Constructivist Theories of Piaget and Vygotsky: General Teaching Implications

Dr. Khadidja Kouicem
Constantine University

AND

Kelkoul Nachoua
Oran University

Abstract
There are many different learning theories that can be used to help guide a teaching/ learning process. Constructivism is one theory that explains how people might acquire knowledge and learn. The theory suggests that people construct their own understanding and knowledge of the world by testing ideas and approaches based on their prior knowledge and experience. Jean Piaget and Lev Vygotsky are two eminent figures in the cognitive development (development of constructivist theories). While there are similarities between the theories of Piaget and Vygotsky, differences exist, and those differences are critical to the understanding and application of the theories in educational settings and have great impact on the teaching methods. We can distinguish therefore between cognitive constructivism which is about how the individual learner understands things, in terms of developmental stages and learning styles, and the social constructivism, which focuses on how meaning and understanding grow out of social encounters.

Key Words: Constructivism, Cognitive Constructivism, Social Constructivism, Teaching Implications

Introduction

The field of education has gone through a notable movement regarding the nature of human learning and the circumstances that best contribute in the different aspects of human learning. This notable change started from behaviorism to cognitivism and now to other theories. Recently, one of the effective views which has captured the researchers' and teachers' interest in the educational sphere is a perspective known as constructivism. In spite of the fact that it advocated a new conceptualization about the process of learning, it continues to be a dominant program in many educational fields, and generate further researches and insights. As any theory, constructivism was not presented by a unique voice, there were many theorists. The two most eminent ones who are often compared, for they both acknowledge the active role of humans in the construction of knowledge, are Piaget (cognitive constructivism) and Vygostsky (sociocultural constructivism). The difference between them lies in the way knowledge is constructed. For Piaget, knowledge is produced in the learner's mind while he is organizing his experiences and cognitive structures. According to Vygostsky, however, knowledge is produced through social and cultural interactions. For the purpose of this paper, both previous views of constructivism are discussed, for we try to display that knowledge is both a cognitive and social process. Most importantly, the paper attempts to suggest some

general implications for teaching, including second/foreign language teaching, from both of the views.

1.Constructivism

Reviewing the available literature about constructivism, it would be folly to assign a limited and inclusive definition of what constructivism actually is. It has a wide range of different understandings. Within the educational context, there are some philosophical meanings as well as personal meanings advocated by some theorists. This concept has been frequently defined as the philosophy of learning established on the premise that when one reflects on his previous experiences and learning environment, he constructs his own new understanding of the world he lives in. For example, Naylor and Keogh (1999: 93) define constructivism as an approach in which the central principles are that "learners can only make sense of new situations in terms of their existing understanding. Learning involves an active process in which learners construct meaning by linking new ideas with their existing knowledge." Flynn on his part sees constructivism as a theory which "is about facilitating the learner to go beyond simple recall (memorization) toward understanding, application, and competence" (2004: 113). Similarly, Brooks and Brooks (1993: vii) defines constructivism as a theory which is related to learning, they say "constructivism is not a theory of teaching, it is a theory about knowledge and learning (…) the theory defines knowledge as temporary, developmental, socially and culturally mediated."

Based on the different definitions available also in the literature, the following are some guidelines which identify the epistemological features of constructivism and help in clarifying its meaning:
1- Learning is an active process.
2- Knowledge is constructed, rather than innate, or passively absorbed.
3- Knowledge is invented not discovered.
4- All knowledge is personal and idiosyncratic.
5- All knowledge is socially constructed.
6- Learning is essentially a process of making sense of the world.
7- Effective learning requires meaningful, open-ended, challenging problems for the learner to solve (Fox, 2001: 24).
Constructivism, therefore, recognizes that knowledge is actively produced by learners in response to interactions with their existing knowledge and environment. This implies that the teacher does not dispense knowledge, but provides students with opportunities and incentives to construct it.

In short, the basic and most important assumption of constructivism which distinguishes it from the rest of theories of learning is that knowledge does not exist independent of the learner, but it is constructed. In other words, constructivism theory relies on the assumption that the learner constructs his knowledge in his mind depending on his various experiences. Moreover, the constructivism theory is a fundamental theory that can serve as a tool to understand and recognize the society with its knowledge and technologies because it establishes a strong relation between the individual and his society, seeks to adapting the individual with the environment he lives in, and promotes the sense of belonging to that society. This individual, therefore, will develop the feeling that he is an active learner in his community which

he is always supposed to maintain its stability and solve its problems through using different concepts and knowledge.

In accordance with the underlying principles of constructivism, two polar views exist. The first one focuses on the interplay between the child mind and society as a basic process of the cognitive development. According to this view, the social interaction and language are not afforded a fundamental interest. As for the second view, theorists claim that the child cognitive development occurs through the social interaction and that language has a crucial role in knowledge construction, because it constitutes one of the cultural aspects, and therefore it is indispensible for thinking and social interactions. Social constructivism also views science learning as the product of the learner's ideas and the outcomes of the discussions and interactions between the learners or with their teachers (Richmond & Striley, 1996).

According to Appleton (1997: 304), the origin of the constructivism theory can be traced back to three main fields:
1-Development psychology of Piaget (1978)
2-Cognitive Psychology of Piaget
3-Social Constructivism of Vygostsky (1978)

1.1 Piaget's Theory of Cognitive Development

Jean Piaget is a Swiss expert who is well known for his studies of the intellectual growth of children and his influential theory of cognitive development. He is considered as the founder of constructivism as this latter is derived from the field of cognitive psychology which is based on his work (Sridevi, 2008).

How do individuals acquire and develop knowledge? Piaget devoted his entire life to this question. His studies spread out over nearly sixty years investigating tirelessly children thinking and reasoning at different stages. Piaget called his theoretical orientation to the study of cognitive development "genetic epistemology", because he was primarily interested in how an organism adapts to its environment (Klahr, 2012). In other words, his theory focuses on an evolutionary epistemology analogizing the development of mind to a biological stance, so pointing out the adaptive function of cognition.

A further point which is unique to Piaget's theory is intelligence: it constitutes the core of his theory. According to Chen and Siegle (2000: 95), Piaget stared from the assumption that "human intelligence is a biological adaptation of a complex organization to a complex environment". Thus, the individual's understanding of a given situation is part of the adaptation of that situation, and the cognitive development is the individual's intelligence in making equilibration of the cognitive structures.

1.1.1 Piaget's Stages of Cognitive development

Piaget identified four distinct stages of normal intellectual development from infancy to adulthood. He claimed that all children should go through these stages to reach the next level of cognitive development and each stage is an indication of times when children are acquiring new ways of mentally representing information.

Sensory Motor Stage: The first major period in Piaget's theory extends from birth to about 2 years of age. This is a stage, according to Pressley and McCormick (2007), where infants' schemes are simple and action-oriented. Infants just use their senses with some physical actions to form these schemes. As for intelligence, it is related to

the activities made by the infant who constructs his understanding of the world through environment rather than his mind (ibid.).

Preoperational Stage: The second major period in Piaget's theory includes the preoperational stage which lasts from roughly two to seven years. For Pressley and McCormick (2007, ibid.), this stage is generally related to pre-school years. In this stage, children start to develop cognitive structures termed 'symbolic schemes'. In other words, they can represent ideas and objects using symbols like language, mental images, gestures …etc (ibid.). This second period of cognitive development is so called because there is as yet no operational thinking which means that children thinking are still not completely logical and they cannot grasp complex concepts like distinction, comparisons, cause and effect.

Concrete Operational Stage: The third major period in Piaget's theory relates to the elementary-grade years. One important characteristic of this stage is the appropriate use of cognitive operations to solve problems of concrete objects (ibid.). In other words, children can only solve problems to actual objects and events (concrete), and not abstract concepts or hypothetical tasks.

Formal Operational Stage: The formal operational stage is the fourth and final period in Piaget's theory of cognitive development. It starts from early adolescence. Learners in this stage begin to think abstractly to solve problems in that they are able to logically use symbols that have relations with abstract concepts (ibid.).

1.1.2 Processes of Cognitive Development

Cognitive development, according to Piaget, is achieved through three interrelated processes: organization, adaptation (assimilation and accommodation), and equilibration (Gupta & Frake, 2009: 20). For Piaget, every act an individual makes is cognitively organized and then adaptation provides the means for change. In order to understand the processes of organization and adaptation, three concepts have to be understood as well.

Schemata: they "are the cognitive or mental structures by which individuals intellectually adapt to and organize the environment" (Wadsworth, 1989: 10).

Assimilation: "the external world is interpreted in terms of current schemes" (Gupta & Frake, 2009: 20).

Accommodation: "old schemes are adjusted and new ones created to produce a better fit with the environment" (ibid.).

To elaborate, organization is the process by which the child links existing schemes into new and more complex schemes to produce an interconnected cognitive system. For example, firstly children can suck and grasp, but they cannot combine these two acts. After a period of time, they can coordinate both of the acts. Piaget explains the occurrence of this as higher level organization of two basic schemes: sucking and grasping (ibid.). This generation of schemes through the processes of assimilation and accommodation is called adaptation (ibid.). Finally, changing the existing knowledge is based on new knowledge equilibration. Gubta and Grake (ibid.) explain thoroughly this last process as follows:

> When children are not changing very much they assimilate more than they accommodate, a state Piaget refers to as cognitive equilibrium. However, during times of swift cognitive change (when new information does not match current schemes) and they swift from assimilation to accommodation: children are in a state of disequilibrium

(cognitive discomfort). Once schemes have been modified children shift back to assimilation, using new structures until they need to be modified again. Piaget called this back and forth process *equilibration*.

1.2 Sociocultural Vygostsky Theory

Vygostsky was a Russian psychologist who is well known for his theory that emphasizes the contribution of social and cultural factors to the cognitive development of the individual. His theory got known in the West lately as his new concepts and ideas were emerged in the fields of educational and developmental psychology. Alves (2014: 25) states that Vygotsky's work was highly impacted by Karl Marx and Friedrich Engels, by Charles Darwin's evolutionism, and by Spinoza's dynamic perceptions of universal development. Being influenced by the ideas of these philosophers, Vygostsgy identified five different principles that should guide epistemological research:

1-Psychology is the science of a historical human being

2- Higher psychological processes originate in social action

3- There exist three distinct classes of mediators: signs/instruments, individual acts, and interpersonal relationships

4- Specific functions as well as social reality emerge from transformational acts or work

5- There exists a fundamental unity between body and mind-that is, people are global beings (ibid.).

The central concept of Vygostsky theory is that the development of the individual cognitive is based first on social interaction. Vygotsky (1978) says "every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals" (57). The nature of learning through social interaction therefore is cooperative. The learner should not be separated from his environment, but should be encouraged to integrate with other learners, teachers, or other sources of knowledge such as books, journals, computers …etc. These interactions provide the learner with the language used for learning communication. The teacher's main role here is a facilitator or a mediator who just coordinates the learner's concepts. According to Derry (2014: 38), Vygostsky differentiates between two sorts of concepts, specifically between what he called 'everyday concepts' or 'spontaneous' and 'scientific concepts'. These concepts have their precise meaning and are learnt through different contexts. While everyday concepts "are those that are learnt spontaneously in daily life" (ibid.), scientific concepts "are those learnt through formal instruction" (ibid.). Further, everyday concepts are formed from concrete experiences to abstract experiences; however, scientific concepts take the opposite direction. The learner, for example, adapts everyday concepts in the school where he learns the scientific concept, and simultaneously he has to learn scientific concepts on the basis of concrete examples' application (everyday concepts). Accordingly, both directions are crucial for understanding and constructing knowledge.

Vygostsky theory was also an attempt to explain the contribution of three factors in the cognitive development of the individual. These factors, according to Oakley (2004: 38) include: culture, language, and zone of proximal development.

1.2.1 Culture

Vygostsky saw that culture and social environment as crucial elements in the construction of human knowledge. The society where the individual lives in and the social settings where he is part of are the elements which determine what the individual learns about the world and acquires as knowledge. Therefore, the child learns through social interactions, but also through elements of his own culture such as language, songs, arts …etc (ibid.).

1.2.2 Language

According to Vygostsky, language is indispensible in the learning process. He considered that there is a close relationship between language development and cognitive development. The individual could encode and represent the world through the contribution of language (ibid.). Vygostsky explains that before the age of 2 years, children language and thought are separate processes because language at that period is used just for social purposes and is not linked to inner thought. However, by the age of 2 years, language and thought become related processes, and therefore language begins to constitute a crucial role in cognitive and social development (ibid.).

1.2.3 Zone of Proximal Development

The term 'Zone of Proximal Development', according to vygotsky (1978: 86) refers to "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." This means that there is such a difference between a learner who performs a task independently and the one who performs a task with assistance and guidance of someone else who has already mastered the concept being learnt. For example, a 16 years old child can drive forward and backward perfectly, but when it comes to parking, he/she may find difficulties. For this reason, a teacher is needed to guide this child and teach him how to park the car. Bridging this gap, therefore, depends on the kind of support that is provided by an adult or any expert. In short, the basic and most important idea about the zone of proximal development is that with the most sensitive instruction or guidance , the child will be able to develop skills to use on his or her own to develop higher mental functions (Vygostky,1978).

1.2.3.1 Scaffolding and Zone of Proximal Development

The concept of scaffolding is central to many recent accounts of teaching and learning. Within literature, scaffolding, cooperative learning and guided learning all share the same meaning and it is synonymous with Vygotsky's concept of Zone of Proximal Development (Stone, 1998). One of the most important aspects of scaffolding, stone (ibid.) says, is the role of the knowledgeable person who provides the learner with guidance in order to progress and achieve difficult tasks, this role then has perceptual, cognitive and affective components Scaffolding can be described then as an intellectual support offered by a teacher to take the learner to the next level of understanding. Sawyer (2006) on his part supports that scaffolding is the support given to students during the learning process with the intention to help them achieve their learning goals.

2. General Teaching Implications of Piaget and Vygostsky Constructivism

Vygostsky and Piaget theories stimulated a wide range of researches in the world with numerous leading theoretical perspectives today derived from their theories. The numbers of concepts which are associated with their theories are widely used in education, and in this section some of the examples of these concepts' application are to be introduced.

2.1 Teaching Implications of Piaget Theory

The influence of Piaget theory in educational fields can be seen in a variety of instructional practices. The following are some applications' examples:

- For Piaget, the main goals of education in general is to have creative and innovative individuals who are able to take initiatives to do things instead of repeating what other generations have achieved. Furthermore, Piaget theory is a call to form critical generations which find out things themselves instead of accepting whatever given by others. To this end, during the initial stages of learning, teachers should provide rich environment for the exploration of any field. They should involve interesting materials to encourage the learners get active and constructors of their own knowledge through their experiences which require the processes of assimilation and accommodation.

- Teachers should act as 'guides on the side' who just provide the learners with opportunities to test their current level adequacy. Ashton and Gregoire-Gill (2003: 102) quote Piaget words as regards the role of teacher in the classroom as follows: "what is desired is that the teacher ceases being a lecturer, satisfied with transmitting ready-made solutions; his role should rather be that of a mentor stimulating initiative and research."

- Piaget's stages of cognitive development can be used in different ways, for example as general guides to sequential curriculum design. If we are to design a particular subject matter, then the organization of the content should be a sequence that is compatible with the learners' cognitive abilities. In other words, programs should be set according to the actual level of learners, and teaching strategies should be aligned with the learners' cognitive level.

- Each learner's cognitive schemas are regularly being revised through the process of assimilation and accommodation to make use of new input. The result is that no two individuals can ever be similar in the level of readiness for a given experience. The recommendation here is that teachers should take into account the learners' differences in performing tasks and activities.

- Learners should be encouraged to experience different materials and assisted to discover or even more construct their concept for themselves. Technology may play a central role in offering the learners such opportunities.

- The basic teaching techniques that the teachers may focus on and that are associated with Piaget theory for language learning may cover the following: problem-based learning, discovery learning, cognitive strategies, and project-based learning.

➢ Piaget theory is also important as to evaluation. Teachers should take into account Piaget's view that the individual cognitive development does not take place immediately, so learners' progress may appear after a given period. Teachers should not think that because something was introduced that the learners should promptly learn and apply it.

2.2 Teaching Implications of Vygostsky Theory

The sociocultural perspective has performed implications for teaching as well. Some of these implications which can enrich the social setting of learning are presented below:

➢ One of the most important applications of Vygostsky theory that can be seen is the principle of peer-peer interaction. Teachers today tend to recognize the significance of peer-peer interaction for many reasons as follows:
- Learners may get aware of the importance of some activities which seem important to their peers.
- Peers may constitute models for other learners who are still developing some skills.
- Peers' explanation of particular points can be more effective than that of the teachers because peers are likely to have the same level of understanding.
- When working in different cognitive stages, less advanced peers may get ideas and correct their miscomprehension from the more advanced peers.

➢ Considering the concept of ZPD, teachers should know the limits of their students and teach them according to these limits, no further. In other words, teachers may provide activities that are just slightly beyond the learners' actual competence, based on their existing abilities. However, if the teacher gives challenging activities which are above the level of possible understanding, the learner will be confused, loose interest, and no learning will take place.

➢ It is very important that the teacher should be aware of the zone of proximal development of each learner so that he can help him properly and according to his individual needs. When the teacher interacts regularly with his learners, he could determine exactly what the learners can achieve alone and by assistance. Reconsidering this, the teacher should treat the learners differently and do not administer standardized instructions.

➢ Based on the sociocultural view, teachers should not look at the learners deviations from the second/foreign language norms as indication of failure, but as attempts made by the learners to create new identities and gain self-regulation. Similar to Piaget theory application, in the initial stages of learning, the learners should be given the opportunities to take risks until they come to the stages where they adjust and correct their understanding by themselves.

➢ The evident implication of Vygostsky theory principles in second language classrooms is in task-based approach. Teachers could emphasize the significance of social and collaborative aspects and learning through focusing

on how learners accomplish tasks and how the interaction between them scaffold and help them.

➢ Other opportunities are available for teachers as to encourage socially mediated learning in their classrooms. They can assign projects which make the learners seek out professionals and experts in order to achieve the assignment in a good way.

➢ One of the important aspects of zone of proximal development also is scaffolding. The teachers may use some techniques of scaffolding such as dividing the task into simple steps, providing guidelines, cues, examples, handouts, questions, visual aids…etc. However, they should keep in their minds that it is not prudent to use the same scaffolding techniques in different situations, because this depends on the context encountered such as the type of task, the learners' level, time ..etc.

➢ Vygostsky views can be applied in the process approaches. Unlike the product approaches where the learners do just receive and follow the instructions, the process approaches focus on the cognitive aspects of learning and knowledge construction. For example, in writing, teachers should encourage the learners to go through the process of writing through doing the following: set goals for writing, generate ideas, plan, draft…etc.

➢ Vygostsky theory encourages teachers also to not focus too much on teaching concrete maters, but to invoke the learners' abstract thinking about the world. This would be helpful for the learners in the sense that it develops multiple skills that will assist them to deal with complex learning matters.

➢ In Vygostsky theory, tools are viewed as having extended human ability to reach the objectives of an activity. To this end, teachers may incorporate educational technology as tools embedded in learners' activity. For example, teachers can create lessons that require the learners to work in groups using a computer. Or they can allow the students to use e-mails and Internet as tools for creating dialogues, discussions and debates. Through these tools, the learners access to many types of information resources that can help them synthesize, think, analyze the course materials …etc. What teachers should ensure is that incorporating technology has to make the learners active, not passive.

➢ Integrating the learners' mother tongue is a controversial pedagogical issue in many ESL/ EFL classrooms. While some advocates of the notion of 'an English only environment' discourage the use of the learners' native language in the EFL classroom, others who are somehow skeptical about its exclusion have reiterated that a judicious and well-planned use of L1 can give positive results. Adhering to the concept of Vygostsky of zone of proximal development, teachers must not prohibit the use of L1, because it has a facilitating role in many aspects of language instruction, rather than being an impediment. In other words, the use of first language can allow the learners to extend their zone of proximal development. Lantolf and Thorne (2007: 210)

support this in the following words: "what one can do today with assistance is indicative of what one will be able to do independently in the future."

Conclusion

The purpose of his paper is to ground education, including language learning, in the general development theoretical framework provided by Piaget and Vygostsky and to suggest some applications that can be recommended according to their theoretical frameworks. Though Piaget and Vygostsky hold distinct views as regards developmental psychology, incorporating both theories in education, including language learning, is beneficial. As has been detailed earlier, Piaget theory emphasized the crucial role of biological factors in the development of higher mental activities. Vygostsky, on his part did not deny the personal attempt and individual function, but he overestimated the mediation of social practices and cultural artifacts, with language being an indispensible sign system.

Vygostsky and Piaget have greatly contributed to the theory and practice of education. The implication of their theories is that the learner's initiative and self determination should not be hindered by educational instruction. The essence of the cognitive theory is to make of the learner a creative individual who builds his knowledge himself and has confidence in his ability to perform the assigned task. Teachers, according to Piaget theory, should use equilibrium to motivate the learners, and therefore make a change in their mental structures. In sociocultural theory, learning is seen as a social event that should take place due to group works and cooperation with more capable individuals. In a nutshell, teachers should encourage constructivist pedagogy in their classrooms, if autonomy, initiative, and leadership are to be promoted and abundant shift in education is to be reached.

About the Authors

Khadidja Kouicem got recently her doctorate in foreign language didactics at Constantine University. Her research interest includes EFL writing, EFL reading, reading-writing connection, discourse analysis, and language policy in Algeria. She has been teaching English at Constantine University since the year 2010.

Nachoua Kelkoula is currently a first year doctoral student in "Linguistics and Language Contact in Algeria" at Oran University. She works actually on her research thesis in "Intercultural Communicative Competence". She acquired an experience in English teaching at middle and high school in Constantine, Algeria. She contributed in a national conference in Souse, Tunisia about Hadrumut Integration and Development Skills.

Alves P.F. (2014). Vygotsky and Piaget: Scientific Concepts. *Psychology in Russia: State of the Art*, 7/3: 24-34.

Appleton, K (1997): Analysis and Description of Students Learning during Science Classes using a Constructivist Based Model. *Journal of Research in Science Teaching*, 34/3: 303-318.

Ashton, P. and Gregoire-Gill, M. (2003). "At the Heart of Teaching: The Role of Emotion in Changing Teachers' Beliefs". In J. Raths and A. C. McAninch (eds.), *Teacher Beliefs and Classroom Performance: The Impact of Teacher Education*, (pp. 99- 123). Greenwich: Information Age Publishing.

Brooks, J., and Brooks, M. (1993). *The Case for the Constructivist Classrooms*. Alexandria, Va: ASCD.

Chen, Z and Siegler, R. S. (2000). "Intellectual Development in Childhood". In R. J. Sternberg (ed.), *Handbook of Intelligence*, (pp. 92-117). Cambridge: Cambridge University Press.

Derry, J. (2014). "Abstrct Rationality in Education: From Vygostsky to Brandom". In M. Young and J. Muller (eds.), *Knowledge, Expertise and the Professions*, (pp. 33-47). London: Routledge.

Flynn, P.; Mesibov, D.; Vermette, P.J.; and Smith, R.M. (2004). *Applying Standards Based Constructivism: A Two-Step Guide for Motivating Middle and High School Students*. Larchmont, NY: Eye On Education.

Fox, R. (2001) Constructivism Examined. *Oxford Review of Education*, 27: 23-35.

Gupta, M. D. and Frake, C. (2009). "Child and Family Development". In N. Dogra and S. Leighton (eds.), *Nursing in Child and Adolescent Mental Health*, (pp.19-33). England: Open University Press.

klahr, D. (2012). "Revisiting Piaget: A Perspective from Studies of Children's Problem-Solving Abilities". In M. Alan and C.Q. Paul (eds.), *Developmental Psychology: Revisiting the Classic Studies*, (pp.56-71). London: Sage Publications.

Lantolf, P. L. and S. L. Thorne. (2007). "Sociocultural Theory and Second Language Learning". In B. Van Patten and J. Williams (eds.), *Theories in Second Language Acquisition: An Introduction*. USA: Lawrence Erlbaum Associates, Publishers.

Naylor, S. and Keogh, B. (1999). Constructivism in Classroom: Theory into Practice. *Journal of Science Teacher Education*, 10: 93-106.

Oakley, L. (Ed.). (2004). *Cognitive Development*. London: Routledge.

Pressley, M., and McCormick, C. (2007). *Child and Adolescent Development for Educators*. New York: Guilford Press.
Richmond, G. and Striley, J. (1996): Making Meaning in Classrooms: Social Processes in Small-Group Discourse and Scientific Knowledge Building. *Journal of Research in Science Teaching*, 33/ 8: 839-858.

Sawyer, R. K. (2006). *The Cambridge Handbook of the Learning Sciences*. New York: Cambridge University Press.

Sridevi, K.V. (2008), *Constructivism in Science Education*. New Delhi: Discovery Publishing House Pvt Ltd.

Stone, C. A. (1998). The Metaphor of Scaffolding: It's Utility for the Field of Learning Disabilities. Journal of Learning Disabilities, 31/4: 344–364.

Vygotsky, L.S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

Wadsworth, B.J. (1989). *Piaget's Theory of Cognitive and Affective Development.* (fourth ed.). New York: Longman.