

RELEVANCE OF CONSTRUCTIVISM APPROACH IN TEACHING-LEARNING OF SCIENCE SUBJECT

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Abstract

Learning is a spontaneous and continuous social process in human life in which man or learner learns himself through his experiences interacting with his environment. The child is easily connected to the environment around him, due to which he feels comfortable to learn under natural conditions. This law or principle of learning is called constructivism in which the child creates or constructs his own knowledge by interacting with his environment. It would be more accurate if constructivism is called a natural or naturalistic theory of learning. Emphasis should be laid on making teaching student-centred rather than teacher-centred because the traditional method of teaching does not provide opportunities to the students to interact, and this method encourages rote system. Whereas the first duty of the teacher is to develop the inherent abilities of the students. During teaching-learning, the teacher should provide such opportunities to the students in which the learning meaning of the students can be complete, permanent, and easy. If the method of teaching used by the teacher is meaningful, then the learning becomes interesting, simple, and easy. Along with pedagogy, the teacher should also keep in mind the interests and needs of the students.

Keywords: *Constructivism, Science Subject, Role of Teacher & Student, 5 Es*



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Introduction

In the present time, education acts as an important tool for human development and social life, but the question arises that what is education? Is it just a degree? Or something more. Education is the process of acquiring or imparting knowledge and information but how does a student or individual acquire that information and knowledge? This is an important question for education. The ancient education system in India was teacher-centred in which teachers directly transferred knowledge to the students. In this education system, the students might have

acquired the knowledge, but they were unable to retain it for a long time so that they could not apply it in their life. An education that does not contribute to our real life is not a complete learning meaning. Therefore, teachers should always try to teach the students using effective teaching method so that meaningful learning takes place. Teachers provide teaching through the experiences gained in their daily life so that the students can have real learning but even today during teaching knowledge is transferred only from one mind (teacher) to another mind (student). Students should be provided with an environment for learning where they can mutually acquire knowledge and skills and the emphasis should be on making teaching student centric rather than teacher centric as the traditional method of teaching does not provide opportunities for students to interact and this method promotes rote system. Whereas the first duty of the teacher is to develop the inherent abilities of the students. During teaching-learning, the teacher should provide such opportunities to the students in which the learning meaning of the students can be complete, permanent, and easy. It is very important for a good teacher to have knowledge of the syllabus. Along with this, he should also have knowledge of proper pedagogy. If the teaching method used by the teacher is meaningful, then learning becomes interesting, simple, and easy. Along with pedagogy, the teacher should also keep in mind the interests and needs of the students. National Curriculum Framework 2005 has been described that keeping the student in mind at the core of education, the teacher should present examples related to his daily life and surrounding environment during teaching so that he can become acquainted with his daily experience and environment. Easy to install and learn. The National Curriculum Framework 2005 lays emphasis on the way students learn. The most important point is what is the student learning? What is more important than knowing how the student is learning it? It is essential to know this.

Concept of Constructivism

Constructivist pedagogy has special importance in the present times. According to constructivism, a person creates new knowledge through the interaction of his previous knowledge and new circumstances. The word constructivism in the English language is derived from the Latin word “construere” which means to construct or to give structure or to arrange. Constructivism is a logical theory based on philosophy and psychology (**Glaser Field, 1995**). Constructivism is a set of beliefs relating to the human learning process that describes constructivist learning theory and constructivist teaching methods. Constructivists believe that knowledge is formed by active participation rather than by imitation or repetition of learning

material and that knowledge is created by the learner himself actively (**Jones & Brader-Araje, 2002; Piaget, 1967**). Constructivism is a theory related to learning which explains that the learner constructs new knowledge because of observation and scientific study. The learner from birth adapts to stay away from the uncertainty of the environment and tries to develop this ability in a coordinated manner. When a learner is faced with an event that he has never experienced before, it creates a kind of cognitive imbalance, which he balances through assimilation and adjustment. Prior experiences play an important role. It is only because of similarity that the learner can construct new knowledge for himself (**Piaget, 1977**). Social interaction plays an important role in the process of knowledge formation. Knowledge is formed by interaction and observation in social situations (**Vygotsky, 1978**). Constructivism is a philosophy of learning based on the idea that we acquire world-related knowledge based on our experiences. Each learner creates rules and mental patterns for himself individually based on his previous experience and he uses them to learn new knowledge and experience. Therefore, learning is a process of adjusting our mental images to new experiences (**Bruner, 1986**). Constructivism is a type of epistemology in which knowledge, sources of knowledge and the process of knowledge creation are described from a specific point of view. It also analyses how the knower constructs knowledge.

The name of the psychologist Jean Piaget is well-known as the originator of the constructivist ideology, who established the theory of cognitive development and the foundation of the cognitivist ideology as distinct from the behaviourist approach to learning. Behaviourists believe that the child learns only from the environment. On the contrary, Jean Piaget believes that in the learning of the child, along with the environment his cognitive abilities also contribute. Thus, the interaction between the environment and the mental structures plays an important role in the learning of the child. After Jean Piaget, the constructivist psychologist Lev Vygotsky rejected the notion that the child learns only through the interaction of mental processes and the environment. Unlike Piaget, Vygotsky pointed out that learning always takes place in a socio-cultural environment. Therefore, learning should always be viewed from a cultural and social perspective. Vygotsky pointed out that the role of society and culture in a child's learning is very important. Thus, here the constructivist approach was divided into two ideologies - first Cognitive Constructivism, whose originator and strong supporter is the famous psychological scholars Jean Piaget, Bruner etc. and the second is Socio-Cultural Constructivism, whose promoter and Supporter Vygotsky is considered. According to the

constructivists each student creates his own knowledge. In the constructivist perspective, the student is not a blank plate, rather he builds his knowledge based on the cultural element and prior knowledge of a situation.

Philosophical and Psychological Philosophy of Constructivism

Constructivism is not a new concept, but its origins lie in philosophy that is used in sociology and anthropology as well as cognitive psychology and education (**Nagalakshmi, 2011**). The famous American philosopher and great educationist John Dewey (1859–1952) believed that knowledge should be based on the learner's prior knowledge and lists so that his learning becomes simple and effective (**Gordon, 2009**). The American psychologist Bruner, who made special contributions to the cognitive psychology of humans and the theory of cognitive learning, holds that learning is an active process in which the learner constructs new ideas or properties based on his or her current and previous knowledge. In this process, the learner receives and analyses the information with the help of visual-visual, image-image and symbolic models, as if to his brain, and obtains new experiences. The learner interacts with his previous experiences to create new and unique knowledge for himself (**Nagalakshmi, 2011**). The development of constructivist ideology in the field of education and psychology has occurred in a paradigm shift from behaviourism to cognitivism, from cognitivism to constructivism, like a paradigm shift (**Cooper, 1993**). In the process of learning, a behaviourist gives the main place to the learning material and the major influence of the environment on the learning whereas a constructivist emphasizes on how the learner is constructing the knowledge rather than the learning material in the process of knowledge formation. (**Richardson, 2003**).

Hall (2018) & Durphy and Cunningham (1996) make the following points about constructivism in education:

1. Learning is an active one where knowledge is not acquired but created in which human beings play an active role.
2. Prior experience and knowledge play an important role in the formation of new knowledge.
3. Man creates knowledge because of the interaction of his previous knowledge, experience, and new situations.
4. Social interaction and language are very necessary in the formation of new knowledge.
5. In the process of new knowledge creation, instruction helps in building knowledge rather than transferring knowledge.

Thus, according to the constructivist view, the learner is an active being in the process of knowledge formation (**Parkins, 1992**) who are individually or collectively and action-based experiences for knowledge formation.

Role of Student in Constructivism Approach

Constructivist ideology believes that the learner creates his own knowledge because of the interaction of his past experiences, knowledge, and new situations. The learner does not receive the knowledge as a passive listener, but as an active producer, he constructs the knowledge through various activities. In the field of education, the student constructs his knowledge in many ways, such as the student creates his own knowledge by being physically active. At the time of creation of new knowledge, the student makes a symbolic form related to the new knowledge and this symbolic form is the student. It is based on prior knowledge and the student constructs his new knowledge with the help of social interaction. Constructivist pedagogy believes that each student is unique in his own right. The teacher should motivate the students to use their previous knowledge in the classroom, they have intuitive concepts in their mind, keeping in mind that the teaching-learning process should be completed. Also, communication should be done between the groups. Students should be encouraged to ask questions in the class and the views of the students should be respected.

Role of Teacher in Constructivism Approach

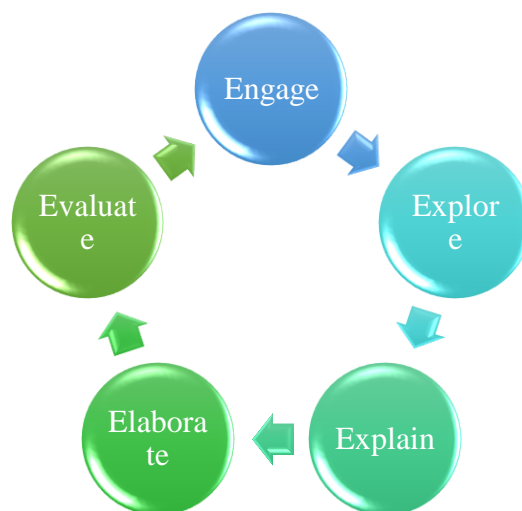
Constructivist teacher tries to create such an environment in the classroom and school to construct knowledge in which students can independently construct their knowledge through various activities. The function of constructivist teaching is to guide and not to answer a problem. Students make their own decisions and create meaning. For meaningful learning, the teacher should organize the students' class and their curriculum so that they can work together. The constructivist teacher also motivates the students to take initiative on their own and acts as a facilitator to create a conducive environment. Along with this, he also helps the students in solving their problems, questions, curiosities, and their difficulties. It is also necessary for the teacher to know the pre-formed understanding of the students and make it a part of the teaching-learning process. The role of the teacher is like that of a facilitator who acts as a facilitator in the ongoing teaching-learning process. Constructivist teacher provides ample opportunities to the students to build new knowledge based on their previous knowledge. At the same time, it also promotes their interaction in the classroom.

A constructivist teacher provides opportunities for students to work together to build knowledge, which is called collaborative learning. Constructivist teacher does not use anyone teaching method, rather he chooses the teaching methods keeping in mind the needs and interests of the students and based on the selection of teaching methods, he ensures that the student himself has more opportunities to construct knowledge. to get more opportunities. The constructivist teacher provides an opportunity to the students to share their information before giving their information on any concept. A constructivist teacher also asks open-ended questions to increase students' thinking. At the same time, he also encourages students to engage in dialogue in which he encourages his peer group to ask questions. Constructivist teacher uses formative assessment instead of summative assessment to assess the knowledge of the students.

5Es Constructivist Teaching Learning Model

The 5Es constructivist teaching-learning model is a teaching model based on the constructivist learning ideology, which was developed in 1987 by Roger Bybee, working in the Biological Science Curriculum Study Colorado, to design the curriculum for Science for Life and Living (Madu and Ezeamagu, 2013). According to the constructivist learning ideology, before the learner learns his ideas, he examines the criteria of pre-established ideas present in him. If these new ideas match with his earlier ideas, then he learns them quickly and if these ideas do not match with his pre-established ideas, then he finds it difficult to learn these ideas. The 5Es is a constructivist teaching model with a learning cycle which includes the following 5 stages (Ranjan & Padmanabhan, 2018; Singh & Yaduvanshi, 2015).

Fig. 1: Learning Cycle of 5E Model



1. **Engage** - This is the first stage of the 5E constructivist teaching-learning model in which the teacher understands the previous knowledge of the learners and tries to connect the learner with the new knowledge on the same basis. Prior knowledge plays an important role in learning new knowledge. Teachers work to add new knowledge with the help of many activities by getting information about the previous knowledge of the students through various mediums. In this first stage, the teacher must take special care that he should choose the activities in such a way that he is able to establish the relation between the knowledge shown to the student in the past and the present and expose the concepts learned earlier.
2. **Explore** - The second stage of the constructivist learning paradigm is investigation. Exploration provides a common basis for student activity. In exploration, students are required to identify their current concepts. In this stage the student also gets the opportunity to change his thoughts.
3. **Explain** - The most important stage of the 5E constructivist learning paradigm is the explanation, which attempts to focus the attention of the students on a specific aspect of the experiences of their engaging stage and exploration stage and demonstrate their conceptual Behavior or processing skills. offers opportunities. This stage also provides opportunities for teachers to introduce new knowledge concepts, processes, and skills. The teacher takes the help of various activities to clarify any new knowledge. Students learn their new knowledge and concepts based on understanding. The teacher also guides the students through various explanations to develop new knowledge and deeper understanding of the concepts.
4. **Elaborate** - In this stage of the 5E constructivist learning model, the student tries to understand the new knowledge gained in detail and depth based on his experience and tries to increase his knowledge, skills, and information. To elaborate knowledge, teachers present different types of problems to the students. Through new experiences, students develop a deeper and wider understanding and adequate skills. Students use their understanding of concepts by conducting extracurricular activities.
5. **Evaluate** - The final stage of the 5E constructivist learning paradigm is evaluation. Students' ability to use conceptual understanding and skills begins at the engagement phase and continues throughout the model. That is, in this stage the student tries to

know his understanding of knowledge. At the same time, the teacher also ensures whether the teaching objectives are progressed or not.

Relevance of Constructivism Model in Teaching of Science Subjects

According to the constructivist approach, in the education of science subjects, when the student actively encounters the learning material, then he constructs his knowledge. The environment and the student's prior knowledge play an important role in the process of knowledge formation (Konold & Johnson, 1991; Glaser Field, 1995). Students of science subjects build science related knowledge with the help of their daily life experiences. Describing the process of knowledge formation in science education, Pasley, Weiss, Shimkus & Smith, (2004) "Looking Inside the Classroom: Science Teaching in the United States" in their book make the following four important assumptions:

1. The learner constructs his own knowledge.
2. The formation of new knowledge is based on its previous experiences.
3. Social interactions only increase learning patterns.
4. Meaningful learning occurs because of the interaction between past experiences and new situations.

In the **National Curriculum Framework 2005**, special emphasis has been laid on the fact that the teacher should teach to build knowledge. Students actively build their knowledge based on pre-existing ideas and currently available materials and activities. A boy or a girl engaged in the process of learning constructs her own knowledge. The National Curriculum Framework 2005 also clearly states with reference to the subject of science that science is a dynamic and constantly growing store of knowledge in which new areas of their experiences are included. Therefore, while deciding the nature of science, various aspects should be included in it. While deciding the nature of science subject, it must be kept in mind that children can get maximum opportunities to learn on their own. Formal education in school develops the natural ability of the student to create knowledge. Therefore, science education in the school should be arranged in such a way that the student's activity can be encouraged, and opportunities should be provided for expression of his own experiences. Students can learn easily in an environment where they feel that they are being valued i.e., the student is being placed at the centre. Curriculum accommodating to real situations inside and outside the classroom facilitates knowledge building among students. Therefore, teaching-learning process should be organized in constructivist science class considering the student as the centre.

Conclusion

In conclusion, it can be said that if the teaching-learning work is done keeping the needs and interests of the student as the focal point, then the student is necessarily more capable of learning than teacher-centred education. Constructivism tries to provide such an environment to the students in which the student can learn easily through the environment around him. At the same time, he constructs new knowledge from his experiences and this type of learning makes him successful and able to overcome difficulties in real life. Learning should be in such a way that the learner can self-engage and learn in detail through investigation, explaining and enhancing his/her knowledge, skills and information and the teacher can evaluate his/her learning progress. A constructivist teacher provides opportunities for students to work collectively to build knowledge. Constructivist teacher does not use any one method of teaching, rather he chooses the teaching methods keeping in mind the needs and interests of the students. The constructivist teacher also motivates the students to take initiative on their own and acts as a facilitator to create a conducive environment. Along with this, he also helps the students in solving their problems, questions, curiosities, and their difficulties. Thus, constructivism provides an opportunity to the students to construct new knowledge based on their previous knowledge.

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