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PROBLEM SOLVING IN MATHEMATICS- IS THERE ANY GENDER DIFFERENCE?

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Abstract

Problem solving has an important role in mathematics teaching and it is also been the centre of mathematics programs. Improving the students' problem solving skills has been emphasized in the program of mathematical studies. Problem solving enables students to do mathematics and to comprehend mathematics meaningfully. The study is aimed to find out whether there is any gender difference mathematical problem solving ability, by taking secondary school students as the sample. The tool used was Test of Mathematical Problem Solving Ability in Mathematics and Test of significance of difference between means was done to find out the difference in the problem solving ability and the result showed that the secondary school boys and girls differ significantly in their mathematical problem solving ability.

Introduction

Problem solving in Mathematics is a complex cognitive activity. Some mathematical literature described mathematics problem solving as several separate activities such as doing word problems, creating patterns, interpreting figures, developing geometric constructions and proving theorems (Willson, F and Hadaway,1993). While Polya's theory defined mathematical problem solving as a process that involved several dynamic activities: understanding the problem, making a plan, carrying out the plan and looking back. In order to achieve the goal, the mathematical problem solver must develop a base of mathematics knowledge and organise it, create an algorithm and generalise it to a specific set of applications, and use heuristics and manage them. Mayer (2003) divided mathematical problem solving into four cognitive phases: translating, integrating, planning and execution. A mathematical problem solver not only required cognitive abilities to understand and represent a problem situation, to create algorithms to the problem to process different types of information, and to execute the computation, but also had to be able to identify and manage a set of appropriate strategies (heuristics, techniques, shortcuts etc.) to solve the problem.

Problem solving has an important role in mathematics teaching and it is also been the centre of mathematics programs (NCTM,2000, Howland,2001). Thus improving the students' problem solving skills have been emphasized in the program of mathematical studies. Problem solving enables students to do mathematics and to comprehend mathematics meaningfully (Van de Walle, 2001).

Teachers have many opportunities to build knowledge about teaching problem solving and using problems as a focus of learning in mathematics. When used as methods for instructional method, it allows students their own understanding and takes some ownership for their learning. Additionally, students perceive an active role in problem solving activities by which their thoughts and ideas become a focus of learning activities (Annable 2006). In addition, Schoenfeld (1992) advocated that problem solving based learning environments enables students to have deep mathematics knowledge and gives them the opportunity of pursue heir own mathematics learning enthusiasm. Hiebert and Wearne (2003) point out that the process of problem solving improves and enrich student's mathematical perception.

Reviews of research led to the conclusions that there were gender differences in mathematical problem solving that favoured males based on the fact that male samples outperformed female samples in their studies (for example, Benbow and Stanley, 1980, 1983: Benbow, 1988; Casey etal.,1995: Gallagher and DeLisi, 1994: Royer, et al.,1999).

However, these findings were often limited to an atypical population, normally talented or highly-motivated or college bound students, and relying on the selection of measures and the particular experimental situations (Caplan and Caplan, 2005). These results were even sometimes challenged by the opposite evidence found among these high-ability populations. For example, Pajares (1996) found that gifted girls outperformed gifted boys in mathematical problem solving. Hence the investigators decided to conduct a study to find out is there any gender difference in mathematical problem solving ability.

Objectives of the study

1. To find out the levels of Problem Solving Ability in Mathematics for boys and girls.
2. To find out whether boys and girls differ significantly in their Problem Solving Ability in Mathematics.

METHODOLOGY

Survey method was adopted for the conduct of the present study.

Sample

400 students consisting of 200 boys and 200 girls of secondary school students of Malappuram district in Kerala state.

Tool

Test of Problem Solving Ability in Mathematics which was constructed by the investigators was used to find out the Problem Solving Ability in Mathematics of secondary school students.

Statistical Techniques

Percentage analysis and Test of significance of difference between means were used.

MAJOR FINDINGS

Statistical constants obtained for the Test of Problem Solving Ability in Mathematics are given in Table1.

TABLE 1

Statistical constants of test of Problem Solving Ability in Mathematics

Sample	Size	Mean	Standard Deviation
Boys	200	29.99	4.70
Girls	200	27.64	4.93

Classification of Sample

Secondary school boys and girls were classified into three groups based on the value of mean and standard deviation. Students having score greater than or equal to M+ σ are classified as High ability group, those having score between M+ σ and M- σ are included in the Average ability group and those having score below M- σ are coming under the Low ability group. The percentage of pupils coming under each group is shown in Table 2.

TABLE 2

Percentage of students with different levels of Problem Solving Ability in Mathematics

Sample	Level	N	Percentage
Boys	High	46	23
	Average	138	69
	Low	16	8
Girls	High	28	14
	Average	136	68
	Low	36	18

From Table 2 it is inferred that 23 percentage of boys were coming under the high ability group and 14 percentage of girls were coming under high ability group. Percentage of average ability group of boys is 69 and that of girls is 68. Percentage of low ability group of boys is 8 and that of girls is 18.

The obtained percentages were compared to find out whether there is any significant difference between the percentages of boys and girls having High, Average and Low ability groups. The results are indicated in Table 3.

TABLE 3

Comparison of percentages

sample	Groups compared	Percentage	N	Critical Ratio
Boys	High	23	23	-3.865**
	Average	69	69	
	Average	69	69	3.377**
	Low	8	8	
	High	23	23	0.929
	Low	8	8	
Girls	High	14	14	-3.738**
	Average	68	68	
	Average	68	68	3.816**
	Low	18	18	
	High	14	14	-0.304
	Low	18	18	

(Note: ** indicate significance at 0.01 level)

From Table 3 it can be seen that the critical ratios obtained for the comparisons among boys and girls with High, Average and Low Problem Solving Ability in mathematics are significant except for boys and girls with high and low Problem Solving Ability in Mathematics. So there is significant difference between boys and girls with different levels of Problem Solving Ability in Mathematics.

Secondary school boys and girls, for the total sample were compared to find out their difference in Problem Solving Ability in Mathematics and the result of Test of significance of difference between means is shown in Table 4.

TABLE 4

Result of test of significance of difference between means of secondary school boys and girls in Problem Solving Ability in Mathematics

Groups Compared	Mean	Standard Deviation	t-value	Level of Significance
Boys	29.99	4.69	4.18	0.01
Girls	27.64	4.93		

From Table 4 it is inferred that the obtained value is greater than the tabled value at 0.01 level of significance. Hence secondary school boys and girls differ significantly in their Problem Solving Ability in Mathematics. It is also revealed that secondary school boys showed higher Problem Solving Ability in Mathematics than girls.

Conclusion

Problem solving has an important role in mathematics teaching and learning. Problem solving enables students to do mathematics and to comprehend mathematics meaningfully. Problem solving based learning environments enables students to have deep mathematics knowledge and gives them the opportunity to pursue their own mathematics learning enthusiasm.

In the present study it was found that 23 percentage of boys were coming under the high ability group and 14 percentage of girls were coming under high ability group. Percentage of average ability group of boys is 69 and that of girls is 68. Percentage of low ability group of boys is 8 and that of girls is 18.

Also it is found that there is significant difference between boys and girls with different categories of Problem Solving Ability in Mathematics. Hence it can be concluded that the secondary school boys differ significantly from girls in their Problem Solving Ability in Mathematics favouring boys with higher ability.

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