



A STUDY ON THE RELATIONSHIP BETWEEN PROBLEM SOLVING ABILITY AND SELF-EFFICACY IN PHYSICS AMONG STUDENTS AT SECONDARY SCHOOL LEVEL

Education

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ABSTRACT

Problem solving is one of the most complex and important cognitive skills which engages a number of cognitive attributes such as domain knowledge, structural knowledge, metacognitive skills and ampliative skills. In order to solve problems in physics pupils need all these skills and knowledge and attitudinal components such as engaging intentionally, persisting on task and approach the task with confidence. Self-efficacy is “the belief in one's capabilities to organize and execute the course of action required to manage prospective situation” Bundura (2005). The intention of the study was to find out whether there exist any relationship between problem solving ability in physics and self-efficacy in physics problem solving among students at secondary school level. Problem solving ability in physics was found out using problem solving ability list and Self-efficacy Assessment Practices, developed and standardized by the investigator. The collected data were analysed using appropriate statistical techniques. The findings of the study revealed that there exist a significant relationship Problem Solving Ability between an d self-efficacy in physics among total sample and sub samples, based on gender. The study was also intended to find out whether there exist any significant difference in the problem solving ability in physics and self-efficacy in physics problem solving among students at secondary school level, based on gender.

KEYWORDS:

Problem Solving Ability, Self-efficacy, Secondary school level

I. INTRODUCTION

Problem Solving is considered as the essential cognitive activity in professional and personal contexts. According to Gagne (1980) the central point of education is to teach people to think, to use their rational process, to become better problem solvers. The first and the foremost aim of all the educational institutions from primary level to professional course level are to develop the skill of problem solving among students. Problem solving permeates almost all areas of learning, but it involved predominantly in the areas of learning such as science, mathematics, engineering, medicine, architecture etc.

Problems are of two types Well-structured problems and Ill-structured problems. Ill-structured problems, that are encountered in everyday life and professional context are not constrained by the content knowledge being learned in the classroom. But Well-structured problems are well defined problems which includes the application of theory principles and laws studied in the Researcher have shown that ability to solve well-structured problems positively transfer to the ability to solve ill structured problems.

To solve well-structured problems in physics the learner should have sufficient domain knowledge or content knowledge, procedural knowledge, or content knowledge, procedural knowledge, metacognitive skills and ampliative skills. In addition to these skills and knowledge, another factor which influence the problem solving ability is the attitudinal factors such as persisting on task, exerting effort, engaging intentionally, and knowledge about self. Self-efficacy is the belief of an individual in his or her capability to accomplish a task or manage situation. It plays a significant role in how challenges or tasks are to be approached by the individual. The sources of self-efficacy are

- Mastery experience
- Social modeling
- Social persuasion
- Psychological responses

People with strong self-efficacy show deeper interest in challenging activities. The growth of self-efficacy continues through out life as people procure unique experiences and skills.

1.1. Objectives of the Study

- To find out whether there exist any significant relationship between problem solving ability and self-efficacy in physics among students at secondary school level for the total sample and sub sample based on gender.
- To find out whether there exist any significant difference in the problem solving ability in physics among students at secondary school level based on gender.

- To find out whether there exist any significant difference in the self-efficacy in physics problem solving among students at secondary school level based on gender.

1.2. Hypotheses of the Study

- There exist a significant relationship between problem solving ability in physics and self-efficacy in physics problem solving among students at secondary school level for the total sample and sub sample.
- There exist a significant difference in the problem solving ability of students in physics at secondary school level based on gender.
- There exist significant difference in the self-efficacy of students in physics problem solving at secondary school level based on gender.

1.3. Sample Selected for the Study

The population of the study comprised of Secondary School Students of Kerala following state syllabus.

The researcher selected 167 IX standard students studying in various schools of Palakkad district using stratified random sampling technique. The total sample consisted of 89 boys and 78 girls.

1.4. Tools used for the Study

The tools developed and standardized by the investigator was used for collecting the data. Problem solving ability in physics was determined using Physics Problem Solving Ability Test and the self-efficacy in physics problem solving was estimated using scale on problem solving efficacy assessment practices.

1.4.1. Physics Problem Solving Ability Test

The Investigator selected the unit 'Laws of Notion' from IX standard physics text book and prepared a draft of 31 items comprised of qualitative and quantitative problems from different content area of the unit. The content validity of the tool was established through expert validation and a pilot study was administered among 100 IX standard students, to estimate the difficulty level and feasibility of each item. After item analysis items with desired level of difficulty index and discriminating power were selected for the final tool. The reliability of final tool with 20 item was established using split-half method, and the value of reliability coefficients was found to be .736.

1.4.2. Scale on Problem Solving Efficacy Assessment Practices

The prime objective of this scale was to find out the belief of students in their potential to accomplish a problem task in physics. The investigator prepared and standardized a five point scale by incorporating all the components of self-efficacy. The final tools after item analysis the items with discriminating power equal to or greater than 1.96 were selected for the final tool. The content validity of the

tool was established through expert validation and the reliability of the tool was assured using split-half method. The obtained value of reliability coefficient was .836.

1.5. Methodology of the Study

The survey method was used for the study. The tools were administered among selected sample of secondary school students and collected the data. The tabulated data were analysed using approximate statistical techniques.

1.6. Statistical Techniques Used

Descriptive Statistics : Mean and S.D
 Inferential Statistics : Independent sample 't' test.

Carl Pearson's Product Moment Correlation

II. ANALYSIS AND DISCUSSION OF RESULT

2.1. Descriptive Analysis of Scores of Problem Solving Ability and Self-Efficacy in Physics

The mean and standard deviation of the scores of problem solving ability test and scale on problem solving efficacy assessment obtained for the total sample and the sub sample based on gender were given in the Table 1.

Table 1: Descriptive Statistics of Scores of Problem Solving Ability Test and Scale on Problem Solving Efficacy Assessment Practice

Statistics	Problem Solving Ability			Self-Efficacy in PS		
	Total	Boys	Girls	Total	Boys	Girls
Mean	24.9	28.2	26.3	44.6	56.5	47.6
S.D	6.07	5.98	5.23	12.4	12.02	11.89

From the table it is evident that the mean scores of problem solving ability and self-efficacy of boys are high than that of girls. The mean value of problem solving ability of boys is 28.2 and that of girls is 26.3. The value of self-efficacy of boys is 56.5 and that of girls is 47.6.

2.1. Relationship between Problem Solving Ability in Physics and Self-Efficacy in Physics Problem Solving

The relationship between problem solving ability and self-efficacy of students belongs to secondary school level for the total sample and sub sample were found out using Pearson's Product moment correlation. The details are given in the Table 2.

Table 2: Pearson's Product Moment Correlation between Problem Solving Ability in Physics and Self-Efficacy in Physics Problem Solving for the Total Sample and Sub Sample based on Gender

Variables	Sample	N	'r'
Problem Solving Ability and Self Efficacy	Total	167	.598**
	Boys	89	.623**
	Girls	78	.607**

** Significant at .01 level

From the table 2 it is evident that the value of correlation coefficient for the total sample and the sub samples based on gender are positive and significant at .01 level. This reveals that there exist a significant positive relationship between problem solving ability in physics and self-efficacy in physics problem solving.

2.1. Comparison of Problem Solving Ability in Physics and Self-Efficacy in Physics Problem Solving for the Sub Samples based on Gender

The significant difference between the mean scores of problem solving ability of boys and girls in physics were found out using t-test. The details of the lists are given below in Table 3.

Table 3: Comparison of Mean Scores of Problem Solving Ability of Boys and Girls in Physics

Variable	Sample	N	Mean	S.D	't' value
Problem Solving Ability in Physics	Boys	89	28.2	5.98	2.191*
	Girls	78	26.3	5.23	

*Significant at .05 level

From the table 3, the value of critical ratio, 't' is 2.191 which is significant at .05 level. It reveals that there is a significant difference in the mean scores of problem solving ability in physics between boys and girls. The mean value of problem solving ability of boys is 28.2 which is greater than 26.3 that of girls. It also reveals that boys have high problem solving ability than girls.

2.1. Comparison of the Mean Scores of Self-Efficacy in Physics Problem Solving for the Sub Samples based on Gender

The significant difference between the mean scores of self-efficacy in physics problem solving for the sub samples based on gender was found out using t-test. The details are given below in the Table 4

Table 4: Comparison of the Mean Scores of Self-Efficacy in Physics Problem Solving of Boys and Girls

Variable	Sample	N	Mean	S.D	't' value
Self-Efficacy	Boys	89	56.5	12.02	4.94**
	Girls	78	47.6	11.23	

**significant at .01 level

From the table the value of critical ratio 't' is found to be 4.94 which is significant at .01 level. This reveals that there exist a significant difference in the mean score of self-efficacy in physics problem solving of boys and girls. The mean value of self-efficacy in physics problem solving for the sub sample boys is 56.5 and that of girls is 47.6. It also reveals that boys have high self-efficacy than girls.

2.5. Major Findings of the Study

The conclusion derived from the statistical analysis of the data are placed below.

- There exist a significant positive relationship between problem solving ability and self-efficacy in physics among students at secondary school level for the total sample and sub sample, based on gender.
- There is significant difference in the problem solving ability in physics between the sub samples boys and girls at secondary school level.
- There is significant difference in the self-efficacy in physics problem solving between the sub samples boys and girls at secondary school level.

III. CONCLUSION

Problem solving is considered as the indispensable part of physics learning. The ability of the learner to analyse complex and abstract concepts in physics, systematic organisation of knowledge structure and the self-efficacy belief of the learner contribute to the problem solving ability. The findings of the study revealed that the self-efficacy in physics problem solving is one of the predicting factor of problem solving ability of the learner. Thus teachers should provide suitable measures to enhance self-efficacy among learners in addition to merely concentrate on the construction of knowledge with in the cognitive structure of the learner.

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