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Effectiveness of Constructivist Approach in Teaching Science

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Abstract

Constructivism is based on the belief that learners are the constructors of their own knowledge and are active participants in the process of learning. They construct their knowledge by experiencing things around them, reflecting on those experiences and by reconciling those with their previous experiences. The present study was conducted to find out the effectiveness of constructivist approach in teaching science. The main objective of the study was to compare the effectiveness of constructivist approach with traditional approach in teaching science in terms of students' achievement. This study was based on post-test only, equivalent group design of experimental research. The purposive sampling was used for selecting a sample of all the 40 Class IX students of a School. The investigator divided all the 40 students into 2 groups: group-1 as experimental group and group-2 as control group on random basis and they were taught through constructivist and traditional approach respectively. An achievement test was administered as post-test and scores of both the groups were analyzed by using mean, S.D. and t-test. The result reveals that the constructivist approach was found more effective than the traditional approach in teaching and learning science.

Key words : Constructivist approach, traditional approach, effectiveness.

Introduction

Constructivism, as a system of learning, believes that knowledge is constructed by learners when they are actively engaged in social experiences and activities either independently and /or collectively. Learners use their experiences to actively construct understandings that make sense to them, rather than to understand what is derived to them in an organized form.

Constructivism is an outgrowth of cognitive science. Constructivism views learning as a process of knowledge construction, with concept development and comprehensive understanding as the goals (Fosnot, 1996; Resnick, 1986). Phye (1997) states that constructivism is a movement that combines cognition from a developmental perspective with other important issues, such as motivation, self-directed learning, and a focus on the social context of learning. According to von Glasersfeld (1996), there are two main aspects of constructivism. First, learning is a process of knowledge construction instead of absorption. We construct knowledge based on our own perceptions and conceptions of our world; therefore; each of us constructs a different meaning or concept (Duffy &Jonassen, 1992; Fosnot, 1996; von Glaserfeld, 1996). Second, learning requires the building of conceptual structures through reflection and abstraction (Schuman, 1987; von Glasersfeld, 1996). Since each learner has to construct his or her knowledge, concepts cannot be transmitted from teacher to learner by means of words (Schank, 1997; von Glasersfeld, 1996). Learning occurs only when the learners are actively involved in the construction and reorganization of concepts.

All the above studies were conducted on constructivist approach both in India and abroad. The studies conducted by Kamii (2000), Chang (2001), Tsai (2001), Esen (2003), Hentry (2003), Johnston (2005), Kim (2005), Cakici and Yvuz (2010), Khalid and Azim (2012) reveal that Experimental group which was used teaching method that is based on constructive approach had significantly higher scores than control group which was used direct instruction method. A number of studies have been conducted on constructivist approach but the field of ICON model is poorly explored.

Rationale of the study

Teachers often disseminate knowledge and expect students to identify the facts of the knowledge presented. Secondly, most teachers rely heavily on textbooks. Thirdly, most classrooms discourage co-operation and require students to work in relative isolation on tasks that require low level thinking, rather than high order thinking. Fourthly, students independent thought is devalued in most classrooms. When asking questions, most teachers seek not to enable students to think through intricate issues, but to discover whether student knows the right answer. Fifthly, schooling is premised on the notion that there exists a fixed world that students should understand. The construction of new knowledge is not as highly valued as the ability to demonstrate mastery of conventionally accepted knowledge. The effectiveness of constructivism as a pedagogical approach has been researched widely in the foreign countries. The classroom size, environment and setting in schools of foreign are largely unsimilar to those in Indian schools. The research studies reveal that the studies were mostly done at higher secondary level and secondary level of English medium schools at international and national level. Viewing the present scenario of teaching, the researcher is quite inquisitive to explore how this approach works in the context of odia medium schools. Therefore, the study aimed to seek answer to the question: whether the constructivist approach will be more effective than the traditional approach in enhancing students' achievement in the present curricular set up in Odisha ?

Statement of the Problem

"Effectiveness of Constructivist Approach in Teaching Science"

Operational Definition of key term

The constructivist pedagogy has been worked out into so many models for classroom practice. Some of popular models are 5 E approaches, ICON model. For the purpose of the present study the researcher conceptualized constructivist approach as construction of new knowledge by the learners using the 7 basic steps of ICON Model with the following steps:

Observation

Students make observations of authentic life situations / events/ phenomenon which would serve as the background to support learning activities carried out in an authentic situation.

Contextualization

Learners relate their analysis with the text for accessing background and text materials for interpretation and argumentation.

Cognitive apprenticeship

Here students attempt to interpret and construct knowledge under the guidance of a teacher as a facilitator.

Collaboration

Here students are engaged in collaborative work in small peer groups.

Interpretation construction

Learners analyze and generate evidences to verify their hypothesis.

Multiple interpretations

Learners provide explanations by their analysis both within and across the groups.

Multiple manifestation

Using the text relating to each contextual materials on various events and behaviour, learners notice that the general principles embedded in what they are doing become manifested.

Objectives of the study

- To find out the instructional effect of traditional approach in terms of student's achievement in science.
- To find out the instructional effect of constructivist approach in terms of student's achievement in science.
- To compare the effectiveness of constructivist approach and traditional approach in teaching science in terms of student's achievement.

Hypothesis of the study

There is no significant difference between the mean achievement of students taught through traditional approach and constructivist approach in terms of post test scores.

Delimitation of the study

The study was confined to class-IX only. The sample of schools was limited to purposive sampling with one school only. The magnitude of the treatment was scaled down to 10 classes on a single chapter.

Design of the study

The present study was based on post-test only, Equivalent group design of experimental research. The paradigm of the design was as follows:

$R \; X \; O_1$

$R \; X \; O_2$

Sample

The purposive sampling was used for selecting all the 40 students of Class IX of Satya Sai High School, Bhubaneswar, Odisha. The Researcher divided the students into 2 groups: group 1 as experimental group and group 2 as control group on random basis.

Tools for Data Collection

Lesson plans based upon constructivist approach and traditional approach for providing treatment to the experimental and to the control groups respectively were used. An achievement test based on Bloom's taxonomy was administered to collect data in terms of post-test scores.

Analysis and Interpretation

The data were analyzed by using appropriate statistical techniques i.e. mean, S.D., t-test.

Table: 1 Test of Significance of difference between 2 mean scores

Method of teaching	N	Mean	SD	SED	t value
Traditional approach	20	27.00	7.086	2.259	2.878
Constructivist approach	20	33.50	7.200		

The mean achievement scores for the traditional and the constructivist approach is 27.00 with standard deviation of 7.086 and 33.50 with standard deviation of 7.20 respectively. The differences between the two means were examined using t-test.

The t-value of 2.878 with df=38, for the difference between the mean achievement scores of students taught through the constructivist approach and the traditional approach is significant at 0.05 level. This speaks that the two mean scores of students taught through constructivist and traditional approach are statistically different. Therefore, the null hypothesis stated as "There is no significant difference between the mean achievement of students taught through traditional approach and constructivist approach in terms of post test scores" is rejected. Hence, it is inferred that the two instructional approaches generated differential achievement among students. The mean achievement score for constructivist approach is 33.50 which is greater than that (=27.00) for the traditional method. Thus, it is evident that the constructivist approach to teaching and learning of Science was more effective to the traditional approach.

Findings

This study shows that constructivist approach is superior to the traditional methods of teaching and learning. This finding is similar to the findings from the studies of Khalid and Azeem (2012), Cakici and Yvuz (2010), Kim (2005), Johnston (2005), Esen (2003), Hentry (2003), Chang (2001) and Kamii (2000). The study demonstrated that more number of students are benefited out of constructivist approach to teaching as compared to the traditional approach of teaching and learning. Moreover, the constructivist approach moved students achievement to higher level as compared to the traditional approach. This finding is quite encouraging to teachers in view of long-standing issues of low achievement of students in India.

Educational Implications

Teaching learning process

Teaching learning process is a two-way process involving both teachers and learners. The teacher imparts knowledge and presents certain ideas and principles before students and the students develop their potentialities after getting instructions and guidance from their teacher. In ICON model of teaching,

instructional aids are very much necessary. It provides concrete knowledge and better experiences to the child. This model provides joyful learning environment to study in the classroom.

School administration

The administration of school has to provide congenial atmosphere in the teaching learning process. ICON model may provide such kind of situation where a learner can interpret the concepts in many ways. For this he can take the help of subject teachers and other classmates. Social interaction among learners and teachers is inevitable. The experimenter implementing ICON model of teaching can take help from school management. For successful implementation of this strategy the school administrator should provide all kinds of resources.

Learners

Learning is not a process of passive acquisition of knowledge. Learners should actively take part in teaching learning process. In general constructivist approach and in particular social interaction ICON model of teaching helps the learners to construct their knowledge positively. Through interaction low achievers can get better opportunity to acquire knowledge. They can develop the ability of analysis, divergent thinking, interpretation ability, critical thinking and scientific attitude.

Teachers

Teachers should create better learning environment in a classroom. He should guide and encourage the learners. Before the learner constructs any knowledge, teacher should provide necessary instructional tools for better understanding. He should encourage group discussions of any topic in the class.

Conclusion

This study showed constructivist approaches improve students achievement both horizontally and vertically. The issueof poor achievement can be addressed through constructivist approaches to teaching and learning. Proper teacher empowerment in the constructivist paradigm is expected to be instrumental in this direction.

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