE (1986) identifies the strengths and weaknesses of the present system of education and clearly articulated the direction for reshaping the system, particularly at high school level. It was explicitly mention in the NPE (1986) about mathematics education in the following words " Apart from being a specific subject it should be treated as a concomitant to any subject involving analysis and reasoning with the introduction of computers in schools, educational computing and emergence of learning through the understanding of cause effect relationship and the interplay of variables, the teaching of mathematics will be suitably redesigned to bring it in with modern technological devices".`

The place of mathematics in modern education must be determined by an analysis of the culture of civilization of the modern society. The Kothari Commission report (1964-66) rightly points out that the study of mathematics plays a prominent part in modern education. It says: "one of the outstanding characteristics of scientific culture is qualification".[P.199] mathematics, therefore, assumes a prominent position in modern education.

Mathematics education in schools is more emphasized as it improves concept development, fosters higher cognitive abilities and skills. Mathematics is a very useful subject for most vocations and higher specialized courses of learning. At the higher secondary and university stages, most of the physical and social sciences require the applications of mathematics. No other subject can be a substitute for mathematics. Thus mathematics has now become compulsory in the school curriculum.

Mathematics has been an inseparable part of school curriculum ever since the beginning of formal education and it continues to be so. Mathematics curriculum has undergone various changes from time to time in accordance with the changing needs of the society. Realizing its social relevance the Kothari education commission (1964-66) recommended that mathematics should be taught as a compulsory subject of general education up to class X.

Problem solving has a special importance in the study of mathematics. A primary goal of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems (James W. Wilson, Maria L. Fernandez, and Nelda Hadaway (1993). Stanic and Kilpatrick (1988) traced the role of problem solving in school mathematics and illustrated a rich history of the topic. Mathematics is synonymous with solving problems -- doing word problems, creating patterns, interpreting figures, developing geometric constructions, proving theorems, etc. On the other hand, persons not enthralled with mathematics may describe any mathematics activity as problem solving (Wilson, Fernandez, and Hadaway, 1993). Problem solving is an integral part of all mathematics learning. In everyday life and in the workplace, being able to solve problems can lead to great advantages. However, solving problems is not only a goal of learning mathematics, but also a major means of doing so. Problem solving means engaging in a task for which the solution is not known in advance. Good problem solvers have a "mathematical disposition"--they analyze situations carefully in mathematical terms and naturally come to pose problems based on situations they see.

Problem solving involves application of thinking and reasoning to various kinds of problems encountered in life. Problem solving is an integral part of developmental activities and provides opportunities for children to practice what they have learned by applying their learning situations. The

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amount of practice needed by any learner is reduced if he understands the concepts and skills to be practiced.

Problem solving is at the very heart of understanding mathematics. The whole purpose of teaching the various concepts which make up mathematics as a tool is to give the learner the tools and the building blocks with which he can actually solve problems that is, resolve difficulties which he wants to resolve.

Objectives:
To carry out the study in a systematic way following objectives were formulated:

1. To study the contribution of predicted variable (problem solving ability) on criterion variable (achievement of mathematics) of high school students.
2. To explore the contribution of predicted variable (problem solving ability) on criterion variable (achievement in mathematics) of high school male students.
3. To explore the contribution of predicted variable (problem solving ability) on criterion variable (achievement in mathematics) of high school female students.

Hypotheses:
1. There is no significant effect of predicted variable (problem solving ability) on criterion variable (achievement in mathematics) of high school students.
2. There is no significant effect of predicted variable (problem solving ability) on criterion variable (achievement in mathematics) of high school male students.
3. There is no significant effect of predicted variable (problem solving ability) on criterion variable (i.e. achievement in mathematics) of high school female students.

Method and Procedure:
The samples of this survey study comprised of 598 high school students currently enrolled in class 10th of South Kashmir of Jammu and Kashmir. This study was delimited to students of class 10th. Secondly the problem solving ability was assessed by Problem Solving Ability Test by (L. N. Dubey) adapted by the investigator. The test consists of twenty items based on multiple choice with four alternatives, each question carry one point (1) for right answer and zero (0) point for wrong answer. The reliability was calculated through Cronbach Alpha which is (.729). The achievement of mathematics was taken from the previous class obtained by the students in previous examination conducted by Board of School Education and Secondary Education. Data were tabulated and analyzed by using regression analysis through SPSS 20.

Results:
To study the contribution of predictor variable (problem solving ability) on criterion variable (achievement in mathematics) of high school students, in order to fulfil this objective linear regression analysis was used. The results were shown in table 1.

Table 1: Showing Stepwise Multiple Linear Regressions Predicting Problem Solving Ability on Achievement in Mathematics of High School Students (N=598)

Model (Predictor)	Standardized Coefficient Beta	t	R	R Square	Adjusted R Square	F
Problem Solving Ability	.889	47.31**	.889	.790	.789	2237.964**

Table 1, shows that the value of R^2, (coefficient of multiple determination) being (.790) is indicative of the fact that 79% of the variance in achievement in mathematics of high school students is accounted by problem solving ability and the remaining percentage of the variance is still to be accounted by the other variables which are not included in the study. The F value comes out to be (2237.964) which are significant at 0.01 level. This means that the model presented is significant in predicting problem solving ability of high school students.

The table also shows the β value (.889) which indicates that problem solving ability was positively related to achievement in mathematics. It means that when problem solving ability increase achievement in mathematics also increases. The corresponding t value was (47.31) which is significant at .01 level, thus indicating a relationship between predictor (problem solving ability) and criterion variable (achievement in mathematics).

Hence, in the light of the results mentioned above, the hypothesis "There is no significant effect of predictor variable (i.e. problem solving ability) on criterion variable (i.e. achievement of mathematics) of high school students" is rejected.

The graphical representation of the criterion variable (achievement in mathematics) is shown in figure 1.

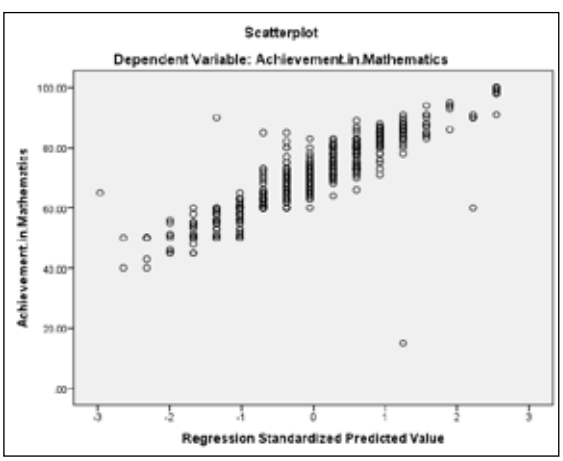

Fig. 1.

To explore the contribution of predictor variable (problem solving ability) on criterion variable (achievement in mathematics) of high school male students, in order to fulfil this objective the investigator use linear regression. The results are shown in table 2.

Stepwise Multiple Linear Regressions Predicting Problem Solving Ability on

Achievement in Mathematics of High School Male Students (N=299)

Model	Standardized Coefficients Beta	t	R	R Square	Adjusted R Square	F
Problem Solving Ability	.885	33.52**	.885	.783	.782	1123.537**

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From the perusal of table 2, it shows that the value of R^2, (coefficient of multiple determination) being (.783) is indicative of the fact that 78.3% of the variance in achievement in mathematics of high school male students is accounted by problem solving ability and the remaining percentage of the variance is still to be accounted by the other variables which are not included in the study. The F value comes out to be (1123.537) which are significant at 0.01 level. This means that the model presented is significant in predicting problem solving ability of high school male students.

The table also shows the β value (.885) which indicates that problem solving ability was positively related to achievement in mathematics. It means that when problem solving ability increase achievement in mathematics also increases. The corresponding t value was (33.52) which is significant at .01 level, thus indicating a relationship between predictor (problem solving ability) and criterion variable (achievement in mathematics) of high school male stuents.

Hence, in the light of the results mentioned above, the hypothesis "There is no significant effect of predictor variable (i.e. problem solving ability) on criterion variable (i.e. achievement of mathematics) of high school male students" is rejected.

The graphical representation of the criterion variable (achievement in mathematics) of high school male students is shown below.

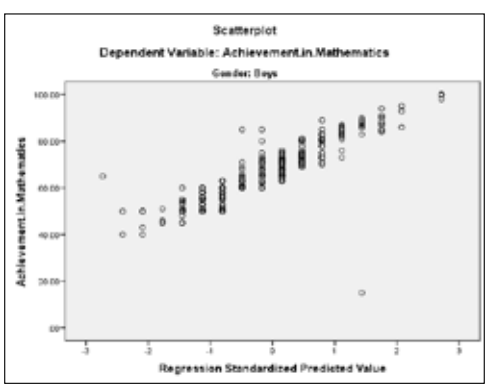

Fig. 2.

To explore the contribution of predictor variable (problem solving ability) on criterion variable (achievement in mathematics) of high school female students, in order to fulfil this objective the investigator use linear regression. The results are shown in table 3.

Stepwise Multiple Linear Regressions Predicting Problem Solving Ability on

Achievement in Mathematics of High School Female Students (N=598)

Model	Standardized Coefficients Beta	T	R	R Square	Adjusted R Square	F
Problem Solving Ability	.884	31.76**	.884	.782	.781	1008.951**

From the perusal of table 3, it shows that the value of R^2, (coefficient of multiple determination) being (.782) is indicative of the fact that (78.2%) of the variance in achievement in mathematics of high school female students is accounted by problem solving ability and the remaining percentage of the variance is still to be accounted by the other variables which are not included in the study. The F value comes out to be (1008.951), which are significant at 0.01 level. This means that the model presented is significant in predicting problem solving ability of high school male students.

The table also shows the β value (.884) which indicates that problem solving ability was positively related to achievement in mathematics. It means that when problem solving ability increase achievement in mathematics also increases. The corresponding t value was (31.76) which is significant at .01 level, thus indicating a relationship between predictor (problem solving ability) and criterion variable (achievement in mathematics) of high school male stuents.

Hence, in the light of the results mentioned above, the hypothesis "There is no significant effect of predictor variable (i.e. problem solving ability) on criterion variable (i.e. achievement in mathematics) of high school female students" is rejected.

The graphical representation of the criterion variable (achievement in mathematics) of high school female students is shown below.

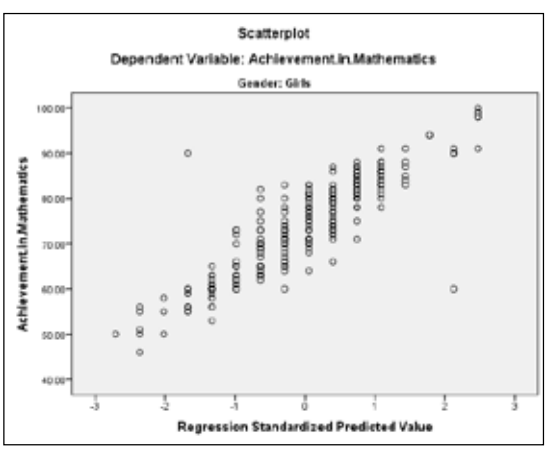

Fig. 3

Discussion and Conclusion:

The findings of the study revealed that problem solving ability is the best predictor of achievement in mathematics of high school students as well when sex was taken as a demographic variable. The finding is in agreement with those of other scholars. These include: (Collier & Lerch, 1969; Kinsella, 1970; Feltovich & Glaser 1980; Jayesh, 1999; Biswajit, 2009) found relationship between problem solving and achievement in mathematics. Therefore, teachers play a most important role in developing students' problem-solving dispositions. They must choose problems that engage students. They need to create an environment that gives confidence students to discover, take risks, share failures and successes, and question one another. In such supportive environments, students develop the confidence they need to explore problems and the ability to make adjustments in their problem-solving strategies (NCTM, 2000).

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Mathematics education today encourages the interpretation and utilization of problem solving in its broadest sense. The teacher is no longer limited totally to the abstract solution of written word problems as traditionally continued in text books. Instead, the teacher may incorporate a variety of techniques to help the child relate the mathematics being learned to situation she or he encounters in life.

Besides, that teacher can use pedagogical strategy to foster problem solving ability. Class discussion reinforces success and transfer learned skills. Studies suggest that active involvement is critical in developing problem-solving skills, so using student learning groups to promote active experimentation with problems is a sound pedagogical strategy. Other effective strategies include accepting multiple attempts of solutions for an assignment, assigning personal journals in which students describe their problem-solving strategies, and allowing students to rework homework and exams for credit. These strategies both dissipate anxiety because they reduce the sole emphasis on "getting the right answer" and encourage reflection on the problem-solving process.

Apart from that teacher can also use methodological strategies to assist students in addressing and solving a new problem, and work hand-in-hand with the pedagogical techniques discussed above. There are two basic types: algorithmic and heuristic methods.

An algorithmic procedure is a "step-by-step prescription for achieving a goal" (Woolfolk, 1993). The mnemonic PEMDAS (Parentheses, Exponents, Multiplication, Division, Addition, and Subtraction) is an algorithm that math students use to remember the order of operations used in simplifying algebraic expressions. Students appreciate algorithms because they are easily applied. However, students may "algorithmize" methods they have observed others using and bring them to bear in a given situation whether applicable or not. Algorithmic methods are limited to low-level tasks and tend to be domain-specific.

Heuristic methods, general schemes used to derive solutions to problems, are more useful than algorithms. There are a variety of heuristics that can be useful to students. Bransford and Stein (1984) use the acronym IDEAL to represent the five steps usually contained in many solution strategies. This scheme is beneficial in a large number of disciplines. Students like the IDEAL heuristic because it is easy to remember and widely applicable

From the above discussion it may be concluded that problem solving is the cornerstone and best contributor of achievement in mathematics, therefore teachers must inculcate problem solving ability among students' through different techniques, which has been already mentioned above. Besides that problem solving ability helps not only in solving mathematical problems but also different day-to-day problems that are encountered an individual in different occasions.

REFERENCE

1. Biswajit, B. (2009). Problem solving skills in mathematics learning. Edutracks, Vol. 8, no. 7, 34-36. | 2. Collier, C, & Lerch, H. (1969). Teaching mathematics in the modern Elementary School. The Mc.Millan Company | 3. Feltovich, & Glasser. (1980). High school student's organization of mathematics word problems in relation to success in problem solving in M.B. BUCH (Ed), Third survey of research in Edu. Vol.1, 1978-83, New Delhi, NCERT. | 4. Jayesh, (1999). A study of VII std students achievement in mathematics and their ability to solve mathematical problems related to daily life situations in M.B. BUCH (Ed). Sixth survey of educational research volume 1, (1993 –2000), New Delhi NCERT. | 5. Keskar, P. U. (1980). A test on problem solving ability for Gujarati children of grades III to VII in M.B. Buch (ed), Third survey of research in Edn, Vol.1, 1978-83, New Delhi, NCERT. | 6. Kothari Commission (1964-66). Government of India Department of education, Ministry of Human Resource Development New Delhi | 7. National Council of Teachers of Mathematics (1991). Professional standards of teaching mathematics. Reston, VA. | 8. National Policy on Education (1986). Government of India Department of education, Ministry of Human Resource Development New Delhi | 9. Stanic, G., & Kilpatrick, J. (1988). Historical Perspectives on Problem Solving in the Mathematics Curriculum. In R. I. Charles & E. A. Silver (Eds.). The teaching and assessing of mathematical problem solving (pp. 1-22). Reston, VA: National Council of Teachers of Mathematics. | 10. Wilson, J.W, Fernandez, M. L, & Hadaway, N. (1993). Mathematical problem solving. In Wilson, P. S. (Ed.). Research Ideas for the Classroom: High School Mathematics. New York: MacMillan. | 11. Woolfolk, A. E. (1993). Educational Psychology, 5th ed., Allyn and Bacon. |