Constructivist Approach in Science Teaching

Prof. Dr. Chidananda Pandit (C.N. Pandit)
Faculty of Education, Tribhuvan University, Nepal

Abstract

Constructivism is a recent and applicable approach among the different methods of teaching, which was developed to improve the teaching learning activities. The instruction is based on teacher centre learning whereas constructivism looks for better things for children to do and will learn by doing. How learner build on existing or prior knowledge to incorporate new knowledge based on their learning experiences and the theory based on the principle that knowledge is not discovered but constructed in the mind of learner. The resulting perception and effect in the classroom are evidents in students' recognition that are legitimate on involving questions. Most of the teaching strategies are found to be autocratic and traditional. It is too difficult to choose appropriate methods according to students' need and interest. The learning of science in Nepal is facing many problems due to lack of qualified and untrained teachers, teacher materials, laboratory facilities and so on. To overcome these problems, constructivist methods should be used to develop the scientific ideas, concepts and active practicing in classroom activities.

Introduction

Constructivism is a learning theory in which learning is seen as an active process in which learner constructs new ideas or concept based on their current and past knowledge. Constructivism is the view in which active role of the students or learner in building understanding and making sense of information. Constructivists believe that we construct meaning based upon air interactions which air surroundings. So, it is a model or metaphor of how learning takes place. It can only be understood through two roots. Ontology has been taken as issues concerning the nature of being and seeks to answer the question and epistemology: related to the origin, foundation, limit and validity of knowledge central question of epistemology.

The constructivist perspectives are grounded in the research of Piaget, Vygotsky, Brunner, Gestalist, Bartlett as well as educational philosophy of John Deway. There are various types of constructivism like cultural constructivism, radical constructivism, critical constructivism, social constructivism, genetic epistemology and cybernetics constructivism. According to Jean Piaget, human beings develop increasingly more complex level of thinking in definite stages. Teaching is the creation of environments in which students cognitive structure can emerge and change. The child constantly creates and recreates his own model of reality.

In another way, L.S. Vygotsky was the founder of social constructivism. An important concept for social constructivists is that of scaffolding which is the process of guiding the learner from what is presenting known to what is to be known. Child learns from the society. Children solve practical work with the help of their speech as well as their eyes and hands have social origins and that they learn through interaction with others. According to Vigotsky (1978), learner problem solving skills fall into three categories as student cannot perform, may be able to perform and can perform with help. In most of theories in cognitive science include

some kind of constructivism because these theories assume that individual construct their own cognitive structure as they interpret their experiences in particular situation. Basic assumption of constructivism:

1. Focus on knowledge construction/ All knowledge is constructed.
2. Learning is an active process.
3. Individual make meaning through the interaction with each other and with the environment they live in.
4. Knowledge is not merely a commodity to be transmitted, encoded, retained and reapplied but a personal experience to be constructed through a previous knowledge.
5. Learner is a unique individual.
6. Social and cultural background of student is significant.
7. Instructor as a scaffolder.
8. Collaboration among learner.
9. Focused on contextualization.
10. Focused on whole learning.
11. Each learning is meaningful.
12. Flexible learning.
13. Zone of proximal development.
14. Learning is an active process of constructing rather than acquiring knowledge.
15. Instruction is a process of supporting that construction rather than communicating knowledge.
16. All knowledge construct through the process of reflective abstraction.
17. Learner's cognitive structures facilitate the learning process.
18. An individual's cognitive structures are constantly developing.
19. Pedagogy back up it and making sense experience.

As discussed previously, in constructivism all learning needs to construct their own knowledge and understanding. According to Malone and Taylor (1993), human knowledge is a process of personal cognitive construction, or invention undertaken by the individual who is trying to make sense of his social or natural environment." This citation supports that knowledge is a construction of reality.

Constructivist Curriculum

Constructivism focused on the student-centered curriculum which is comprehensive and highly subjective. "While it should seem fairly obvious that students are not "blank states" and that some form of construction process takes place in the development of learning. (cited in Sharma & Sharma 2011). In the constructivist curriculum, following aspects are focused.

1. Child-centeredness
2. Subjectivity
3. Challenge and stretch learner's competence

4. Focused more knowledgeable order (MKO)
5. Student authentic activity connected to real life environment
6. Interaction between learner and learning task
7. Embedded learning is the social experience
8. Encourage ownership and voice in the learning process

From the above discussion, in the gist, it focused knowledge should not be divided into different subjects or compartments but should be discovered as an integrated whole.

Developing a situation
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Grouping
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Bridging
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Questioning
↓
Exhibiting
↓
Reflecting

Constructivist Learning Design

Learning is not a process that takes place inside our mind, nor is it a passive development of our behaviours that is shaped by external forces and that meaningful learning occurs when individual are engaged in social activities (McMohan 1997, cited in Dhakal and Koirala 2009). The most important element in the process of teaching and learning: According to the biological science curriculum studies (BSCS), Roger Bybee developed the 'Five Es' model as engage, explore, explain, elaborate and evaluate

Constructivist learning environment

In the constructivism the student/ learner constructs a new knowledge/ideas so a certain type of environment is created, i.e. real world environment which provides a variety of experience to the child. According to Jonasgen (1994) (cited in Radha Mohan), following are the characters of the constructivist learning:

1. Provide multiple representation of reality
2. Represent that complexity of the real world
3. Emphasis on knowledge construction
4. Stress authentic task in meaningful context
5. Provide real life settings
6. Encourage reflection on experience
7. Enable content- and context-dependent knowledge construction
8. Support collaboration and social negotiation among learners

Some teaching strategies of constructivist approach

There are many strategies in the field of teaching but construction of knowledge is one of the most important metaphors. So in this epistemology some certain strategies are necessary. Some important teaching strategies of constructivism are:

1. Dialogue and instructional conservations
2. Co-operative learning
3. Problem-based learning
4. Inquiry learning
5. Cognitive apprenticeship
6. Collaborative learning

7. Interpersonal and intrapersonal interaction
8. Instructional analogies
9. Developing higher mental process, i.e. high critical thinking

Constructivist Classroom

In the constructivist classroom, there is a need to create an atmosphere in the classroom in which students discuss their ideas with one another, share ideas with peer group and have discussion on these ideas in a healthy environment. According to the Duschi and Gitomer (1991), focused constructivist classroom is developed in 'Portfolio culture'. The term portfolio culture refers to convey an image of a classroom learning environment that reflects a comprehensive interplay between teacher, student and curriculum. The constructivist classroom has following features.

1. Heterogenous classroom
2. Develop 'portfolio culture' in classroom environment
3. Interaction between teacher-learner and learner-learner
4. Create real-world situation
5. Provide environment to the students to think, reflect upon and construct ideas
6. Classroom environment is non-threatening to allow free discussion and meaningful dialogues
7. Shared knowledge with more knowledgeable other
8. It should provide hand-on-experience to learners
9. The classroom carries the concept of 'inclusive education'
10. The nature of classroom should be 'knowledge sharing' rather than 'knowledge imparting'

A Constructivist Teacher

In this model, it is most important to know the prior knowledge and understanding of students. Learners use prior knowledge to help make sense of the new knowledge being constructed. This helps learners think critically and make informed decisions. The teacher should be perfect in the skill of testing prior knowledge, eliciting students' thought process and bringing their misconception on the surface. In the constructivist theory, teacher should become a 'prime resource centre' but not be the only primary source of information. In this epistemology, the teacher is a facilitator, coach and scaffolder, i.e. supporter to construct the knowledge.

About Learner in Constructivism

Knowledge construction is the active learning process in which learner is not only knowledge receiver, but he/she is active participant to construct knowledgeable ideas. Students/learners challenge each other's conceptualization of ideas in a very healthy environment and with the attitude of learning to learn more.

Learner is very important to construct knowledge in constructivism because child/learner has the ability to create the ideas and sharing with their peers so that the role of learner is not unhealthy competitor. They convert to the peer from competitor to a resource. In this metaphor, learner is

1. Active learner
2. Creator of new ideas or concept

3. User of various method to construct knowledge
4. Interactor
5. Reflection of experience
6. Develop zone of proximal development

Evaluation System in Constructivist Approach

In the constructivist approach, teacher could develop the checklist in which the lists of responses are a matter of 'fact' not of judgment. Constructivist advocates ongoing evaluation rather than one-time evaluation at the end of the different course. There are many strategies of the evaluation but in the field of project work, activities centered action checklist is the one proper guideline for evaluation. Some strategies used in evaluation of constructivist classroom are:

1. Portfolios
2. Checklist
3. Presentation
4. Learner-learner (peer) feedback and assessment
5. Project report
6. Interaction of learner
7. Authentic assessment/ Examination

Conclusion and Suggestion

In order to draw the conclusion from the analysis of the above part of this article, Science is a practical subject which includes various scientific skills (observation, classification, grouping, prediction, reasoning, interpretation, conclusion, drawing, reporting, handling apparatus, record keeping, etc.). For developing such scientific skill as well as scientific attitude, the constructivist approach is suitable and most effective method for science teaching. It concludes that 'learner is active' and teacher as 'scaffolder'.

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