

## Analyzing The Progress Of Primary Level Students In Mathematics Taught By Problem Solving Method

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### ABSTRACT

*Many researches have been carried out to examine the comparative efficiency of applied methods in teaching Mathematics at primary level but no research has been concluded in finding the best method to improve the potential of learner and removing the fear of Mathematics. This is a quasi experimental research aims to analyze the progress of primary level students in Mathematics taught by Problem Solving Method The population consists of all students of Public Schools studying at Primary Level. Sample is selected on the basis of purposive sampling. Out of 27 students 14 students are kept in Experimental group (EP) and 13 students in Control group (CP). Results of post test (PoT) revealed that null hypothesis is not accepted and alternative hypothesis is accepted. Hence there is a clear change seen in the achievement numbers of grade 4 students taught concerned method. Proper utilization of this method is recommended at primary level.*

**Key words:** Mathematics, Problem Solving, Primary level, Experimental Group (EG), Control Group (CG), Pre Test (PrT), Post Test (PoT)

### INTRODUCTION

Math is a field of study which becomes basis for many other areas of study. Implementation of Mathematics cannot be overlooked in any sphere of life. Mathematics has multidimensional role in Science and Technology with its application in all areas of life. Okereke (2006). In spite of the importance of Mathematics it is not favorite among learners. Teachers do not put efforts to create progressive and attractive methods of teaching in Mathematics. Hence the performance of learners is not up to the mark in Mathematics. They want to avoid it. Besides, it has its place in all areas of life so it must be taught with real life application.

At primary level real life scenario based study is rarely seen. Students are taught with numbers and formulas they are not facilitated to apply the basic knowledge obtained by numbers and formulas to the situation and interpret the results.

Problem solving method enables the learners to think creatively collect the data, organize the data, manipulate it, apply it to the life issues, interpret it and draw conclusions. This method involves all learners practically and efficiently. Problems are derived from the life experiences

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of learners so they do not feel bore. It is highly student centered approach that motivates learners for active participation. It develops problem solving skills on the basis of broad knowledge and critical thinking.

### **OBJECTIVES**

- i) To collate the students' performance instructed through PSM and the regular teaching method in concerned subject
- ii) Analyze knowledge retention of students instructed through PSM
- iii) To identify the participation of students in problem solving method
- iv) To enable the students to apply the Mathematical formulas for the solution of real life problems

### **HYPOTHESIS**

Ho1: The results of students instructed through traditional teaching technique are not significantly different from the results of students instructed through PSM in PrT

Ho2: The results of students instructed through traditional teaching technique are not significantly different from the results of students instructed through PSM in PoT

Ho 3: Knowledge retention of students is not significantly different instructed by traditional teaching technique and students instructed by PSM

Ho 4: Participation of students while learning is not significantly different in students instructed by traditional teaching technique and student instructed by PSM

Ho 5: Engagement level of students is not significantly different in students instructed by traditional teaching technique and student instructed by PSM

Ho 6: Application of technical knowledge applied by students is not significantly different in students instructed by traditional teaching technique and students instructed by PSM

### **LITERATURE REVIEW**

Teachers use different pedagogical methods on the basis of students needs in the teaching of Mathematics. Teacher must be proficient in using the preferred method. With the strong teaching skills teacher may assist the students in developing knowledge base and applying it on real life scenarios. (Santos-Trigo, M. 2007) A positive correlation between curriculum and knowledge of pedagogies can give better findings. Teachers apply different teaching approaches and use pedagogies for better learning experiences Gul R.,etal.(2020). Teachers prefer problem solving method for teaching Mathematics because it develops creative thinking, enables students to use basic knowledge of Mathematics, help them to generate samples, engage them in practical work, help them to retain knowledge, make them active learner, recapitalization becomes easy, it is less time consuming, gives a general review, develops strong interpersonal skills and generates learners interest (Menderes Unal 2017). (Menderes Unal 2017) in her research preferences of teaching methods and techniques in Mathematics with reasons explored that teacher's keep question answer and discovery method at first place, games and lecture method at second place, Problem solving and cooperative learning at third place and so on. Discovery is the root of deeper understanding. In 1969, Polya (1981) generated

a unique image of problem solving. Polya considers the problem solving as a practical art, like horseback riding, skating, or playing the French horn, which one can excel by practice. Polya observed that problem solving is not learnt very fast but it takes time to learn the skill. It makes learner independent. He was among the pioneers of this approach who point out that teaching problem solving is possible and designed a plan of action for the process. Among all teaching approaches problem solving approach is the most current, up to date and strategic in the rapidly changing world. It is important for personal and professional life of the people living in the world based on technological advancement, innovative trends and emerging economies (Soloan 2006). It promotes higher order thinking, advocates visualizing by cognitive operations. It enables the learners comprehend, manipulate, and analyze. (Nafees 2011). According to Swedish curriculum teaching of mathematics is focused at developing unique teaching strategies for solving mathematical problems (Swedish National Agency for Education 2011). Thinking and a doing can be distinguished under this approach in military, management or game theory .(Grant 2008). This approach motivates students to practice, and reflect to solve problems (Weber 2008). Usman and Ikechukwu (2018) study revealed that Problem-solving approach develop operational and effective strategies for teaching and learning. It is an experiential technique and works with student centered curriculum. Hence it plays vital role in improved learning among children. It makes them self driven as students collect data by themselves and analyze it. In present days it is necessary to learn mathematics as it has close connection with all subjects specially science subjects. Thus according to However, Diaz et al. (2017) it is essential to excel in problem solving to learn mathematics. Teacher should be able to create argument making in students to solve a problem. (Weber 2008).

#### Research Related to PSM in the Teaching of Math in Pakistan

Author	Area	Methodology
Malik Ghulam Behlol et al(2018)	The study investigates effectiveness of (PSA) in teaching math to students studying at grade 8 in public schools.	PrT PoT equivalent group design was used to conduct this study
Nasrin Akhter et al (2015)	The view point of Problem Solving Teaching Methods at higher level in Mathematics	Mentioned research was quantitative. Semi structured interviews and questionnaires were used to collect the data.
Riasal Ali et al (2022)	This research analyze the effect of PSM on results of students at elementary level.	On the basis of mean and standard deviation results of students were analyzed.
Mushtaq Ahmed et al (2022)	The study aimed to analyze the effect of problem-solving teaching methods in mathematics on the achievements of elementary level students	To examine the effect of independent variables (teaching method) on dependent variables (achievement and problem-solving ability) quantitative approach is applied.

Bushra&Dr.Mumtaz (2020)	To study the impact of PSA on eighth class students for learning mathematics.	Experimental research with the application of PrT PoT
Riasatali et al (2010)	Effects of using PSM on students' scores in teaching mathematics at elementary level.	On the basis of mean and standard deviation results of students were analyzed.

## **THEORETICAL BACKGROUND**

Constructivist theories have gained mass acceptability in teaching of Math in present years. In constructivist view, learner must be operative participant in the development of their own understanding rather than passive receiver. The teacher's job is to provide situations and nurturing environment to constructs appropriate knowledge (Glaserfeld, 1989). The theoretical foundation of teaching of Mathematics through problem solving method focus on constructivist view of learning (Cobb, 1994).

### **Research Methodology**

It is experimental research aligned with set objectives. Deductive approach is used. It is a study that is based on scientific research design, composed of hypothesis and variables that can be orchestrated, deliberated, sustained and collated. A laboratory atmosphere is required to execute the research. Data is collected and results will assess the hypothesis for rejection or acceptance. (Babbie 1998). On the basis of PrT PoT students are placed under two different groups. This technique is supportive to place the students in both the groups in impartial manner without any biasness. They are equally treated in terms of knowledge and treatment.

### **Primary Sources of Data**

Data was taken from randomly selected students. Primary data was collected from class 4 students of G.G.P.S III, Jacob Lines, Nizami Road through questionnaires.

### **Secondary Source of Data**

Attendance roster and marks card of the students were the secondary source of data.

### **Sampling Technique**

Sample is collected on the basis of purposive sampling technique, convenient to visit and conduct the study in a nearby public sector school where the principal and staff are cooperative and willingly participating in the study.

### **Population**

Population of the study consists of all students studying at primary level in grade IV in Karachi.

### **Table 1 Sample**

Total Group	EG	CG
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M	F	T	M	F	T	M	F	T
5	22	27	3	11	14	2	11	13

### Methodology

PrT PoT was put in to evaluate performance of students after conducting lessons. An initial test was given to the students of grade 4 to form CG and EG. Upon the analysis of PrT marks, students are placed in the CG and EG. Fourteen students were placed in EG and thirteen students were placed in CG. PrT results of students were also substantiate with the records of Mathematics teacher before placing them in experimental and control group to make sure that the sample is mixed ability sample. Pre test scores were placed under four different ranges. First was placed under the range of 1-5 these were termed as low achievers. Second was placed under the range of 6-10 these were termed as middle achievers. Third was placed under 11-15 these were termed as high achievers and Fourth was placed under 16-20 these were termed as exceptional achievers. Pre test results of Experimental group and Control group shows the following distribution as high achievers, middle achievers and low achievers.

**Table 2** Distribution of students in Experimental Group

Exceptional Achievers	High Achievers	Middle Achievers	Low Achievers	Total
-	6	5	3	14

**Table 3** Distribution of students in Control Group

Exceptional Achievers	High Achievers	Middle Achievers	Low Achievers	Total
1	4	4	4	13

### Construction and validation of Instrument

Researcher designed a test to use as instrument. Experts were consulted in the development of test. The test is developed in two manners. One is Objective based on MCQs and other is subjective.. The face validity of the items was assessed by mathematics education expert. Cronbach's alpha coefficient for 10 items of MCQs test found to be 0.712 whereas Cronbach's alpha coefficient for 10 items of subjective test found to be 0.810

### Method of Data Analysis

Quantitative research method is applied in this study. Data was run on SPSS (statistical package for the social science): Data was analyzed with mean (M), standard deviation and p. The raw data has been analyzed summarized and interpreted into a meaningful form using paired group sample t-test between experimental and control group students. Students score for PrT and PoT were obtained for both group. Tables are formed to show the data.

Data is analyzed through SPSS. Coded data is entered in SPSS and group sample t test is applied to analyze the results and compare the scores of students

**Results**

**Table 4 Comparison of MCQs EG PrT PoT - academic achievement score by Paired sample t-test**

Groups	N	M	SD	df	t	p
Pre test	14	9.79	4.458	13		
					-7.472	0.000
Post test	14	17.71	1.437	13		

\*p<0.05

PrT PoT MCQs test academic achievement scores of 14 students from the EG are compared. At the p value (0.000<0.05) notable difference occurs among the mean values PrT PoT. The mean value of PrT scores is 9.79 which is notably less than the mean value of PoT scores that is 17.71. It shows that students achievement rate taught by PSM is higher than the achievement rate of students taught through traditional method

**Table 5 Comparison of MCQs CG PrT PoT academic achievement score by Paired sample t-test**

Groups	N	M	SD	df	t	p
Pre test	13	9.31	5.63	12		
					-7.472	0.000
Post test	13	9.00	3.266	12		

\*p<0.05

PrT PoT academic achievement scores of 13 students from the CG are compared. At the p value (0.000<0.05) difference occurs among the mean values PrT PoT. The mean value of PrT scores is 9.31 which are more than the mean value of post test scores that is 9.00. It shows that students showed a decline in achievement results. Hence it is evident that student's achievement rate taught by PSM is higher than the achievement rate of students taught through traditional method

**Table 6 Comparison of EG PrT PoT academic achievement score by Paired sample t-test**

Groups	N	M	SD	df	t	p
Pre test	14	9.86	4.185	13		

-8.606

0.000

Post test	14	17.71	2.268	13
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\*p&lt;0.05

PrT PoT academic achievement scores of 14 students from the EG are compared. At the p value (0.000<0.05) notable difference occurs among the mean values PrT PoT. The mean value of PrT scores is 9.86 which is notably less than the mean value of PoT scores that is 17.71. It shows that students achievement rate taught by PSM is higher than the achievement rate of students taught through traditional method

**Table 7 Comparison of CG PrT PoT academic achievement score by Paired sample t-test**

Groups	N	M	SD	df	t	p
Pre test	13	8.38	4.959	12		
					8.74	0.000
Post test	13	7.85	3.716	12		

\*p&lt;0.05

PrT PoT academic achievement scores of 13 students from the CG are compared. At the p value (0.000<0.05) difference occurs among the mean values PrT PoT. The mean value of PrT scores is 8.38 which is more than the mean value of PoT scores that is 7.85. It shows that students showed a decline in achievement results. Hence it is evident that student's achievement rate taught by PSM is higher than the achievement rate of students taught through traditional method.

These result are supportive to Schultz (1984), as explained above students produced better results when taught through problem solving method

### Discussion and Findings

The sample of 27 students was observed under two groups EG with 14 students and the CG with 13 considering the scores of PrT. These groups were similar in base and shown similar behavior towards number play at the start of process. PoT was taken after the completion. Concluding, when the students were instructed through PSM, their marks in mathematics were better than the students instructed by the traditional strategy Hence it rejects null hypothesis 1 and 2 and accepts alternative hypothesis that there the performance of students taught by traditional method is significantly different than students taught by PSM in pre test and post test. Upon Comparing the results of both test of two groups, reflected improved results of low achievers of this group instructed through PSM as compare to those low achievers instructed by traditional style. Hoffer and Gamoran (1993) support findings of research. On average high achievers of EG performed better than CG. Thus PSM puts high impact on high achievers. Schultz (1984) is the good supporter of these results. This study reveals that PoT average results of the EG were improved than the CG. PoT was given to the students after experiment. It was observed that understanding of EG was better than CG. Blainer and Worthem (1970) and

Willson (1970) and Chitrive (1983) support the results. High achievers of EG clearly know the concepts than CG. It means PSM was more effective in knowledge retention than traditional method. Hence the null hypothesis 3 is rejected and alternative hypothesis 3 is accepted that the retention level of knowledge of students taught by PSM is significantly different than traditional method. Achievement results were better in group instructed through PSM over all. This study was performed at Government school. Students were found shy and reluctant to answer the questions due to several reasons. They showed lack of confidence in responding to a new technique. They hardly accept the change but they tried to some extent. Students took time to adjust with PSM.. The result show that if same time is given to both the approaches students taught under problem solving approach perform well in less time. This study proves that the understanding and retention of knowledge is done in much better way with the application of those methods under problem solving in most effective way at primary level. It was notices during the study that students were weak in basic mathematical operations. During the study it was noticed that basic knowledge of students was also weak.. They are lacking in basics which should be led down in very primitive classes. And if they are lacking in basics they would definitely face problem in advance concepts. Strong base of previous knowledge was pre requisite for solving mathematical problems.(Khanum, 2006) .

During the study when the researcher applied different techniques such as group work, use of material student took great interest and showed their potential hence it is proves that null hypothesis 4 is rejected and alternative hypothesis is accepted that there is significant difference in the participation of students instructed by traditional method and taught by problem solving method. It also rejects null hypothesis 5 and accepts alternative hypothesis that there is significant difference in the engagement level of students instructed by traditional method and by problem solving method as the students are engaged in different activities while solving problems. Students are actively engaged in solving problem in groups or pairs so they share knowledge and learn by trial and error hence our null hypothesis 6 is rejected and alternative hypothesis is accepted that there is significant difference in the application of technical knowledge applied by students taught by traditional method and students taught by problem solving method.

## **Conclusion**

Students were divided into two groups on the basis of PrT. One group was named as EG and the other group was named as CG. Both the groups were equal by every respect. They were sharing the same level of previous knowledge in the subject of mathematics. CG was taught with traditional method and the EG was taught with PSM. On the basis of the results of both the groups of PoT we can conclude that the achievement scores of EG were improved. Low achievers of EG showed better performance when treated with PSM. Knowledge retention level of students taught by PSM was much better than the CG. Students of experimental group were more comfortably applying the knowledge to solve real life problem. It is also concluded that students taught by problem solving method enjoyed the lessons and they were zealous to solve exercises related to life matters. Hence it is finally concluded that problem solving method in teaching of mathematics at primary level has more capacity to develop cognitive skills among learners.

## **RECOMMENDATIONS**

On the basis of conclusion researcher can make following recommendations,



- As it is proved that problem solving method is an effective method to develop critical thinking and analytical skills among learners, teachers should apply this method more often in the class so the learning can be done on more advance and scientific grounds.
- To know the relationship of mathematics with the other branches of science, teachers must motivate students to use and apply problem solving approach.
- Interactive classrooms are recommended to engage the students in the process of learning through problem solving method.
- Creating humor and fun in classroom is a mind booster; Teachers can start the learning process with some fun filled activity.
- To develop critical thinking teachers can use their experience and knowledge as a catalyst.
- Teacher can take input of students in designing problem solving activities to make the lesson learner centered.
- Refresher courses and training must be provided to the teachers in order to keep themselves up dated.
- Problems should be designed in student friendly language so they can understand and comprehend.

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