

Applying Constructivist Approach in Teaching of Mathematics

Abstract

The present study was conducted to investigate the effect of constructivist learning approach on achievement of secondary school students in mathematics. The data was collected from a sample of 200 of ninth grade students from public and government schools of Amritsar district. Instructional material based on constructive learning approach were prepared and implemented to the experimental group after pre-testing. The gain scores was computed after post-test for all the students. The data was analyzed statistically with the help of Mean, SD, and t-ratio. The present investigation revealed that students taught through constructivist approach had achieved higher score in the post-test compared to those exposed to conventional (traditional) method of teaching.

Keywords: Achievement, Constructivist Pedagogy, Conventional Approach

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Introduction

The field of education has undergone a significant shift in thinking about the nature of human learning and the conditions that best promote the varied dimensions of human learning. As in psychology, there has been a paradigm shift in designed instructions; from behaviorism to cognitivism and now to constructivism (Cooper, 1993). Certainly one of the most influential views of learning during the last two decades of the 20th century is the perspective known as constructivism. Constructivism is an emerging pedagogy among teaching community across the world and National curriculum Frame work (NCF, 2005) confirmed the direction to it in Indian classroom situation. As, constructivism is an epistemological and psychological theory about how we learn by actively and consciously bringing our past experiences and understandings into a collaborative exercise with other students (Splitter, 2009). It is a synthesis of multiple theories diffused in to one form. It is the assimilation of both behaviorist and cognitive ideals. The "constructivist stance maintains that learning is a process of constructing meaning; it is how people make sense of their experience" (Merriam & Caffarella; 1999). 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). It is characterized as a classroom in which constructivist learning activities and evaluation strategies exist, 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). 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 (Fardouly, 2001). 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).

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, problems 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,

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Wilson & Bhojwani; 1997. The existing mode of teaching of mathematics in schools has not fulfilled the needs of vast majority of our students (Airasian & Walsh; 1997). 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). There is need to replace orthodox techniques of teaching by constructivist pedagogy. As, Constructivist instructions are found to be more effective during teaching learning process than the direct instructions in the classroom. It helps students to develop their own thinking and ideas through experience, action and reflection to become independent thinkers capable of solving their everyday problems. It is widely taught as an approach to probe for children's level of understanding and to show that that understanding can increase and change to higher level thinking. Thus, constructivism refers to the way the students can make sense of the material and also how the materials can be taught effectively. With Constructivism as an educational theory in mind, the teachers should consider what students know and allow their students to put their knowledge in to practice (Mvududu & Thiel-Burgess; 2012).

Review of Literature

Applefield (1985) conducted an experimental study in which a traditional classroom lesson and a constructivist version of the same lesson are described and analyzed. The study reported that constructivist lessons had a clear content goal designed around an authentic learning task, question or problem. Students in constructivist classrooms were more challenged to become more active learners. Clark (1997); Simon and Schifter (1997); Bay et al. (1999) investigated the attitude of students for mathematics when they are instructed using constructivist methods of teaching. In this study the sample of 15 different teachers, investigate the reactions of the students in relation to the standards-based mathematics curriculum. Approximately 1,000 students respond to 24 Teacher -guided feedback with no specific numbers reported to the researchers. The sample was taken from the 6th and 7th grades from five different school districts incorporating both large cities and small towns. The study revealed that the majority of the students preferred the new standards based curriculum to the previous traditional curriculum. The majority of the students experienced more enthusiasm for the new curriculum than the previous curriculum. Kim (2005) conducted a study to find what effect constructivist teaching would have on the academic achievement of students in Korea. The sample of 76 students has been taken from 6th grade. The students were divided into two groups, an experimental group and a control group. The Experimental group consisted of 21 males and 17 females. The control group consisted of 22 males and 16 females. It was concluded that in overall academic achievement there was a significant difference ($F=89.11, p < .001$) in academic achievement with the students who learned mathematics constructively. Tuncel (2015) found that a learning environment that includes active learning, reflecting learning,

associating with life and assessing simultaneously with teaching were created in teaching-learning process in content knowledge courses. Chowdhury (2016) found significant difference in the achievement of the students taught through constructivist approach and conventional method of teaching. This study consists of the idea about constructivist approach makes teaching technique more effective than those of traditional methods. Mehar (2017) conducted an experimental study and revealed that performance in mathematics of students taught through constructive learning approach was significantly higher than those which were taught through conventional teaching approach.

Significance of the Study

In the present scenario, learners are facing problems regarding the methods and techniques of teaching especially in mathematics. Most of reasons behind student failure in learning mathematics are mainly due to defective curriculum and teaching methodology and strategy as it is corroborated by the findings of (Jones, Wilson & Bhaswani; 1997). The National Curriculum Frame work 2005 recommends a paradigm shift from student rote learning to learning by understanding. It suggests that curriculum should help students to develop their own thinking and ideas through experience, action and reflection (Knoesbergen & Van Luit; 2012). So, the present study focuses that the effective teaching strategies and curriculum help the teachers in solving learners' problems and bring remarkable improvement in their achievement. Review of the literature also shows that use of various teaching strategies gave quite positive results in comparison to traditional teaching methodology.

Research Methodology

The present study falls under the domain of experimental research. The students were divided into two groups viz. one is experimental group and other is control group by equating the groups on the basis of their intelligence. Mean scores, Standard deviation, t-values were computed for the data analysis.

Sample

Sample consists of 200 students of public and government schools of Amritsar district. Out of which 100 students were taken from two public schools and 100 students were two from two government schools.

Tools Used

1. Achievement test (both the pre-test and post-test prepared by the investigator)
2. Constructivist pedagogy Based Lessons (developed by the investigator)

Hypotheses

H₁: Learning outcomes of students taught through constructivist pedagogy are more than the students taught through conventional pedagogy.

H₂: Learning outcomes of students taught through constructivist pedagogy are different with respect to gender.

H₃: Learning outcomes of students taught through constructivist method are different with respect to type of school.

Results and Discussion

Hypothesis 1

Table 1: showing Mean, SD, SE_D and t-ratio for mean gain scores of control group and Experimental group.

Groups	N	Mean	S.D.	S. Ed	t-value
Experimental	100	10.00	3.53	0.46	11.15**
Control	100	4.87	3.14		

**Significant at 0.01 level and 0.05 level (critical value 2.58 at 0.01 level and 1.96 at 0.05 level, df=99)

The table 1 indicates significant difference in the achievement in mathematics of group taught through constructivist pedagogy and conventional method. Achievement of experimental group is higher than controlled group. As the Mean gain scores and S.D. of experimental group was 10.00 and 3.53 respectively and the Mean gain scores and S.D of control group was 4.87 and 3.14 respectively. The t-value comes out to be 11.15, which is found to be significant at both 0.01 and 0.05 levels of significance. The result indicates that the achievement of group taught through constructivist pedagogy is found to be higher than that of conventional method. So, the

hypothesis H₁: "Learning outcomes of students taught through constructivist pedagogy are more than the students taught through conventional pedagogy", is not rejected. The results are supported by the finding of Kim (2005), revealed that constructive learning approach was more effective than conventional teaching approach. The study recommends the use of constructive learning approach for better performance of mathematics students.

Hypothesis 2

Table 2: showing Mean, SD, SE_D and t-ratio for mean gain scores of boys and girls of experimental group

Groups	N	Mean	S.D.	SE _D	t-value
Boys	76	10.02	3.40	0.94	0.12
Girls	24	9.91	4.23		

(Critical value 1.96 at 0.05 level, df = 98)

Table 2 indicates no significant difference in the achievement of boy and girl students taught through constructivist pedagogy as the Mean gain scores and S.D of boys found to be 10.02 and 3.4 respectively and the Mean gain scores and S.D of girls found to be 9.91 and 4.23 respectively. The t-value comes out to be 0.12, which is not insignificant at 0.05 level of significance with df = 98. The result reveals that the achievement of boys in mathematics

is same as the achievement of girls in mathematics taught through constructivist pedagogy. So, the hypothesis H₂: Learning outcomes of students taught through constructivist pedagogy are different with respect to gender, is rejected.

Hypothesis 3

Table 3: showing Mean, SD, t-ratio for mean gain scores of private and government school students:

Groups	N	Mean	S.D.	SE _D	t-value
Private	50	9.70	3.14	0.75	0.93
Government	50	10.04	3.92		

(Critical value 1.96 at 0.05 level and 2.58 at 0.01 level, df = 99)

The table 3 indicates no significant difference in the achievement of public and government school students taught through constructivist pedagogy as the Mean gain scores and S.D of private school students was found to be 9.70 and 3.14 respectively and the Mean gain scores and S.D. of government school students was found to be 10.04 and 3.92 respectively. The calculated t-value 0.93 which is not significant at 0.05 and 0.01 level of significance with df= 99. It may be concluded that the achievement in mathematics of private school students is not less to the achievement of government school students taught through constructivist pedagogy. The hypothesis H₃: Learning outcomes of students taught through constructivist method are different with respect to type of school, is rejected.

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.

Findings

1. Learning outcomes of students taught through constructivist pedagogy are more than the students taught through conventional pedagogy.
2. The achievement of boys in mathematics is same as the achievement of girls in mathematics taught through constructivist pedagogy.
3. The achievement in mathematics of private school students is not less to the achievement of government school students taught through constructivist pedagogy.

Educational Implication

The educational implications of the present study are as under:

1. As significant difference is found in achievement in mathematics group taught through constructivist pedagogy and conventional method and achievement of experimental group is found higher than controlled group, so, in order to increase the achievement level of students in mathematics, constructivist method should be applied in the classrooms.

2. Appropriate training should be given to teachers to make them aware about the skills and equipments needed for practice of constructivist pedagogy.
3. School authorities should also take initiatives to encourage teachers to implement this pedagogy to improve the performance and outcome of the students.

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