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CONSTRUCTIVISM: TOWARDS A PARADIGM SHIFT IN CLASSROOM TEACHING & LEARNING

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Abstract

Constructivism is a theory of Knowledge, a philosophy of learning. Its proponents include Piaget, Vygotsky and later-day philosopher Glasersfeld. The constructivist philosophy has been adopted in teaching of science by many enthusiastic pedagogues and teachers in many countries. A Constructivist pedagogy does not consists of a single teaching strategy. Instead, it has several features that should be attended to simultaneously in a classroom. It has been asserted that for a successful constructivist strategy, the teaching has not only to be student-centred and the teacher a mere facilitator, but the teacher has the added responsibility to create a conducive classroom environment. Research has established that constructive methods of science teaching have been much more successful than the traditional methods. In the present research paper the author has identified some of the most important reasons for lack of success of constructivist strategy, especially in developing countries.

Keywords: *Constructivism, Classroom environment, Collaborative learning, Scaffolding, Reflecting, Peer dialogue, Science education, Technology.*

1. Introduction

Constructivism is a theory of knowledge, i.e.; epistemology and a theory of learning. It is not any particular pedagogy. Constructivists believe that human beings are active information receiver. They use their existing experience to construct understanding that makes sense to them. Humans assimilate and accommodate new knowledge and build their own understanding. Knowledge is viewed as personal and subjective. Reality resides in the mind of each person. Learning takes place when individuals make use of their existing knowledge and experience. Thus, multiple interpretations of an event are possible, and multiple answers to a question are source of creativity in learners. It is held by constructivists that learners need time to reflect on their experiences in relation to what they already know. After some time, they reach consensus about what specific experience means to them.

Constructivism is an epistemological view of learning rather than teaching. Students' previous knowledge and their active participation in problem solving and critical thinking all play a crucial part in the construction of knowledge. One of the most important

goals of constructivism is to develop students' critical thinking skills, which is possible only in a conducive learning environment in the class. The teacher may have to improvise the day's lesson or change the sequence of activities, depending on the needs of the students or due to any other unexpected development. Such flexibility is said to be a valuable quality of a positive learning environment. The following are some of the important features of a constructivist learning environment:

1) Learners should be challenged by ideas and problems that generate inner cognitive conflicts.
2) Learners are encouraged for active participation in the classroom activities and raise questions.
3) Learning environment should encourage students to enter into dialogue with the teacher as well as with their peers.
4) Students should be given sufficient time for reflection, for constructing relationship and for discussion.

1.1 Objectives of the Present Study

The following are the major objectives of the present study:

(1) To explain the Constructivist Philosophy and to know its major exponents.

(2) To identify important features of Constructivist philosophy having relevance in Science classrooms, and to know the related pedagogies which can be usefully applied in Science teaching.

(3) Another objective of the present study is to find how far constructivist strategies have been successfully employed in schools, both in India and abroad, and why it has had only a limited success elsewhere, especially in developing countries.

(4) To present a few suggestions to improve the chances of success for a constructivist science classroom, including better training of teachers and more financial and moral support from the administration and government.

1.2 Methodology of the Present Study

This research is a descriptive study of constructivist philosophy and its implementation in academics. Keeping in view of availability of the resources and thefeasibility of the present research study, the author conducted his research studies on the basis of secondary sources of data. Secondary data has been collected from several books, research articles published in standard and prestigious Journals etc. The author has included the thoughts and views of various important philosophers in the field.

2. Views of Some Early Constructivist Philosophers

a) Jean Piaget (1896-1980)

Piaget's constructivist theory is based on analogies with biological evolution and adaptation. He believed that the child's own actions in this world were important for cognitive development. The social context was important in this development process. Cognitive structures build up from simple initial processes in conjunction with personal action and experience. The development is a form of adaptation to the environment. Later, Piaget tended to shift from the isolation of individual to a more social learning process.

b) Lev Vigotsky (1896-1934)

He believed that the developmental process was governed by the learning process. Pedagogy creates learning processes that lead to development. He distinguished between actual (development) and potential (learning) levels of development. Actual level is achieved independently, potential levels is obtained by the guidance of an adult.

In Vygotosky's (1986)[11] scheme, in the process of constructing knowledge, the learner is not only active internally but also in a social context with the learning material. Here comes the use of "cognitive conflict". If the designed activities lead students to a framework which differs from correct scientific concepts, this creates "cognitive conflict". This 'conflict' should be neither too easy nor too difficult. That is, the 'conflict' should neither be beyond their capabilities nor should be too easy. It should be within Vygotsky's "zone of proximal development". When a child cannot accomplish a task alone and can find a peer who possesses a slightly higher cognitive level, one within the child's "zone of proximal development", the child can complete the task with that person's assistance. In Piagetian cognitive Constructivism the emphasis is on the individual constructing knowledge through a cognitive process of analyzing and interpreting. In Vygotskian social constructivism, emphasis is on the social interactions with the teacher and peers.

c) Ernst Von Glasersfeld (1917-2010)

Von Glasersfeld is known for his "radical constructivist" philosophy. According to Von Glasersfeld, knowledge is not passively received but built up by the cognizing subject. He calls his theory as "theory of knowing" rather then a "theory of knowledge". Von Glasersfeld underscores the importance of active learning. Knowledge is entirely constructed out of social relations. Knowledge needs to be relevant and related to the person's interest. The teacher can create environments so that kids can act upon the basis of their ideas and discover which of their ideas lead to 'friction' and need revision.

Glasersfeld is a radical constructivist. He asserts that internalization is a condition for learning. "The responsibility of learning resides increasingly with the learner" (Glasersfeld, 1989)[8]. Learners construct their own understanding. Glasersfeld also believes that sustaining motivation to learn is strongly dependent on the learner's confidence in his potential for learning. This feeling of confidence in his own competence is derived from his first hand experience with problems.

3. Constructivism in a Science Classroom

There is no single Constructivist strategy for instruction in the class. Different pedagogies and researches have highlighted various elements in varying degrees for the benefit of classroom instructors. Even so, there are several common themes which can be described here. Education is a student-centred process and the teacher is only a facilitator. Learning depends on shared experience with peers and teachers. Collaboration and cooperation is a major teaching method. Students actively explore and use hands-on experience. The constructivist views knowledge as being constructed in a social context. It is an active social process. Learners cannot construct understanding alone; they do it collaboratively, through interactions. Learning is an active process; hence the learner should be encouraged for guesswork and intuitive learning.

"Thinking" effectively, with focus on the problem at hand, is an important aspect of Constructivist learning. "Understanding" becomes clear and strong if the learner "thinks" over the issue at hand and if he can monitor his own thinking. "Thinking" is also called "self-reflection". An expert learner thinks about his own thinking. It helps in self-questioning and self-reviewing. It is called "metacognition" or a purposeful thoughtfulness. A motivated and thinking learner tries to check his errors and tries to find why he failed in his earlier attempt. Such a learner's knowledge would be deep and durable. As Yager says, "One only knows something if one can explain it", (Yager, 1999)[12]. On the other hand, a novice leaner does not check for quality in his work and thus he fails to make amends to his earlier errors.

3.1 Teacher's Role in a Constructivist Science Classroom

A teacher is not an authority. He does not lecture. He is a facilitator or guide. He helps the learners. The facilitator has to create proper environment in the class so that the students are motivated, challenged and think deeply to arrive at his own conclusion.

As a facilitator, the teacher has to support the learners in becoming effective thinkers. The facilitator and the learners both learn from each other. Students should be encouraged to arrive at their own version of truth and then compare it with that of the instructor as well as

with that of their fellow learners. Teachers have only to observe in the beginning of a session and assess the progress. They should pose questions to create right environment. They should intervene if any "conflict" arises or if the process of learning is going astray. An important task for a constructivist Science teacher is to create a "learning environment" which facilitates students thinking and motivate them to explore. An authentic leaning environment is obtained if real-life complexities and real-world situation is simulated. A Science teacher creates congenial learning environment when learning goals are negotiated through consensus and dialogue with students.

Direct instruction is not appropriate. Learning should take place by "active involvement" of the students, by "doing", by generating their own ideas. In a well planned classroom environment, students learn how to learn. Learning is like a spiral. Students reflect on their past experience and integrate new experience.

Teachers can use various strategies to promote and strengthen students' capacity to think and to "think about their thinking". Eggen, P & Kauchak, D, (2007) have suggested the following strategies for the purpose:

(i) Teachers should pose some provocative questions to students and also encourage them to frame their own questions on the problem at hand.

(ii) **KWL Strategy:** Teachers should teach the students to be aware of (a) what they already Know, (b) what they Want to learn, and (c) What they have eventually Learnt.

(iii) **PQ4R strategy:** PQ4R is an acronym for Preview, Questions, Read, Reflect, Recite and Review.

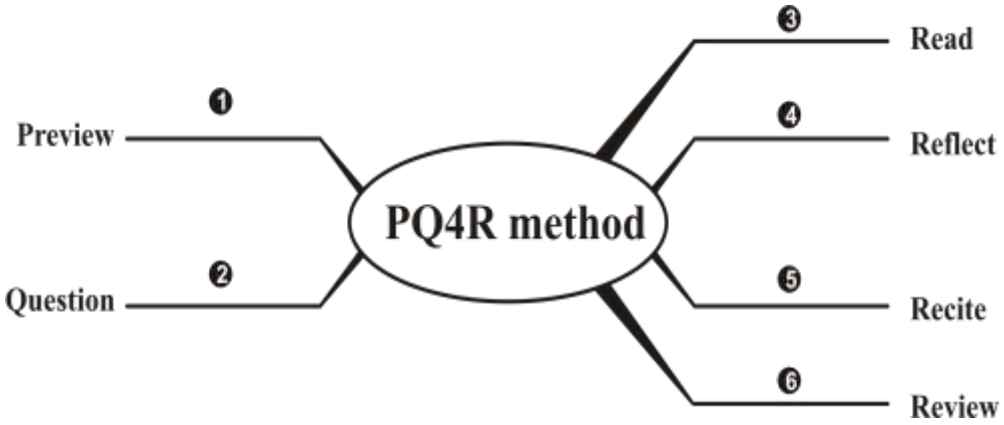

Figure 1: PQ4R strategy

The steps are described below:

Preview: The learner surveys the material.

Question: Students ask questions on the available material.

Read: Students read the material to ask questions.

Reflect: The learners think about the material, relating it to the things they already know.

Recite: The students practice remembering.

Review: The students review the material and ask questions.

(iv) **IDEAL strategy:**

IDEAL is an acronym for Identify, Define, Explore, Act and Look. To facilitate effective thinking, the teacher can teach each of these metacognitive skills to students. Identify potential difficulties, and define these problems. Then, students explore to find solution. Finally, they have to look and note which actions lead to solutions.

3.2. Collaboration and Scaffolding in a Constructivist classroom

Students are encouraged to work together to discuss a 'controversy', to ask each other questions. Students should be allowed for 'reciprocal' learning. A less skilled child may be 'tutored' by a more skilled child. Such cooperative learning and group discussion definitely create great interest and motivation among the students.

Some experts have also recommended the organization of "jigsaw" techniques. In a jigsaw technique, students are divided in groups and one member from each group is taught new skills. This "expert" member then goes back to his original group and teaches the new skills to his group members. A particularly weak student may be given greater help and support by his teachers or even by his peers. This level of support may be changed, increased or decreased, as needed by that student. This is called "scaffolding".

3.3 Assessment and Examination in a Constructivist Science Classroom

The traditional system of evaluation and examination has more or less remained unchanged in schools. The summative approach – an examination at the end of school year—promotes accumulation of knowledge. Most of the students cram their notes and resort to rote learning. Such a procedure sends a very wrong message to the students---that learning means simply reproduce lessons without understanding it.

In a constructivist set up, the traditional assessment system will defeat the very purpose of teaching. Learning means "understanding" and which implies that one is able to explain what one knows. In a constructivist approach, assessment is interwoven with teaching. Students' activities, their work and portfolios, are all taken into account. It is their understanding and "knowledge" that is assessed.

Though judgments are involved in a constructivist classroom, but these are given to community authority and negotiation rather than to the individual teacher. In addition, assessments are made using multiple authentic measures, such as observations, dialogue journals, field notes, and portfolios, as well as test scores. These authentic assessments encourage students to participate in lifelike problem-situations, which are therefore long remembered. Memorization of facts is less important than developing skills for problem-solving and life-long learning. The real purpose of assessment should be to assist the teacher in determining how well the student is mastering the concepts. Hence students' performance should be monitored continually while the lesson is taught.

4. Conclusion

In many countries, like USA, Italy, Turkey, Nigeria and many other countries efforts have been made to adopt constructivist philosophy in the teaching of science classes. It has been noted that these practices were made in primary and secondary schools. Obviously, constructivist theory relates more to growing children and not much to the higher learning stage.

Mathews (2000)[7], says that there are limitations in applying constructivist principles to science education, because many scientific concepts such as atomic structure, electro-magnetic radiation, have no connection with prior conceptions. Then there may be some students who have not developed the schemata enough to understand the information provided by the teacher. Studies in Nigeria have established that the pupils taught using constructivist strategy achieved significantly better scores in their examinations then those taught by expository strategy (Etuk, 2011)[2]. The constructivistically taught students scored higher both on the post test and on the delayed post test.

Teachers generally offer resistance to adopting constructivist position. The reason is simple. Firstly constructivist strategy is time consuming. Students have to be given ample time for "reflecting", group discussion and so on. Teachers are generally worried about covering the syllabus within a limited time. This time factor has placed great practical constraints on the implementation of constructivist learning. In most private and government schools, many students come from a very poor background. They are slow and have little motivation or interest in learning. In fact they do not possess the minimum level of readiness that leads to learning.

Secondly teachers are not trained in constructivist methodology. Generally teachers are averse to creating learning environments as it entails "waste" of time. Pre-service teacher

training should include constructivist methods. Technology has a definite role to play in a constructivist classroom. It has been found that online animations, virtual labs, computer software and sensors have increased test scores significantly.

Most of the schools in India lack access to technology. Unless the government helps in a massive way, most of the schools and school teachers in India are not likely to change their ways.

In order to create constructivist setting for the learners, the pre-service and in-service teachers should be trained in constructivist setting. It has been found that the prospective teachers trained in a constructivist setting are able to be effective constructivist teachers (Hasssard, 1999)[4].

To conclude, it can be said that Constructivist pedagogy is a very effective means of science teaching. However, the success of this pedagogy presupposes that the teachers should not only be well trained in a constructivist approach, but they should also be dedicated enough to follow its requirements patiently. This strategy is time consuming and requires lot of patience on the part of teachers and administrators. The teachers should also be trained in the use of relevant technologies. This all implies massive support from administration and the government.

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