

# Effect of Constructivist Approach on Students' Achievement in Science at Secondary Level

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## ABSTRACT

Throughout the world, Science is one of the compulsory subjects in schools. Now-a-days online media (like Youtube) is frequently opted by faculties and students for online teaching learning process specially in science. But science learning is incomplete without hands on experience. That's why majority of the students have lack of interest and motivation to learn science. It leads to low academic achievement in science. Constructivist approach (Known to unknown) provides tremendous opportunities for inculcating creativity and innovation, so that learner's performance is enhanced. NCF 2005, states "*Child centered pedagogy*" means giving more primacy to children's experience, their voices and their active participation. The objectives of present study are: to study the effect of constructivist approach on class VI students' achievement in science, to study the effect of constructivist approach on the achievement of low achievers of class VI in science and to compare the performance of boys and girls of class VI students learnt through constructivist approach. This study was conducted in D.A.V School, Bhagalpur. It was limited to the students of class 10<sup>th</sup>. 5E Model of constructivist approach was implemented in the study. The present design of study was quasi-experimental. Class 10<sup>th</sup> students of D.A.V School were population of this research. The purposive sampling was used for selecting secondary school. 54 students were selected from two sections for the purpose of this study. Researcher selected section 'A' as experimental group and section 'B' as control group. Researcher had used two types of tools: Instructional Tool (5E model) & Measuring Tool (Teacher made Achievement Test). The data were analyzed by using appropriate statistical techniques i.e., 't'-test and ANCOVA. Constructivist approach had significant effect on the achievement of class 10<sup>th</sup> students in science (M1 = 22.16, M2 = 16.20, 't'-value is 2.345\*\*). Constructivist approach had significant effect on achievement of low achievers of class 10<sup>th</sup> students in science (M1 = 7.66, M2 = 5.5, 't'-value is 3.01\*\*). It can be concluded that constructivist approach provides enough scope for active participation and interaction in classroom with peers and teachers. Through interaction, low achievers can get better opportunity to acquire knowledge and increase their achievement.

**Keywords:** Constructivist approach, 5E-model, Achievement, Science learning, Learners

Education is the process of living through a continuous re-construction of experiences. A child has his own experiences of world. Education reconstructs or reorganizes these experiences, refines them and gives them meaning. The reconstruction or reorganization of experiences adds to the further refinement of experiences.

Educating the child means directing the child properly. Direction is fixation of the activity in to

a proper response by elimination of unnecessary and confusing movements. Direction includes guidance as well as control. This is the natural way of educating the child. Learning without burden (Yashpal committee report, 1990) pointed out that

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learning at school could not become a joyful unless we change our perception of the child as a receiver of knowledge that we generally follow in traditional approach.

Studies in the 1970s typically compared experimental classrooms with control. New teaching approaches were tried out and were compared with traditional teaching and so on. Theorists in cognition, curriculum and instruction (e.g., Di Vesta, Vygotsky, Von Glaserfeld, etc.) are now providing the underlying rationale and language for discussing this fundamental change in teaching and learning which is at the heart of current school improvement agenda. Constructivist theory provides a framework through which the emergent ideas about teaching, learning and assessment can be unified (Young and Collin, 2003).

Since the seventies, the change from behaviorism to cognitive in educational psychology has placed an increasing responsibility upon the learners for their own learning, (Chen, 2002) and student centered approach has become the focus of many researches. The constructivist approach is based on the premise that science is a human construction. As far as learning is concerned, the constructivist approach accepts that children construct or change their representations about the environment in which they live, mainly through three processes: interaction with adult, interaction their peer group, and their personal experiences (Kokkotas and Vlachos, 1998).

In brief, constructivism argues that learners actively construct meaning from existing knowledge structures, and highlights the importance of children's existing ideas in the learning process. Although constructivism is not a theory of teaching, it suggests taking a radically different approach to classroom teaching-learning process (Osborne, 1996).

## **Rationale**

Throughout the world, Science is one of the compulsory subjects in schools. But majority of the students in schools ignored to learn science due to lack of interest and motivation which leads to low academic achievement in science. Majority of Teachers generally follow the traditional methods of instruction in schools. The conventional (lecture) teaching method of teacher as sole information-giver

to passive students appears outdated. In a study carried out by Colburn (2000) on undergraduates in a large lecture hall setting, it was found that only 20% of the students retained what the instructor discussed after the lecture. They were too busy taking notes to internalize the information. Also, after a lecture has passed eight minutes, only 15% of the students are paying attention.

For effective instruction and learning, there is a need to create learning settings in the classroom that will enable learners to actively participate in the process of instruction, rather than be passive listeners only. NCF 2005, states "*Child centered pedagogy*" means giving more primacy to Children's experience, their voices and their active participation. In traditional method, students mostly focus on the question answer of the text rather than to understand them by correlating with their day-to-day experiences and surroundings.

Constructivist approach provides tremendous opportunities for inculcating creativity and initiative, so that learner's performance is enhanced. NCF 2005 has also suggested that at upper primary stage, the child should be engaged in group activities, discussions with peers and teachers, surveys, organizations of data and their display through exhibition etc in schools are to be an important component of pedagogy. Secondary education is the base of higher secondary education. It prepares the student for higher education.

Science occupies an important subject at secondary level and few studies have been conducted on the effect of 5E model on students' achievement and gender based performance. Most of the studies are conducted by Peter, *et al.* (2010), Bimbola and Daniel (2010); Cakici and Yvuz (2010). Fisher and Kim (1999), Nayak (2010) reveals that students taught through constructivist approach scored higher than those taught with traditional method. The existing literature in science education is inconclusive concerning gender achievement in science. As a result of this inconclusiveness, there is a need to examine the role of constructivist 5E model on the performance of male and female students in science. Several studies including those of Rogelman (1980); Lawson (1973); Brendzel (1978); Doddy (1980); and Ethindero (1980) have reported that males perform better than female on tasks requiring logical operations.

Therefore, keeping the views of constructivist approach of learning in Indian context, this research has been undertaken to investigate the effectiveness of constructivist approach on students' achievement in science at secondary level.

### **Constructivist Approach**

Constructivist approach refers to construct knowledge by connecting new ideas/experience to existing ideas/experience. Here, the researcher has taken 5E model of constructivism.

### **Achievement**

Achievement refers to performance of the students. Here, the achievement refers to the scores obtained by secondary school students in science before and after using constructivist approach.

### **Science**

Science (from Latin *scientia*, meaning "knowledge") is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.

### **Secondary School Students**

The students studying in class 9<sup>th</sup> & 10<sup>th</sup> are considered as secondary school students. In this study researcher had selected class 10<sup>th</sup> students only.

### **Objectives of the Study**

- To study the effect of constructivist approach on class 10<sup>th</sup> students' achievement in science.
- To study the effect of constructivist approach on the achievement of low achievers of class 10<sup>th</sup> in science.
- To compare the performance of boys and girls of class 10<sup>th</sup> students learnt through constructivist approach.

### **Hypotheses**

- Students learnt through constructivist approach will gain significantly high score as compared to their counterpart learnt by traditional method.
- Low achievers learnt through constructivist approach will gain significantly higher score

as compare to their counterpart learnt by traditional method.

- There is no significant difference between the performance of Boys and Girls students learnt through constructivist approach.

### **Delimitations of the Study**

- The study was conducted in D.A.V. School, Bhagalpur City, Bihar.
- It was limited to the students of class 10<sup>th</sup>.
- The study was limited to two lessons (one from Physical science and one from Biology) of class 10<sup>th</sup> science.
- Only 5E Model of constructivist approach was implemented in the study.

### **Design of the Study**

The present design of study was quasi-experimental.

### **Population**

Class 10<sup>th</sup> students of D.A.V School were population of this research.

### **Sample**

The purposive sampling was used for selecting secondary school. 54 students were selected from each sections for the purpose of the study. Researcher selected section 'A' as experimental group and section 'B' as control group.

### **Tools and Techniques**

For the present study, the researcher had used two types of tools:

- Instructional Tool
- Measuring Tool

### **Instructional Tool**

It was in the form of unit wise lesson plans based on 5E model of teaching. Other teaching aids like pictures, chart papers, models etc., were used.

### **Measuring Tool**

It is the teacher made achievement test based on Constructivist principle.

## Procedure of data collection

### *Pre-experimental phase*

Before going to conduct the study, the experimenter had selected D.A.V School, Bhagalpur by using purposive sampling. Two units (Life Processes and Chemical reactions) of class 10<sup>th</sup> NCERT Science textbook were selected to prepare the questions of achievement test. Achievement test of 50 marks containing multiple-choice question, fill in the blanks, matching, short answer type and long answer type questions based on knowledge, understanding, application, and skill was administered before intervention in section A and B of Class 10<sup>th</sup>. The researcher in science prepared lesson plan in two methods (Traditional method and Constructivist method). Low achievers had been identified in two groups with the help of quartile deviation

### *Experimental phase*

The duration of data collection was spread over a period of 15 days. Lesson plans were prepared separately on traditional method and 5E's model of learning. After the Pre-test, the two groups were intervened by two different methods of teaching separately. Experimental group was taught by 5E's model of teaching and control group was taught by traditional method. Twelve lessons had been delivered through each method. The experimenter had used instructional aids for teaching learning process. The 5E's model represents five stages of sequence for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluation. A situation was created by the researcher in which students are stimulated towards learning. The whole process was monitored by the researcher who was working as a facilitator to ascertain students' progress. Similarly, control group was taught by traditional method of teaching. After teaching, a post achievement test was administered to both the groups. A comparison was made to find out the effect of 5E's model.

### *Post-experimental phase*

After the completion of intervention, post achievement test was administered by using same question given in pre achievement test. A comparison was made on the post achievement test of experimental group and control group to find out

the effect in achievement. Similarly, a comparison was made on the post achievement test and pre achievement low achievers (identified after pre-test in both groups) to find out the effect.

## Data Analysis

The data were analyzed by using appropriate statistical techniques i.e., 't'- test and ANCOVA. Each hypothesis was tested statistically by using 't'-test and F-test to increase the reliability and to arrive at the conclusion. Application of ANCOVA guarantees to equate both the groups prior to the treatment and thus helps in valid conclusion. Here, ANCOVA is performed by taking pre-test score of experimental and control group as co-variant and post-test score of both as dependent variable.

## Major Findings

- ❑ There was no significant difference between experimental group and control group in pre-test. (M1 = 10.28, M2 = 9.44, 't'-value is 0.472).
- ❑ Constructivist approach had significant effect on the achievement of class 10<sup>th</sup> students in science. (M1 = 22.16, M2 = 16.20, 't'-value is 2.345\*\*).
- ❑ Constructivist approach had significant effect on achievement of low achievers of class 10<sup>th</sup> students in science. (M1 = 7.66, M2 = 5.5, 't'-value is 3.01\*\*)
- ❑ Constructivist approach had no significant effect on the performance of experimental boys and girls in science. (M1 = 14.56, M2 = 9.87, 't'-value is 0.208).

## Educational Implications

The most outstanding characteristics of any research is that it must contribute something new to the development of the area concerned. The researcher may find out the following educational implications of the present study:

- ❑ 5E model of learning helps the learners to construct their knowledge positively.
- ❑ It gives enough scope for active participation and interaction in classroom with peers and teachers.
- ❑ Through interaction, low achievers can get better opportunity to acquire knowledge.

- ❑ Teacher can provide better opportunities to the learners to learn.
- ❑ 5E's model provides joyful learning environment between teacher and students.
- ❑ It is a better way to introduce hands on experience in learning.

### Suggestions for Further Research

- ❑ Present study was conducted only on secondary school students. Further study can be conducted with other group of sample.
- ❑ The study was conducted on students' achievement in science at secondary level. Therefore, study can be conducted on the specific branch of science like on Biology, Physics, and Chemistry at secondary level.
- ❑ A study may be undertaken to know the effect of Constructivist approach on students' self-concept and their learning process.
- ❑ In this study only 5E's Model has been implemented. Other models of constructivist approach (ICON MODEL) may be taken up for the purpose of study.
- ❑ Problems and issues regarding assessment through constructivist approach is an emerging topic to investigate for the present situation.

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