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A Study on the Relationship Between Metacognition and Problem Solving Ability of Physics Major Students

KEYWORDS: Metacognition, Physics Metacognition, Physics problem solving ability, College students

S. Anandaraj
Ph. D. Scholar, Department of Education, Manonmaniam Sundaranar University, Tirunelveli - 627 012. Tamil Nadu.

Dr. C. Ramesh
Assistant Professor and Head i/c, Department of Education (DD&CE), Manonmaniam Sundaranar University, Tirunelveli - 627 012. Tamil Nadu.

ABSTRACT *This research article briefly describes the relationship between metacognition and problem solving ability of physics major students with regard to gender, locale of the student and locale of the college. In order to study the problem, the survey method was used to collect the data. The population of the present investigation is all the Physics major students studying final year B.Sc Physics degree course in Tirunelveli, Tuticorin and Kanyakumari districts. From the population, 636 Physics major students were randomly selected as the sample for the study. The finding reveals that the level of metacognition and problem solving ability of Physics major students are found to be moderate. The research reveals that there is a significant relationship between metacognition and problem solving ability.*

Introduction

One of the main objectives of education is to enable the students to develop their knowledge in problem solving. Besides enhancing the content knowledge, solving problems help the students to develop different cognitive abilities and skills (Vazgen & Etkina, 2007). The goal of physics instructors is to develop the students' conceptual learning and their problem solving performances in physics. Instructors are responsible person to develop students' problem solving performances. Experienced instructors recognize that in spite of their best efforts, many students emerge from their study of physics with serious gaps in their understanding of important topics. In the last two decades, physicists have begun to approach this problem from a scientific perspective by conducting detailed systematic studies on the learning and teaching of physics (Hayrettin ERGÜN, 2010). Problem solving plays a vital role in discovery and invention in physics. These discoveries and inventions have been of great benefit to humanity and, consequently, a major educational goal in all countries is to develop the problem-solving skills of students learning physics (Chi, 2006)[1].

Need and significance of the study

Solving problems plays a major role in studying physics. Rolf Plotzner (1994) argues that the most efficient way of studying physics is independent solving of less complicated problems. Many researchers complain that students solve problems mostly mechanically, not giving a thought to the contents. Metacognition has been found to be a critical factor in contributing to students' learning of physics (Gita & John, 2012). Costa (1984) emphasized that if the teachers do pay attention to "thinking about thinking", then the students will learn the process of perception, understanding and the link between mental processes. Redish (1994) argues that the successful students can able to solve the problem without understanding but by memorising. But metacognition helps the students to give the knowledge about what I learn, why I learn and how I learn, which is helps the students for constructive learning. Therefore educational institutions and the instructors are in need to prepare students to enable the metacognition while learning physics, which helps the learners to solve the physics problem. In this context it is imperative to assess the relationship between metacognition on problem solving ability of physics major students.

Objectives of the study

1. To find out the level of metacognition and problem solving ability of physics major students.
2. To find whether there is any significant difference between physics major students in their metacognition and problem solving ability with regard to their gender, Locale of the student and locale of the college.
3. To find whether there is any significant relationship between physics major students in their metacognition and problem solving ability.

Hypotheses

1. There is no significant difference between physics major students in their metacognition and problem solving ability with regard to their gender, Locale of the student and locale of the college.
2. There is no significant relationship between physics major students in their metacognition and problem solving ability.

Methodology

The researcher used the survey method for the present study. For data collection, the investigator used the "Physics metacognitive inventory" which comprises of 51 items and "Physics Problem solving ability test" which comprises of 25 questions, both are developed and validated by the investigator (2013). The investigator has selected the sample by random sampling technique for the present study. It comprises 636 physics major students studying B.Sc final year degree course in Tirunelveli, Tuticorin and Kanyakumai districts. The data were analysed by using Mean, Standard Deviation,'t' test and Pearson product moment correlation.

Analysis of data

The data were subjected to statistical treatment leading to the findings which may satisfy the requirements of the objectives of the study.

Table 1 Level of metacognition of physics major students with regard to gender, locale of the student and locale of the college

Variables No		Low		Moderate		High	
		%	No	%	No	%	
Gender	Male	23	28.4	50	61.7	8	9.9
	Female	67	12.1	390	70.3	98	17.7
Locale of the student	Rural	64	15.6	277	67.7	68	16.6
	Urban	26	11.5	163	71.8	38	16.7

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Locale of the college	Rural	33	17.8	118	63.8	34	18.4
	Urban	57	12.6	322	71.4	72	16.0

It is inferred from the above table that the physics major students having moderate level of metacognition with regard to gender, locale of the student and locale of the college.

Table 2 Level of problem solving ability of physics major students with regard to gender, locale of the student and locale of the college

Variables No		Low		Moderate		High	
		%	No	%	No	%	
Gender	Male	19	23.5	59	72.8	3	3.7
	Female	78	14.1	398	71.7	79	14.2
Locale of the student	Rural	67	16.4	292	71.4	50	12.2
	Urban	30	13.2	165	72.7	32	14.1
Locale of the college	Rural	30	16.2	133	71.9	22	11.9
	Urban	67	14.9	324	71.8	60	13.3

It is inferred from the above table that the physics major students having moderate level of problem solving ability with regard to gender, Locale of the student and locale of the college.

Ho 1: There is no significant difference between physics major students in their metacognition with regard to their gender, locale of the student and locale of the college.

Table 3 Difference between physics major students in their metacognition with regard to their gender, locale of the student and locale of the college

Variable	Group	Number	Mean	SD	't' value	Remarks
Gender	Male	81	78.69	23.704	3.729	S
	Female	555	89.11	21.917		
Locale of the student	Rural	409	86.62	22.745	1.975	S
	Urban	227	89.86	21.671		
Locale of the college	Rural	185	87.41	23.153	0.265	NS
	Urban	451	87.93	22.114		

(at 5% level of significance the table value of 't' is 1.96, S- Significant, NS- Not Significant)

It is inferred from the above table that there is no significant difference between physics major students in their metacognition with regard to the locale of the college. But, there is a significant difference between physics major students in their metacognition with regard to their gender and locale of the student.

Ho 2: There is no significant difference between physics major students in their problem solving ability with regard to their gender, locale of the student and locale of the college.

Table 4 Difference between physics major students in their problem solving ability with regard to their gender, locale of the student and locale of the college

Variable	Group	Number	Mean	SD	't' value	Remarks
Gender	Male	81	9.72	2.798	3.757	S
	Female	555	11.01	3.420		
Locale of the student	Rural	409	10.56	3.212	2.700	S
	Urban	227	11.34	3.599		
Locale of the college	Rural	185	10.55	3.252	1.418	NS
	Urban	451	10.96	3.418		

(at 5% level of significance the table value of 't' is 1.96, S- Significant, NS- Not Significant)

It is inferred from the above table that there is no significant difference between physics major students in their problem solving ability with regard to the locale of the college. But, there is a significant difference between physics major students in their problem solving ability with regard to their gender and locale of the student.

Ho 3 : There is no significant relationship between metacognition and problem solving ability of the physics major students.

Table 5 Relationship between metacognition and problem solving ability of the physics major students

Dimensions	ΣX	ΣY	ΣX^2	ΣY^2	ΣXY	N	Calculated 'r' value	Remarks
Metacognition and Problem solving ability	55828	6895	5219306	81975	609688	636	0.0926	S

(at 5% level of significance the table value of 'r' is 0.077, S- Significant)

It is inferred from the above table that there is a significant relationship between metacognition of the physics major students and their problem solving ability.

Findings of the study

The major findings derived from the study are:

1. The level of metacognition is found to be moderate with regard to gender, locale of student and locale of the college.
2. The level of problem solving ability is found to be moderate with regard to gender, locale of student and locale of the college.
3. There is a significant difference between physics major students in their metacognition with regard to their gender and locale of the student. While comparing the mean scores of male and female students, female students are better than male students in their metacognition. While comparing the mean scores of rural and urban students, urban students are better than rural students in their metacognition
4. There is a significant difference between physics major students in their problem solving ability with regard to their gender and locale of the student. While comparing the mean scores of male and female students, female students are better than male students in their metacognition. While comparing the mean scores of rural and urban students, urban students are better than rural students in their metacognition
5. There is a significant relationship between metacognition of the physics major students and their problem solving ability.

Discussion and implication

The emergence of metacognition is an important concept in psychological education and science education. Meta-

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cognition played an important role in physics problem-solving. Hence, the physics teachers could be made aware of the importance of the metacognition, which would lead to the successful problem solver in physics. To become an expert in physics problem-solving one has to acquire strategic knowledge of when to apply what basic concepts and principles and how to apply them (Sabella & Redish, 2007). Rozencwajg, (2003) study is also supported to this study and he indicates that students who are more metacognitive during physics problem solving are more likely to correctly solve the problems. Zare and Mohammadi (2011) observed that Metacognitive processing can positively affect learning of problem - solving and transfer of learning. This study reveals that the female and urban area students are better in their metacognition and problem solving ability. Hence, the physics teachers should be taken care of male and rural area students and make necessary arrangement to improve the metacognition. The metacognitive skills, not only make the students understand about the concept better but can inculcate greater interest towards Physics. Hence, the physics teachers should emphasise the metacognitive activities of their students which could help them to solve the physics problem.

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