CHAPTER I

INTRODUCTION

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1.0 INTRODUCTION

It seems that every 3 to 5 years a new idea surfaces in the educational community about teaching and learning process. The new ideas are researched, discussed, and argued in institutions of higher learning; however, when it eventually filters down to the teachers in elementary and high school, there is little time invested in explaining and understanding the new theory - they are told, "Just do it!" The latest educational buzzword in India is ***constructivism*** advocated and propagated by National Curriculum Framework for School Education: 2005 (NCFSE 2005) evolved and endorsed by National Council of Educational Research and Training (NCERT). In this context, Regional Institute of Education (RIE), Bhopal being a constituent unit of NCERT, adopted constructivism as an approach to teaching and learning during the of internship in teaching (2013-14) for pre-service trainee teacher education programs i.e. two year B. Ed and B. Sc. B. Ed. and B.A. B. Ed. semester courses.

Furthermore, RIE Bhopal has trained the said pre-service trainee teachers in 5E Model that enables teachers in creating learning situations that falls under constructivist paradigm/ approach. It is in this context the proposed study attempts to inquire into pre-service teachers attitude towards 5E model as they have completed the internship in teaching and learning in various schools of Madhya Pradesh (MP), Maharashtra (MH) and Gujarat (GJ).

Training to pre-service trainee teachers is given through this teaching and learning approach, and design instruction accordingly. The basic definition of constructivism: individuals building their own understanding, to a more thorough explanation of the theory and its various aspects. Examples are provided via the 5E learning Model. The 5E model for designing science lessons is just one method of instruction that supports constructivist teaching/learning.

1.1 GUIDING PRINCIPLES: NCF-2005

1. Connecting knowledge to life outside the school.
2. Ensuring learning is shifted away from rote method.
3. Enriching the curriculum to provide for overall development of children rather than remain textbook centric.

4. Making examinations more flexible, non-threatening and integrated into classroom life.

5. Nurturing an over-riding identity informed by caring. Concerns within the democratic polity of the country.

1.2 WHAT IS CONSTRUCTIVISM?

Constructivism may be considered an epistemology (a philosophical framework or theory of learning) (Jean Piaget), which argues humans construct meaning from current knowledge structures. Formulization of the theory of constructivism is generally attributed to Jean Piaget, who articulated mechanisms by which knowledge is internalized by learners. He suggested that through process of accommodation and assimilation, individuals construct new knowledge from their experiences. When individuals assimilate, they incorporate the new experience into an already existing framework without changing that framework. This may occur when individuals' experiences are aligned with their internal representations of the world, but may also occur as a failure to change a faulty understanding.

1.3 CONCEPTUAL FRAMEWORK

Constructivism in science education is based upon a philosophy that all learning is constructed and that new knowledge is built upon the prior experiences of the learner (Fox, 2001;

Gil-Pérez et al., 2002; Hoover, 1996; Kruckeberg, 2006; Naylor, 1999; Toh, Ho, Chew, & Riley II, 2003). The foundation of constructivism is attributed to the work of Dewey, Piaget, and Vygotsky who maintain that how students respond to new learning situations is influenced by their prior knowledge (Hyslop-Margison&Strobel, 2011).

This philosophy has influenced a change in science curriculum and instruction to take into account students' experiences (Osborne, 1996). Fox (2001) asserts that the foundation of constructivism is based upon the idea that learning is not passively absorbed. It is an active process in which knowledge is both invented and personal to the learner. The key for learning is fundamentally linked to the active participation of the learner. New knowledge can only be constructed by linking meaning to the learner's previous, existing knowledge (Naylor, 1999).

Construction of science knowledge is dependent upon the experiences the student brings into the classroom (Kruckeberg, 2006). With that in mind, teaching is more than filling the learner's head with prepackaged pieces of information that the learner dumps after tests

(Roth, 1990). These "downloaded" pieces of knowledge have little value to the learner unless he is able to organize and process the information in relationship to his current understandings and previous experiences (Henze, 2008; Hoover, 1996; Kruckeberg, 2006).

The constructive process of learning is considered an inquiry process that is student-centered. The learner constantly is referencing new knowledge to prior experiences either to build upon what he/she already knows or to modify existing knowledge. Actively processing information involves examining new information, organizing the information and comparing interpretations with others, all the while trusting that the new knowledge is worth the effort of integration. For students to be able to compare their interpretations to their peers, they must first be able to express their understanding of the information. This articulation process alone helps the student to organize and evaluate his/her understanding. Discussion with peers exposes students to perspectives that may be different from their own and may ultimately result in a different or deeper understanding of concepts (Henze, 2008; Hoover, 1996).The process of integrating knowledge takes time since pre-existing knowledge and beliefs are resistant to change. Because of this, it is important that students be given time necessary for integration of the new material (Hoover, 1996; Hyslop-Margison&Strobel, 2011).

Instruction following the constructivist method does not mean abandoning all traditional instructional tools, such as lecture, which is a viable tool when appropriately used (Hyslop-Margison&Strobel, 2011). Constructivist instruction relies heavily on problem-solving and inquiry-based activities that encourage students to form and test their own ideas, ultimately drawing their own conclusions, which they share in a cooperative learning environment. Throughout this process, the teacher is constantly evaluating student understanding and providing a nudge, when necessary, to consider new ideas or materials to solve problems. Students are able to refine their thinking by being given as many opportunities as possible to practice and apply their newly -gained knowledge (Toh et al., 2004).

1.4 THEORETICAL BACKGROUND OF CONSTRUCTIVISM

Constructivism emerged in the 1980's and 1990's and was based on the study of human learning in increasingly realistic settings. This philosophy has a long history. The major philosophies behind this theory are of Dewey, Montessori, Piaget, Vygotsky and Novak. Later on Posner 1982, Driver 1989, Novak 1993, and others conducted studies on 'how children construct knowledge' and 'how teacher can provide interventions to help children construct their own concept'. According to the knowledge construction view, the

learner is a sense maker, whereas the teacher is a cognitive guide who provides guidance and modeling on authentic academic tasks.

Constructivism believes that students do not come to the class with **'Tabularasa'- clean slate** and their previous experiences, believes and ideas affect the interpretations they make of their observations (driver 1983). Constructivists' and improvement of knowledge based on experiences and observations.

1.5 BASIC ASSUMPTION AND PRINCIPLES

Its **basic assumptions** could be listed as:

- Knowledge acquisition is a constructive or generative process and each student's knowledge is personal and idiosyncratic (Fisher and Lipson, 1986).
- Students hold intuitive ideas that are both identifiable and stable and have enough commonality to make it worth in planning and instructional strategies (Clough and driver, 1986).
- Misconception may originate because of students' interaction/experiences with the real world and/or because of her/his misinterpretations of the world of ideas to him (Driver and Easley, 1978).
- Development of alternatives frameworks or misconceptions is from the same mechanism that leads to the development of conception. In addition, some modes and sequences of presenting information during teaching may result into development of misconception (Eylon and Lin, 1987).
- Due to their different conceptual ecologies, different students can 'incorporate' the same new experiences/ideas differently in their conceptual structures/frameworks (Jordan, 1987).
- The process of concept formation is a continuous process of successive approximation and refinement (Fisher and Lipson, 1986).

Its **basic principles listed as:**

- Learning is a search for meaning. Hence, learning must start with the issue around which students are actively trying to construct meaning.
- Meaning requires understanding wholes as well as parts. Parts must be understood in the context of wholes. Hence, the learning process focuses on primary concept not isolated facts.

- In order to teach well, the teacher must understand the mental models that students use to perceive the world and the assumptions they make to support those models.
- The purpose of learning for an individual is not just memorizing the 'right' answer but to construct his or her own knowledge.

Brooks and Brooks (1993) opined that there are two basic principles of constructivism. They are as follows:

1. The learner actively assembles what a person knows.
2. Learning serves as an adaptive function of storage of useful information.

1.6 CONSTRUCTIVISM AND CLASSROOM

As is the case with many of the popular paradigms, teachers are already using the constructivist approach to some degree. Constructivist teachers pose questions and problems, and then guide students to help them find their own answers. They use many techniques in the teaching process. For example, they may:

1. Prompt students to formulate their own questions (inquiry)
2. Allow multiple interpretations and expressions of learning (multiple intelligence)
3. Encourage group work and the use of peers as resources (collaborative learning)
4. The primary goal of constructivist approach is to helping students: learn how to learn. In a constructivist classroom, learning is constructed.

Students are not blank slates upon which knowledge is etched. They come to learning situations with already formulated knowledge, ideas, and understandings. This previous knowledge is the raw material for the new knowledge they will create. Students control their own learning process, and they lead the way by reflecting on their experiences. This process makes them experts of their own learning.

The teacher helps to create situations where the students feel safe questioning and reflecting on their own processes, either privately or in-group discussions. The teacher should also create activities that lead the student to reflect on his or her prior knowledge and experiences. Talking about what was learned and how it was learned is really important.

The constructivist classroom relies on collaboration among students. There are many reasons why collaboration contributes to learning. The main reason it is used so much in constructivism is that students learn about learning not only from themselves, but also from

their peers. When students review and reflect on their learning processes together, they can pick up strategies and methods from one another.

1.7 HISTORY OF CONSTRUCTIVISM

As long as there were people asking each other questions, we had constructivist classrooms. Constructivism, the study of learning, is about how we all make sense of our world, and that really has not changed Jacqueline Grennan Brooks (1999).

Concept of classroom interview

The concept of constructivism has roots in classical antiquity, going back to Socrates's dialogues with his followers, in which he asked directed questions that led his students to realize for themselves the weaknesses in their thinking. The Socratic dialogue is still an important tool in the way constructivist educators assess their students' learning and plan new learning experiences.

In this century, Jean Piaget and John Dewey developed theories of childhood development and education, what we now call Progressive Education that led to the revolution of constructivism. Piaget believed that humans learn through the construction of one logical structure after another. He also concluded that the logic of children and their modes of thinking are initially entirely different from those of adults. The implications of this theory and how he applied have shaped the foundation of constructivist education.

Dewey called for education to be grounded in real experience. He wrote, "if you have doubts about how learning happens, engage in sustained inquiry: study, ponder, consider alternative possibilities and arrive at your belief grounded in evidence." Inquiry is a key of constructivist learning.

Among all educators, philosophers, psychologists and sociologists who have added new perspectives to constructivist learning theory and practice are Lev Vygotsky, Jerome Bruner, and David Ausubel. Vygotsky introduced the social aspect of learning into constructivism. He defined the "zone of proximal learning," according to which students solve problems beyond their actual developmental level (but within their level of potential development) under adult guidance or in collaboration with more capable peers.

Bruner initiated curriculum changes based on the notion that learning is an active, social processes in which students construct new ideas or concepts based on their current

knowledge. SeymourPaperts' groundbreaking work in using computers to teach children has led to the widespread use of computer and information technology in constructivist environments. Modern educators who have studied, written about, and practiced constructivist approaches to education include John D.Brandford, Ernst Von Glasersfeld, Eleanor Duckworth, George Forman, Roger Schank, Jacqueline Grennon Brooks, and Martin G. Brooks.

1.8 SOME CRITICAL PERSPECTIVES

Constructivism has been criticized on various grounds. Some of the charges that critics level against it are:

1. Critics say that constructivism and other "progressive" educational theories have been most successful with children from privileged backgrounds who are fortunate in having outstanding teachers, committed parents, and rich home environments. They argue that disadvantaged children, lacking such resources, benefit more from instruction that is more explicit. In the context, E.D.Hirsch said, "In truth, progressivism didn't work with all 'privileged' kids, just those who had advantages at home or were smart enough to do discovery learning".

2. Constructivism leads to "group think." Critics say that collaborative aspects of constructivist classrooms tend to produce a "tyranny of the majority," in which a few students' voices or interpretations dominate the group's conclusions, and dissenting students are forced to conform to the emerging consensus.

3. There is a little hard evidence that constructivist methods work. Critics say that constructivists, by rejecting evaluation through testing and other external criteria, have made themselves unaccountable for their students' progress. Critics also say that studies of various kinds of instruction—in particular Project Follow Through, a long-term government initiative—have found that students in constructivist classrooms lag behind those in more traditional classrooms in basic skills.

Constructivists counter that in studies where children were compared on higher-order thinking skills, constructivist students seemed to outperform their peers.

1.9 BENEFITS OF CONSTRUCTIVISM

1. Children learn more, and enjoy learning more when they are actively involved, rather than passive listeners.
2. Education works best when it concentrates on thinking and understanding, rather than on rote memorization. Constructivist concentrates on learning how to think and understand.
3. Constructivist learning is transferable. In constructivist classrooms, students create organizing principles that they can take with them to other learning settings.
4. Constructivist gives students ownership of what they learn, since learning is based on students' questions and explorations, and often the students have a hand in designing the assessments as well. Constructivist assessment engages the students' initiatives and personal investments in their journals, research reports, physical models, and artistic representations. Engaging the creative instincts develops students' abilities to express knowledge through a variety of ways. The students are also more likely to retain and transfer the new knowledge to real life.
5. By grounding learning activities in an authentic, real world context, constructivism stimulates and engages students. Students in constructivist classrooms learn to question things and to apply their natural curiosity to the world.
6. Constructivism promotes social and communication skills by creating a classroom environment that emphasized collaboration and exchange of ideas. Students must learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in-group projects. Students must therefore exchange ideas and so must learn to "negotiate" with others and to evaluate their contributions in a socially acceptable manner. This is essential to success in the real world, since they will always be exposed to a variety of experiences in which they will have to cooperate and navigate among the ideas of others.

1.10 5E MODEL

One of the most useful forms of constructivist theory that is used during the teaching process is the 5E Model, which is developed, by Rodger W. Bybee in the 1980s, who is among the innovators of BSCS (Biological Science Curriculum Study) and which consists of five phases. These are Engagement, Exploration, Explanation, Elaboration and Evaluation. 5E Model is built up on the results of the researches determined at National Science Education Standards.

The five Es is a teaching model, based on piagetian theory, which can be used to implement an implicit constructivist (more specifically neo-Piagetian, human or social-constructivist) view of teaching and learning. It is built around a structured sequence and designed as a tangible and practical way for teachers to implement constructivist theory. It purposefully promotes experiential learning by motivating and interesting students, as they are encouraged to engage in higher-order thinking. Students will become intrinsically in the content presented and therefore motivated to construct meaning for them so that they will be able critically analyze and incorporate new views and different perspectives. Rather, the model provides a tangible referent for teachers to scaffold their developing expertise in structuring a learning environment that will facilitate students' interaction with a learning context in a critical, reflective, and analytical way. The five Es, as such, in an aid or organizer for the teacher to structure and sequence potential with a constructivist view of teaching and learning. In itself, the five Es is not an essential part of student learning. The (Boddy, 2003: Aguilar and Lopez, 2011)

1.11 THEORETICAL BACKGROUND OF 5E MODEL

Origin of 5E Model can be traced to the philosophy and psychology of the early 20th century. The idea of instructional model is not new but based on the earlier models similar in psychology and philosophy of Johann Herbart, John Dewey, Atkin and Karplus and so on.

1. Herbart's Instructional Model:

According to Johann Friedrich Herbart (1901), a German philosopher, psychology of learning can be synthesized into an instructional model that begins with student's current knowledge and their new ideas that relate to the current knowledge. The connections between prior knowledge and new ideas slowly form concepts.

2. Dewey's Instructional Model:

According to John Dewey (1916) in his theory states that students learn by Directed Living with an emphasis on workshop type project so that learning is combined with concrete activity and practical relevance. In the 1930s an instructional model based on John Dewey's "complete act of sense a perplexing situation, clarify the problem, formulate a hypothesis, test the hypothesis, revise tests and act on solutions.

3. Heiss, Obourn & Hoffman Learning Cycle:

Heiss, Obourn & Hoffman (1950), gave their learning cycle which was a variation of John Dewey's instructional model emerged in science methods textbooks. The author based

their "learning Cycle" on Dewey's complete act of thought. The learning cycle includes exploring the unit, getting experience, Organization of learning and application of learning.

4. Atkin-Karpus Learning Cycle:

The Atkin and Karplus (1962) in their learning cycle used the terms exploration, invention and discovery. Exploration refers to relatively unstructured experiences in which students gather new information. Invention refers to a formal statement, often the definition and terms for a new concept. The invention phase allows interpretation of newly acquired information through the restructuring of prior concepts. The discovery phase involves application of the new concept to another, novel situation. During this phase, the learner continues to develop a new level of cognitive organization and attempts to transfer what he or she has learned to new situations. This learning cycle also referred to as SCIS cycle.

5. 5E Model:

Rodger W. Bybee (1980), who is among the innovators of BSCS (Biological Science Curriculum Study), developed the 5E Instructional model. The BSCS model is a direct descendant of the Atkin and Karplus learning cycle, which was used in the Science Curriculum Improvement Study (SCIS). The BSCS Model has five phases: engagement, exploration, explanation, elaboration and evaluation. At BSCS, there was two additional phases from the SCIS, an initial phase designed to engage the learner's prior knowledge and final phase to evaluate the student's understanding.

1.12 PHASES OF 5E MODEL:

New designs for Elementary School Science and Health (BSCS, 1989) describe the phases of the 5E instructional model. Phases of the 5E model can be applied at several levels in the design of curriculum materials and instructional sequences.

1. ENGAGEMENT:

The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept with short activities that promote curiosity and elicit prior knowledge. The activity should make connection between past and present learning experiences, expose prior conceptions, and organize students 'thinking toward the learning outcomes of current activities.

2. **EXPLORATION:**

Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.

3. **EXPLANATION:**

The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors'. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.

4. **ELABORATION:**

Teachers challenge and extend students conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

5. **EVALUATION:**

The evaluation phase encourages students to assess their understanding and abilities and provide opportunities for teachers to evaluate student progress toward achieving the educational objectives.

1.13 NEED AND JUSTIFICATION OF THE STUDY

Learners constructing knowledge out of their experiences, which are associated with pedagogical approaches that promote active learning, characterize a constructivist-learning environment. (Afolabi & Akinbobola, 2009). Constructivist learning environments place much premium on students' prior knowledge, which is also referred to as alternative framework or alternative conception. According to Neo and Neo (2009), a constructivist learning environment play an important part in achieving meaningful and retentive learning

since it allows students to improve their problem solving, creative thinking and critical thinking skills.

According to Akinbobola and Afolabi (2010) in a constructivist-learning environment, the teachers' role is to serve as the facilitator of learning in which students are encouraged to be responsible, autonomous, and construct their own understanding of each of the scientific concepts. Hence, the activities are learner-centered, democratic, and interactive. The teacher provides students with experiences that allow them to use science process skills. According Thorndike (2000), the teachers' responsibility in a constructivist-learning environment involves taking into account students' prior knowledge and understanding the nature of the concepts to be learned and the learning outcomes expected, conceptual demands made on the child and the strategies available to the teacher.

It is important for teachers to create learning environments, which ensures that students play an active role in their own learning process and access knowledge through investigation, and questioning. Constructivist teaching strategy has been known to create learning environments where the learners are actively involved.

Keeping the above-mentioned facts in view, the pre-service trainee teachers need to know about Constructivism as the most widely accepted pedagogical approach and the latest developments that have taken place in education. As the pre-service trainee teachers are offered 45 days of a glimpse into their professional lives, they are also trained for applying constructivism in their classroom teaching, in which 5E model has surfaced as one of the latest practice for the interns (B. Sc. B. Ed. VII Semester and B. Ed. II Year) of RIE, Bhopal of the batch 2013-14. Internship program in teaching was conducted for duration of four weeks for B. Sc. B. Ed. and six weeks for B.Ed. In such a context, it is pertinent to know the attitudes that pre-service teachers developed on 5 E Model of teaching and learning. In addition, it is of utmost important to understand their experiences with regard to the easiness in creating and implementing the learning situations based on 5 E Model. At the same time, it is more than important to understand the challenges that they might have faced in creating and implementing learning situations.

Significance of any research depends on its applicability to bring educational reform. The present study is significant to teacher educators and pre-service trainee teachers to improve upon the mistakes that might have occurred during internship. In addition, the findings of the study may help to overcome the dilemmas faced by the present pre-service

trainee teachers in a constructivist teaching- learning approach. This research will help the institute to improve upon the present pedagogical practices of the trainees teachers and may become wide spread across the nation.

1.14 STATEMENT OF THE PROBLEM

"Attitude of pre-service trainee teachers towards 5E model of creating learning situation: Achievability and Challenges."

1.15 OPERATIONAL DEFINITION OF THE KEY TERMS

1. **5E Model:** The 5E's is an instructional Model based on the constructivist approach to learning, having five phases of teaching: engagement, exploration, explanation, elaboration and evaluation, where each phase has a specific function and contributes to the teacher's coherent instruction and to the learners' formulation of a better understanding of scientific and technological knowledge, attitudes and skills.
2. **Attitude:** Refers to predisposition to perceive feel or behave towards specific objects in a particular manner. However, Attitude for this study is defined as the feelings of the trainee teachers towards the 5E Model of creating learning situations.
3. **Achievability:** The extent to which the pre-service trainee teachers perceive that his/her 5E Model learning situation has been created and implemented successfully may be defined as achievability in this proposed study.
4. **Challenges:** The extent to which a pre-service trainee teacher perceived the challenges she or he encountered while creating and implementing 5E model learning situations may be defined as challenges in this proposed study

1.16 RESEARCH QUESTIONS

The following were the research questions of the present study:

1. What attitude do pre-service trainee teachers have about 5E model as a teaching learning approach?
2. Does pre-service trainee teachers' attitude towards 5E model of teaching and learning influence their creating and implementation of learning situations?
3. What were the achievability and challenges that pre-service trainee teachers encountered while creating and implementing the 5E model of creating learning situation?

1.17 OBJECTIVES OF THE STUDY

The following were the objectives of the present study:

1. To study the attitude of pre-service trainee teachers towards 5E model of creating learning situations and influence of attitude of pre-service trainee teachers on preparing and implementing learning situations through 5E Model.
2. To study the achievability and challenges that pre-service trainee teachers encountered while preparing and implementing learning situations through 5E Model.

1.18 DELIMITATIONS OF THE STUDY

The study has some unavoidable limitations arising out of the constraints of human and physical resources and the time of the investigator. In view of the research constraints under which the study was conducted, it remained confined to the following:

1. Only the Regional Institute of Education, Bhopal was selected for the study.
2. Only B. Sc. B. Ed. VIII sem. and two-year B. Ed. pre-service trainee teachers were selected for the study.
3. Challenges faced in teaching science (namely chemistry and biology) subjects only were considered.