EFFECTIVENESS OF SELF-REGULATORY STRATEGY IN SCIENCE PROBLEM SOLVING AMONG THE HIGH SCHOOL STUDENTS

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ABSTRACT

The present study examined the self-regulatory awareness of high school students. The sample of the study consisted of 40 high school students. Self-regulation of students was measured using Self-regulatory awareness inventory (SAI). Results further indicated that male and female students do not differ in their Self-regulatory awareness during their problem solving action in the pre-test and post-test. The Self-regulatory awareness of students of science in rural areas in Karaikal district during their problem solving action is comparatively less in the pre-test. Post-test, mean and SD scores revealed that students of science could improve their Problem solving using Self-regulatory strategies with multimedia learning materials. The orientation on Self-regulatory strategies with multimedia learning materials could enhance the level of Self-regulatory awareness of students in the post-test.

INTRODUCTION

In recent decades, the topic of "self-regulation processes" has been one of the most researched areas in the field of psychology, seeing substantial growth since the 1990s (Post, Boyer & Brett, 2006). Self-regulation lies at the core of successful and lifelong learning. Self-regulated learners tend to be active, reflective and productive in their own thinking and learning (Zimmerman and Kitsantas, 1996). They think critically, use problem solving strategies and memory techniques when appropriate. From a strictly psychological perspective, self-regulation has been defined as the process by which a person generates thoughts, feelings and actions which are systematically oriented toward achieving one's goals (Bembenutty & Karabenick, 2004; Zimmerman, 2002).

Self-regulation skills may influence students' abilities to solve problems (Swanson, 1990). Self-regulation is the controlling of a process or activity by the students who are involved in it rather than by an external agency (Johnson et.al, 2009). In PBL, students become responsible for their own learning, which necessitates reflective, critical thinking about what is being learned (Hmelo-Silver, 2004, p.239).

The interactive multimedia technology and self-regulation not only enable the students to review their thought processes but also to get them exposed of modern techniques and hence students may be helped regulate their thinking processes and enhance their problem solving in science. Problem solving has been identified as an important aspect of student learning in science and technology and in the development of scientific literacy (National Research Council, 1996).

RATIONALE OF THE STUDY

The Kothari commission report (1960) states, "If science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it could degenerate even into new superstitions". It is necessary to identify the problems of the learners and plan the learning activities before teaching and using innovative strategies for effective dissemination of instruction. So there is a growing need for appropriate science education. The most important purpose of the teaching of science is the development of the problem solving ability in the pupils as well as the ability to meet and solve problems in daily life.

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OBJECTIVES

The objectives of the study were to:
1. Measure self-regulation of high school students.
2. Examine the gender differences in self-regulation of students
3. Find difference between self-regulation of high school students in pre-test and post-test.
4. Find difference between different dimensions of self-regulatory awareness between the pre-test and the post-test.

HYPOTHESES

1. Students do differ in their Self-regulatory awareness between the pre-test and the post-test.

2. There is no significant gender difference in self-regulatory awareness among the students in the pre-test.
3. There is no significant gender difference in self-regulatory awareness among the students in the post-test.
4. Students do differ significantly in the different dimensions of self-regulatory awareness between the pre-test and the post-test.

METHODOLOGY

This was an experimental study. Self-regulation of students was measured using Self-regulatory awareness inventory (SAI). It was developed and validated by the investigators. SAI was designed after conceptualizing different components of self-regulation. The survey has 48 statements to ascertain the self-regulatory awareness of student-teachers in their Planning, Information management strategy, Comprehension Monitoring, Debugging strategies, Evaluation, Declarative Knowledge, Conditional knowledge and Procedural knowledge with three point scale i.e Yes, No, Uncertain. Pre-test was conducted to all the 40 high school science students to assess the entry behaviour of them. Theoretical orientation on Self-regulation with Science examples on problem solving was administered. Hands-on experience through Multimedia for the Experimental group on how to do Science problems at standard X was provided. Finally, Post- test was conducted.

SAMPLE

A sample of 40 high school students from standard X of S.R.V.S National higher secondary school, Karaikal was taken for the study. Purposive random sampling technique was adopted for the study.

Table 1: Self-regulatory awareness between the pre-test and the post-test

Self-regulatory Awareness	Mean	N	S.D
Pre-test	133.25	40	13.781
Post-test	148.42	40	21.453

Table 2: Paired Samples t-test Self-regulatory awareness between the pre-test and the post-test

Test	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	99% Confidence Interval of the Difference				
				Lower	Upper			
Self-regulatory Awareness (Pre-test and Post-test)	14.98	24.207	3.780	25.20	4.75	3.961	40	.000

From the table 1, 2, the 't' test analysis indicates that students (N=40) differ significantly in their Self-regulatory awareness between the pre-test and the post-test at 0.01 level of significance as the 't' value was found 3. 961 at 0.01 level of significance. Also the mean score of the post-test (M=148.42) is greater than that of the pre-test (M= 133.25). This clearly indicates that Self-regulatory strategies with multimedia were found effective to enhance the self-regulatory awareness of students hailing from rural schools.

**Table- 3: Comparison of Mean scores of male and female students
in Self- regulatory awareness in the pre-test**

Category	N	Mean	S.D	d.f	t-value
Male	6	136.50	17.59		
				39	0.357
Female	34	134.17	14.39		

Table 3 indicates that male and female students do not differ significantly in their self-regulatory awareness in the pre-test at 0.01 level of significance. It is seen from the table that the mean score of male students is slightly more than that of female students.

**Table - 4: Comparison of Mean scores of male and female students
in Self-regulatory awareness in the post-test**

Category	N	Mean	S.D	d.f	t-value
Male	6	135.66	43.56		
				39	1.639
Female	34	151.86	16.91		

Table 4 indicates that male and female students do not differ significantly in their Self-regulatory awareness in the pre-test at 0.01 level of significance. It is seen from the table that the mean score of female students is more than that of their male students. Hence female teachers are more self-regulative in their problem solving action when compared to male teachers in the post-test.

**Table 5 Paired Samples t-test for different dimensions of
Self-regulatory awareness between the pre-test and the post-test**

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	99% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Declarative Knowledge Declarative Knowledge	1.46	2.346	.366	2.45	.47	3.994	40	.000
Pair 2	Conditional Knowledge - Conditional Knowledge	1.73	5.040	.787	3.86	.40	2.200	40	.034
Pair 3	Procedural Knowledge - Procedural Knowledge	1.44	2.001	.312	2.28	.59	4.606	40	.000
Pair 4	Planning - Planning	1.22	3.103	.485	2.53	.09	2.517	40	.016
Pair 5	Information Management Strategies - Information Management Strategies	2.93	4.751	.742	4.93	.92	3.945	40	.000
Pair 6	Comprehension Monitoring - Comprehension Monitoring	2.71	5.492	.858	-5.03	.39	3.156	40	.003
Pair 7	Debugging strategies - Debugging strategies	1.32	2.859	.446	2.52	.11	2.950	40	.005
Pair 8	Evaluation - Evaluation	2.17	5.394	.842	4.45	.11	2.577	40	.014

It is heartening to note from the table 5 that students differ significantly between the pre-test and the pos-test in all the dimensions of Self-regulatory awareness such as Declarative Knowledge, Conditional Knowledge, Procedural Knowledge, Planning, Information Management Strategies, Comprehension Monitoring, Debugging strategies and Evaluation at 0.01 level of significance. As the scores in the post-test is significantly greater than that of the pre-test in all the dimensions, self-regulatory strategies with multimedia learning materials are proved to be effective in enhancing Self-regulatory awareness of students pertinent to Problem solving competence.

FINDINGS

1. Self-regulatory awareness of students X in rural areas in Karaikal district during their problem solving action is comparatively less in the pre-test.
2. Post-test, mean and SD scores revealed that students of X could improve their problem solving using self-regulatory strategies with multimedia learning materials.
3. The orientation on Self-regulatory strategies with multimedia learning materials could enhance the level of Self-regulatory awareness of students in the post-test.
4. Students of Standard X differ significantly between the pre-test and the post-test in Self-regulatory awareness, the Self-regulatory strategies with multimedia learning materials were found effective in enhancing their level of Self-regulatory awareness during their problem solving action.
5. Male and female teachers do not differ in their Self-regulatory awareness during their problem solving action in the pre-test.
6. Male and female teachers do not differ in their Self-regulatory awareness during their problem solving action in the post-test.

CONCLUSION

Problem solving is a widely used instructional strategy in Science courses. Often, Problems are used as a means of evaluation, and therefore, the students pay a great deal of attention to this activity. In the light of the research findings it is felt that the present piece of research may contribute on alleviation of difficulties of students in approaching Science Problems. It is hoped that appropriate training so called self-regulatory problem strategy training with interactive multimedia may be given for the needy students and the findings of the study may be taken into consideration for a better framework in developing Science Problem solving ability of the students.

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