INDIAN STREAMS RESEARCH JOURNAL
ISSN NO : 2230-7850
IMPACT FACTOR : 5.1651 (UIF)
VOLUME - 14 | ISSUE - 11 | DECEMBER – 2024

EFFECTIVENESS OF CONSTRUCTIVIST BASED APPROACH OF TEACHING MATHEMATICS IN ENHANCING SELF-REGULATED LEARNING

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ABSTRACT:-

In this study we find effectiveness of intervention of constructivist approach of teaching mathematics in enhancing Self-regulated learning. Constructivist based 5E model of teaching learning was administered on class 9 students in mathematics.The purpose of the study was toA total of 80 students of Class IX are included in the sample using random proportionate sampling technique. The findings wereanalysed by comparing control group and experiment group with respect to pre-test and post-test scores of students. Findings indicate effective increase in mathematics achievement and self-regulated learning by employing standardisedassesssments. Implications for future self-regulated learning interventions in mathematics are discussed.

Keywords : *self-regulated learning, constructivism,mathematics, 5E model*

INTRODUCTION

Several studies give the effectiveness of Constructivists based approach of teaching mathematics in improving student's achievement. Few studies on constructivist based approach of teaching mathematics in enhancing Self-regulated learning are found. Recent systematic reviews and meta-analytic studies (online learning: Broadbent and Poon, 2015; long-term effects of metacognitive strategy training: de Boer et al., 2018; learning strategies: Donker et al., 2014) examined different aspects of Constructivist and SRL interventions. Studies on SRL of mathematics have focused on cognitive and metacognitive processes, as summarized in Zimmerman's cyclical phases model.Self-regulated learning (SRL) is about self-regulation in learning by the learner. It refers to learning that is guided by metacognitionstrategies like planning, monitoring, and evaluating one's own progress and the motivation of the learnerto learn. A self-regulated learner "monitors, directs, and regulates actions toward goals of information acquisition, expanding expertise and self-improvement"(Zimmerman, 1990).

Self-regulated learning can be described as: "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their cognition, motivation and behavior, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000). Zimmerman and Schunk (1989) defined self-regulated learning in students as becoming "masters of their own learning".

The first person to introduce the idea of self-regulated learning in education was Gardner (1963) who "recognized the importance of personal initiative in learning". Gardner found that the ultimate goal of the education system was to "shift to the individual the burden of pursuing his own education". Researchers gathered at a symposium in the American Educational Research Association in 1986, defined self-regulated learning as "the degree to which students are metacognitively, motivationally, and behaviourally active participants in their own learning process" (Zimmerman, 2008, p.167). Cleary and Zimmerman (2004) stated that self-regulation involves learners who proactively direct their behaviour to achieve self- directed goals. Here the student is involved in the learning process and so is considered as an active participant.

Self-regulated learning (SRL) has been defined in various ways:

Bandura (1986) and Winne (1995) viewed SRL as requiring an interaction between personal, behavioural and environmental factors, resulting in the development of cognitive and metacognitive strategies for self-managing learning opportunities. Baumeister and Vohs (2007) defined self-regulation simply as the capacity of an individual to alter his or her behaviour in order to achieve particular goals. Zimmerman and Martinez-Pons (1988) added that self-regulated learners need to be sensitive to their own academic strengths and weaknesses, and be able to apply appropriate strategies to tackle specific academic tasks. Pintrich (2000) defined SRL as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features of the environment."

Pintrich (1999) said that motivation can promote and sustain self-regulated learning, indicating that students are motivated to engage in a task, if the task itself is important, interesting and useful to them. Recent research has supported this view, and has focussed on effective ways for designing stimulating learning environments and tasks that can enhance students' motivation through active engagement (Chan Lin, 2009; Keller, 2008). Students have to plan and arrange the necessary time duration needed to complete a task. In order to manage time effectively, students must set goals and identify effective learning strategies to achieve them within the allotted time (Zimmerman & Martinez-Pons, 1992).

In recent times, teachers are being encouraged to teach their students self-regulated cognitive strategies, and to provide opportunities for them to apply these in different subjects (Khezrlou, 2012; Pressley &Woloshyn, 1995). The implementation of self-regulated strategies began with language learning and later it was extended to mathematics and other subjects.

Cognitive processes view self-regulated learning as an interaction between the person, their behaviour and the environment.

1) Self-observation (monitoring one's activities); seen as the most important of these processes.
2) self-judgment (self-evaluation of one's performance), and
3) Self-reactions (reactions to performance outcomes).

Principles of Self-regulated learning

Self-regulation is how individuals go about their goal-directed activities over time. These regulations are very important for self-regulated learning as they are controlled by the learners and form the basis for future subject development. The self-regulated behaviours include planning, monitoring, attention, and effort.

1. Helps clarify what good performance is (goals, criteria, expected standards)
2. Facilitates the development of self-assessment (reflection) in learning.
3. Delivers high quality information to students about their learning.
4. Encourages teacher and peer dialogue around learning.
5. Encourages positive motivational beliefs and self-esteem.
6. Provides opportunities to close the gap between current and desired performance
7. Provides information to teachers that can be used to help shape the teaching

Self-regulated learning in mathematics

Mathematics includes abstract concepts, it needs thinking, reasoning and problem solving in learning. Mathematics is not only counting, building relations with different concepts but also problem solving, leading to the Mathematisation. There is an urgent need to employ innovative practices and adopt it in our schools. "Math teaching in India is robotic", make it creative: Manjul Bhargava (2017). This statement clearly supports the fact that mathematics learning is desperately to be updated and improved.

Concept of Constructivism and Self-regulated learning

Self-regulated learning and constructivism are closely related. Constructivism basically is learning by the active involvement of learners. This active involvement inspires the self-activeness and readiness of the learners in the process of learning and meaning making, during this process the role of mentor is scaffolding and act as a facilitator.

Objectives of the Study

The present study was designed with the following objectives:

1. Study the difference between control group and experiment group with respect to pre-test and post-test of self-regulated learningof students.
2. Study the difference between control group and experiment group with respect to pre-test and post-test ofself-regulated learningof students.

METHODOLOGY

This research study is quasi experimental in nature. Quasi-experimental designs provide experimental control in natural settings. Pre-test and Post-test comparisons will be conducted within group as it allows assessment of a pedagogical intervention by detecting differences in learning outcomes between two points of time, before and after the intervention. The present study will assign students randomly to groups and use identical measures to assess the learning outcomes of each group.

Sample

The sample for the present study is an urban government school in Dharwad district, selected for conducting the experiment for the study. One section of Class IX of the school will be taken as the Experimental group and the other section as the Control group.

The Experimental group consisting of 40 students will be given treatment in Constructivist Based approach whereas the Control group consisting 40 students will be given treatment in Traditional Method of Teaching. A total of 80 students of Class IX are included in the sample using random proportionate sampling technique.

Tools

For the collection of the data following tools were employed by the researcher,Self-regulation Strategy Inventory developed by Cleary in 2006, a Self-Report Questionnaire was used. This tool has been administered before the treatment and after the treatment.To collect the needed data for the study the researcher prepared and used Instructional materials. Researcher will develop different instructional materials which will help in imparting instruction and facilitate learning. The constructivist based approach facilitating program will have 30 lessons on the Unit "Surface Areas and Volumes" in subject Mathematics of Class IX for the experimental group and the traditional method of teaching for the control group.

STATISTICAL TECHNIQUES

Descriptive Statistics

Descriptive statistical analysis define the characteristics of the sample using common statistical techniques. It limits the generalization to the selected sample. Measures of Central tendency calculated

was mean and measures of variability calculated was standard deviation on the pretest and post-test scores on self-regulated learning. This was calculated on both control group and experimental group.

Analysis and Interpretation

Null Hypothesis 1: No significant difference between control group and experiment group with respect to pretest and posttestscores of self regulated learning strategy of students.

To accomplish above hypothesis or assumption, the independent t-test was applied and the results are presented in the following table.

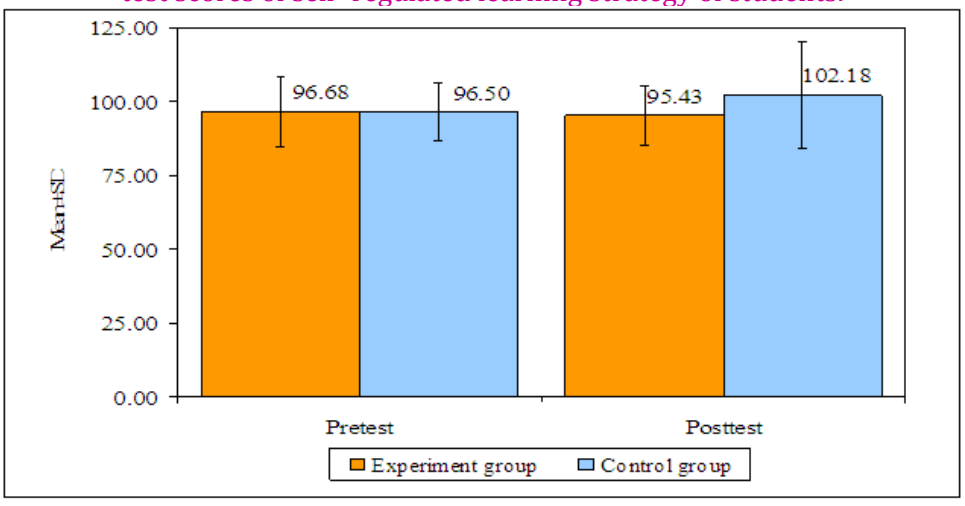
Table-1: Results of independent t-testbetween control group and experiment group with respect to pre-test and post-test scores of self-regulated learning strategy of students.

Time	Groups	Mean	SD	t-value	P-value
Pre-test	Experiment group	96.68	11.90	0.0717	0.9430,NS
	Control group	96.50	9.84		
Post-test	Experiment group	95.43	9.98	-2.0757	0.0412,S
	Control group	102.18	17.98		

From the results of the above table, it can be seen that

- No significant difference was observed between control group and experiment group with respect to pre-test scores of self-regulated learning strategy of students (t=0.0717, p=0.9430) at 5% level of significance. Hence, the above null hypothesis is rejected and alternative hypothesis is accepted. It means that, the pre-test scores of self-regulated learning strategy of students is similar in control group and experiment group. We conclude that, the control group and experiment group have a similar in pre-test scores of self- regulated learning strategy of students.
- A significant difference was observed between control group and experiment group with respect to post-test scores of self-regulated learning strategy of students (t=-2.0757, p=0.0412) at 5% level of significance. Hence, the above null hypothesis is accepted and alternative hypothesis is rejected. It means that, the post-test scores of self-regulated learning strategy of students are significantly higher in experiment group as compared to control group. We conclude that, the experiment group is showing significant and higher improvement in of self-regulated learning strategy of students after post-test as compared to control group. The mean and SD of pre-test and post-test scores of self- regulated learning strategy of students are also presented in the following figure.

Figure-1: Comparison between control group and experiment group with respect to pre-test and post-test scores of self -regulated learning strategy of students.



Null Hypothesis 2: No significant difference between pre-test and post-test scores of Self-regulated learning strategy of students in control group and experiment group. To accomplish or achieve above hypothesis, the dependent t-test was applied and the results are presented in the following table.

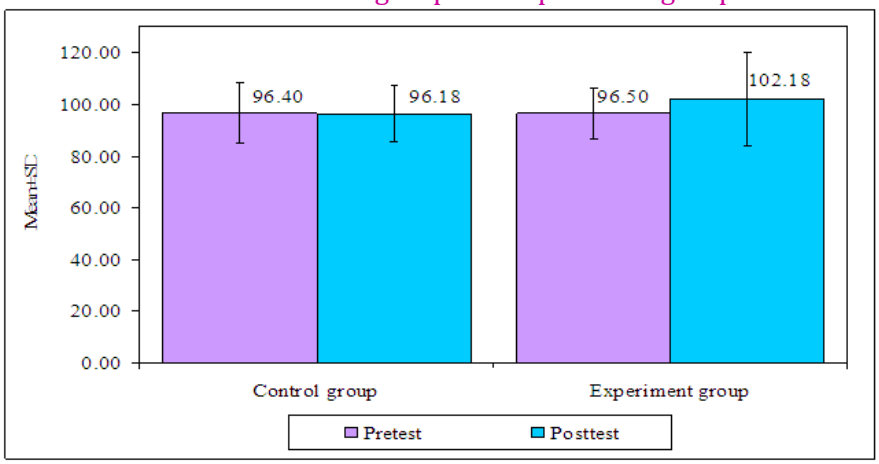
Table-2: Comparison between pre-test and post-test scores of Self-regulated learning strategy of students in control group and experiment group

Groups	Time	Mean	SD	Mean Diff.	SD Diff.	% of effect	t-value	p-value
Control group	Pre test	96.40	11.71	0.23	8.24	0.23	0.1726	0.8639 NS
	Post test	96.18	10.81					
Experiment group	Pre-test	96.50	9.84	-5.68	17.27	-5.88	-2.0786	0.0443 S
	Post-test	102.18	17.98					

From the results of the above table it can be seen that,

- No significant difference is observed between pre-test and post-test scores of self- regulated learning strategy of students in control group (t=0.1726, p=0.8639) at 5% significance level. Hence, the above null hypothesis is accepted and alternative hypothesis is rejected. It means that, the pre-test and post-test scores of self-regulated learning strategy of students in control group are similar. In another word, the change in self-regulated learning strategy scores of students from pre-test to post-test in control group is 0.23%.
- A significant difference is observed between pre-test and post-test scores of Self-regulated learning strategy of students in experiment group (t=-2.0786, p=0.0443) at 5% significance level. Hence, the above null hypothesis is rejected and alternative hypothesis is accepted. It means that, the post-test scoresare significantly higher as compared to pre-test scores of Self-regulated learning strategy of students in experiment group. In another word, the change in self-regulated learning strategy scores of students from pre-test to post-test in control group is 5.88%. Therefore, we concluded that, the experiment group i.e. constructivist based approach of teaching mathematics is showing the significant and higher changes in Self-regulated learning strategy of students as compared to control group. The mean and SD of pre-test and post-test scores of Self-regulated learning strategy of students are also presented in the following figure.

Figure-2: Comparison between pre-test and post-test scores of Self-regulated learning strategy of students in control group and experiment group.



DISCUSSION AND CONCLUSION

In this study, the researcher aimed to Effectiveness of constructivist based approach of teaching mathematics in enhancing Self-regulated learning

From the analysis it is concluded that,

1. The control group and experiment group have a similar score in pre-test scores of self-regulated learningof students.
2. The experiment group is showing significant and higher improvement in self-regulated learningof students after posttest as compared to control group.
3. The pre-test and post-test scores of self-regulated learningof students in control group are similar with change of 0.23%.
4. The experiment group, with the effect of Constructivist approach of teaching mathematics is showing significant and higher changes of 5.88% in self-regulated learningof students after posttest as compared to control group.

Self-regulated learning makes learning meaning full and child centred by providing better chances for learners to interact. This proves to be supportive in promoting and enhancing the learning activity and ways of learning in mathematics.

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