



International Research Journal of Interdisciplinary & Multidisciplinary Studies (IRJIMS)

A Peer-Reviewed Monthly Research Journal

ISSN: 2394-7969 (Online), ISSN: 2394-7950 (Print)

Volume-I, Issue VI, July 2015, Page No. 65-74

Published by: Scholar Publications, Karimganj, Assam, India, 788711

Website: <http://www.irjims.com>

**Constructivist Approach to Learning–
An Effective Approach of Teaching Learning
Jayeeta Bhattacharjee**

Faculty, Vivekananda College of Education, Karimganj, Assam, India

Abstract

Constructivism is an epistemology, or a theory, used to explain how people know what they know. Fundamentally, constructivism says that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences. Constructivism is a theory that asserts that learning is an activity that is individual to the learner. This theory hypothesizes that individuals will try to make sense of all information that they perceive, and that each individual will, therefore, “construct” their own meaning from that information. Driscoll (2000) explains that constructivist theory asserts that knowledge can only exist within the human mind, and that it does not have to match any real world reality. Learners will be constantly trying to derive their own personal mental model of the real world from their perceptions of that world. As they perceive each new experience, learners will continually update their own mental models to reflect the new information, and will, therefore, construct their own interpretation of reality. The basic idea is that problem solving is the core of learning, thinking, and development. As people solve problems and discover the consequences of their actions through reflecting on past and immediate experiences – they construct their own understanding and deeply understand what they have constructed.

Constructivism is basically a theory based on observation and scientific study about how people learn. When we encounter something new, we have to reconcile it with our previous ideas and experience, may be changing what we believe, or may be discarding the new information as irrelevant. In any case, we are active creators of our own knowledge. To do this, we must ask questions, explore, and assess what we know. In the light of these themes, in this paper, discussions have been made on concept of constructivist learning, salient features of constructivist learning approach, difference between constructivist learning and traditional approach of learning, teacher's position in constructivist learning approach, learner's position in constructivist learning approach and implications of constructivist learning approach.

Keywords: *Constructivist learning approach, accommodation, assimilation, schema*

Introduction: The theory of constructivism is generally attributed to **Jean Piaget**, who articulated mechanisms by which knowledge is internalized by learners. He suggested that through processes of **accommodation** and **assimilation**, individuals construct new knowledge from their experiences. When individuals *assimilate*, they incorporate the new experience into an already existing framework without changing that framework. This may occur when individuals' experiences are aligned with their internal representations of the world, but may also occur as a failure to change a

faulty understanding; for example, they may not notice events, may misunderstand input from others, or may decide that an event is a fluke and is therefore unimportant as information about the world. In contrast, when individuals' experiences contradict their internal representations, they may change their perceptions of the experiences to fit their internal representations.

According to the theory, *accommodation* is the process of reframing one's mental representation of the external world to fit new experiences. Accommodation can be understood as the mechanism by which failure leads to learning: when we act on the expectation that the world operates in one way and it violates our expectations, we often fail, but by accommodating this new experience and reframing our model of the way the world works, we learn from the experience of failure, or others' failure.

It is important to note that constructivism is not a particular pedagogy. In fact, constructivism is a theory describing how learning happens, regardless of whether learners are using their experiences to understand a lecture or following the instructions for building a model airplane. In both cases, the theory of constructivism suggests that learners construct knowledge out of their experiences.

Constructivism is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models," which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences. There are several guiding principles of constructivism:

1. Learning is a search for meaning. Therefore, learning must start with the issues around which Students are actively trying to construct meaning.
2. Meaning requires understanding wholes as well as parts. Parts must be understood in the Context of wholes. Therefore, the learning process focuses on primary concepts, not isolated facts.
3. In order to teach well, we must understand the mental models that students use to perceive the world and the assumptions they make to support those models.
4. The purpose of learning is for an individual to construct his or her own meaning, not just memorize the "right" answers and regurgitate someone else's meaning. Since education is inherently interdisciplinary, the only valuable way to measure learning is to make the assessment part of the learning process, ensuring it provides students with information on the quality of their learning.

Constructivist learning is inductive. Constructivist learning dictates that the concepts follow the action rather than precede it. The activity leads to the concepts; the concepts do not lead to the activity. Essentially, in constructive learning, the standard classroom procedure is turned upside down – no lectures, no demonstrations, and no presentations. From the beginning, students engage in activities through which they develop skills and acquire concepts. According to Good and Brophy (1994), constructivist learning includes:

Learners construct their own meaning: Students are not passive receptacles. They do not easily process or transfer what they passively receive. In order to make knowledge useful in a new situation, students must make a deliberate effort to make sense of the information that comes to them. They must own it. They must manipulate, discover, and create knowledge to fit their belief systems.

New learning builds on prior knowledge: In making an effort to make sense of information, students must make connections between old knowledge and new information. They must compare and question, challenge and investigate, accept or discard old information and beliefs in order to progress.

Learning is enhanced by social interaction: The constructivist process works best in social settings as students have the opportunity to compare and share their ideas with others. Learning occurs as students attempt to resolve conflicting ideas. Although social interaction is frequently accomplished in small group activities, discussions within the entire class provide students the opportunity to vocalize their knowledge and to learn from others.

Meaningful learning develops through “authentic” tasks: This aspect of constructivism is frequently misinterpreted. Using authentic tasks mean that activities are chosen to simulate those that will be encountered in real life or in an assignment.

Constructivist teaching is based on constructivist learning theory. Constructivist teaching is based on the belief that learning occurs as learners are actively involved in a process of meaning and knowledge construction as opposed to passively receiving information. Learners are the makers of meaning and knowledge. Constructivist teaching fosters critical thinking, and creates motivated and independent learners. This theoretical framework holds that learning always builds upon knowledge that a student already knows; this prior knowledge is called a **schema**. Because all learning is filtered through pre-existing schemata, constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge passively. A wide variety of methods claim to be based on constructivist learning theory. Most of these methods rely on some form of guided discovery where the teacher avoids most direct instruction and attempts to lead the student through questions and activities to discover, discuss, appreciate, and verbalize the new knowledge.

Constructivist teaching methods are based on constructivist learning theory. Along with John Dewey, Jean Piaget researched childhood development and education. Both Dewey and Piaget were very influential in the development of informal education. Dewey’s idea of influential education suggests that education must engage with enlarge experience and the exploration of thinking and reflection is associated with the role of educators. Piaget’s role in the constructivist teaching suggests that we learn by expanding our knowledge by experiences which are generated through play from infancy to adulthood which are necessary for learning. Their theories are now encompassed in the broader movement of progressive education. Constructivist learning theory says that all knowledge is constructed from a base of prior knowledge. Children are not a blank slate and knowledge cannot be imparted without the child making sense of it according to his or her current conceptions. Therefore children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences.

The following concepts are considered as central to the constructivist instructional design (Wilson & Cole, 1991):

1. Learning is embedded in a rich authentic problem-solving environment;
2. Authentic versus academic contexts for learning are provided;
3. Provisions for learner control are incorporated;
4. Errors are used as a mechanism to provide feedback on learners’ understanding; and
5. Learning is embedded in social experience.

History of Constructivism: The psychological roots of constructivism began with the developmental work of Jean Piaget (1896–1980), who developed a theory (the theory of genetic epistemology) that analogized the development of the mind to evolutionary biological development and highlighted the adaptive function of cognition. Piaget proposed four stages in human development: the sensor motor stage, the preoperational stage, the concrete operational stage, and the formal operational stage. For Piaget, the development of human intellect proceeds through **adaptation** and **organization**. Adaptation is a process of assimilation and accommodation, where

external events are assimilated into existing understanding, but unfamiliar events, which don't fit with existing knowledge, are accommodated into the mind, thereby changing its organization. Countless studies have demonstrated—or tried to discredit—Piaget's developmental stages. For example, it has become clear that most adults use formal operations in only a few domains where they have expertise. Nonetheless, Piaget's hypothesis that learning is a transformative rather than a cumulative process is still central. Children do not learn a bit at a time about some issue until it finally comes together as understanding. Instead, they make sense of whatever they know from the very beginning. This understanding is progressively reformed as new knowledge is acquired, especially new knowledge that is incompatible with their previous understanding. This transformative view of learning has been greatly extended by neo-Piagetian research.

The Russian psychologist Lev Vygotsky's (1896–1934) relevance to constructivism derives from his theories about language, thought, and their mediation by society. Vygotsky held the position that the child gradually internalizes external and social activities, including communication, with more competent others. Although social speech is internalized in adulthood (it becomes thinking), Vygotsky contended that it still preserves its intrinsic collaborative character. In his experiments, Vygotsky studied the difference between the child's reasoning when working independently versus reasoning when working with a more competent person. He devised the notion of the *zone of proximal development* to reflect on the potential of this difference. Vygotsky's findings suggested that learning environments should involve guided interactions that permit children to reflect on inconsistency and to change their conceptions through communication. Vygotsky's work has since been extended in the *situated approach* to learning. Vygotsky and Piaget's theories are often contrasted to each other in terms of individual cognitive constructivism (Piaget) and social constructivism (Vygotsky). Some researchers have tried to develop a synthesis of these approaches, though some, such as Michael Cole and James Wertsch, argue that the individual versus social orientation debate is over-emphasized. To them, the real difference rests on the contrast between the roles of cultural artifacts. For Vygotsky, such artifacts play a central role, but they do not appear in Piaget's theories.

For the American philosopher and educator John Dewey (1859–1952), education depended on action—knowledge and ideas emerge only from a situation in which learners have to draw out experiences that have meaning and importance to them. Dewey argued that human thought is practical problem solving, which proceeds by testing rival hypotheses. These problem-solving experiences occur in a social context, such as a classroom, where students join together in manipulating materials and observing outcomes. Dewey invented the method of progressive education in North America. The Fostering Communities of Learners (FCL) program, devised by Ann Lesley Brown and Joseph Campione, is a current attempt to put Dewey's progressive education theory to work in the classroom.

In summary, Piaget contributed the idea of transformation in learning and development; Vygotsky contributed the idea that learning and development were integrally tied to communicative interactions with others; and Dewey contributed the idea that schools had to bring real world problems into the school curriculum.

Characteristics of Constructivist Learning:

1. Multiple perspectives and representations of concepts and content are presented and encouraged.
2. Goals and objectives are derived by the student or in negotiation with the teacher or system.
3. Teachers serve in the role of guides, monitors, coaches, tutors and facilitators.

4. Activities, opportunities, tools and environments are provided to encourage meta cognition, self-analysis -regulation, -reflection & -awareness.
5. The student plays a central role in mediating and controlling learning.
6. Learning situations, environments, skills, content and tasks are relevant, realistic, and authentic and represent the natural complexities of the 'real world'.
7. Primary sources of data are used in order to ensure authenticity and real-world complexity.
8. Knowledge construction and not reproduction is emphasized.
9. This construction takes place in individual contexts and through social negotiation, collaboration and experience.
10. The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.
11. Problem-solving, higher-order thinking skills and deep understanding are emphasized.
12. Errors provide the opportunity for insight into students' previous knowledge constructions.
13. Exploration is a favoured approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals.
14. Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition.
15. Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary learning.
16. Collaborative and cooperative learning are favoured in order to expose the learner to alternative viewpoints.
17. Scaffolding is facilitated to help students perform just beyond the limits of their ability.
18. Assessment is authentic and interwoven with teaching.

Constructivist Learning and Its Difference from Traditional Approaches of Learning: A constructivist approach to learning and instruction has been proposed as an alternative to the objectivist model, which is implicit in all behaviorist and some cognitive approaches to education. Objectivism sees knowledge as a passive reflection of the external, objective reality. This implies a process of "instruction," ensuring that the learner gets correct information.

Traditional classroom	Constructivist classroom
Begins with parts of the whole – emphasizes basic skills.	Begins with the whole – expanding to parts.
Strict adherence to fixed curriculum.	Pursuits of student questions/ interests.
Textbooks and workbooks are used.	Primary sources/ manipulative materials are used.
Instructor gives/ students receive.	Learning is interaction-building on what students already know.
Instructor assumes directive/ authoritative role.	Instructor interacts/ negotiates with students.
Assessment via testing/ correct answers.	Assessment via student works, observations, points of view, tests. Process is as important as product.
Knowledge is inert.	Knowledge is dynamic, changes with experiences.
Students work individually.	Students work in groups.

In the constructivist classroom, students work primarily in groups and learning and knowledge are interactive and dynamic. There is a great focus and emphasis on social and communication skills, as well as collaboration and exchange of ideas. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook.

Some activities encouraged in constructivist classrooms are:

- Experimentation: students individually perform an experiment and then come together as a class to discuss the results.
- Research projects: students research a topic and can present their findings to the class.
- Field trips: This allows students to put the concepts and ideas discussed in class in a real-world context. Field trips would often be followed by class discussions.
- Films: These provide visual context and thus bring another sense into the learning experience.
- Class discussions: This technique is used in all of the methods described above. It is one of the most important distinctions of constructivist teaching methods.

Constructivism is an Instructional Strategy: Constructivism involves collaboration between instructors, students and others (community members), it is tailored to needs and purposes of individual learners. Through this approach, life-long learning takes place.

The teacher's role in Constructivist learning approach: The teacher's role in a constructivist classroom is not limited to give lecture to students but to act as an expert learner who can guide students into adopting cognitive strategies such as self-testing, articulating understanding, asking probing questions, and reflection. The role of the teacher in constructivist classrooms is to organize information around big ideas that engage the students' interest, to assist students in developing new insights, and to connect them with their previous learning. The activities are student-centered, and students are encouraged to ask their own questions, carry out their own experiments, make their own analogies, and come to their own conclusions. Becoming a constructivist teacher may prove a difficult transformation, however, since most instructors have been prepared for teaching in the traditional, objectivist manner. It "requires a paradigm shift," as well as "the willing abandonment of familiar perspectives and practices and the adoption of new ones" (Brooks and Brooks, 1993).

A constructivist approach to education is widely accepted by most researchers, though not by all. Carl Bereiter argues that constructivism in schools is usually reduced to project based learning, and John Anderson, Lynn Reder, and Herbert Simon claim that constructivism advocates very inefficient learning and assessment procedures. In any event, the reality is that constructivism is rarely practiced in schools.

In constructivist learning, the teacher's function is to "arrange the conditions of learning" in such a way that students will learn what is intended (Gagne, 1985). Designing suitable activities requires careful planning and greatly increases preparation time. Finding perfect examples and problems that will lead students to an appropriate "Aha!" experience is difficult and requires a great deal of intense, time-consuming work.

Constructivist learning usually begins with a question, a case, or a problem. In typical constructivist sessions, as students work on a problem the instructor intervenes only as required to guide students in the appropriate direction. Essentially, the instructor presents the problem and lets the students go.

Jonassen (1991) notes that many educators and cognitive psychologists have applied constructivism to the development of learning environments. From these applications, he has isolated a number of design principles:

1. Create real-world environments that employ the context in which learning is relevant;
2. Focus on realistic approaches to solve real-world problems;
3. The instructor is a coach and analyzer of the strategies used to solve these problems;
4. Stress conceptual interrelatedness, providing multiple representations or perspectives on the content;
5. Instructional goals and objectives should be negotiated and not imposed;
6. Evaluation should serve as a self-analysis tool;
7. Provide tools and environments that help learners interpret the multiple perspectives of the world;
8. Learning should be internally controlled and mediated by the learner.

Constructivism encourages instructors. Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally become "expert learners." This gives them ever-broadening tools to keep learning. With a well-planned classroom environment, the students learn how to learn. You might look at it as a spiral. When they continuously reflect on their experiences, students find their ideas gaining in complexity and power, and they develop increasingly strong abilities to integrate new information. Teacher's main role becomes to encourage this learning and reflection process.

For example: Groups of students in a science class are discussing a problem in physics. Though the teacher knows the "answer" to the problem, she focuses on helping students restate their questions in useful ways. She prompts each student to reflect on and examine his or her current knowledge. When one of the students comes up with the relevant concept, the teacher seizes upon it, and indicates to the group that this might be a fruitful avenue for them to explore. They design and perform relevant experiments. Afterward, the students and teacher talk about what they have learned, and how their observations and experiments helped (or did not help) them to better understand the concept.

Learner's Position in a Reflective Learning Approach: In a constructivist learning approach, teacher provides a variety of learning situations to the learners and the students' role change from 'knowledge acquisition' to 'knowledge construction'. Learning is a process of construction of knowledge. Learners actively construct their own knowledge by connecting new ideas to existing ideas on the basis of materials/ activities presented to them. For example, use of text or a set of pictures/ visuals on a phenomena/ object is followed by discussion or interaction in a group situation. Engagement of the learners in a relevant activity further helps in structuring and restructuring of ideas. Collaborative learning provides opportunities for sharing of multiple views and negotiation of meaning. Each individual learner individually and collectively constructs meaning related to a phenomenon or an object or an event as he/ she learns. The teacher allows children to ask questions relating to what they are learning in schools, and encourage children to answer in their own words and from their own experiences. 'Intelligent guessing' is encouraged as a valid pedagogical tool. Learner questions teachers' and other students' ideas, gives prediction about phenomenon, designs experiments to test his/ her own ideas, formulates and tests hypothesis and discusses results. He/ she compares that findings and results with those of the others, draws independent conclusions, applies the new concepts to familiar situations and familiar concepts to new situations. The learner verifies and validates his/ her own beliefs and ideas, demonstrates solutions and procedures and elaborates and interprets from the text. Learner develops the habit of self-directed learning. Constructivism also helps student in pursuing personal interests and purposes. In this approach, learners use and develop his or her abilities.

Implications of Constructivism for Teaching and Learning: Jonassen (1994) summarizes what he refers to as "the implications of constructivism for instructional design". The following principles illustrate how knowledge construction can be facilitated:

1. Provide multiple representations of reality;
2. Represent the natural complexity of the real world;
3. Focus on knowledge construction, not reproduction;
4. Present authentic tasks (contextualizing rather than abstracting instruction);
5. Provide real-world, case-based learning environments, rather than pre-determined instructional sequences;
6. Foster reflective practice;
7. Enable context-and content dependent knowledge construction;
8. Support collaborative construction of knowledge through social negotiation.

Ernest (1995) in his description of the many schools of thought of constructivism suggests the following implications of constructivism which are derived from both the radical and social perspectives:

1. Sensitivity towards and attentiveness to the learner's previous constructions;
2. Diagnostic teaching attempting to remedy learner errors and misconceptions;
3. Attention to meta cognition and strategic self-regulation by learners;
4. The use of multiple representations of mathematical concepts;
5. Awareness of the importance of goals for the learner, and the dichotomy between learner and teacher goals;
6. Awareness of the importance of social contexts, such as the difference between folk or street mathematics and school mathematics (and an attempt to exploit the former for the latter).

Honebein (1996) describes seven goals for the design of constructivist learning environments:

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

Some of the implications of constructivism for teaching and learning are mentioned below:

- Teachers act as facilitators, supports, guides and models of learning.
- Learning concerns in adjusting our mental models to accommodate new experiences.
- Learning concerns in making connections between information.
- Instruction should be built around more complex problems, not problems with clear, correct answers.
- Context and personal knowledge have high significance.
- Students should help in establishing the criteria on which their work is assessed.
- Teachers know more and shouldn't let students muddle around.
- Student learning depends on background knowledge – that's why teaching facts is so necessary (reversed).
- Student interest and effort are more important than textbook content.
- It is sometimes better for teachers, not students, to decide what activities are to be done.
- Sense making and thinking are most important, not knowing content.
- Experimentation replaces rote learning.

- Teaching utilizes both skill-based and open-ended approaches.
- Motivation to learn is intrinsic rather than extrinsic (done for its own sake rather than for grades, test scores or rewards).
- Learners often produce unique and personal knowledge.
- Naïve beliefs are used as the starting point for further discussion, exploration and evaluation for development, rather than being discounted as ‘wrong’.
- Learning for transfer is important.
- Learners learn best through finding and generating their own knowledge.
- Discovery and guided discovery learning are important.
- Exploration and active learning are important.
- Learning is collaborative and cooperative, not just individual.
- Higher order thinking is significant.
- Classrooms become multidimensional, with different activities at different levels taking place simultaneously.

Illustrations from curricular subjects: Following illustrations explain that constructivist learning method can be used across the curriculum.

Science: Students in their day to day life do a number of activities where sound is produced. For example, students play musical instruments of different types. Some of them might have played the highest and lowest note of a particular instrument. Students might think of how the sounds of different pitches and loudness are produced in each instrument. In order to understand and find answer to their observations, students may do concrete activities of the type given below.

Activity1: Take an empty coca cola bottle made of glass. Blow across the top of the bottle. Does it make any sound? Add some water to the bottle and try again. Add more water to the bottle and try again. In what way does the pitch change as you add more water?

Activity 2: Take an empty can. Run a string through a small hole in the can. You may also use a strong cardboard box. Tie a button at the end of the string to prevent it from coming out through the hole. Rub rosin on the string to make the string rough. You may use some other material also. Sit on a chair and hold the box between your feet. Grasp the free end of the string in your left hand. Run a match stick or iron nail up the string quickly and firmly. Does the pitch depend on the size of the box or something else?

Students might observe that in the bansuri, air is set into vibration by the lips. The player opens and closes different holes on the wooden tube. The length of the tube is modified by opening and closing different holes and these changes the pitch. In the bottle activity also the pitch changes as more water is added. Students will form their own concepts and validate these against the existing theories.

Summary: Constructivism as a philosophy has a long history. The term Constructivism is considered to be equivalent to a set of epistemological theories which are grounded in the belief that meaning is constructed in the minds of individuals through the cognitive processing of interactions in world and explored some important variations on this theme. Constructivist paradigm calls for a change in the classroom culture, attitudes, beliefs and practices. Significant aspects of constructivist theories is shown to include the notion that learning is active, social and situated in particular physical, social and cognitive contexts, that it involves the ongoing development of complex and interrelated mental structures, and that the construction of knowledge is, to a greater or lesser degree distributed across individuals, tools and artifacts. Constructivism is seen to have various implications for instruction, the most significant of which is to shift the focus of pedagogical design away from instruction and toward the design of learning environments that are learner-centered,

knowledge-centered, assessment-centered, and community centered. Constructivism shifts emphasis from teaching to learning; focuses on knowledge construction, not reproduction; helps students develop processes, skills and attitudes; individualizes and contextualizes students' learning experiences; considers students' learning styles; uses authentic tasks to engage learners; provides for meaningful, problem-based thinking; requires negotiation of meaning, reflection of prior and new knowledge; extends students beyond content presented to them. Constructivist approaches can also be used in online learning. For example, tools such as discussion forums, wikis and blogs can enable learners to actively construct knowledge. Constructivist paradigm is a new culture, a new environment in the class.

References:

1. Brooks, J. G., & Brooks, M. G. (1993). *In Search of Understanding: The Case for Constructivist Classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.
2. Christie, A. (2005). Constructivism and its implications for educators. <http://alicechristie.com/edtech/learning/constructivism/index.htm>
3. Clarkson, B., & Brook, C. (n.d.). I can't understand why I didn't pass: Scaffolding student activities. <http://www.ascilite.org.au/conferences/perth04/procs/pdf/clarkson.pdf>
4. Gagne, R.M. (1985). *The Conditions of Learning*. New York, NY: Holt, Rinehart & Winston.
5. Good, T.L. & Brophy, J.E. (1994). *Looking in Classrooms*, New York, NY: HarperCollins
6. College Publishers.
7. Moore (Eds), *Elements of Quality Online Education: Engaging Communities*. Needham, MA: Sloan-C.
8. Piaget, J. (1952). *The Origins of Intelligence in Children*, trans. Margaret Cook. New York International Universities Press.
9. Piaget, J. (1971). *Biology and Knowledge*. Chicago: University of Chicago Press.
10. Sharma, S. (2006). *Constructivist Approaches to Teaching and learning*. NCERT: New Delhi.
11. Swan, K. (2005). A constructivist model for thinking about learning online. In J. Bourne & J. C.
12. Vygotsky, LEV S. (1987). *Collected Works of L. S. Vygotsky, Vol. 1: Problems of General Psychology*, trans. Norris Minick. New York: Plenum.
13. Wilson, B. G. & Cole, P. (1991). Cognitive dissonance as an instructional variable. *Ohio Media Spectrum*, 43 (4), 11-21.