

Effect of Constructive Learning Approach on Achievement in Mathematics in Relation to Self-efficacy

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ABSTRACT

The present study investigates the effect of constructive learning approach on achievement in mathematics in relation to self-efficacy. The sample of 120 students of 9th class taken from two different schools of Mohali, affiliated to CBSE, New Delhi. Instructional material based on constructive learning approach were prepared and implemented to the experimental group after pre-testing. The gain scores were computed after post-test for all the students. Self efficacy scale was also administered. The data was analyzed statistically with the help of Mean, SD, t-ratio and Analytical Variance. A two way (2×3) Analysis of Variance was used to arrive at the following conclusions: (i) The performance of constructive learning approach group was found to attain significantly higher achievement scores as compared to control group, (ii) The performance of students with different self efficacy levels through constructive learning approach was found significant, (iii) No interaction effect was found to exist between the two variables.

Keywords: Mohali, analytical variance, performance, CBSE, t- ratio

The most critical shift in education in the past 20 years has been a move away from a conception of “learner as sponge” toward an image of “learner as active constructor of meaning.” Constructivist classroom is a center of intellectual inquiry—a place where teachers and students engage in the in-depth exploration of important ideas (Prawat, 1992). In such a classroom, knowledge is constructed by learners as a result of their own activities and interaction with the environment rather than being imparted by the instructor (cited in Fardouly, 2001). A constructivist classroom is characterized as a classroom in which constructivist learning activities and evaluation strategies exist, learning experiences are relevant to prospective teachers’ future teaching needs, students’ reflective thinking skills are developed, the students negotiate with their classmates and the instructors assume leadership, empathetic and supportive qualities to facilitate students’ learning (Taylor & Maor, 2000; Taylor, Dawson & Fraser, 1995; Taylor & Fraser, 1991).

Self-efficacy is the individuals’ assessment of their capabilities to organize and execute actions required to achieve successful levels of performance (Bandura, 1986). Self-efficacy makes a difference in how people feel, think and act. In terms of feeling a low sense of self-efficacy is associated with depression, anxiety and helplessness. In terms of thinking, a strong sense of competence facilitates cognitive processes and performance in a variety of settings, including quality of decision-making and academic achievement. In terms of act, self-related cognition is a major ingredient of motivation process in comparison to low self-efficacy people. People with high self-efficacy choose to perform more challenging tasks; they set for themselves higher goals and stick to them. Bandura (1977) proposes the key sources of self-efficacy as performance accomplishments, vicarious experiences, and emotional arousal.

Mathematics has the ability to confuse, frighten and frustrate learners of all ages. If a child has negative experience in mathematics, that experience

would affect his/her achievement as well as attitude towards mathematics during adulthood. The obvious question is whether students' failure to learn mathematics can be ascribed to problems of curriculum, problem of teaching, or the student, or perhaps the combination of these (Carnine, 1997). There are many possible reasons as to why students fail in mathematics. But most of the reasons are related to curriculum and methods of teaching rather than the students' lack of capacity to learn (Jones, Wilson & Bhojwani, 1997). Airasian and Walsh (1997) argue that the existing mode of teaching of mathematics in schools has not fulfilled the needs of the vast majority of our students, and that not nearly enough instructional stress is put on the higher order skills. Traditional method of teaching makes the learner to memorize information, conduct well organized experiments and perform mathematical calculations using a specific algorithm and makes them submissive and rule-bound. The traditional teacher as information giver and the text book guided classroom have failed to bring about the desired outcomes of producing thinking students (Young & Collin, 2004). So constructivist teaching practices in science and mathematics classrooms are intended to produce much more challenging instruction for students and thus, produce improved meaningful learning (Ginsburg-Block & Fantuzzo, 1998).

Need and Significance

The proper teaching strategies help teachers in solving learners' problems and bring remarkable improvement in their overall behavior. Review of the literature shows that use of various teaching strategies gave quite positive results in comparison to traditional teaching methodology. While teaching mathematics to student's, investigator found conventional method not that much effective. The investigator thought to conduct research study by using constructive learning approach for teaching experimental group and conventional method for second group of students and investigate whether the use of constructive learning approach is effective or not. Self-efficacy affects how better students go about studying. Thus, the present study will give wider range of knowledge regarding the effect of constructive learning approach and relationship with student's self-efficacy in mathematics. The

findings of the present study will also be helpful to assist the students to improve their learning skills in mathematics. The results of the present study will also be helpful for teachers in understanding and adopting the constructive learning approach and break the monotony of the conventional teaching methods. Therefore, the investigator made an attempt to enquire into the effect of constructive learning approach on achievements in mathematics in relation to self-efficacy.

Objectives

1. To compare the performance of groups taught through constructive learning approach and conventional teaching approach.
2. To study the performance of group have high, average and low self efficacy.
3. To examine the interaction effect between constructive learning approach and self-efficacy.

Hypotheses

- H_1 : The performance on mathematics of constructive learning approach group will be higher than that of conventional teaching approach.
- H_2 : The performance of high self-efficacy group will be higher than that of average and low self efficacy group.
- H_3 : There will be significant interaction effect between constructive learning approach and self efficacy.

Sample

The study was conducted on a random sample of 120 students of IXth class, both boys and girls mathematics students including 60 students from Harryson Model School, Mohali and 60 students from Guru Nanak Public School Mohali (Punjab). It was random and purposive sample. The study was conducted on two intact sections viz. one is experimental group and other is control group in each school. The two schools were randomly selected from the total school of Mohali from each school the two intact sections of 30 students were selected.

Design

For the purpose of present investigation a pre and post-test factorial design was employed. In order to analyze the data a 2x3 analysis of variance was used for the two independent variables viz. instructional treatment and self efficacy levels. The impact of teaching strategy was examined at two levels, namely constructive learning approach and conventional teaching approach. The self efficacy group classification was done for self efficacy variable operating at three levels viz. high, average and low self efficacy. The main dependent variable was performance gain which was calculated as the difference in post-test and pre-test scores for the subject.

Tools used

The following tools were used for the collection of data:

1. General Mental Ability Test (1972) by Jalota was used for matching the group
2. Self-efficacy Scale by Mathur and Bhatnagar (2012) was used.
3. An Achievement Test in Mathematics was prepared by the investigators.
4. Five Lessons in Mathematics (Such as Properties of Rational & Irrational numbers, Set, Trigonometric Ratios, Arithmetic Mean and Properties of Circle) based on constructive learning approach and conventional teaching prepared by the investigators.

Procedure

After the selection of the sample and allocation of students to the two instructional strategies, the

experiment was conducted in five phases. Firstly, the general mental ability test was used for matching the group. Secondly, the test of self efficacy was administrated in each school, in order to identity self-efficacy levels of the students. Thirdly, a pre-test was administered to the students of experimental and control groups. The answer-sheets were scored to obtain information regarding the previous knowledge of the students. Fourthly, one group was taught through constructive learning approach and control group was taught through conventional teaching approach by the investigators. Fifthly, after the completion of the course, the post-test was administered to the students of both the groups. The answer-sheets were scored with the help of scoring key. Time limit for the test was 40 minutes.

ANALYSIS AND INTERPRETATION OF THE RESULTS

Analysis of Descriptive Statistics

The data were analyzed to determine the nature of the distribution of scores by employing mean and standard deviation. The two way analysis of variance was used to test the hypotheses related to strategies of teaching and self-efficacy levels. The mean and standard deviation of different sub groups have been presented in table 1, 2 & 3.

Table 1 shows that the mean scores of constructive learning approach (M=11.10) is higher than the conventional teaching approach (M=6.16). This shows that constructive learning approach is more effective than the conventional teaching approach. It is also confirmed that the mean of the three group's i.e. high, average and low self efficacy group is 10.53, 8.34 and 7.03 respectively. It is concluded that the gain mean with constructive learning approach has

Table 1: Means and SD of Achievement Scores for the Different Sub Groups

Self-efficacy Level	Teaching						Total		
	Constructive Learning Approach			Conventional Teaching Approach			N	Mean	SD
	N	Mean	SD	N	Mean	SD			
High Self-efficacy	16	14.37	2.74	16	6.68	3.44	32	10.53	4.93
Average Self-efficacy	28	10.67	3.64	28	6.00	3.92	56	8.34	4.47
Low Self-efficacy	16	8.25	3.32	16	5.80	2.29	32	7.03	3.10
Total	60	11.10	4.03	60	6.16	3.36	N= 120		

Source: Field Study, 2016

Table 2: Summary of Analysis of Variance (2×3) Factorial Designs

Source of Variance	Sum of Squares	df	Mean Sum of Squares	F-ratio
Constructive Learning Approach (A)	821.61	1	821.61	68.13**
Self Efficacy (B)	558	2	279	23.13**
Interaction (A × B)	5.15	2	2.58	0.21
Error	1374.74	114	12.06	

** Significant at 0.01 level

(Critical Value 3.93 at 0.05 and 6.87 at 0.01 level, df 1/114)

(Critical Value 3.08 at 0.05 and 4.80 at 0.01 level, df 2/114)

Table 3: t-ratio for different combinations of self-efficacy levels

Self-efficacy Level	High Self-efficacy			Average Self-efficacy			Low Self-efficacy		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
	32	10.53	4.93	56	8.33	4.47	32	7.03	3.10
High Self-efficacy									
N	Mean	SD	—	—	—	—	—	—	—
32	10.53	4.93							
Average Self-efficacy									
N	Mean	SD	—	—	—	—	—	—	—
56	8.33	4.47							
Low Self-efficacy									
N	Mean	SD	—	—	—	—	—	—	—
32	7.03	3.10							

*Significant at 0.05 level **Significant at 0.01 level

(Critical Value 2.00 at 0.05 and 2.60 at 0.01 level, df 62)

(Critical Value 1.99 at 0.05 and 2.63 at 0.01 level, df 86)

shown significant differences for high, average and low self-efficacy students. These differences are also found in respect of the different self efficacy group taught through conventional teaching approach.

Analysis of Variance on Achievement Scores

The mean of different sub-groups, sum of squares, degree of freedom, mean sum of squares and the F-ratio have been presented in table 2.

MAIN EFFECTS

Constructive Learning Approach (A)

Table 2 reveals that the F-ratio for difference in mean gain scores of constructive learning approach and conventional teaching approach group is 68.01, which in comparison to the table value was found significant at 0.01 level of significance. It shows

that the groups were not different beyond the contribution of chance. Hence, the hypothesis H₁: The performance on mathematics of constructive learning approach group will be higher than that of conventional teaching approach group, is accepted .The result indicates that the performance of constructive learning approach was more effective than that of the conventional teaching approach group in mathematics.

Self-efficacy Level (B)

Table 2 shows that the F-ratio for difference in mean of the three groups of self-efficacy level is 23.10, which in comparison to the table value was found significant at 0.01 level of significance. It suggests that the three groups were different in respect of achievement scores. Hence, the hypothesis H₂: the performance of high self efficacy group will be higher than that of average and low self-

efficacy group in mathematics, is accepted. The result indicates that the performance of students in mathematics through constructive learning approach has significant differences for high, average and low self-efficacy students.

In order to probe deeper, the ratio was followed by t-test. The value of the t-ratio for the different combinations of self efficacy level have been given in table 3.

Table 3 shows that the t-ratio for the difference in gain means of high and average self-efficacy groups is 2.08, which in comparison to the table value was found significant at 0.05 level of significance. Hence, the hypothesis of significant differences is accepted in case of high and average self-efficacy irrespective of grouping across other variable. The result indicates that the achievement of high and average self-efficacy groups was significantly different in respect of gain scores.

Table 3 shows that the t-ratio for the difference in gain means of high and low self-efficacy groups is 3.40, which in comparison to the table value was found significant at 0.01 level of significance. Hence, the hypothesis of significant differences is accepted in case of high and low self-efficacy irrespective of grouping across other variable. This infers that high self-efficacy group performs significantly better than that of low self-efficacy groups on achievement in mathematics respect of gain scores.

Table 3 shows that the t-ratio for the difference in gain means of average and low self-efficacy groups is 1.60, which in comparison to the table value was not found significant even at 0.05 level of significance. Hence, the hypothesis of significant differences is rejected in case of average and low self-efficacy irrespective of grouping across other variable. The result indicates that the achievement of average and low self-efficacy groups was not significantly different in respect of gain scores.

Interaction Effect (A × B)

Table 2 reveals that the F-ratio for the interaction between treatment and self-efficacy groups is 0.21, which in comparison to the table value was not found significant even at 0.05 level of significance. It indicates that the two variables do not interact with each other. Thus, the null hypothesis H_3 : There will be significant interaction effect between

constructive learning approach and self-efficacy, is rejected. The constructive learning approach and conventional teaching approach yielded equal levels of achievement for high, average and low self efficacy level for the students.

DISCUSSION

The result of the present investigation have lead to the conclusion that constructive learning approach yields higher levels of achievement in mathematics as compared to the conventional teaching approach group.

The hypothesis H_1 was accepted. The results are supported by the finding of Saigo (1999); White (1999); Kim (2005); Vijayalatha and Krishnaiah (2011) and Anwar (2015) revealed that constructive learning approach was more effective than conventional teaching approach. The results are contradicted by the findings of Gatlin (1992) and Makanong (2000) revealed that there is no significant difference in achievement of students taught through constructive learning approach and conventional teaching approach.

The performance of students in mathematics through constructive learning approach has shown significant differences for high, average and low level self efficacy students. Hence, the hypothesis H_2 was accepted. The results are consistent with the findings of Wood and Locke (1987), Bandura (1989), Zeldin and Pajares (2000) concluded that the students who show higher self-efficacy are more successful with their academic performance.

The performance of constructive learning approach was not found interacting with each other at different levels of self-efficacy. Hence, hypothesis H_3 was rejected.

CONCLUSION

The present study reveals that performance in mathematics of students taught through constructive learning approach was significantly higher than those which were taught through conventional teaching approach. Further, the gain means with constructive learning approach has shown significant differences for high, average and low self efficacy level students. However, the difference in mean score for interaction across different grouping did not turn out to be significant. The

study recommends the use of constructive learning approach for better performance of mathematics students at secondary stage.

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