

### Reconstruction of Mathematics Pedagogy in a Constructivist Perspective

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#### Introduction

Constructivist perspectives on learning have been central to much of recent empirical and theoretical work in mathematics education (Steffe and Gale, 1995, von Glaserfeld, 1991) and as a result, have contributed to shopping mathematics reform efforts (National Council of teachers of mathematics 1989, 1991). Although construction has provided mathematics educators with useful ways to understand learning and learners, the task of reconstructing mathematics pedagogy on the basis of a constructivist view of learning is a considerable challenge.

Constructivism provides a useful frame work for thinking about mathematics learning in classroom and therefore can contribute in important ways to the effort to reform classroom mathematics teaching, it does not tell us how to teach Mathematics, that is, it does not stipulate a particular model.

The word pedagogy meant to signify all contribution to the mathematical education of students in mathematics classroom, it includes not only the multi-faceted work of the teacher but also the contributions to classroom learning of curriculum designers, educational materials developers and educational researchers.

#### Constructivism: An overview

Jean piaget is widely recognized as the founding father of constructivism with his notion that learning is individually constructed constructivism is one of the modern learning theories and it claims that knowledge is constructed by learners themselves. In constructivism, student explore learning environment in order to construct knowledge they do not passively read or listen to the teacher.

Before constructivism was applied in our education system, a teacher-centered approach used to be adopted at schools. The topic to be taught, the aims to be achieved at the end of the

lesson, the method of teaching and the evaluation techniques used to be determined before hand by the teacher. Teachers used to prepare lesson plan, write all the steps to be followed during the lesson and teach the content verbally. In this way, all the decision were taken by the teachers in this teacher-centered environment while students listened to and watched the presented the creativity, self respect and sense of responsibility in the learners. The passive learning situation forgets what he/she learnt in a short time money mathematics educations and education researcher have suggested the constructivist theory is an important strategy.

### Characteristics of Constructivist Learning and Teaching

Honbein (1996) describes seven goals for the design of constructivist learning environments-

1. Provide experience with the knowledge construction process.
2. Provide experience in and appreciation for multiple perspectives.
3. Embed learning in realistic and relevant contexts.
4. Encourage ownership and voice in the learning process.
5. Embed learning in social experience.
6. Encourage the use if multiple modes of representation.
7. Encourage self – awareness in the knowledge construction process.

### Types of Constructivism

The types of constructivism are as follows.

- (i) Trivial Constructivism
- (ii) Radial Constructivism
- (iii) Social Constructivism
- (iv) Cultural Constructivism
- (vi) Critical Constructivism
- (vi) Psychological Constructivism

(i) **Trivial** – This is simplest idea in constructivism what Glaserfeld (1990) calls trivial constructivism what known as personal constructivism. The principle has been credited to piaget, pioneer of constructivist thought and can be summed up by the following statement.

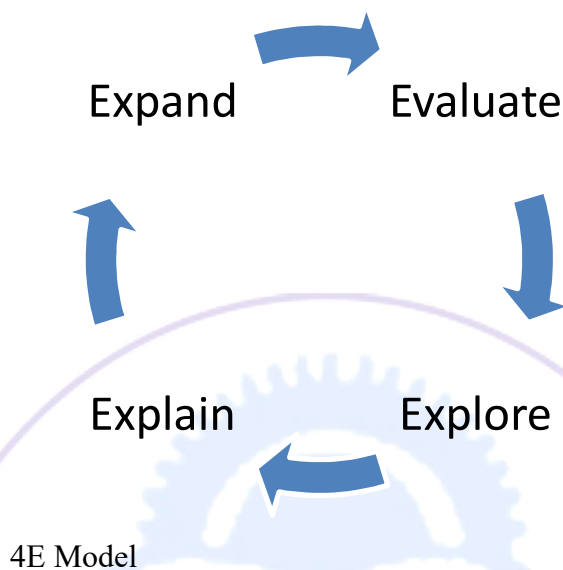
1. Knowledge is actively constructed by the learner, not passively received from the environment.
2. Reacts against epistemologies promoting simplistic model of communication as simple transmission of meaning from one person to another. The prior knowledge of the learner is essentially to be able to actively construct new knowledge.

- (ii) **Radial Constructivism** – It adds a second principle to trivial constructivism, which can be expressed as coming to know is a process of dynamic adaptation towards viable interpretations of experience. The knower does not necessarily construct knowledge of real world.
- (iii) **Social Constructivism** – The social world to the learning includes the people that directly affect the person – teachers, friends, students, a administrator and participant in all forms of activity. This taken in to account the social nature of both the local processes in collaborative learning and in the discussion of wider social collaboration in a given subject such a mathematics.
- (iv) **Cultural Constructivism** – Beyond the immediate social environment of a learning situation are wider content of culture influence including custom, religion, biology, tool and language for example format of a books can affect learning by promoting views about the organization, accessibility and status of the information they contain.
- (v) **Critical Constructivism** – It looks at constructivism with in a social and cultural environment, but adds a critical dimension aimed at reforming these environments in order to improve the success of constructivism applied at referent.
- (vi) **Psychological Constructivism** – It is based on jean Plaget model of developmental of individual. The process focuses learning as a personal, intellectual, individual construction based on experiences of one in the world according to plaget, the child's mind is self – organized by a constant antagonism between internal, subjective, mental states and external reality.

### **Constructivism Design Model**

The constructivism design model is as follows :-

- (i) The learning cycle is a three step design that can be used as a general frame work for many kinds of constructivist activities. The process begins with the discovery phase. In it the teacher encourages student to generate questions and hypothesis from working various materials next the teacher provides concept introduction lessons. Here the teacher focuses on the student's question and help them create hypothesis and design experiments. In the third step concept application student work on new problems that reconsider the concepts studied in the first two steps. The cycle continues again.
- (ii) In 4E model the process is explained by employing 4E's



In this model the process explained by employing five “E” s. They are :- Engage, Explore, Explain, Elaborate and Evaluate

**Engage** – The objective of the first phase of the 5E model is to give students an opportunity to become motivated or excited about the information they will learn engagement is designed to tap in to student’s previous knowledge and identify misconceptions before proceeding with the learning process. This is done with questions, activities, demonstration or stories that grab student’s attention and help them make connections between the new information and the world they know.

**Explore** – In the exploration phase, students interact directly with the material, concepts or phenomenon. The teacher, although intricately involved in the process, acts as a facilitator rather than giving direct instruction to students.

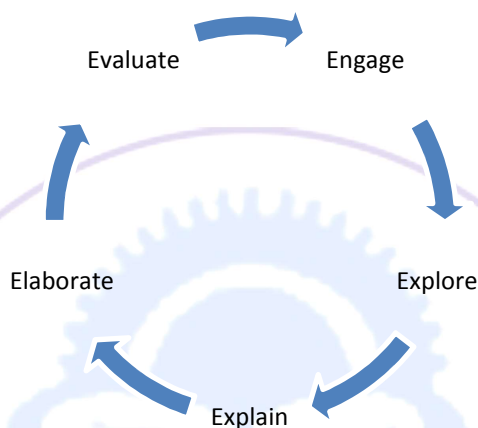
**Explain** – Most of the teachers recognize the explain phase as “lecturing” or interactive discussion, where teachers give students information, they may not be able to collect in their own. At this point in the 5E model, teachers facilitate the students to understand scientific explanations and introduce terminology to provide students with a common language about the content.

**Elaborate** – The Elaborate phase of the 5E model allow the students to apply knowledge they have gained to new situation so that they can expand their understanding.

**Evaluate** – Evaluation is the final stage of the 5E model, it can occur at each phase Evaluation of student understanding need not be formal. It can be a quick question from the

teacher as students as student exit the class or it can be a unit test and summative assessment on specific information.

The 5E learning cycle is shown below –



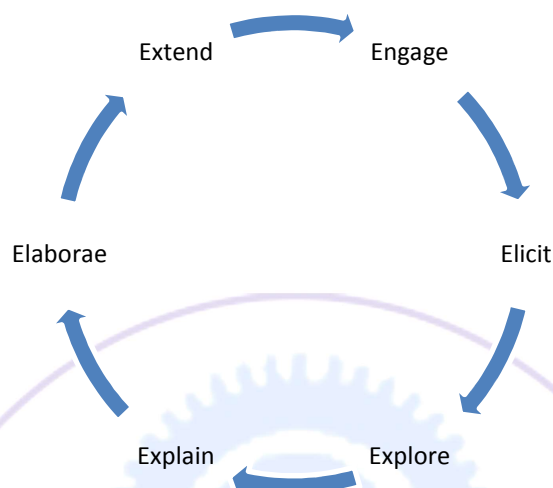
The 5E instructional model and ultimately the learning cycle have been modified or adapted by other researchers as the basis for new instructional strategies. 7E models added two extra phase to the 5E instructional model.

**7E Model** – 7E learning model consists of elicit, engage, explore, explain, elaborate, evaluate and extend steps Elicit is the stage in which the prior knowledge of the learner is elicited by questions and scenarios.

Engage is the stage in which events are associated with daily activities explore is the stage in which students explores knowledge by showing attitudes like Scientist. In this stage student are assisted to explore knowledge.

Explain is the process in which students are expected to explain about their explorations. In the elaborate stage, learners construct new knowledge. In evaluate stage learners make comparisons and discuss their findings with other learners in or outside groups extend stage is the one in which students adopt their constructed knowledge to another subject.

7E model includes almost all the characteristics of constructivist approach and helps to grater extend to understand the mathematics effectively.



### Strategies that can be used

- Grouped Partners
- Jigsaw
- Literature circles
- Numbered Heads
- Philosophical chairs
- Deliberating in a Democracy
- Circle the sage
- Round – Robin Brainstorming
- Think – Pair – Share
- Three Minute Review
- Three Step Interview

### Conclusion

Constructivism gives a frame work for various type of thinking related to mathematics like logical,critical,reflective,problem solving etc. These thinking patterns,can be used to reform mathematics class room in effective manner and pedagogy in generally related with the procedure to teach mathematics in the class room. Mathematics cannot be taught through with lecture method because it needs active participation of student in teaching learning procedure. As it is discuss earlier that constructivism in mathematics deals with construction of basic concepts and logic of the content by the student. Student constructs his knowledge as per his ability and capability. In this process students previous knowledge provide a base for the construction of new knowledge is basically focused on learner's experiences. Mathematics is the subject of logical thinking and prepare student to solve his daily life problems in a systematically manner. If a student has proper knowledge about construction of mathematical

concepts the we will never defeat in any area of his life so mathematics teacher should help students to achieve their goals, creation of learner friendly environment and provide opportunities to student for their overall development.

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