CHAPTER 1
INTRODUCTION

1.1. INTRODUCTION

Modern education emphasizes on learner centered education. It is interactive in nature and students are actively involved in learning. But the traditional educational practices are quite opposite, where teacher dominates the class and students turn out to be passive learners. In the present practice, activities like rote learning and repetition do not engage the students in active learning; they emphasize more on transfer of information. Moreover, the ways and means used do not support the psychological needs of the learner. In true sense, learning occurs within the individual but not outside. Learning takes place in the minds of learner in the form of internalization of ideas, views and thoughts. To make it much more meaningful teacher has to create situation to engage the learners in meaning making experience. The present education scenario claims that learning is not an isolated activity; it is connected with child ideas and the surrounding environment. It points out that, the ideas, views, thoughts, and experiences which are existing in a learner are the main source for learning. Thus, previous experience and prior knowledge is necessary to create new knowledge for the learner. These ideas presents a new way of learning called “Constructive Learning” or “Constructive Perspective”. The main vision of this perspective is that the learner constructs new knowledge individually and collectively in the background of prior and previous experience. Overall, the main notion of constructivism is to nullify the teacher dominated classroom and initiate learner ownership in the classroom.

The present education practice also emphasizes the importance of technology usage in education. It is observed that the learner, the teacher and the learning experience are influenced by computer and information and communication technology. The 21st century society expects children learning through technology mediation. At present, technology is not only used for transfer of knowledge but also used for discussion, debate and collaborative activity. In this way, constructivism as well as technology considers learner as a constructor of knowledge not merely passive participant. Hence, blend of technology into constructivism engage students actively in learning and teaching process. In reality, there is a need for technology integration
in constructivist practice or use of technology based constructivist teaching. This approach gives new framework for learning, teaching as well as for learner centered educational environment. Particularly, integration of technology is useful and relevant for social science subject to encourage active learning and students’ involvement in the subject.

1.2. CONCEPT OF CONSTRUCTIVISM

Constructivism as a new theory of learning, rule the education system all-over the world. It is contrary to traditional teacher dominated classroom and encompasses the learner centered education system. It keeps the children active in a classroom and engages in knowledge construction process.

1.2.1. Meaning of Constructivism

“The verb ‘to construct’ is derived from the Latin word ‘construere’ which means to arrange or to give structure, ongoing structuring (organizing) process” (Narang, 2013). Therefore, structuring, restructuring and organization of ideas for meaning making are the tasks of constructivism.

In constructivism, knowledge construction proceeds in two ways: Individual and in group. Usually, students construct their knowledge individually rather than collectively. In antagonistic, learning is considered as a lifelong process and social process; it results from the social interaction. Hence, students are expected to construct their ideas, thoughts, and concepts from the negotiation and interaction in group or in an environment.

The knowledge construction process proceeds and is performed in many ways as mentioned in the following way:

- Physical Construction of knowledge: Through active learning
- Symbolical Construction of knowledge: By making own representation of actions
- Social Construction of Knowledge: Meaning making in social setting
- Theoretical Construction of knowledge: Explain the ideas and things on their own (Gupta, 2012).
1.2.2. History of Constructivism

Constructivism is not a new concept; it is deep rooted in philosophy, psychology and education. The first philosopher in this field is Giambtista Vico. He commented in 1710 that “one can only know something if one can explain it” (Bala & Tandon, 2009). Further he viewed “Human can understand only what they have themselves constructed” (Kumar & Gupta, 2009). Later, due to enormous contribution of leading psychologists, philosophers and technologists, constructivism emerged as a theory of learning. It revolt against the traditional theories of learning and started its focus on knowledge construction as a key component in educational practice. This kind of paradigm shift procured from the contribution and ideas of Piaget, John Dewey, Bruner, Vygotsky, Glasersfeld and others.

John Dewey, an American educationist, started progressive education reform movement for child centered education. Through this, he focused that, society or experience is the third pole of education. His movement is highly related to constructivist practice in school education. According to him; previous experience helps the students in learning new ideas. He stated “children did not arrive at school as blank slates upon which teachers might write the lessons of civilization. By the time the child enters the classroom, he was already intensively active and question of education is the question of taking hold of his activities of giving them direction” (as cited by Westbrook, 2004). So, education links with what child already knows and what child is supposed to learn in a classroom. Dewey also asserted that “when learner engage with the reflect upon authentic problems to resolve their internal dissonance, they reconstruct the situation, which in turn rebuilds their reality and self-concepts. Learners transform to become new people with the potential for new cycles of disequilibrium, problem exploration, resolution, and reconstruction. Ultimately he called this process as a ‘growth’. It is the teacher’s responsibility to provide students with problematic practical situations obligating the student to confront previous understandings in order to solve problems” (as cited by Cornelius-White & Harbaugh, 2010). Dewey’s another well-known contribution is project method and it follows constructivist approach. He defined it as whole hearted purposeful activity carried out in natural setting. The approach is developed based on the principle ‘learning by doing, and ‘learning by living’.
Jean Piaget contributed much in the field of constructivism. His cognitive development theory laid strong foundation to constructivism. The theory proposes that, human beings cannot be “given” information which they immediately understand and use. Instead human must ‘construct’ their own knowledge to make meaning of their knowledge. Experience helps them in constructing knowledge, beliefs, and self-concepts. The existing previous patterns help in learning new mental patterns of life. It interprets individual way of construction of knowledge, so it is also called individual or psychological constructivism.

Vygotsky was a distinguished psychologist in constructivism. He was the founder of social constructivism and introduced social nature of construction of knowledge. His theory is called ‘s socio-cultural approach to learning’ and ‘cultural historical approach to learning’. His theory believes that ‘biological and cultural development does not occur in isolation’ (Thamarasseri, 2008) and it results from individuals’ interaction with environment. So, social interaction profoundly influences cognitive development.

An American psychologist, Jerome Bruner also well-known in the field of constructivism. He was motivated by reading the works of Vygotsky. As he described, child is a problem solver and learns effectively from the intrinsic motivation and it must replace extrinsic motivation (Cowan, 2014). His discovery learning engages construction of new knowledge. His theory holds that “structuring of instruction in such a way as to foster conceptualization and development of problem-solving skills through process of inquiry and discovery. He advocated autonomy in learning”. Padmanabhan (2007) stressed how students construct their knowledge problem-solving environment in enquiry and discovery mode. Nevertheless, he extended the Zone of Proximal Development (ZPD) and developed discovery learning. It includes inquiry-based constructivist approach (Stockford, 2014).

In recent educational development constructivism underlies in many ways such as ZPD, scaffolding, peer tutoring, cooperative learning, experiential learning, cognitive apprentice, social learning and authentic learning. These practices fall under any one of the category of constructivism i.e. Cognitive or Social or Radical constructivism. However, these things are practiced in school education based on the nature of subject taught.
In connection to the meaning and history of constructivism the features of constructivism and types of constructivism are given in the next headlines.

### 1.2.3. Features of Constructivism

Murphy (1997) has listed the characteristics of constructivist education. They are presented in the following figure.

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<table>
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<tbody>
<tr>
<td>1.</td>
<td>Multiple perspectives and representations of concepts and content are presented and encouraged.</td>
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<td>2.</td>
<td>Goals and objectives are derived by the student or in negotiation with the teacher or system.</td>
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<td>3.</td>
<td>Teachers serve in the role of guides, monitors, coaches, tutors and facilitators.</td>
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<td>4.</td>
<td>Activities, opportunities, tools and environments are provided to encourage metacognition, self-analysis, self-regulation, self-reflection and self-awareness.</td>
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<td>5.</td>
<td>The student plays a central role in mediating and controlling learning.</td>
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<td>6.</td>
<td>Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the 'real world'.</td>
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<td>7.</td>
<td>Knowledge construction and not reproduction is emphasized.</td>
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<td>8.</td>
<td>Primary sources of data are used in order to ensure authenticity and real-world complexity.</td>
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<td>9.</td>
<td>This construction takes place in individual contexts and through social negotiation, collaboration and experience.</td>
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<td>10.</td>
<td>The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.</td>
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<td>11.</td>
<td>Problem solving, higher-order thinking skills and deep understanding are emphasized.</td>
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<td>12.</td>
<td>Errors provide the opportunity for insight into students' previous knowledge constructions.</td>
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<td>13.</td>
<td>Exploration is a favored approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals.</td>
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<td>14.</td>
<td>Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition with the help of a teacher.</td>
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<td>15.</td>
<td>Knowledge complexity is reflected with an emphasis on conceptual interrelatedness and interdisciplinary learning.</td>
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<td>16.</td>
<td>Collaborative and cooperative learning are favored in order to expose the learner to alternative viewpoints.</td>
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<td>17.</td>
<td>Scaffolding is facilitated to help students perform just beyond the limits of their ability.</td>
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<tr>
<td>18.</td>
<td>Assessment is authentic and interwoven in teaching.</td>
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</table>

*Figure 1.1. Characteristics of Constructivist Education.*

**Source:** Murphy, E. (1997). *Constructivism: From philosophy to practice.* Retrieved from ERIC data base. (ED 444 9666)
1.2.4. Features of Constructivist Teaching as Listed in NCF-2005

Like in the other parts of school system of the world, the Indian school system found the importance of constructivism and adopted in school education. NCERT considered and advocated constructivism as a quality parameter for classroom teaching and learning in the state and central school syllabus. It has expounded constructivism as one of the important pedagogical practice in ‘National Curriculum Framework-2005’. Following are the important constructivist pedagogical practices listed in NCF 2005.

1. In Constructivist view, learning process emphasizes on construction of knowledge.
2. Students interact with materials and experiences provided by the teachers to construct their knowledge in the background of prior knowledge.
3. Structuring and restructuring of ideas leads to progress in students’ learning process.
4. Students construct their mental images of relationship i.e., cause and effect relationship through relevant activities.
5. Knowledge construction is also a social process. In true sense, complex knowledge situated in group and needs collaborative learning to enable the students to engage in discussion of meaning, sharing of multiple views and to change their internal representation of external reality.
6. Students construct their knowledge individually as well as socially (Pal, 2005).

1.3. TYPES OF CONSTRUCTIVISM

Constructivism is mainly classified into three types based on the nature of knowledge construction. Jean Piaget, Lev Vygotsky, Glaserfeld and others contributed their ideas, views and developed psychological constructivism, social constructivism and radical constructivism respectively.

1.3.1. Cognitive Constructivism

The first category of constructivist process is called cognitive constructivism. Jean Piaget is most influential cognitivist psychologist and also called as father of cognitive constructivism. He laid emphasis on individual way of construction of
knowledge. It is deep rooted in the theory of cognitive development. His classical efforts on cognitive development made him to design a new framework for studying mental development of the child. It created landmark contribution in cognitive development and new pedagogical practice called constructivism in educational field.

Piaget expressed that human mind has two aspects. First, cognitive structure and second cognitive functioning. Human cognitive development operates through these two aspects.

Cognitive Structure

Cognitive structures are the basic cognitive patterns; they are the basic instincts and reflexes such as sucking, looking, reaching and grasping. Those patterns are called basic schemas (mental model) and biologically inherited in child. They are potential in performing particular class of behavior in life. As the child grows he interacts with physical and social environment and able to form different schemas based on change and modification in basic cognitive structures (Mangal, 2014). Thus, enlargement in schema brings cognitive development in the child. Piaget identified three types of schemas. They are behavioral schemas, symbolic schemas and operational schemas. Behavioral schemas are physical actions based on mental representations such as grasping, banging, shaking etc. and helps in understanding the surrounding objects. The symbolic schemas are language based mental represents attach with events and objects. Soon child attains development, they become more abundant and additional composite. Finally the early schemas differentiate into basic sentence, running sentence and incomplete sentences. And final schemas are operational schemas. According to Piaget, schemas are mental actions in nature. They help to carry out mental manipulations to solve problem or to logical reasoning (Bhatt, 2007). Thus schemas are very important in cognitive development process.

Cognitive Functioning

While explaining the cognitive functioning, Pagets’ ideas evolved new theory of cognitive development and contributed to the development of cognitive constructivism. In cognitive functioning, human mind performed varied roles such as organization, adoption, assimilation, accommodation and equilibrium.
Cognitive schemas are the potential or basic structures. These mental models or structures are extended through mental functioning. Because of this reason, he viewed that human beings are born with minimum knowledge or cognitive development. Further, he believes that schemas are enlarged and restructured in process of cognitive development. But child’s mental development occurs when dynamic interaction happens between child and environment. And another enhancer of development is social interaction (Hendrick, 1998). We learn directly look into the world around us as well as from the direct instruction of others. The amount of learning is less from the direct instruction. However, the chalk and talk method was found to be useless to involve in the process of learning world realities. So, students should be encouraged in activity based methods, which inspire in direct involvement of students in the process of personal discovery and creation. In this way, students are engaged in construction of world realities (Mitchell & Ziegler, 2013). Thus, Piaget’s theory trusts on inner construction of knowledge (Hendricks, 1998). However, what we construct knowledge out of interaction with environment is based on subjectivity and objectivity and they are jointly as well as complementary constructed (Houde, 2004).

The main reason for cognitive development is to attain equilibrium. Interaction with environment the individual finds disequilibrium in development and inspires to assimilate the knowledge to have cognitive development. To maintain such equilibrium individual put meaning making interaction with environment to assimilate new knowledge and adjust understanding or cognitive development internally as well externally (Fleming, 2011). He states that child is constructivist-an organism that interacts with the materials, environment and events to increase the understanding. In reality construction depends on the knowledge which the child has at the time of knowledge construction process. Thus level of maturity is also taken into account in the level of the interpretation of the environment (Shaffer, 1999).

To accomplish mental development individual has to fulfill two principles: adoption and organization (Solso, 2004). What the child adds to existing knowledge is called adoption. “Adoption consists of two sub process: assimilation and accommodation. Assimilation occurs when children incorporate new information into their existing knowledge. This often occurs when children adjust the way they think about and solve problems in order to make sense of new information that challenges,
and cannot be explained by their existing way of thinking” (Sheehy, 2004). In the accommodation process, the child can also be in a position to create own schemas when they are not able to fit or alter prior knowledge on the base of new knowledge. At last, assimilation and accommodation brings balance between the structure of the mind and structure exists in environment. The resulting balance process is called as equilibrium. It results in individual with emerging or good model of universe. This ideal state he calls as equilibrium. (Kalia, Singh, & Singh, 2012).

Assimilation and accommodation have several implications. “Development is a continuous process that, at the same time, leads to structural change (differentiation and integration of knowledge structures); Activity is always organized in the sense that it is based on structure (otherwise objects interacted with would be devoid of meaning). Structure, however, does not exist as an entity in the mind that results in reasoning; rather, they exist as potential coordination’s of operations; Assimilation and accommodation continue, on a functional plane, the materials process of self-organization (metabolism), thereby securing the continuity between biological and psychological functioning” (Carpendale, Müller, & Bibok, 2008).

Piaget’s analysis laid foundation for cognitive constructivism and suggests that a child constructs knowledge and understanding based on experiences and prior knowledge. More meaningfully his ideas are adopted in educational practice. As Piaget view “A school without coercion is a place where pupils actively experiment with a view to reconstruct for themselves what is to be learnt”. He also stressed that “A truth learnt is only a half-truth; the whole truth is reconquered, reconstructed and rediscovered by the pupil himself or herself” (Edutracks Series, 2005). Indeed, emphasizes more on knowledge construction in a classroom rather than passive receive of information from teacher. Hence cognitive constructivism created paradigm shift in education. Alsop and Hicks (2003) clearly viewed that “constructivism created a shift in teaching and learning and learning is not as a passive representation but as an active reconstruction and reinterpretation of experience”

1.3.1.1. Educational Implications of Piaget Constructivism

Following are the important implications listed based on the Piagetian cognitive development theory. They help the teacher to promote constructivist practices in the classroom.
1. Ensure learning and instructional events that relate to the schema of a child. It focuses that experiences and activities provided to the child must work on that basic mental model.

2. Before engaging the child in any knowledge construction process, one need and to identify the pre-existed schema i.e., the prior knowledge of child.

3. Initial interaction between teacher and students obligatorily to form disequilibrium in mental development of the child. Such process cause curiosity in the child as well as motivation for further learning and mental development.

4. Teacher should organize conducive environment wherein the child is indispensably allowed to direct interaction with physical and social environment and the material or learning tool. In this sense, its objective is to provide context or learning experience for students learning.

5. Effective educational context should engage students in the assimilation process. At this juncture, child adapts new knowledge and thoughts in the light of prior knowledge. It also helps in extension and enlargement of mental modal.

6. Further, teacher encourages the child to use prior knowledge and connects with present knowledge and put further in an organized way.

7. At last child should construct the mental model and they are treated as world realities. It is a stage of equilibrium.

1.3.2. Social Constructivism

Lev Vygotsky is an exponent of social constructivism. He emphasized social aspect of knowledge construction instead of individual aspect of learning. He advocated “Sociocultural theory” for cognitive development. This theory argued that “children develop through a process of internalization: They absorb knowledge from their social context that has a major impact on how cognition unfolds over time” (Gerrig & Zimbardo, 2008). His theory infers that, learning always results due to continuous interaction with child’s social, cultural environment. Therefore, the theory dominates that learning is a social process and it results from individual interaction with peer, elders, society and culture. He interprets that cognitive development shapes through three core themes.
1. Mind constantly changes due to continuous interaction with the environment. Individual influence on environment and environment influence on individual. Additionally, it is a process not a product.
2. Social interaction is fundamentally necessary for all cognitive development. It helps in developing higher level of mental functions of individual. He has identified two types of mental functions. One is low-level mental function: it is genetically inherent and it enables us to react to environment. Second is higher order mental function results from social interaction.
3. The last theme emphasizes on language. All higher order mental function is result from the mediation of language and sings. Here language is best tool for interact, influence and learn effectively in social setting (Davey, 2006).

Thus, core themes assert that cultural background is main source of knowledge construction process. More importantly, the knowledge is existing in social context and it is also called “social cognition”. Knowledge construction takes place centrally through group oriented activity and everyone will actively engage in negotiation, exchange, discussion, dialogue, debating and interaction. Hence the theory identifies potentiality of social discourse and emphasis the importance of social activities.

1.3.2.1. Zone of Proximal Development (ZPD)

While pioneering the social constructivism, Vygotsky has developed new notion called Zone of Proximal Development (ZPD). According to Vygotsky (1978) ZPD is “the distance between a child’s actual developmental level, as determined by independent problem solving and the higher level of potential development, as determined by problem solving under adult guidance or in collaboration with more capable peers” (Elliott, Kratochwill, Littlefield, & Travers, 1999). ZPD is considered as important concept in cognitive development for several facts. First, it helps to recognize what child is able to do independently. Second, it highlights bringing cognitive development within the limit of “Zone” (Passer & Smith, 2013). Third, it benefits the teacher to decide appropriate assistance to reach that Zone. With this, the social constructivism trusts cognitive development in social process and intelligence of a child is not innate or static but everyone has potential to learn. Students reach that potential development and fill-up the gap by interacting with peers, teachers and
classmates (Phillips, 2010). ZPD advocates need for scaffolding to achieve potential development.

1.3.2.2. Scaffolding

Scaffolding is a key concept often associated with ZPD in social constructivism. Towards attaining potential development in ZPD one needs assistance from the elder. The assistance process is called scaffolding. It used to elucidate “the nature of the progress of learning and the support systems which may enhance the process” (Pritchard & Woollard, 2010). It is socially mediated dialogic learning that results from interaction between teacher and students. Its objective is providing assistance and guidance when it is impossible to achieve the goal without assistance (Cruz, 2008). By using this technique teacher accelerates and inspires the students to learn by giving hint, clue, assistance and encouragement (Parkay & Stanford, 1999). Undeniably, it is considered as a support mechanism to help the child to grow and develop within the zone of proximal development (Jarvis, 2006). However for fruitful scaffolding, educators and parents should scale the degree and types of instruction needed according to the current ability and knowledge of the child (Nevid, 2007). The strategy asserts that support needed to withdraw when the child able to develop abilities independently. The effective scaffolding situation appeared to be based on two main rules. Indeed, tutor offer immediate more help to children when they are struggle to learn. Later, gradually withdraws or provides less support until child performs proficiently (Long, Wood, Littleton, Passenger, & Sheehy, 2011).

For effective scaffolding teacher has to organized systematic teaching and learning environment. Concern to this Mercer and Fisher (1993, as cited by Wells, 1999) listed the following suggestions to qualify teaching learning as scaffolding. Teaching learning event should: Enable the learners to carry out the task which they would not have been able to manage on their own; and be intended to bring the learner to a state of competence which will enable them eventually to complete such a task on their own; and Be followed by evidence of the learners having achieved some greater level of independent competence as a result of the scaffolding experience.
So, absolutely new educative experience should always carried in the light of ZPD and Scaffolding to create learner centered environment. Teacher has to consider their new role and it need to be initiate in the light of what child able to perform by own or perform with guidance and assistance. Hence, in constructivism the teacher role is like a director and guide instead of main person on the stage. Especially, ZPD and scaffolding plays pivot position in social learning and in other from the constructivism. Hence, the main claim of this technique is “Teacher centered education into learner centered environment and teacher guided environment”.

Scaffolding draws many premises for teacher and parents and they can use in many ways to engage their children in knowledge construction. They are; “demonstrating how to do things; explaining procedures; providing written or actual model; systematically developing all the pre requisite skills required for more demanding tasks; correcting on task errors, identifying and correcting misconceptions; motivating students and providing clear and realistic objectives” (Lefrancois, 2000).

1.3.2.3. Essential Elements of Scaffolding

Larkin, (2008) has listed essential elements of scaffolding and it can be followed in different stages of lesson. And it is not necessary to follow in order. They are,

1. “The teacher considers curriculum goals and standards along with students and needs to select appropriate tasks.
2. The teacher works with the students to establish shared goals. This involvement may result in students who are motivated and invested in learning.
3. The teacher actively diagnoses student needs and understanding to ensure that student are making progress.
4. The teacher provides tailored assistance through promoting, questioning, modeling, telling or discussing.
5. The teacher helps students to remain focused on the intended goals by asking questions and providing clarification as well as offering praise and encouragement”.
In this study scaffolding technique is used as a basic component of constructivist teaching to assist and help the student learning with the help of teacher, peer and technology component in different stages of learning.

1.3.2.4. Educational Implications of Social Constructivism

Based on the comprehensive review, the following principles of social constructivism formulated and adopted in this study.

1. Knowledge is an active social construction process. The new learning is structured around the social activity. It is primary notion of social construct classroom.
2. New learning occurs within the framework of prior knowledge of the group.
3. Teacher must encourage social interaction activities such as debating, discussion, collaboration and mutual interaction.
4. Teacher facilitates authentic group activity or social situation or task to encourage knowledge construction activity.
5. Learner should allow constructing their understanding and meaningful learning in the form of analysis, synthesis, evaluation and creating of their cognitive structure. Collection, verification, generalization and creation of new knowledge.
6. Assessing the students’ progress in the context of knowledge construction process. Constructive formative assessment helps and encourages knowledge construction process.
7. Teacher assistance (ZPD), tutoring and guidance (Scaffolding) increases efficiency of social knowledge construction process.

Tuckman and Monetti (2011) has listed few implications for how to use social constructivism in school education. They are 1) Creating challenging task to ensure and allow ZPD and Scaffolding. 2) Providing Cooperative learning task to organize assistance from more competent peers to less competent one. 3) While providing instruction teacher and peer should serve as cognitive model. 4) Providing real world
environment in school to relate the learning to real life situations. 5) Instruction and instructional styles should be match with cultural context.

1.3.3. Radical Constructivism

Radical constructivism was put forward by Glasersfeld. It is extreme form of constructivism and emphasizes subjective nature of construction of understanding. He developed his theory based on the ideas of Piaget’s constructivism. In his later writing, he explains “Constructivism as theory of knowing rather than knowledge” (Wellington, 2014). According to Glasersfeld, (2002) “Radical constructivism is an unconventional approach to the problems of knowledge and knowing. It starts from the assumption that knowledge, no matter how it is to be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she known on the basis of his own experience. What we make of experience constitutes the only world we consciously live in. It can be stored into many kinds, such as things, self, other, and so on. But all kinds of experience are essentially subjective and through I may find reason to believe that my experience may not be unlike yours, I have no way of knowing that it is the same. The experience and interpretation of language are no exception” Therefore, he advanced subjective nature of construction of knowledge.

Radical constructivism associated with two propositions, namely “1. Knowledge is not passively received, but is actively built up by the cognizing subject and 2. The function of cognition is adaptive, and serves the subject’s organization of experiential world, not the discovery of an objective ontological reality” (Holtorf & Cornelius). Therefore, it emphasizes on reality which is external to individual and unknown. But individual efforts are towards construction of subjective type of reality based on experience rather than knowing the objective reality of the world.

1.4. Constructivist Teaching Strategies

There are many constructivists teaching strategies which are followed in education. Few strategies are aware to many and followed from many years and many are becoming popular now days. Experts have listed the following strategies for constructivist practices.
Table 1.1.

Activities and Strategies for Constructivist Teaching

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<thead>
<tr>
<th>Activities and Strategies for Constructivist Teaching Listed by in Different Sources</th>
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<tbody>
<tr>
<td>1. Discussion</td>
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<tr>
<td>6. Role Playing</td>
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<tr>
<td>7. Project Method</td>
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<td>8. Virtual Tour</td>
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(Rao, 2012) (Kasinath, 2009) (Doolittle, n.d.)

1.5. Role of Teacher in Constructivist Teaching

Teacher has to discharge diverged role in classroom to create constructivist environment. Brooks and Brooks, (1999) listed the following role of constructivist teacher in their famous book ‘In search of understanding: the Case for Constructivist Classrooms”.

1. Constructivist teacher encourages and accepts student autonomy and initiative.
2. Constructivist teacher uses raw data and primary sources, along with manipulative, interactive, and physical materials.
3. When framing the tasks, Constructivist teacher uses cognitive terminology such as “classify”, “analyze”, “predict” and “create”.
4. Constructivist teacher allows student responses to drive lessons, shift instructional strategies and alter content.
5. Constructivist teacher inquires about students understanding of concepts before sharing their own understandings of those concepts.
6. Constructivist teacher encourages students to engage in dialogue, both with teacher and with one another.
7. Constructivist teacher encourages student inquire by asking thoughtful, open-ended questions and encouraging students to ask questions of each other's.

8. Constructivist teacher seeks elaboration of students' initial responses.

9. Constructivist teacher engages students in experiences that might engender constructions to their initial hypotheses and then encourage discussion.

10. Constructivist teacher allows wait time after posing questions.

11. For students to learn they need to receive different 'lenses' to see things in new ways.

12. Constructivist teacher provides time for students to construct relationships and create metaphors.

13. Constructivist teacher nurtures student’s natural curiosity through frequent use of the learning cycle morel.

Besides there many roles discharged by teacher in constructivist teaching. Some roles are predominant in modern education scenario to encourage students in knowledge construction. They are not performed by teacher on the stage but they always keep the teacher role at the side and engage in the role as guide and direct knowledge construction. Concerning this David Johnson listed three important roles, that helps the teacher to engage the child in construction. They are modeling, coaching and scaffolding (Singh, 2011).

With rational reason two important constructivist strategies were explained in detail in the under the headline of 5 E’s Instructional Model and cooperative learning

1.6. 5 E’s INSTRUCTIONAL MODEL

5 E’s learning models is a well-known constructivist learning model in science and other school subjects. The early effort for development of learning cycle was made by Karplus (1963). His concept of learning cycle comprises of three phases namely exploration, invention and discovery (Madu & Amaechi, 2012). Later, 5 E’s model has become the general philosophy of teaching learning with foundation of constructivist idea. Following this, Bybee and associates had developed schematized learning cycle with 5 steps i.e., engage, explore, explain, elaborate and evaluate (Liu, Peng, Wu, & Lin, 2009). The distinguish 5 steps as therefore made as 5 learning
model or instructional model. They developed it for Biological Science Curriculum study. There of the 5 E’s instructional model is also called BSCS 5 E’s instructional model. The five stages of the model begin with letter ‘E’ hence the model is popularly recognized as a 5 E’s learning model. The model adopts “all components of inquiry based learning and is intended to help each and every individual learner” (Fletcher, 2011). The instructional procedures engage the students in connecting prior knowledge and new knowledge further it encourages student to reconnoiter their ideas and lastly apply and elaborate their ideas. Thus, it might provide sequential, orderly and rational steps for knowledge construction.

The approach plays significant place in 21st century. The educational leaders of this age want their students to be competent, confident and productive citizen through acquiring various skills like critical thinking, communication, collaboration and creativity. Furthermore, these skills are addressed as 21st century skills. To attain these skills, it is mandate to use prior knowledge and to learn what they have not learnt yet. By following constructivist oriented 5 E’s instructional model students and educational practices can address all those skills systematically in 21st century (Booker & Kopp, 2013).

1.6.1. Meaning of 5 E’s Instructional Model

5 E’s instructional model is systematic instructional model designed to engage students based on prior knowledge and subsequently they are leading for construction of new knowledge through process of exploring the ideas in given situation, explanation of explored ideas and elaboration of those understanding and thereby teacher evaluate the entire understanding.

1.6.2. Stages of 5 E’s Instructional Model

As the title says the model consists of 5 steps design namely engage, explore, explain, elaborate and evaluate. In all the stages knowledge is linked with prior knowledge with new knowledge in a systematic way and engages in activity based knowledge construction. The model often reflects that teacher acts like a facilitator and students are become the knowledge constructors.
Engage

It is the first stage which links prior knowledge and new knowledge. Teacher use appropriate devises like questioning, demonstration, role play, graphic organizer etc. to connect their prior knowledge. In this aspect, the students are motivated and attain their attention in learning new knowledge. This stage forms disequilibrium in students (Tuna & Kacar, 2013) and creates curiosity for further learning. To a large extent, it uses law of readiness to prepare the students mind to receive new knowledge. All the activities are connecting past knowledge to future/current knowledge. At the end of the stage, teacher state the name of the lesson and write on the black board. The objective of this stage are; to determining the child already known about the phenomenon; creating motivation and curiosity among the students and to introduce the lesson to class (Patro, 2008).

Explore

In this stage, students explore new knowledge by means of interaction with environment or material provided by the teacher. As Bybee (2013) described, the stage offers common base of experience within the students to explore new ideas, concepts and practices. Specifically they place in contextual situation to explore by via reading books, discussion, laboratory experience, collaborative environment, peer interaction etc. The resulting outcome of exploration is often viewed as equilibrium. To visualize Piagetian view, the disequilibrium i.e. gap identified by the stage engage, whereas the gap is filled by the stage exploration in the form of equilibration. To conform this, students record their valuable insights, ideas which are explored.

Explain

After exploring ideas students were entreated to explain to their class. The main objective of the stage is, giving opportunity for students to communicate their constructed ideas to the class. On the other hand, they process and consolidate their ideas and use language to present it in a logical format (Erickson, 2013). The teacher inspires the students to map their presentation strategies in a creative way. Mind maps, learning logs, graphic organizers etc. will help in student’s presentation. On the other hand, teacher can also elicit explanation and summary of students understanding by asking question or using devices like KWL chart, graphic organizer etc. Thus, the stage converts students’ knowledge construction process into visualization and
Elaborate.

Elaborate is an expansion or application stage. The main task of student’s is to get chance to apply their new knowledge to novel situation or day to day use. It gives opportunity to illustrate their own ideas, give new example or answers to the questions of teacher. Through new experiences, the learners transfer what they have learn and develop broader and deeper understanding of concepts about the contextual situation and refine their skills and abilities (Bybee, 2013). On the whole, the students present and define their ideas in group discussion by giving better definition and gathering more information to successfully complete their instructional task. At this point, teacher adopts Vygotskys learning model to align students in social learning and cooperative learning environment. It also creates opportunity to present their ideas, application of ideas in new situation and to receive feedback from peer and teacher to complete their understanding (Ergin, 2012).

Evaluation

This is the last stage of the model, teacher test the effectiveness of the learning and how for the students understood the lesson. Teacher uses informal evaluation in different stages of this model. At the end, formal evaluation is organized orally or may be in the form of paper pencil test to know the realization of the objective of the lesson. Students receive feedback concerning to their academic achievement.

1.7. COOPERATIVE LEARNING AND SOCIAL CONSTRUCTIVISIM

Similar to constructivism, cooperative learning strategies are evolving practices in education field. Cooperative learning is concern with engaging child cooperatively in the group. To make a lucid decision, cooperative learning strategies has often been associated with social constructivism and involves a wide range of strategies developed based on many theories such as generative learning theory, Lev Vygotsky’s sociocultural theory of learning, Piagetian learning theory and Albert Banduras socio cognitive theory of learning. Among all, Vygotsky and Piagetian views were highly useful in engaging the students in knowledge construction by means of cooperative groups.
Social cultural theory, language and its importance, ZPD and scaffolding are leading work contributed in the field of cooperative learning. Vygotsky gave due importance to socialization and instruction and devised general law of cultural development. Accordingly, skill appeared in social context, before developing as psychological skill (Hamilton, 1996). His sociocultural theory pointed out that learning results from social interaction and situated in cultural environment. It also articulates that learning takes at two levels social and individual level. In cooperative environment they interact with group members and learning tools and express and conceptualize their ideas and views. Also they listen to other and solve the problems and complete their task in the form generation of new ideas. As result, they are able to get complete accomplish their learning in sequence way. Another influential concept on cooperative learning process is ZPD. Zone of proximal development indicate what learner can learn independently and what learner can learn with assistance of peer. The development occurs in two procedure i.e. interaction occurs in the zone and Scaffolding (Wang, 2007). The tasks which are found in ZPD usually complex cognitive tasks and individual will complete those tasks in cooperative learning environment with assistance from more competent peers. The interaction procedure is called as cognitive apprenticeship it strongly involves engagement of students in academic interaction with more competent peer or adult and consequently they internalize ideas and learn new skills (Stevens, 2008). Preliminarily Vygotsky idea of assistance includes hint or clue, a word of praise, suggestion, a learning strategy, a grammar reminder or an intensive review given at given time. When they need of intensive assistance it turned-out into scaffolding by teacher and provides greatest assistance to grow stronger and more complex. Further assistance amount reduced when the student able to perform the task independently and individual become self-empowered and task become self-directed (Oxford, 1997).

Whereas the Piagetian individualistic or cognitive theory recommends that disequilibrium is results from the interaction between teacher and peer and it is essential to engage learners in cognitive growth. Group discussion enables the learner to practice, organization and expansion process as well as they explain their thought to other to their peer and listen to the new standpoints (Moreno, 2010). To sum-up, Piaget and Vygotsky view of constructivism gives strong foundation for cooperative leaning and engages students in cooperative learning groups. Many cooperative
learning methods also follows the theories of constructivism. In this rationality, as Moskowitz, Malvin, Schaeffer and Schaps(1983) states that cooperative learning techniques supports development of social competencies and constructive peer relationships. By bearing this in mind the study adopted one of the prominent cooperative learning method ‘Jigsw’ Researcher also made judicious effort to amalgamate 5 E’s Instructional model and Jigsaw to ensure social constructivist learning in this study.

1.7.1. Jigsaw Cooperative Learning Strategy

Jigsaw is a renowned cooperative learning strategy used in education. It was developed based on social constructivism and encourages knowledge construction in small groups. It was developed by Elliot Aaronson and associates. Elliot Aronson also called as father of cooperative learning. He developed the Jigsaw I. Further in 1987 Slavin had developed Jigsaw II.

Jigsaw Defined

“The name jigsaw group comes from the metaphor that each of the children in the group hold a unique piece of a jigsaw puzzle, and the task facing all the children in group is to put the piece of the puzzle together so that they all share the whole picture” (Walker, 2010). In educational context Jigsaw procedure specifies student in group represent jigsaw puzzle and the students of particular group together gain complete knowledge of the content. Jigsaw technique emphasizes learning by teaching. “Jigsaw is collaborative learning technique that emphasizes the fact that we can learn by teaching. This technique generally forces students to dive into the subject matter acquire new knowledge or skill, and teach it to another student”.

Jigsaw work on basic principles or elements namely 1) Positive interdependence 2) Individual and group accountability 3) Interpersonal skill 4) and Positive interaction and group process (Husain, Husain, Abdul, Samad, & Wahab, 2013). All these elements emphasize the social nature of construction of knowledge.

Jigsaw I: It is cooperative learning technique it leads in the form of dividing the entire class into small group and each made up of six members. Each member has small section of content and same section content members of different group’s meat and become experts. Next, they return to their home team and each member teaches to
their team members. They learn entire portion by listen from the team members (Manning & Lucking, 1991). Finally student progress assessed with the help of quiz. However in Jigsaw II modified cooperative learning adopts Student Team Learning Program. In this strategy the class will be divided into 4 to 5 students and the students are assigned with same topic than the specific section. They read the common content such as book chapter, short story or biography. Further they receives specific topic on which they mastered. Accordingly they meet in the expert group and gets mastery over the content. Later they return to their team and teach to their team members. At last they take individual quiz which results in individual score and team scores as in STAD (Slavin, 1996). The major difference between the Jigsaw I and Jigsaw II is the content received for cooperative learning. In Jigsaw I students receives only specific portion/section which is already divided for specific jigsaw group where as in Jigsaw II students receives common topic or chapter, later based on mastery over the specific portion they decide the content for jigsaw group. Main mechanism of Jigsaw is Home and Expert group activity. In both the Jigsaw Home and Expert group are the main events in Jigsaw strategies. In jigsaw process at first they sit in home group and collect their chunk material/content/portion and forms expert group to mastery over their respective content. After that, they return to their home group and teach/share their expertise content to their home group member. Likewise, each student and group members gets complete master over the content through cooperative groups. At the end, students’ progress is measured through quiz or any other test.

In the present study Jigsaw I cooperative learning strategy is considered. The steps of this cooperative learning explained in detail in the how to organize jigsaw.

1.7.2. Organization of Jigsaw Strategy

The Jigsaw strategy involves few process or steps. They are “1) Formation of home groups and pre-work 2) Giving the groups of experts the units of work 3) Expert group research their expertise subject before they return to their home groups 4) Students in expert groups return to their home groups to share what they have learnt with their friends 5) Individual evaluation and grading” (Holliday 2000, as cited by Sahin, 2010). These steps are presented in the following figure 1.2.
Step-1 Formation of Home Group and Collecting Learning Chunk

It is the first step of Jigsaw, in the beginning the entire class sits in small groups. Each group consists of four students and group is called as home group. For cooperative learning teacher divides the day content/portion/chunk into four meaningful portions. During this stage, teacher distributes the small portion/chunk to each group in the form of pocket. Group leader collects and distributes portion to group members. For requirement “the students given letters, numbers or names that will help them to form expert groups” (Gregory & Hammerman, 2008). Else small portion may be labeled with different color bands or ribbons may also represented in the form of different color or based on the name of the content sheet like Sheet-A, Sheet-B, Sheet-C, and Sheet-D.

Step-2 Formation of Expert Group and Mastering Respective Learning Chunk:

In second step the students who are assigned with same portion forms expert group. At this point, the entire class converted into four expert groups. With this, students are able to meet same content mate and to master the specific content. “The goal of working together in expert groups is very simple to learn their part of the task better they would working alone” (Parker, 2001). “They read and discuss learning material provided by the teacher and help each other learn about their assigned topic. They also decide how best to present the material to others when their home teams reconvenience” (Arends & Kicher, 2010). Furthermore, the expert group mates are
also free to discuss and negotiate with their team to clarify their doubt. The step support the expert group to get complete knowledge and mastery of the content. The student works with common goal based on the principle interdependency. Meanwhile the teachers supervise the teams to know how they are engaged. If needed, the students may get assistance of the teacher when the team members fail to assist problems.

**Step-3 Return to Home Group and Serving as a Teacher**

In this stage students get complete mastery over the entire content by teaching their mastered and assigned content to their group members as well as understanding the teachings of their teammates (Parker, 2001). Here the students return to home teams and complete the two tasks. First, teach the material to group members with appropriate time as well as involving in clarifying questions and discussions. Second, the group members negotiate and interact with one another to master the entire content in the group. Successfully mastery over the content depends on how team mates show their interest, motivated support from the other team members in learning other portion along with their own work (Slavin, 2011). Across the stage they need to involve conciously and activiely in the team realted activity and work collaboratively in their group.

**Step-4 Quize Organization**

Quiz organizers is the last step of Jigsaw. Teacher conducts the quiz activity to know the mastery level of the different groups. The teacher rewards the home teams who performed better in their teamwork and scored highest in cooperative learning.

To conduct Jigsaw co-operative learning teacher has to know the seating procedure involved in it. It specifies exact seating procedure when students need to engage in home and expert group activity. In the beginning of the class students sit in home group as indicated in figure No. 1.2. In this group students collect their colour tags and wear and this will helps in engaging the home and expert group activity. The colour representation remains throughout the class for home group. According to their colour tag and alphabet they collect the respective content chunk or portion. In expert group respective colour or alphabet students forms the groups as indicated in
the figure and engage in getting complete mastery over the content. Based Jigsaw home and expert activity they complete the steps of the cooperative learning. The nature of home and expert group depicted in the following figure.

*Figure 1.3. Nature Home Group and Expert Group in Jigsaw strategy*

By keeping the nature of 5 E’s Instructional model and Jigsaw, the study kept these two as major component for development of module of the present study. And integrated the both the steps in a meaningful way to develop the module i.e. constructivist teaching of the present study. Additional technology components are considered to develop technology based module of the study. The technology aspects are discussed under educational technology and integration of educational technology.

**1.8. EDUCATIONAL TECHNOLOGY**

Commission on Instructional Technology, USA defined educational technology is a “systematic way of designing, implementing and evaluating the total process of learning and teaching in terms of specific objectives based on research in human learning and communication and employing a combination of human and non-human resources to bring about more effective instruction” (Kumar, 2003). In education, Education Technology is represented as unique area. It is not a simple combination of education and technology. But, it transfigures educational practice by applying various technological component and psychological principles in education field. It is emerged from technology in education and technology of education. The former one represents simple use of various technological gadget in education field i.e., computer, tape-recorder etc. in class. So it is termed as hardware approach to educational technology. It is not completely used for educational purposes. In later, concept technology is developed based on the principles strategies, techniques and
theories of learning to address effective learning and learning environment in education. Ex. Well-developed Multimedia CD package, MS office can be used in the form of technology of education. Initially technology in education was developed later technology of education. In essence, the knowledge of both is important.

In modern educational scenario across the world educational technology is influenced and impact by cognitive psychology and constructive psychology. These two schools of psychology influenced computer based education and ICT and created new opening up in use of educational technologies in education. Today they are also addressed as Cognitive technologies and constructive technology tools. These technologies argues confidently that technology is not only for importing knowledge to student community but highly significant in engaging students in problem solving, inquiry, discovery learning and knowledge construction process. As a result, today in classroom technology too addressed in the light of instructive technology model and constructive technology model. But second wave of educational technology had created new shift from instructive technology to constructive technology.

1.9. INTEGRATION OF TECHNOLOGY

Technology integration or integration of technology emerging practice in education. It is used to improve the input, process and products of teaching and learning environment. It refers to use of various components of technology to support and enhance teaching, learning and other educational connected tasks. When technology is integrated, it helps in accelerating the task of teacher, simplifying the learning teaching process, and eventually students will be engaged in specific and activity oriented task. Moreover, it engages students in higher level learning ability such as analysis, evaluates and creates. In this aspect, technology integration influenced on curriculum practices. The International Society for Technology in Education (2008) also noticed that “Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions - as accessible as all other classroom tools. The focus in each lesson or unit is the
curriculum outcome, not the technology” (ac cited by Raihan & Lock, 2012). Therefore there is abundant need and scope for technology integration in educational practice. Experts are also made their effort and developed models for technology integration based on different theories of learning.

1.9.1. Need for Technology Integration

In education, technology integration is essential for effective management of curriculum. Churma (1999) has listed need of technology integration in curriculum from the point of teacher and student. As he listed for teachers it helps to manage the curriculum and by adopting technology components such as word processing, electronic grade books, electronic communication and other features. For students technology integration need to 1) Review of basic skills such as development of writing skills, research skills, higher order thinking skills and creativity 2) A visual representation moves the students from concrete to abstract learning 3) Develop problem solving and higher order thinking skills 4) Explore relationships of ides, test hypotheses and construct knowledge 5) and it moves beyond computation and memorization and allows towards applying knowledge, testing results and synthesizing information.

1.9.2. Procedure for Development and Integration of Technology

Based on review of theoretical background three prominent standpoint and directs observed for how to integrate technology and use technology in education field. The basic model is concept of education technology guides technology integration. And second and most noticeable and recently developed practice is Technological Pedagogical Conant Knowledge (TPACK). And third is technology integration model. When these three are observed from implementation part; first one is basic requirement and second is modern approach with using advanced components and last one is categories the integration model. However knowledge of all the three is essential requirements of integration of technology and development of education technology.

1.9.2.1. Education Technology as a Basic Model of Integration of Technology

Essentially, the concept educational technology contributes for technology integration model and obviously considered as basic technology integration model.
For developing educational technology, need to care technology in education as well as technology of education. Accordingly, necessity to identify the technologies which are need to use in education and how they can be handled. For using those technological gadgets one has to use technology in education. But technology in education will be more meaningful and successful in the presence of technology of education. This specifies development and use of software based on the principles of education. The sound pedagogical knowledge significantly helps in development of technology of education. It can be seen that, for effective use of educational technology teacher must have through knowledge of technological component, pedagogical component and skill to integrate both in systematically into content area. Therefore education technology emphasizes technology, pedagogy, psychological principles and content knowledge for integration and development of technology.

1.9.2.2. Technological Pedagogical Content Knowledge (TPACK)

From recent research, it is evident that many researchers made their effort in development of integration of technology model using technology, pedagogy, content components. Among, the most noticeable research has been demonstrated by the Mishra and Koehler (2006). They are the leading researchers who developed new model for technology integration and it is widely known as TPACK model. It is well-known model in technology integration in pedagogical practices. The model is extension of PCK derived by Shulman (1986). PCK means pedagogical content knowledge. It points out the need of connection of technological knowledge and pedagogical knowledge. This might help the teacher to design and implementation of appropriate learning experiences to maximize student’s learning. By keeping this as a model, they developed the TPACK. While developing, Mishra and Koehler (2006) proposed that “technology increasing prominence and widespread use in classrooms situate it as third area of expertise that should integrate into the PCK model. Their new Technology, Pedagogy and Content Knowledge (TPACK) posit that true technology integration in the classroom happens when teachers comprehend and interweave all three of the expertise area and attain an understanding and insight that supersedes expertise in technology, pedagogy or content along” (Smith, Chen, Johnson, O'Brien, & Voss, 2012).
The model showed that technology integration perspectives draw from content, pedagogical and technological to frame Technological Pedagogical Content Knowledge frame work. The model capable of separate all the three components, at the same time it understand and shows that they are co-exist in a dynamic transactional relationship. Knowledge of all the three is essential for overcome the problem of teaching with technology. For effective teaching with technology TPACK is required (Spires, Zheng, & Pruden, 2012). The transactional relationship of three basic components forms three main components. The components of TPACK model are presented in the following headline.

**Content Knowledge**

The content knowledge represents knowledge of subject matter of teacher. It is main factor in education and guides us about what to teach? What children need to learn and what to evaluate in class. For effective development and integration of technology depth knowledge of content is essential.

**Pedagogical Knowledge**

Pedagogy is science of teaching, guides in how to lead students in classroom through appropriate teaching strategies. Always guided by the various theories of learning; principals of learning; maxims of teaching; models of teaching etc. Thus, teacher knowledge of pedagogy is another essential component for technology integration. This means, quality of educational environment is always assured through the pedagogical practice which employed by the teacher.

**Technological Knowledge**

It is a refers to knowledge of various technologies used in education. For integration of technology basically one should be aware about the technologies like audio, video, multimedia, hypermedia as well as the various gadgets and how to use in classroom situation.

**Pedagogical Content Knowledge (PCK)**

It is a mutual relationship between content and pedagogy. It refers to use of appropriate pedagogy for teaching specific content. It addresses that teacher must
chose/select appropriate pedagogical factors to teach specific content area (An & Wilder, 2010)

**Technological Content Knowledge (TCK)**

“Knowledge that involves understanding of manner in which technology and content are reciprocally related to each other” (An & Wilder, 2010). Content is presented with the help of suitable technological component. It is like development of electronic content. Instead of delivering content in a traditional way, teacher knowledge about how to present content using technology components in a newer way. It represents e-content development using text, audio, video or in multimedia and hypermedia etc. format for technology integration.

**Technological Pedagogical Knowledge (TPK)**

Technology tools are used in education to import teaching and learning based on pedagogical procedure. TPK assist us about the use of specific technological tools for specific pedagogical purpose. Thus, technology and pedagogy are combined together meet the demands of education system. Discovery learning, problem solving mode of Computer assisted instruction are also good example. Similarly, today we can use technologies for construction of knowledge in the form of collaborative technology tools.

**Technological Pedagogical Content Knowledge (TPACK)**

TPACK means technological pedagogical content knowledge. It emphasizes dynamic, transactional relationship between these three knowledge components. Here all the three elements interact systematically and dynamical for creation of appropriate integration of technology in education field.

**1.9.2.3. Technology Integration Model**

Roblyer, Edwards and Havriluk (1997) discussed two type of technology integration model in their book “Integration of Educational Technology into Teaching” as listed below. It provide guidelines for nature of development of using technology or integrating technology in development of educational technology.
Table 1.2

Features of Direct Instructional Model and Constructivist Model

<table>
<thead>
<tr>
<th>Direct Instructional Model</th>
<th>Constructivist Model</th>
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<tbody>
<tr>
<td>o Teacher-directed</td>
<td>o Discover learning</td>
</tr>
<tr>
<td>o Systematic instruction</td>
<td>o Unstructured learning</td>
</tr>
<tr>
<td>o Systems approaches</td>
<td>o Self-directed learning</td>
</tr>
<tr>
<td>o Teacher-Centered</td>
<td>o Student-centred</td>
</tr>
<tr>
<td>o Knowledge transfer</td>
<td>o Knowledge construction</td>
</tr>
<tr>
<td>o Transmission models</td>
<td>o Generative learning model</td>
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</tbody>
</table>

Technology Integration Based on Direct Instructional Model:

It is traditional model of technology integration approach. It has highest potential and helpful for teacher to transfer information in classroom. Teacher controls the environment and leads student learning in step by step sequential order. The students are observed as passive learners and not encourage activities or interaction. Despite this, students feel that learning environment is irrelevant for self-learning.

Technology Integration Based on Constructivist Model:

Technology based constructivist model is contrary to direct model. The model engages in different technology mediated learning environment and control and engage themself in knowledge construction activity. They get assistance from the teacher and self motivation enables them to take active engagement in various activities. As a consequence, the model direct learner oriented, authentic task oriented and group oriented learning instead of teacher directed learning environment. The model is based on inquiry based learning and evolved from cognitive learning theories. It uses problem solving, multimedia production and web based learning to follow constructivist based instructional model. The theories of learning developed by John Dewey, Lev Vygotsky, Jean Piaget, Bruner and Harvard Gardner were influenced on development of constructivist based technology integration strategy (Roblyer, 2008).
Other Important Reflections related to Use of Technology Tools in Development of Constructivist Teaching

From comprehensive review it is found that technology facilitates constructivist practices in many way and technology tools are available and highly useful for engaging students in knowledge construction activity.

Moreno (2010) has listed few points and those supports technology and constructivist views of learning. They are

- “Individual constructivist perspective the role of technology is to provide instructional materials and environments where students can make intellectual choice for themselves as they construct knowledge in their minds.
- Inquiry based learning includes technologies that support individual constructivism by presenting students with opportunities to carry out experiments, process data collected by sources and interpret the results of different graphic representations.
- Cognitive tutors and collaborative computer-based environments are technologies that can help students construct meaningful understanding by interacting with others”.

Bransford, Brown and Cocking (2000) reported major ways, where and how learning improved with technology based and pedagogical innovations in school curriculum. Among few ways are directing constructivist pedagogical practice by using technology. They are: Technology brings real-world problems in classroom practice in class; provides scaffolds and tools to enhance learning; creates more opportunities for feedback, reflection and revision in teaching and learning.

Molenda (2008) has presented technology application for constructivist principles listed by Driscoll. He also listed how those principles can be addressed better from technology based delivery than the face to face conventional instruction.
Table 1.3  
*Technology Application Listed by Molend Based on Constructivist Principles Listed by Driscoll*

<table>
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<tr>
<th>Constructivist Principles listed by Driscoll (2005)</th>
<th>Technology Used to Address the Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Embed learning in complex, realistic and relevant environment</td>
<td>1. Can be created by using simulation software</td>
</tr>
<tr>
<td>2. Provide for social negotiation as an integral part of learning</td>
<td>2. Facilitated by e-mail, chart rooms, and threaded discussion facilitate</td>
</tr>
<tr>
<td>3. Support multiple perspectives and the use of multiple modes of representation</td>
<td>3. World Wide Web platform enables designers to link pictures and moving animation clips to verbal presentations</td>
</tr>
</tbody>
</table>

Finkelstein and Samsonov (2008) makes clear in detail about how to use powerpoint in constructivist teaching and listed many instances to show the use of constructivist practice. As they viewed, creative and engaging powerpoint projects encourages participation in project based and problem based activities and engage the students in knowledge construction. Interactive quiz or review, an interactive map, clickable menu with hyperlinks to many other resources, a class question and answer game, and graded test are good example for interactive projects can be effectively created in powerpoint for ensure application of constructivist approach. For promotion of such design PPT need to be design in a non-liner model than the linear mode for construction of knowledge. The non-linear PPT design such as game, assisiting retention and understanding; problem-based learning, fun in the early years, expressing knowledge in college etc are potentially interactive in engaging the students.

Chandra, (2003) listed computers and networks might be used with a constructivist frame work in many way. He includes; simulation; facility for collection, examination and analysis of statistical data; a word processing, document presentation, or utilizing system; create environment for domain-specific problem solving; facilitate group collaboration; an interactive hypertext encyclopedia; a medium for communication with parent, children, teachers etc.
Similar factors were also highlighted by one of the project ACOT. The project realized several factors from its outcome. They are 1) Special softwares designed in education focus on skill development. The tool software such as word processing, databases, spreadsheets, hypermedia applications, and multimedia can lead opportunities for students problem solving and critical thinking. 2) Technology creates child centered environment and empower the students as thinkers and problem solvers. 3) Technology tools platforms the child activities in a collection of information from multiple formats and organization, visualization, linking and discovering facts and events. 4) Technology has moved teacher centred instruction into student centered instruction. Also applies constructivist teaching in designing and implementation of such technology based/integrated units (Sandholtz, Ringstaff, & Dwyer, 1997).

“Seymour Papert’s is eminent constructivist ground breaking work in using computers to teach children had led to the widespread use of computer and information technology in constructivist environment” (Talawar & Kumar, 2009). He invented LOGO programme for constructive practice. It is a student’s programming tool highly concedes natural curiosity of the students and keeps them in construction of reality of their world. He expressed that right educational reforms are needed to make the children as motivated learners, problem-solvers and meta-cognitionists. This will enable the child to take ownership of their own learning. Taken together, computer is a useful educational tool to achieve all such reforms in education (Tomar & Sharma, 2005).

Sharma (2013) view that there are many reasons and elements of rational use technology in education. Few of elements contribute for development of constructivist environment in classroom. They are technology increases perceptions of control; engages in productive work; supports new instructional approaches such as cooperative learning, shred intelligence and problem solving and higher level skills. Besides many technology tools are helpful in integration into curriculum practice. Commonly used application software’s are word processing, spreadsheet, database software, presentation graphic software and instructional software.

From the above theoretical background of integration of technology, the study kept TPACK model as framework for developing technology based module of the
present study. And identified the technology tools those supports constructivist teaching such as audio, video, audio visual, multimedia, animation, hyperlink, hypermedia, animation and PPT etc. under technology component and 5 E’s Instructional model and Jigsaw component under pedagogical component for developing technology based constructivist teaching module. Another crucial feature of these two model is use ZPD and constructivist assessment strategies for initiating the constructivist teaching. Both are inherent in the 5 E’s Instructional model and Jigsaw. The detail note on ZPD under head line social constructivism and constructivist assessment strategies are given in the headline constructivist assessment and integration of technology in constructivist assessment.

1.10. CONSTRUCTIVIST ASSESSMENT

Constructivism has given birth to many practices in education. Even it is evident in testing and assessment. It has devised new form of assessment called constructivist assessment. It is new alignment between learning and construction of knowledge. Constructivist assessment is prerequisite for knowledge construction. Piaget cognitive constructivism and Vygotsky Social constructivism provides guidelines for such assessment practice. From Piaget cognitive perspective assessment is essential to elicit the prior knowledge and to keep the students in knowledge construction process. James and Lewis (2012) expressed that “Constructivist perspective of learning received extensive attention for its implications for assessment. In view of the importance attached to prior learning as an influence on new learning, formative assessment emerges as important, integral elements of pedagogic practice because it is necessary to elicit students’ mental models, in order to scaffold their understanding of knowledge structures and to provide them with opportunities to application of concepts and strategies in novel situations. In this context teaching and assessment are enabled towards the goals of learning, particularly bridging gaps between current understanding and the new understanding sought”

Vygotsky constructivism given groundwork to develop noted alternative assessment so-called dynamic assessment. His work has created evolutionary change in assessment and testing procedure and development of new form of assessment in school education. In school, there are two forms of assessment namely static
assessment environment and dynamic assessment. In states assessment teacher ask questions to collect the answer from the students. But the answer may be correct or wrong examiner move on to the next listed question. Here Vygotsky ideas are emphasize dynamic assessment to collect correct response from the examine. At this time child would provide with guided hints to encourage problem solving. Thus examiner needs to act like teacher as well as tester. Thus Vygotsky recommended need of passing from static assessment to dynamic assessment (Lutz & Stenberg, 1999). All such assessment procedures are addressed in the light of ZPD i.e., zone of proximal or potential development. ZPD is distance between existing cognitive development and expected or potential development in the child. Usually the test procedure adopted by the Binet and others test actual cognitive level of the child i.e., zone of actual development, it indicates tested isolated individual under control condition. Although there is necessary to test and measure zone of proximal development, i.e., the difference between the scores of potential development achieved after receiving assistance and support of elder (Moghaddam, 2007). It means, the potential development achieved after scaffolding needs tap by special testing procedures.

McDevitt and Ormrod, (2002) listed the factors involved in assessing the potential development with dynamic assessment system. They are (a) identifying tasks that student cannot initially do independently (b) providing in-depth instruction and practice behaviors and cognitive process related to the task, and then (c) determining the extent to which each student has benefited from the instruction. This approach yields more optimistic evaluation of students’ cognitive capabilities than traditional measure of cognitive ability. Later in his publication Ormrod, (2008) expressed that dynamic assessment suits formative assessment than the summative assessment. Like formative assessment tool dynamic assessment provides child cognitive development strategies and approaches to learning

Another distinguish contribution of constructivism in the field of assessment is alternative assessment. According to Senapaty (2014) “Alternative assessment procedures are based on constructivist principles. Fundamental focus of such procedures lies on learners’ ability for creative expression and proficiency in real life task and activities. Learners have to carry out task which are collaboratively decided by learners, instructors and the institution; and total artifact of people performance are
subjectively assessed by the learners, peers and instructors. The task and performance are show cased for every learners and the term which act as motivators to learn to excellence. Here the task, the criteria, performance condition and the indicators are collaboratively defined and designed. This makes the learners understand from the beginning what they are expected of in a definite context of learning” Portfolio assessment, performance task and rubrics are good example for such alternative assessment and they have highest value in constructivist educational practice.

In Indian situation NCF 2005 and NCFTE 2009 also gives guidelines for constructivist assessment or evaluation. They identified constructivist assessment as an obvious need of constructivist philosophy. It is used to develop new teaching learning approach and carried out before, during and after teaching work. Therefore it is recognized as paradigm shift from quantitative assessment to qualitative assessment (Murthy, 2012). Overall constructivist assessment or evaluation follows process evaluation, product evaluation and emphasis will be given to formative evaluation.

1.10.1. Criteria Followed in Constructivist Assessment

To ensure constructivist assessment must follow conditions. Jonassen (1992) listed the several factors and they help in addressing the constructivist assessment they are: vast assessment

1. “Learners should construct their own goals
2. Learner should be asked to do something they would do in real world.
3. Should be driven by the content.
4. Evaluation should assess higher order thinking.
5. Constructivist evaluation should be conducted on ongoing basis during the process and not just at the end of the course.
6. Should be dependent on the context.
7. Should be tied to a domain of possible outcomes, each of which would provide acceptable evidence of learning.
8. Evaluation should be multimodal.
9. Should encourage socially constructed meaning.
10. Constructivist elevation should be more like a self-analysis and meta-cognitive tool” (As cited by Bhatia & Chopra, 2012).
1.11. CONSTRUCTIVIST ASSESSMENT STRATEGIES

For activating knowledge construction teacher can use many assessment strategies. Several sources are reported useful constructivist strategies to engage constructivism in classroom and presented in the following table.

Table 1.4
*Constructivist Evaluation Strategies*

<table>
<thead>
<tr>
<th>Constructivist Evaluation Strategies</th>
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<tbody>
<tr>
<td><strong>Pictorial Assessment</strong></td>
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<tr>
<td>1. Pictorial Assessment</td>
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<tr>
<td>2. Reflective Questioning</td>
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<tr>
<td>3. KWL Charts</td>
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<tr>
<td>10. Anecdotal Records</td>
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<tr>
<td><strong>Student Self-Assessment</strong></td>
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<tr>
<td><strong>KWL chart</strong></td>
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KWL chart is useful two dimensional chart include three headlines i.e., what you know? What you wanted to know? And what you have learnt. Students requested write their responses in each section. First section initial level they write their prior knowledge in the form of answering the question or listing prior knowledge about the content. Second section lists what they wanted to learn? With the help of teacher. With this students will be engaged in knowledge construction during knowledge construction process. Lastly students will verify whether they have learnt.

Exit Cards

Exit cards are the square shape card contains three questions. These cards are also named as three minute activity card and used before, during and after teaching to assess the students. By reading the questions students gives their responses spontaneously and teacher to engage students in instruction and constructivist activity.

Graphic Organizers

Graphic organizers are diagrammatic representation ideas using different shapes like star, square, lines etc. Organizers may be designed or presented by the teacher to assess the learning. Either students may also prepare their ideas in the form of organizer and presented to the entire class through their oral presentation. The students designed graphic organizers shows the novel vision of productive of their learning. Despite it can be used as tool for eliciting prior knowledge.

Mind Maps

Mind maps are also type of graphic organizers. In this, mind ideas are presented in the form of flow charts and other diagrammatic representations. Frequently they are suitable in assign the concepts, attributes and other features learnt in the class.

Self-Assessment

Self-assessment is process in which students assess their achievement by themselves. It makes the students to realize their achievement level and decides how efficient in construction of their knowledge. For this teacher can utilize rubrics, checklist and open-ended questions to enrage the students to know their level of knowledge construction. Among all the other form constructivist assessment strategies, it perceived as most effective when it allow the students in realizing their learning abilities by themselves.

Questions

Questions are most commonly used assessment tool and strongly identified as the building blocks of constructivist learning process. Their main function is to identify the prior knowledge of the students and to connect their ideas to higher order
thinking levels. Guided, anticipated, clarifying and integrating category of questions will helps in encourage students to demonstrate their learning capacities in the class (Sridevi, 2007).

Peer Assessment

Peer assessment is a different formative assessment strategy in constructivist assessment. Students or groups are assessed by the entire class of group of students. Friends are going to give feedback by assessing the progress of their friends in classroom. From constructivist view teacher should use this strategy to engage students in sensing the gaps in their learning and understanding and to get a more refined grasp of learning process; clarify, review and edit their ideas of others, encourage collaborative learning through interchanging their ideas” (Spiller, 2012). Thus, it adopts scaffolding, cognitive apprentice and social constructivist practice with the assistance of knowledgeable student in classroom.

Celebration of Learning

Celebrations of learning are the product of students expertise learning area presented to their friends, teachers and parents (Sasikumar, 2009).

1.12. TECHNOLOGY BASED CONSTRUCTIVIST ASSESSMENT

For assessing progress of students in technology based teaching quite essential compulsion is technology based assessment. Technology based assessment is become very popular through computer technology. In traditional way computer is used for the purpose of multiple choice based assessments. Series of questions helps assessing the achievement of the student. In addition, other forms of objective test managed effectively by using computers. Computer application software and their features such as smart art, animation, and hyperlinks are effectively operate assessment and evaluation. On regular basis MS office tools includes all these features and supports in technology based assessment. While, modern technology i.e., ICT addresses assessment and evaluation in an advanced mode known as online mode or online testing. In the absence, this mode technology also organizes assessment in offline mode.
The above discussed tools also engage the students in technology based constructivist teaching. Hyperlinks, animations, mind maps, smart art etc. enable teacher to adopt constructivist assessment strategies for technology based constructivist teaching. Besides MCQ other forms of objective type questions also be managed using computer based assessment. Words, figures, graphs, diagrams etc. also best medium for assessment of students’ progress in the class. By using these tools one can design KWL chat, peer assessment, rubrics, questions, mind maps, graphic organizers, exit cards and self-assessment tools in wise and dynamic way to introduce technology based constructivist assessment.

The conceptual framework of the study has covered the constructivism and its approaches, jigsaw cooperative learning and integration of technology and its approaches. The frame work has laid a foundation for the present research and given in understanding for the need for the study.

1.13. NEED AND RATIONAL FOR THE STUDY

The progress of a nation depends mainly on quality education. The quality emerges through teaching and effective learning. To achieve this pre-request, children’s are engaged and facilitate with quality learning in educational setting. But quality learning is always guided by how teacher engage students in different level. If students are engaged in the dominance of teacher, it represents passive involvement of students in learning. And emphasize more on importing knowledge and understanding abilities in the child. On the other hand, if child engaged through different activities, it assures students involvement, and not only receives and understand but also to analyses, synthesis and evaluates their learning abilities in educational settings. Overall, students engage in higher order level like analyses, synthesis and evaluation level. These desires witnessed in education in terms of theories of learning and revised of taxonomy of educational objectives.

The history of theories of learning visualizes that modern theory of learning useful in engage students in higher order learning ability called construction of knowledge. Rather simple modification of behavior or receiving ideas from the teacher in classroom based on behaviorist theory of learning. On the other hand new version of taxonomy of objective kept creation as higher level objective. Brooks and Brooks viewed in this book that (1993, as cited by Sousa, 2006) “Constructivist
teacher ask open-ended questions to encourage analysis, evaluation and creation abilities in the child. From this point the teacher who wants to develop higher order thinking as for Blooms revised taxonomy demonstrates same abilities in the child demonstrate accounts the teachers”. In this ground, teacher must organize teaching and learning activities systematically in the form of analysis, evaluation and creation. From the above it obvious that education activities like teaching, learning, and evaluation must be organized towards knowledge building abilities in the students. These changes addressees paradigm shift in education and widely known as constructivist environment. It considers ‘educational environment as constructivist environment’, ‘teacher as constructivist teacher’, ‘learner as constructivist learner’ and it is accepted as ‘constructivist movement’ in education. Therefore classroom activities are “shifting from instruction to construction and knowledge instruction to knowledge construction” (Sandholtz, Ringstaff, & Dwyer, 1997).

Constructivism perspective claims that “learning is constructive process instead of receiving process from the teacher”. The focuses here is students construct their new views, thoughts, and understandings based on the ideas already known to learner. Thus, prior knowledge and previous knowledge is building block of learning. Bruner (1966) viewed that “Learning is active and learner constructs their own knowledge about a subject through active engagement in learning by building on past knowledge and experiences” (as sited by Whitton, 2014). Ornstein, Levine, Gutek and Vocke (2011) reported that Constructivism is innovation process, in which child interact with their environment and build their world knowledge. They discover the inadequacy in their existing concepts and new situation and by exploring the environment they reconstruct or conceptualize their knowledge in more complete higher level knowledge”. So, “Knowledge construction is better strategy to help learners personalize and deeply internalize ideas, to create situations where skills, concepts can be applied in different contexts to solve problems, to explore or generate ideas, and to generalize and synthesize knowledge” (Sandholtz, Ringstaff, & Dwyer, 1997). Really such types of practice are requirement of modern education. Jean Piaget also visualized that “Cognitive growth only occurs when children construct their own knowledge. Children need opportunities to figure things out on their own” (Cari, 2000)
From the above underlying argument it is evident that constructivism revolt against teacher dominated classroom. All constructivists also agree that transmission nature of traditional approach to teaching not entertaining interact with prior knowledge and new knowledge as well as not involves not includes any conversation, which are necessary internalization of and deeper understanding (Richardson, 1997). They encourage wide range of experiences such as inquiry activities like discovery, problem solving, discussion with peers and teachers, collecting and interpreting information from the different sources, experiencing their understanding in diverse ways, applying and validating their understanding in new way etc (Sharma, 2006). Thus, constructivism unquestionably accepts unique character of children as visualized by Papert “Children as builder of their own intellectual structures”. Piaget also pronounced “Learner construct their knowledge restructuring and structuring of the cognitive patterns”. Overall constructivism operates learning is “constructing something” instead of ‘receiving something’ in classroom. Meanwhile, it forms new watchword in education and address teaching is a “LEARNING TEACHING PROCESS” rather than “TEACHING AND LERNING PROCESS”. The novel approach also claims “ACTIVE LEARNING OVER PASSIVE LEARNING” “STUDENT OWNERSHIP IN LEARNING”. Obviously constructivism is considered “DNA OF LEARNER CENTERED EDUCATION”. In this way, constructivist pedagogy or theory of learning brought revolutionary change in education and in fact, constructivism practice is also manifest in National Curriculum Framework 2005 and National Curriculum Framework for Teacher Education 2009. Thus is hallmark of school education and teacher education programme.

The present education scenario is not incomplete in the absence of technology usage. Especially computer technology and information communication technology greatly influenced and shaped different facets of education. Today computer technology is not only adopted for traditional practice like tutorial, gaming drill and practice but also used innovative models like simulation, discovery learning, and problem solving. These are called as modes of computer assisted instruction. The technology era indicates that it is necessary to use technology tools in construction of knowledge. Gance, (2002) expressed that “Technology is inherently constructivist and encouraging its use uncritically in classrooms or as replacement for teachers”. Constructivist approaches can also be adopted by using technology tools like concept-
mapping, multimedia and hypermedia developed software technology tools to involve or engage actively in many thinking skills such as manipulation of information, problem solving, own illustrations and examples etc. (Sikdar & Bhojwani, 2010). These tools rightly termed as “Mind Tools” by Jonaseen. Tool software’s such as word processing, databases, spreadsheets are highly useful in constructivist teaching.

It can be noticed very often that “constructivism is based on the idea that children learn better by actively constructing knowledge and by reconciling new information with prior knowledge” (Ojha, 2011). From the above discussion it can be furnish that constructivism as well as technology tools are used construction of knowledge. However technology specialist made their effort in integration of technology based on constructivist theories of learning. In this connection Sharad, (2006) rightly argued that “the role of technology in education so important that it will force the issue of didactic versus constructivist teaching. The teacher will no longer have the choice but will be compelled to use a constructivist approach in a technology rich environment”. Here, the argument is really call for technology integration in constructivist practice and it gives new framework for learning, teaching as well as for learner centered educational environment. In this context, technology practitioners suggested that direct technology integration model and technology integrated constructivist model. Constructivist ideas of Piaget, Vygotsky, Pepet, and Glassesrfeld influence on development of technology integrated constructivist model.

From these discussion it can be conclude that “21st century society and parents are expects their child learning through technology, learning with technology, and technology based learning. Another side educationists, national curriculum frame works and policies are emphasizing constructivist teaching”. Therefore blend of technology and constructivist teaching is novel need of present education as well as fulfill the thirst of every one in education field.

Social Science is one of the import subject in school curriculum. It deals with different sections specifically history, political science, geography and economic compartments. There is few blind issues like “the subject matter of social science not helps to keep active in class and forms monotony in class and negatively influenced on learner”. Teacher also struggling to improve their involvement and improving the
academic achievement of students in the subject. But social and cultural features of human society is the subject matter of social science; it platforms social nature of construction of knowledge. One should realize inherent reality of this subject and need to adopt discussion, interaction, collaboration in classroom. Ediger, (2010) expressed that “constructivism in teaching social studies emphasizes that pupil create their own knowledge as a lesson or unit progress. With enriched experience, the pupil gain knowledge to develop more apprehensive concepts and generalization. There are no absolutes, the pupil continues to achieve, grow, and develop in stimulating social studies environment”. Similarly technology components such as audio, video, text, multimedia also best medium to communicate realities in terms of virtual realities in social science subject. So, integration of technology in constructivist teaching in social science subject eliminates all problems and creates interest, attention, motivates, increases students’ involvement and improves their achievement. It is also evident from opinion of many.

Ayas, (2006) expressed that “integration of technology into the social studies classroom has the potential to facilitate development of student’s critical thinking, decision-making and problem-solving skills”. Rice and Wilson (1999) discoursed that “Technology tool that aid in constructivist learning in the social studies classroom include various types of simulation and strategy software/CD-ROMs videodisc, multimedia/hypermedia and telecommunications. The major benefit to social studies teachers who integrate technology to support constructivism in the social studies include the obtain relevant information and opportunities for students to examine a verity of viewpoints so they can construct their own knowledge of various social studies topics”. Hence there is greater scope and crucial need for integration of technology tools in constructivism in social science subject. Thus, the present study is conducted to know the impact of Technology Based Constructivist Teaching on academic achievement of IX standard students of Social Science subject.

1.14. RELEVANCE AND SCOPE OF THE STUDY

The present research is relevant from theories of learning and theories of integration of technology into pedagogical practice. The study also shows its importance in the back ground of NCF-2005 and NCFT-2009. By way of these two
highest documents of curriculum frame work, constructivist practices are guidelines for school curriculum and framing curriculum. Apart from this, technology based pedagogical practice is a global demand of all society. In this context, the present study aims at studying “An impact of Technology Based Constructivist Teaching on Academic Achievement of IX standard students of Bengaluru City”

The study was conducted in two secondary schools of Bengaluru city namely government and private school. The sample of the study compressed 156 students. The study is conducted in IX standard Social Science subject and academic achievement is considered as dependent variable whereas constructivist teaching, technology based constructivist teaching and types of school are considered as independent variable. The moderator variables are: Gender and IQ. In each school IX classes were equated and experimental group-1 and experimental group-2 were identified based on the mid-term academic achievement scores in social science subject. Therefore the study follows two group equivalent design. Before intervention Ravens Progressive Matrices and validated pre-test was administered. During intervention validated CT and TBCT modules were taught in both schools and validated Daily Assessment Sheet and Unit Test are administered. After this, validated post-test and rating scale for CT and TBCT and free writing sheet were administered. Further research recorded the scores of IQ test, pre-test, DAS, Unit-Test, Post-test, rating scale and free writing sheet data was analyzed. Researcher used SPSS 17 version to calculate descriptive statistical and inferential statistical analysis namely t-test, person product movement correlation, Two Way ANOVA and linear regression model.

1.15. OVERVIEW OF THE CHAPTERS

The study is organized under the following chapters;

The first chapter deals with background of the study. It describes various concepts of the studies such as constructivism, types of constructivism, 5 E’s Instructional model, Jigsaw, integration of technology, constructivist assessment and need of the study.

The second chapter gives account of review of related literature. It is organized under studies related to constructivism, Jigsaw, technology and integration of
technology based constructivist teaching. And inferences and conclusion drew from literature survey.

The third chapter describes the research methodology followed in the study. It gives detailed account of statement of problem, operational definitions, objectives, variables of the study, hypotheses, sampling procedure, research design, validation procedure, tools used in the study, try-out, experimentation procedure, and statistical technique used in this study.

The fourth chapter deals with the analysis and interpretation of data. It is organized under normality test, descriptive statistics, inferential statistics analysis, analysis of findings of rating scale, two question analysis and qualitative analysis.

The final chapter is summary and conclusion of the study. It includes brief summary, findings of the study, implication of the study, limitations of the study, and suggestion for further research. Lastly, reference and appendices have been included.