Constructivist Approaches in Science Teaching and Learning

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Abstract

Constructivism is a recent applicable approach among the different methods of teaching, which was developed to improve the teaching learning activities. The instruction of these days is based on teacher centre learning whereas constructivism look for better things for children to do and will learn by doing. How a learner's 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 effects in the classroom is evident in students' recognition that is legitimate on involving questions. Most of the teaching strategies are found to be autocratic and traditional. It is too difficult to choose appropriate methods of teaching so as to meet to students' need and interest. The learning of science in Nepal is facing many problems due to lack of qualified and untrained teaching, teacher materials, laboratory facilities. To overcome these problems, constructivist methods should be used spices to develop the scientific ideas, concepts and active participation of students in classroom activities.

Introduction

Constructivism is a learning theory in which learning is seen as an active process in where learner constructs new ideas or concepts based on their prior knowledge. Constructivism is the view in which active role of the learner in building understanding and making sense of information. Constructivist believes on the construct of meanings based upon air interactions surroundings. So, it is a model or metaphor of how learning takes place actively. It can only be understood through two roots.

i. Ontology: to issues concerning the nature of being and seeks to answer the question.

ii. 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.

i. Cultural constructivism
ii. Radical constructivism
iii. Critical constructivism
iv. Social constructivism
v. Genetic epistemology
vi. 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 learner 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.

In the Vigotky's view, child learns from the society. Children solve practical work with the help of their speech as well as their eyes and hands which have social origins. They learn through interaction with others. According to Vigotsky (1978), learner problem solving skills fall into the three categories.

i. Student cannot perform
ii. May be able to perform
iii. 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. The basic assumptions constructivism are as follows :

- Focus as on knowledge construction/ All knowledge is constructed.
- Learning is an active process.
- Individual make meaning through the interaction with each other and with the environment they live in.
- Knowledge is not merely a commodity to be transmitted, encoded, retained and reapplied but a personal experience to be constructed through a previous knowledge.
- Learner is a unique individual.
- Social and cultural background of student is significant.
- Instructor is taken as a scaffolder.
- Collaboration among learners.
- It is focused on contextualization.
- It is focused on whole learning.
- Each learning is meaningful.
- Flexible learning is significant
- There is zone of proximal development.
- Learning is an active process of constructs rather than acquiring knowledge.
- Instruction is a process of supporting that construction rather than communicating knowledge.
- All knowledge construct through the process of reflective abstraction.
- Learner's cognitive structures facilitate the learning process.
- An individual's cognitive structures is constantly developing.

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."

Constructivist Curriculum

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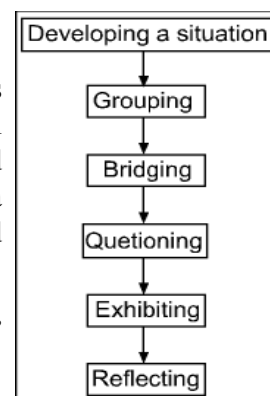
"While it should seem fairly obvious that students are not "blank states" and that some form of construction process takes place in the development of learning." (as cited in Sharma & Sharma 2011). In the constructivist curriculum, following aspects are focused.

- Child-centerness
- Subjectivity
- Challenge and stretch learner's competence
- Focused on more knowledgeable order (MKO)
- Authentic activity connected to real life environment
- Interaction between learner and learning task
- Social experience; embedded learning
- Encourage next of ownership and voice of student in the learning process

In the gist, should not be divided into different subjects or compartments but should be discovered as an integrated practices that consideres learner as a whole rather than a passive part of it.

Constructivist Learning Design

Learning is not a process that takes place inside our mind, nor it is a passive development of our behaviours that is shaped by external forces the meaningful learning occurs when individual are engaged in social activities (McMohan 1997, as cited in Dhakal and Koirala 2009). The most important element in the process of teaching and learning tables as on the right side:

According to the biological science curriculum studies (BSCS), date, Roger Bybee developed the 'Five Es' model. They are :

- Engage
- Explore
- Explain
- Elaborate
- 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) as cited in Radha Mohan, following are the characters of the constructivist learning:

- Provide multiple representation of reality
- Represent that complexity of the real world
- Emphasise on knowledge construction
- Stress authentic task in meaningful context
- Provide real life settings
- Encourage reflection on experience
- Enable content- and context-dependent knowledge construction
- 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:

- Dialogue and instructional conservations
- Co-operative learning

- Problem-based learning
- Inquiry learning
- Cognitive apprenticeship
- Collaborative learning
- Interpersonal and intrapersonal interaction
- Instructional analogies
- Developing higher mental process, i.e. high critical thinking

Constructivist Classroom

In the constructivist classroom, a teacher need to create an atmosphere in which students discuss one another, share ideas with peer groups and have in a healthy environment. According to the Duschi and Gitomer (1991), constructivist classroom a 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.

- Heterogenous classroom
- Develop must 'portfolio culture' in classroom environment
- Interaction between teacher-learner and learner-learner
- Real-world situation
- Participatory classroom environment learn without fear classroom environment
- Classroom environment is non-threatening to allow free discussion and meaningful dialogues
- Shared knowledge with more knowledgeable others
- It hand-on-experience to learners
- Inclusive educational provisions
- '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 to 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
- 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. The epistemology is the teacher is a facilitator, coach and scaffolder, i.e. supporter to construct the knowledge.

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 has the ability to create the ideas and sharing with their peers so that the role of learner is not unhealthy competitor. It converts to the peer from competitor to a resource. In this

metaphor, learner is :

- Active learner
- Creator of new ideas or concept
- User of various method to construct knowledge
- Interactor
- Reflection of experience
- 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:

- Portfolios
- Checklist
- Presentation
- Learner-learner (peer) feedback and assessment
- Project report
- Interaction of learner
- Authentic assessment/ Examination

Conclusion and Suggestion

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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