CHAPTER-I

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As mathematics is a compulsory subject at the secondary stage, so, access to quality mathematics education is the right of every child. According to National Curriculum Framework (2005), developing children's abilities for mathematisation is the main goal of mathematics education. The narrow aim of school mathematics is to develop 'useful' capabilities, particularly those relating to numeracy–numbers, number operations, measurements, decimals and percentages. The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusion and to handle abstraction. It includes a way of doing things, and the ability and the attitude to formulate and solve problems.

When children learn a variety of approaches (over time), their toolkit becomes richer, and they also learn which approach is the best. Children also need exposure to the use of heuristics, or rules of thumb, rather than only believing that Mathematics is an 'exact science'.

The ***NCF (2005)*** has highlighted with emphatic assertion that there is a need to recognize the students' as 'natural knowledge constructor and thus, the teaching should be for the construction of experimental knowledge. In other words it urges the teacher to situate teaching and learning in a constructivist paradigm for the quality advancement of elementary education which is termed as foundational structure of entire education.

Traditional approach followers assume that there is a fixed body of knowledge that the students' must come to know. Students' are expected to blindly accept the information they are given without questioning the instructor (Stofflett, 1998). The teacher seeks to transfer thoughts and meaning to the passive students' leaving little room for student-initiated questions, independent thoughts or interaction between students' (VAST, 1998).

Constructivist approach learning is one strategy that can enable all the learners to construct valid knowledge and also enable them to transmit it in different contexts. Learning in the constructivist framework contributes to intellectual, social and psychological development of learners unlike other methods of instruction. Constructivist pedagogy in Mathematics believes that learner can construct knowledge by active participation rather than acquiring knowledge by watching teachers' demonstration in the classroom and, to learn to speak and act mathematically participating in Mathematical discussion and solving new or unfamiliar problems (Richards, 1991).

Kennedy (1997) also noted that "what students' learn is greatly influenced by how they are taught". Mathematics by nature is a subject that requires learners to be fully engaged in order for learning to take place. Therefore, this paper explores the extent to which learners were given the opportunity to construct their own knowledge in the mathematics lessons.

1.1.0 WHAT IS CONSTRUCTIVISM

Constructivism is a theory of learning, which offers an explanation of the nature of knowledge and how human being learns. In the constructivist perspective, learning is a process of the construction of knowledge. Learners actively construct their own knowledge by connecting new ideas to existing ideas on the basis of materials/activities presented to them (experience). For example, using a text or a set of pictures/visuals on a transport system coupled with discussions will allow

young learners to be facilitated to construct the idea of a transport system. Initial construction (mental representation) may be based on the idea of the road transport system, and a child from a remote rural setting may form the idea centred on the bullock cart. Learners construct mental representations (images) of external reality (transport system) through a given set of activities (experiences).

Construction indicates that each learner individually and socially constructs meaning as he/she learns. Constructing meaning is learning. The constructivist perspective provides strategies for promoting learning by all. The teacher's own role in children's cognition could be enhanced if they assume a more active role in relation to the process of knowledge construction in which children are engaged. A child constructs her/his knowledge while engaged in the process of learning.

1.2.0 WHY IS CONSTRUCTIVISM IMPORTANT

Educational curricula and teaching methods are changing. One component of the current redevelopment of all subject area curricula is the change in focus of instruction from the transmission curriculum to a transactional curriculum. In a traditional curriculum, a teacher transmits information to students' who passively listen and acquire facts. In a transactional curriculum, students' are actively involved in their learning to reach new understandings. Constructivist teaching fosters critical thinking and creates active and motivated learners. This demonstrates that constructivism is evident in current educational change

1.3.0 THEORETICAL BACKGROUND OF THE CONSTRUCTIVIST APPROACH

The constructivist approach has emerged from the Theories of Learning by Psychologists like Piaget, Dewey, Vygotsky, Skinner, etc.

Dewey (1916), an American philosopher and educator who established the Experimental Laboratory School at the University of Chicago, is regarded as the Father of Progressive Education in America. 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. He rejected the practice of rote learning which a common mode of instruction in those days was.

Piaget (1977), who is best known for his research on the development of cognitive functions in children, laid the foundations of Constructivism. His theory says that children evolve through specific stages in which cognitive structures become progressively more complex. There are four levels of Cognitive Development – Sensory-motor, Pre-operational, concrete Operational and Formal Operational. Learning occurs through adaptation to interactions with the environment. Disequilibrium gives rise to assimilation of a new experience, which is added to existing knowledge, or accommodation, which is modification of existing understanding to provide the new experience.

Vygotsky (1978) is a Russian psychologist whose theory is that social interaction plays a fundamental role in the development of cognition. He believed that everything is learned at two levels. First through interaction with others, and then integrated into the individuals mental structure. Another aspect of Vygotsky's theory is the idea that the potential for cognitive development is limited to a "zone of proximal development". This 'zone' is the area of exploration for which the student is cognitively prepared, but requires help and social interaction to fully develop.

Skinner (1948), an American psychologist who was the primary exponent of Behaviorist approach explored the application of Operant Conditioning. His theory is that humans are trainable with Stimulus-Response techniques. Changes in behavior are the result of an individual responding to events in the environment (stimuli). A response involves some action on the part of the learner. When a desired Stimulus-Response pattern is reinforced (rewarded), the individual is conditioned to respond in a particular manner.

Bruner (1960), an American psychologist whose theory says that learning is an active, social process in which students' constructs new ideas or concept based on current knowledge. The student selects information and makes decisions in the process of integrating experiences into their existing mental constructs.

Gagne (1970), an American psychologist and educator, co-developer of "Instructional Systems Design" theorized that instruction can be analyzed and broken down into component parts which can then be taught sequentially as Reception, Expectancy, Retrieval, Selective Perception, Semantic Encoding, Responding, Reinforcement, Retrieval and Generalization.

Ausubel (1963), Meaningful Reception Theory of Meaningful Verbal Learning is concerned with how material is learned in classroom presentation and self-study. Ausubel argued that learning new materials depends greatly on the existing cognitive structure or what the person already knows. New information is more meaningful if it is related to existing knowledge.

1.4.0 TEACHER'S ROLE IN CONSTRUCTIVIST CLASSROOM

- To invite student questions and ideas.
- To accept and encourage student's' invented ideas.
- To encourage students' leadership, cooperation, seeking information, and the presentation of the ideas,
- To modify their instructional strategies in the process of teaching based upon student's; thought, experience and or interests.
- To use printed materials as well as experts to get more information.
- To encourage free discussions by way of new ideas inviting student questions and answers.
- To encourage or invite student's' predictions of the causes and effects in relation to particular cases and events.
- To help students' to test their own ideas.
- To invite student's' ideas, before the student is presented with the ideas and instructional materials.

- To encourage students' to challenge the concepts and ideas of others.
- To use cooperative teaching strategies through student interactions and respect, sharing ideas and learning tasks.
- To encourage students' to respect and use other people's ideas through reflection and analysis.
- To welcome the restructuring of his/her ideas through reflecting on new evidence and experiences (Yager, 1991)

1.5.0 TEACHING LEARNING PROCESS

Teaching learning is very complex process. This process involves learner, teacher, teaching-learning materials, suitable approaches and strategies and conducive learning environment leading to meaningful learning. Learner at the centre of learning process and teacher works as the facilitator of learning.

Approaches and strategies of teach of learning helps us to decide how to initiate learning process to engage learners; how to transact the concept and what teaching- learning materials can be selected to make tranasaction enjoyable and learning meaningful. Studies show that different learners have different styles and learn differently. They come to the class with some prior knowledge about the natural world around them. Therefore, a teacher has to consider about various approaches and strategies of learning to cater to the learning needs and learning styles of all learners

1.7.0 CONSTRUCTIVIST TEACHING MODEL

There are number of constructivist teaching model like:

- Generative Learning Model(1985)
- Problem based learning model(1992-1995)
- Interpretation Construction (ICON) model (1995)
- 5-E model (1995)
- Voices model(1997)
- Constructivist Learning Design Model(2001)

- Motivational Model of constructivist –Informed Teaching (2005)

In studies conducted using the 5-E instructional model, evidence repeatedly reveals that the model increases the success of student, elevates their conceptual understanding and positively changes their attitude. In the activities based on the 5-E learning cycle sequence, the teacher creates interest and curiosity to draw the students' attention and to excite them in the phase of engagement; provide opportunities for students' to make them discover the topic and create a situation of "need to know" setting in the phase of exploration; and allowed them to explain the topics in their own words with a Further, description in the explanation phase. The teacher encourages students' to examine the presented situations Further, in the topic in elaboration phase, and the teacher observed the students' to evaluate their knowledge and skills in the phase of evaluation. In this way, the students' were engaged in more meaningful and permanent learning.

1.8.0 5-E LEARNING CYCLE

The 5-E Learning Cycle, originally credited to Karplus & Thier (The Science Teacher, 1967) and later modified by Roger Bybee for the BSCS project. The 5-E model divides learning experiences into five stages: Engage, Explore, Explain, Elaborate, and Evaluate. Each stage builds upon the previous as students' construct new understanding and develop new skills.

Engage

The first phase is to engage the student in the learning task. The student mentally focuses on an object, problem, situation, or event. The activities of this phase should make connections to past and future activities. The connections depend on the learning task and may be conceptual, procedural, or behavioural. Asking a question, defining a problem, showing a discrepant event, and acting out a problematic situation are all ways to engage the students' and focus them on the instructional activities. The role of the teacher is to present a situation and identify the instructional task.

Explore

Once the activities have engaged students', they need time to explore their ideas. Exploration activities are designed so that all students' have common, concrete experiences upon which they continue building concepts, processes, and skills. This phase should be concrete and meaningful for the student's. The aim of exploration activities is to establish experiences that teachers and students' can use later to formally introduce and discuss content area specific concepts, processes, or skills. The teacher initiates the activity and allows the students' time and opportunity to investigate objects, materials, and situations based on each student own ideas and phenomena.

Explain

Explanation means the act or process in which concepts, processes, or skills become plain, comprehensible, and clear. The process of explanation provides the students' and teacher with a common use of terms relative to the learning experience. In this phase, the teacher directs student attention to specific aspects of the engagement and exploration experiences. First, the teacher asks the students' to give their explanations. Second, the teacher introduces explanations in a direct and formal manner. Explanations are ways of ordering and giving a common language for the exploratory experiences. The teacher should base the initial part of this phase on the student's' explanations and clearly connect the explanations to experiences in the engagement and exploration phases of the instructional model. The key to this phase is to present concepts, processes, or skills briefly, simply, clearly, and directly, and then continue on to the next phase.

Elaborate

Once the students' have an explanation of their learning tasks, it is important to involve them in Further, experiences that apply, extend, or elaborate the concepts, processes, or skills. Some students' may still have misconceptions, or they may only understand a concept in terms of the exploratory experience. Elaboration

activities provide Further, time and experience that contribute to learning. The teacher should provide an opportunity for students' to practice their learning in new contexts.

Evaluate

At some point, it is important that students' receive feedback on the adequacy of their explanations. Informal evaluation can occur from the beginning of the teaching sequence. The teacher can complete a formal evaluation after the elaboration phase. As a practical educational matter, teachers must assess educational outcomes. This is the phase in which teachers administer formative or summative evaluations to determine each students' level of understanding. This also is the important opportunity for students' to use the skills they have acquired and evaluate their understanding. This is also the time when the teacher determines whether students' have met the performance indicators.

1.9.0 NEED AND JUSTIFICATION OF THE STUDY

Our vision of excellent mathematical education is based on the twin premises that

All students' can learn mathematics and that

All students' need to learn mathematics

It is therefore, imperative that we offer mathematics education of the very highest quality to all children. Mathematics has the ability to confuse, frighten and frustrate learners of all ages. If a child has negative experience in mathematics, that experience would affect his/ her achievement towards mathematics during adulthood. The obvious question is whether student's' failure to learn mathematics can be ascribed to problems of curriculum, problem of teaching, or the student, or perhaps the combination of these (Carnine, 1997). There are many possible reasons as to why students' fail in mathematics.

As per **NCF 2005,** some problems in school Mathematics education are:

- A majority of children have a sense of fear and failure regarding Mathematics. Hence, they give up early on, and drop out of serious mathematical learning.
- The curriculum is disappointing not only to this non-participating majority, but also to the talented minority by offering them no challenges.
- Problems, exercises and methods of evaluation are mechanical and repetitive, with too much emphasis on computation. Areas of Mathematics such as spatial thinking are not developed enough in the curriculum.
- Teachers lack confidence, preparation and support.

NCF- 2005 has strongly recommended the use of constructivist approach to teaching learning in schools. In a recent study, constructivist instruction is found to be more effective than the direct instruction for achievers (Kroesbergen and Van Luit, 2012); Kroesbergen and Van Luit, (2012); P. Zubair, M. Gayathri (2012); Vasan, Gafoor (2014); Kadem (2013). Therefore, there is a need to shift from the behavioural approach to constructivist approach of teaching.

Mathematics teaching should always be made an interesting one. Any learning aims at enabling the child to acquire the concepts. It depends on the context and situation in which the child learns. If the context and conditions are supportive it will create interest in learning. Activities should be performed by the students themselves; in this it will create a lot of difference. This will ultimately help in acquisition of knowledge in children. The mathematics teaching should involve a scientific method that will help the child to think critically and develop scientific skills in them.

The present study gives importance to students' achievement in mathematics and their reaction. Achievement in mathematics can measure the understanding of the

learner. The study plans to find out whether children taught through constructivist approach has there any difference in their achievement and reaction compare to children taught through conventional method.

The present investigation is undertaken with an objective that the findings will help to stress the importance of constructivist approach in classroom teaching, especially in mathematics teaching, wherein the attempts for strengthening the constructivist approach can be supported.

1.10.0 STATEMENT OF THE PROBLEM

"Effectiveness of Constructivist approach on Mathematics Achievement of class VII students' "

1.11.0 OPERATIONAL DEFINITION OF THE KEY TERMS

The important terms will be used in the study are explained below:

Constructivism: constructivism is a theory based on observation and scientific study about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences.

Mathematics achievement: It refers to students' scores obtained from mathematics achievement test.

1.12.0 OBJECTIVES OF THE STUDY

The present study has the following objectives:

1) To study the effectiveness of Constructivist Approach in terms of
    a) Achievement of the students' in mathematics and
    b) Reaction of the students' towards the approach.

2) To study the effect of treatment, gender and their interaction on students' Achievement in mathematics by taking pre-test scores of mathematics as covariate.

1.13.0 HYPOTHESES OF THE STUDY

The following hypotheses are formulated for the present study:

1) There is no significant effect of treatment on the students' achievement in mathematics when their pre-test scores were taken as covariate.
2) There is no significant effect of gender on students' achievement in mathematics when their pre-test scores were taken as covariate.
3) There is no significant interaction of treatment and gender on students' achievement in mathematics when their pre-test scores were taken as covariate.

1.14.0 DELIMITATION OF THE STUDY

The present investigation was conducted under the following constraints:

1) Lesson plan was developed in English language.
2) The treatment of seven days was given
3) Only one unit of the mathematics was taught.
4) The textbook of CBSC syllabus was followed.
5) The school was selected only from the Bhopal city.