Active Learning as an Effective Tool to Enhance Cognition

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Abstract

Children need to be encouraged to explore alternative thinking, multiple view and creative insights. The capacity for abstract thinking begins around the age eleven. At this stage, of adolescents reason much like a scientist searching for solutions in the laboratory. They come up with new, more general logical rules through internal reflection. So, the teaching methodology used should be designed in such a way that it satisfies the cognitive need of the adolescents. The highest value that all methods should try to inculcate is love to work and desire to do it with the highest measure of efficiency of which one is capable of. Research indicates that active involvement is an additional characteristic that increases student's interest in an activity. An attempt has been made through this article to give an insight regarding the significance of active learning strategies in enhancing the information processing activities of human brain.

INTRODUCTION

The challenge of education is to design learning environments and processes where students' way of thinking and learning are manifested in active, collaborative, self-regulated and self-directed learning. The visibility of students' cognition is a prerequisite for effective mediation and facilitation. Modern society demands that schools be asked to teach thinking and problem-solving skills. "An effective learner is a resourceful, adaptable person, able to use what he knows in new situations and to discover for himself solutions to problems that he

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has never faced before. Emphasis upon insightful learning, rather than upon rote learning or mechanical skills, encourages such problem solving behaviour" (Ernest Richard, 1953).

If we analyse the history of theories of learning, the three trends in education can be summarised as behaviourism, cognitivism and constructivism. Once upon a time good pedagogy was about making content knowledge visible to students. Behaviourist psychology, as a science of learning, provided for the basis for effective teaching and learning in the first half of the 20th century. The behaviourist establishment led by Skinner continued its influence and contributions through the 1960s and 1970s. The behaviourist school interpreted learning in terms of connection or association between stimulus and response. The learners start as a clean slate (*tabula rasa*) and their behaviour is shaped through positive or negative reinforcement. Behaviourism does not take mental process of learning into consideration, which disregards the activities into the mind.

Cognitivism

Dissatisfied with the approach of behaviourists, the cognitive psychologists tried to see learning as a more deliberate and conscious effort of the individual rather than a product of mere habit formation or a stimulus response machine like mechanism. The school of thought arising from this approach is known as cognitivism which is interested in how people mentally represent information processing. Cognitivism focused on the inner mental activities—thinking, memory, knowing and problem-solving. Knowledge was seen as schema or symbolic mental constructions. Learning is defined as change in a learner's schemata. It has found its actions in the work of Wilhelm Wundt, Marx Wertheimer, Koffka, Kohler and Lewin and in the work of Jean Piaget who provided the theory of stages/phases that describes children's cognitive development.

Gestalt psychologists in their investigation of perception, learning and thinking, first emphasised cognitive learning. The Gestalt school of thought believed that the learner understands the relation among the different elements of the situations through insightful learning. Insight involves a perceptual reorganisation of elements in the environment such that new relationships among objects and events are suddenly seen. It is described as the sudden and new way of looking at the problem and solving it. The cognitive theories emphasised the role of purpose, insight, understanding, reasoning, memory and other cognitive factors in the process of learning. Like a computer, the brain takes in information, processes it and gives back an answer. In human the processing of information is called cognition (Robert, 1977).

In the 1960s, recognition of Piaget's work gained momentum.

Piaget addressed the internal world of the individual in relation to intelligence and questions pertaining to the structure of the mind (Piaget, 1956, 1959; Piaget and Inhelder, 1969). His work was based on three inter-related conceptions—(i) the relation between action and thought, (ii) the construction of the cognitive structure, and (iii) the role of self-regulation. Piaget's work on cognitive development is truly monumental. He is probably best known as the principal spokesman for the view that cognitive development evolves a series of qualitative changes in a child's thinking. The qualitative shifts in thinking are described by Piaget as a sequence of developmental stages.

Piaget believed that logical thinking and reasoning about complex situations represent the highest form of cognitive development. Contrary to the behaviourist and Gestalt psychologists, Piaget did not study animals but children. Piaget researched in developmental psychology which centered on the question of how knowledge developed in the mind. Piaget approached the problems of thinking and learning by focusing on the mental and cognitive proceses that make them possible. This focus became the defining element of the cognitivist theory.

Next came the constructivist learning theory which believed that the knowledge gained by the learners is constructed by the learners themselves.

Constructivism and Active Learning

Just as cognitive learning psychology began replacing the predominant behavioural psychology constructivism replaced cognitivism. Constructivist learning theory came as a challenge to cognitivism. This is a new learning theory that attempts to explain how learners learn by constructing knowledge for themselves. Central to constructivist theoretical perspective is the belief that knowledge is constructed and not transmitted and that the learners play an active role in the learning process (Duffy and Cunningham, 1996; Johnson and Johnson, 1996; Jonassen, 1999). To foster the construction of knowledge, learners should have opportunities for exploration, interaction and manipulation within the learning environment. Since learners have more control in the learning process, the learning environment must provide scaffolding to foster learners (Hannafin et al., 1994).

The constructivist stance maintains that learning is a process of constructing meaning; it is how people make sense of their experience. In other words learners, the active creators of knowledge, can learn by observing, manipulating and interpreting the world around them as they make sense of their learning experiences (Alessi and Trollip, 2001).

Constructivism is an electic view of learning that emphasises on four key components—*(i) Learners construct*

their own understanding rather than having them delivered or transmitted to them, *(ii) New learning depends on prior understanding and knowledge*, *(iii) Learning is enhanced by social interaction*, and *(iv) Authentic learning tasks promote meaningful learning* (Donald and Paul, 2007). As opposed to passive recipients of information, learners become active meaning makers, building on their current knowledge. To facilitate the process, teachers design learning activities in which learners can work with others on meaningful learning tasks. Constructivist vision of teaching emphasises that teachers look not for what students can repeat, but for what they can generate, demonstrate and exhibit (Brooks and Brooks, 1994). Constructivist theories see knowledge as a constructed entity.

Constructivists believe that meaningful learning or purposeful knowledge may be promoted by a learning environment that has three main features. First, one should use authentic problems that are tasks having the contextual feel of the real world. Second, the learning environment should represent the natural complexity of the real world and avoid oversimplification of the task and instruction. And third, a constructivist learning environment should support collaborative knowledge construction through social negotiation.

The overriding goal of constructivist educator is to stimulate thinking in learners that results in meaningful learning, deeper understanding and transfer of learning to real world contexts. To accomplish this goal, a constructivist framework leads teachers to incorporate strategies that encourage knowledge construction through primarily social learning processes in which students develop their own understanding through interactions with peers and the teacher.

Cognitive constructivism focuses on internal individual constructions of knowledge. This perspective is derived from Piagetian theory which emphasises individual knowledge construction stimulated by internal cognitive conflict, as learners strive to resolve mental disequilibrium. Cognitive constructivists focus on the active mental construction struggling with the conflict between existing personal models of the world, and incoming information in the environment.

Dialectical constructivism or social constructivism views the origin of knowledge construction as being the social intersection of people, interactions that involve sharing, comparing and debating among learners and members (Brown and Duguid, 1989). This view is a direct reflection of Vygotsky's socio-cultural theory of learning which accentuates the supportive guidance of mentors as they enable the apprentice learner to achieve successfully more complex skills, understanding and ultimately independent competencies. The fundamental nature of constructivism is collaborative social interaction in

contrast to individual investigation of cognitive constructivism. Socio-cultural constructivists emphasise the process of enculturation into a community of practice, in which learners construct their models of reality as a meaning making undertaking with culturally developed tools and symbols and negotiate such meaning through cooperative social activity, discourse and debate. Vygotsky was the main proponent of the social constructivist approach to learning. His theoretical framework supports that social interaction plays a fundamental role in the development of cognition.

Constructivist approach to teaching influenced by constructivist principle provides opportunities for children to develop skills in critical and creative thinking and to explore new phenomena through which meaningful learning can happen. In a context where power is perceived to be shared, students are encouraged to challenge each other's ideas and those of the teacher (White and Mitchell, 1994). The basic premise in constructivism is that meaningful learning occurs when the learner strives to make sense of the presented material by selecting relevant incoming information, organising it into a coherent structure and integrating it with other organised knowledge (Mayer, 2003). Constructivism is a theory about how we come to know what we know. In a constructivist point of view, the learner constantly filters incoming information based on his or her existing conceptions and preconceived notions to construct and reconstruct his or her own understanding. Thus, the meaning of knowing is an active, adaptive and evolutionary process. In short, constructivism is a view of learning suggesting that learners use their own experiences to create understanding that makes sense to them, rather than having understanding delivered to them in already organised forms.

Research indicates that active involvement is an additional characteristic which increases the student's interest in an activity. Children need to be encouraged to explore alternative thinking, multiple view and creative insights.

According to Marilla (1998), active learning produces the following benefits.

(i) Activities focus your attention on the key ideas that are being examined.

(ii) During active learning you are required to draw on your prior knowledge to construct your response to the activity. This results in deeper processing of the material. Deeper processing means looking at the material beyond mere memorisation. Information that is processed deeply is more easily recalled later because it has more connections with your specific prior knowledge.

(iii) Active learning participation provides an opportunity to get early feedback on your understanding.

(iv) Active learning opportunities result in an 'episodic memory' which is a type of memory specific to an event. With episodic memory, if you cannot remember the idea you can reconstruct it from your memory of the event. This type of memory is practical, long-lasting and can serve as the key to recall information.

Philosophical Background of Active Learning

As a philosophy of learning the beginning of active learning thought can be traced back to the 18th century and the work of the great philosopher Giambattista Vico who maintained that humans understand only what they have themselves constructed (Yanger, 1991).

Traces of active learning can be seen in the educational literature from Socrates to present day. Aspects of discovery principles date back to the works of Socrates, Plato and Aristotle. Socrates asked direct questions that led his followers to realise for themselves the weaknesses of their thinking. Socrates roamed Greece asking questions in such a way that students were able to generalise themselves. He believed that once a man was stirred by the teacher, he was able to see new meaning in life. Man was guided by curiosity and took pleasure in intellectual inquiry. This method was often known as Socratic Method.

The traces of active learning can also be seen in the theories of philosophers like Comenius in the 7th century to Dewey in the 20th century. We can see its direct link in the pragmatist theory of Charles S. Pierce and William James. Similar types of school can be found in Maria Montessori's philosophy of teaching, Froebel's Kindergarten concept, Heuristic method and Playway method. All of them reflect the principles of discovery-oriented teaching environment. Other educators related to this theory of learning include Jacqueline Brooks, Catherine Fosnot, Linda Lambert, Joseph Novak, Von Glaserfeld, Robert Yager and many others. According to Van Hiele (1986), true learning is that in which students achieve through their own efforts which causes them to experience what he terms a 'crisis of thinking'.

Many great philosophers and educationalists have worked with these ideas, but the first major philosophers to develop a clear idea of what active learning consists were Rousseau, John Dewey and Pestalozzi. Rousseau's statements are of special significance for the present-day interpretation of discovery learning. According to Rousseau, et.al. (1977), "Put the problem before him and let him solve them himself. Let him know nothing because you have told him, but because he has learnt it for himself. Let him not be taught science, let him discover it. If ever you substitute authority for reason in his mind he will stop reasoning, and become the victim of other people's opinions". According to him, the child

should be made to learn, he should not be taught. Rousseau considered a child to be the centre of teaching-learning process. His 'Emile' is an exemplary treatise on education and he advocated natural methods for teaching.

Dewey believed that information became knowledge only when it was understood. Understanding or comprehension resulted when various parts of the information were grouped in relation to one another. Therefore, understanding was dependent upon arranging or rearranging of information gained through concrete experiences. In the words of Dewey (1910), only by wrestling with the conditions of the problem at hand, seeking and finding his / her own solution does one learn. Dewey (1916) described learning as an action where knowledge and ideas emerge as learners interact with other learners in a community and build their knowledge by applying conclusions from past experiences that had meaning and importance. He believed that children were naturally motivated to actively learn and that education only served to make more learning possible. According to Dewey, knowledge is an outcome of inquiry and a resource in further inquiry. He felt that posing problems of significant interest that draw upon the student's prior knowledge activates the learning process. His strategy involved the lure of outdoors and providing problems for students to solve. Inquiry as a method of learning was of course, central to all Dewey's teaching and writing. In his How We Think, he developed the theoretical concept of nature of inquiry and of reflective thought. He identified learning with thinking and thinking with active discovery of relationships and organising principles. He considered the quality of searching to be the prime motive power of thinking and therefore maintained that the problem-solving process is essential to active learning.

The psychological principles of known to unknown, simple to complex, concrete to abstract all had their origin in the mind of Pestalozzi which reflects the principles of active learning. Pestalozzi believed that abstraction was possible only after concrete ideas had been mastered (Mayer, 1970). His theory also conveys the idea of discovery. According to Herbert, the aim of all instruction is to cultivate clearness, definiteness and continuity of thought. Similar types of thinking can be found in philosophies of Montessori, Froebel, Kilpatrick, Armstrong, Parkhutst, etc., which reflects the principles of discovery method. All philosophers from the ancient time to the modern era, both western as well as eastern philosophers, claimed that knowledge exists in man. It is through education that we rediscover the knowledge.

Psychological Background of Active Learning

The psychological background of active learning has its roots in the theory of cognitivist theory of learning.

The advent of Gestalt psychology introduced a new stream of interest in learning by discovery. Another great advocate of discovery learning principles can be found in the learning theory of Jean Piaget. It was Piaget who first articulated mechanisms by which knowledge is internalised by learners. In his book, *To Understand is to Invent,* Piaget (1973), he wrote that understanding comes from discovery and that without understanding production and creativity are lost and the individual is caught in only repetition. Piaget was the first to show that children were not empty vessels to be filled with knowledge, but active builders of knowledge. Piaget saw children as constantly creating and testing their understanding of the world, in other words active participatory learners.

One of the fundamental underlying principles of discovery is the concept of socio-cognitive conflict. This mechanism for learning derived from the work of Piaget and his followers who proposed that cognitive conflicts leads to higher levels of reasoning and learning (Webb and Palinscar, 1996). According to Piaget (1956), children shape their own conception of reality through continuous interaction with their environment. Cognitive development therefore occurs as children adapt to their environment thus building their sense of reality. Piaget regarded knowledge growth as something that happens continually in a sequential process consisting of logically embedded structures (schemata) succeeding one another throughout an individual's lifetime. This is divided into stages of development (pre-operational stage, concrete operational stage and formal operational stage) and children move from one stage to the next by maturation and exploration.

During all developmental stages, the child experiences his/her environment using whatever mental maps he/she has constructed so far. If the experience is a repeated one, it fits easily into the child's cognitive structure (that is, assimilated into the existing cognitive structure) so that the child maintains mental equilibrium. If the experience is different or new, the child loses equilibrium (have disequilibrium) and alters his/her cognitive structure to accommodate the new conditions. In this way, the child builds more and more adequate cognitive structures. According to Piaget (1971), intelligence is an adaptation. Life is a progressive balancing of adaptation and organisation to cope up with the environment. Piaget conceived of human cognition as a network of mental structures created by an active organism constantly striving to make sense of experience (Laura, 1994). His concept denotes the importance of activity as a central ingredient of intelligence. Active learning experiences tend to promote cognitive growth while passive and vicarious experiences tend to have minimal effects.

Cognitive development theory put forward by him provides the important conceptual basis of active learning.

In the words of Piaget (1964), "The question comes up whether to teach the structure or to represent the child with situations, where he is active and creates the structures himself….the goal of education is not to increase amount of knowledge but to create the possibilities for a child to invent and discover. When we teach too fast, we keep the child from inventing and discovering himself….teaching means creating situation where structures can be discovered, it does not mean transmitting structures which may be assimilated at nothing other than a verbal level."

Jerome Bruner had been a key player in the development of psychology over the past five decades. As one of the founders of cognitive psychology, he was instrumental in revolutionising the thinking of the day from a strictly behaviouristic stance to a more cognitive approach. His work emphasised metalism and the ways in which people make sense of the world by going beyond the information given. Bruner's contribution to cognitive psychology was particularly significant in his ability to demonstrate unobservable mental process in an empirical framework. His was the first systematic attempt to apply an experiment approach to this difficult area of psychology.

Jerome Bruner is thought of as one of the founding fathers of constructivism and his theory of constructivism was influenced by the earlier theoretical research of Lev Vygotsky and Jean Piaget. A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The process of learning is active and involves transformation of information, deriving meaning from experience forming hypotheses and decision-making. Through his work he presented the idea that children could be active problem-solvers and were capable of exploring more difficult subjects of instruction. Learners are considered to be the creators and thinkers through the use of inquiry and the role of experience in learning.

A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current and past knowledge. The learner chooses and permutes the knowledge, constructs hypotheses, makes decisions and while performing these, he relies on his cognitive structuring. His cognitive structure caters for grasping the meaning and organisation of the experiences and enables him to go beyond the given information.

When the instruction is considered, the instructor should try and encourage the students to discover the principles themselves. This should be achieved through engagement of learners and teacher in an active conversation. Teachers should be able to transform the material to be learned in such a way that it suits the learners' cognitive level.

The way of presenting the material should be spiral, not linear so that it allows both learners to contemplate and construct gradually upon what they have learned. A theory of instruction should specify those early experiences which would be more likely to produce a predisposition to learning. Predisposition influences include cultural, motivational and personal factors. Learning depends upon exploration of alternatives, the three aspects of which are activation, maintenance and direction. Therefore, instruction must facilitate and regulate the exploration of alternatives on the part of the learner.

Active learning includes what may be called metacognition: a capacity to understand not only particular content but also the psychological or intellectual processes and strategies one uses in acquiring the content. In teaching problem-solving, one must structure situations where students are required to face a new question, define it in specific terms and evaluate potential solutions to the problem, what comes out of an approach of this kind is an emphasis on process rather than on substance. Rapidly evolving work and life and citizenship in 21st century requires a more comprehensive approach to educating young people. Content knowledge remains critical but a growing body of research suggests students' attitude and beliefs about their education and their learning strategies they deploy can have a powerful influence on their ability to succeed.

Conclusion

Active learning has become a way to describe the types of pedagogy that are rooted in constructivism. It calls for student participation that is not just social, but involves meaningful cognitive engagement with the content, both individually and collectively. New and dynamic problems in the 21st century require constant attention, controlled execution and strategic interaction. Active learning equips students with these skills to confront and overcome complex, non-routine challenges in order to succeed.

Children learn best when they are engaged in their learning, when it matters to them, when it is contextualised in meaningful ways and when they have a sense of ownership and agency. When students are engaged in learning, there is movement and laughter and sometimes lots of noise. They are up and out of their seats involved in activities that promote thought, creativity, and discovery. When students actively participate in the learning environment, they take more responsibility for their performance in the course. Similarly, when they have an opportunity to make decisions about what they learn and how they use that knowledge, students see a course as more valuable and more directly related to their goals. Students are busy, self-disciplined, and best of all, willing to take responsibility for their own learning because they understand that what they are doing is important.

We need to provide our students with activities that are innovative and challenging as well as purposeful if we want them to be engaged in learning. In active learning environment, students learn by doing, and activating the brain's perception. It makes memories more deeply embedded in the brain and more easily retrievable. Modern world needs complex cognitive abilities to lead a successful life. Active learning gives training to learners to tackle the problems they face in their life. Critical thinking and problem-solving skills utilised in active learning empower students' life skills. It is high time that active learning be made an integral part of school curriculum.

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