Active Learning: The Dewey, Piaget, Vygotsky, and Constructivist Theory Perspectives

Pardjono

Abstract: Active Learning Approach has long been implemented in Indonesian schools, and until now the implementation of Active Learning Approach remains to be suggested to improve the quality of learning process in Indonesian classrooms. However, the constraint is still on the definition of active learning itself. This article discusses the nature of Active Learning from the perspectives of four theories: Dewey's theory of progressive education, Piaget's theory of assimilation and accommodation, Vygotsky's theory of social context and zone of proximal development, and theory of constructivism. The discussion involves the nature of knowledge, learning, and teaching including the roles of teachers in active learning based on the four theories.

Keywords: active learning, Dewey's theory of learning, Piaget's theory of learning, Vygotsky's theory of learning, theory of constructivism.

In the 1994 curriculum the government of Indonesia recommended that active learning approach should be adopted for learning and teaching in all schools (Ministry of Education and Culture, 1993). Pardjono's research concerning the implementation of active learning in primary schools conducted in 2000 showed that there were many different views among teachers over the philosophical and conceptual basis of active learning (Pardjono, 2000). Therefore, the obstacles and constraints associated with

Pardjono is a lecturer of the State University of Yogyakarta (UNY).

the concept of active learning would need to be overcome for the effective implementation of this approach in all Indonesian schools. One of the efforts is to provide clear description of the nature of the active learning approach.

Any attempt to define active learning faces some semantic difficulties because all learning seems to be active. How can learning takes place if there is no some kind of action? Learning always involves action-if not physical action then mental action. Therefore, it would seem that there is no non-active learning. However, the issue is not whether or not there can be learning without action but rather what the nature of active learning is.

The discussion in this article focuses on four theories of learning: Dewey's progressive education, Piaget's theory of assimilation and accommodation, Vygotsky's theory of the social context of learning and Constructivism. Dewey's progressive education has inspired the idea of active learning, while Piaget's assimilation and accommodation and Vygostky's theories of learning of social context have been respectively adopted in constructivism and social constructivism. The discussion in this article also considers the development of active learning ideas from progressive education to constructivist education.

DEWEY'S PROGRESSIVE EDUÇATION

Through his project method in progressive education in the early part of the twentieth century Dewey rejected the traditional notion of traditional education. There are two approaches in traditional education according to Lloyd (1976) emphasizing classical subjects and preparing children for life. Furthermore, Lloyd (1976) stated that both approaches were justified from quite different grounds, seeing:

> Education as something that had to be "put into" children... The teacher was said to "inculcate good taste", "to imbue with the love of learning", "to infuse ideas", "to instill wisdom", "to implant good sense" and more colloquially. "to ensure the something sinks in" (Lloyd, 1976:91).

From these notions, accordingly, the teacher was the one who possesses knowledge and the child was the one to whom this knowledge must be passed on.

Dewey (1933) criticized traditional education as "passive and receptive learning" as children receive knowledge from the teacher and knowledge is assumed to be bodies of information and skills that have been worked out in the past with standards and rules of conduct. Instead of traditional, he proposed active learning principles in his discussion of progressive education, allowing students to be more active in their learning.

Dewey saw the classroom as a microcosm of a democratic society. The teacher would model democratic ideals and the students would learn by experience (Dewey, 1933). Dewey described the mind as a verb, as something which does rather than something to be filled like a sponge. He believed that students needed to interact with their environment in order to think and therefore every student should be involved in lively activity around a project. The project method or scientific method of problem solving was Dewey's alternative to the traditional method and included this concern of teaching for students being active in learning.

Dewey (1938) explicitly proposed principles of active learning in progressive education, as opposed to non-active education as follows:

> If one attempts to formulate the philosophy of education implicit in the practices of the new education, we may, I think, discover certain common principles amid the variety of progressive schools now existing. The imposition from above is opposed to the expression and cultivation of individuality; external discipline is opposed to learning through experience; the acquisition of them as a means of attaining ends which make direct vital appeal; the preparation for a more or less remote future is opposed to making the most of opportunities of present life; static aims and materials are opposed to acquaintance with a changing world (Dewey, 1938:19-20).

Following these principles, the nature of active learning has three aspects-the nature of knowledge, learning, and teaching. According to Dewey, in active learning knowledge is individual experience organized and constructed through learning. Similarly, learning is the acquisition of knowledge and skills through individual experiences not from texts nor from teachers. Teaching is facilitating the learning environment to allow students to acquire knowledge through active involvement in the learning activity. Thus, in active learning, students' learning involves physical and mental action. Physical activities are needed in learning in

order that students have their own experience with objects. Mental activities are needed in learning in order for students to process their learning experience to become knowledge. In other words, education is a process of modification of personal experience. This modification affects subsequent experiences, so that something learned in one situation will help understanding and action in future situations, and also person and environment interactions lead to a continual reconstruction of thought.

PIAGET'S THEORY OF ASSIMILATION AND ACCOMMODATION

Aspects of the nature of active learning can also be identified in Piaget's theory of assimilation and accommodation. Like Dewey, Piaget also rejected traditional methods of learning. Piaget posits that it is not realistic to expect a mutual communication to occur between a teacher and a student in the traditional method when a teacher is telling and the student is listening. Piaget argued that a student heard what he perceived and that might not be the same things as what the teacher was saying (Page, 1990). What teachers taught, therefore, was not always what the students learned. Another reason for his rejection of traditional method as cited by Labinowicz (1980) was that he disagreed with the associated behaviorist theory that knowledge originated outside of the learner.

Piaget was also interested in mental activity in learning. In particular he was interested in what an individual does in his interaction with the world. Piaget (1953) argues that life is a continuous creation of increasingly complex forms and a progressive balancing of these forms with the environment. Thus, according to Piaget, all organisms are born with a tendency to adapt to the environment through a biological adaptation process. Piaget's adaptation process is similar to active learning principles proposed by Dewey. The process of adaptation goes on all the time. The ways in which adaptation occur differ from species to species, from individual to individual within species, and from stage to stage within one individual.

In the context of human learning, the basic mechanism of adaptation that leads to cognitive advancement, according to Piaget, is composed of two complementary processes: assimilation and accommodation. "Assimilation is the process by which an individual understands an experience in terms of his or her present stage of cognitive development" (Royer & Feldman, 1984). Therefore, assimilation is an intellectual process whereby the individual deals with the environment on terms of his present

cognitive structure (or schemas). The individual will see something new in terms of something already familiar. Assimilation occurs when the current structure of knowledge incorporates new experience.

Accommodation is defined "as a process of changing one's existing ways of thinking as a response to a new event or stimulus" (Royer & Feldman, 1984). The concept of accommodation refers to the organism's tendency to modify its structures according to the pressures of the environment. Thus, accommodation involves possibly extensive change to existing structures or the development of new structures in response to stimulus or cognitive dissonance produced by the environment. Clearly, assimilation is the recognition of functional identity, while accommodation is the recognition of functional differences between the existing cognitive structures and new stimuli from the environment. Both of these functions are necessary for adaptation to occur. Adaptation that involves accommodation and assimilation will be completed when the organism reaches equilibrium. The equilibrium is used to describe a balanced condition, a harmonious adjustment between at least two factors; in this case between the person's cognitive structures and the environment. Piaget comments:

> In short, intellectual adaptation, like every other kind, consists of putting an assimilatory mechanism and a complementary accommodation into progressive equilibrium. The mind can only be adapted to a reality, intervenes to modify the subject's schemata. But always and everywhere adaptation is only accomplished when it results in a stable system, that is to say, when there is equilibrium between accommodation and assimilation (Piaget, 1953:7).

This clearly shows that when the environment disturbs the equilibrium, the individual can perform mental actions to reconstruct the balance. Gorman (1972) states that the final state, if the process has involved accommodation, is a new way of thinking and structuring things, a way that gives new understanding and satisfaction, in a word, a state of new equilibrium.

The principle of adaptation presumes activity on the part of the organism because modification of structures is never a passive reception of environmental simulation. It should be stressed that, according to Piaget, knowledge is not absorbed passively from the environment-nor is being constructed by the child through his/her interaction between his mental structures and his environment (Labinowicz, 1980). The process of building

(through accommodation) and restructuring knowledge is intellectual development or learning. Movement from disturbance (initiated by the organism's external environment) towards equilibrium is active, the actions being the processes of accommodation and assimilation.

There are four principles of active learning according to Piaget (Page, 1990): students should construct their own knowledge so that it is meaningful; students learn best when they are active and interact with concrete materials; learning should be student-centered and individualized; and social interaction and cooperative work should play a significant role in the classroom. Thus, learning is constructing knowledge; and teaching is providing a stimulating environment with concrete materials and hands-on activities.

VYGOTSKY'S SOCIAL CONTEXT AND THE ZONE OF PROXIMAL DEVELOPMENT

Vygotsky is also concerned with mental and physical activities of student learning. He views learners as active organizers of their experiences and emphasizes the social and cultural dimensions of the development. However, his socio-cultural account of development is in contrast to Dewey's and Piaget's because of its rejection of their focus on individual development. According to Vygotsky, "formal education is an essential tool of enculturation" (Blanck, 1990).

Within the context of an active, systematic interaction between a child and a pedagogue, the child is provided in an organized way, with the psychological tools that will determine the reorganization of his mental function. In determining a child's overall development level, one must see at least two aspects of developmental levels. The first is the actual level, the result of completed development cycles. The second is the potential level (Van Geert, 1994). Vygotsky made distinction between the actual development level of a child, the potential development and the intermediate zone of proximal development. The zone of proximal development probably is the most widely known concept in Vygotsky's theories.

> The zone of proximal development is defined as: The distance between the actual developmental level as determined by independent problem solving and level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky, 1978).

The concept implies that the zone of proximal development is the territory between those tasks that a child can undertake successfully and those that require the assistance of an adult or capable peer. In essence, the zone of proximal development represents a child's susceptibility to influence, that is, the difference between what a child can do with assistance and what he or she is able to do without assistance, the limits of the child's independence and the remaining dependency of the child. It is assumed that most capable adults are able to target appropriately their strategic interaction with children within the child's zone of proximal development, thereby facilitating learning.

Learning according to Vygotsky is the process of performing activities that can be performed only with the help of others, and transforms the potential developmental level into the actual level. He says:

> We propose that an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when a child is interacting with people in his environment and in cooperation with his peers, independent developmental achievement (Vygostky, 1978:90).

Blanck (1990) says "Vygostky's most important contribution was to acknowledge children as active agents in the educational process". They are agents because they internally elaborate on pedagogical activity. In particular, it focuses attention on the real psychological zone within which social processes are able to construct new knowledge in the child, namely, the functional relationship between the lower and higher psychological processes. The emphasis distinguishes Vygotsky from his most notable contemporary, Piaget, whose central concern is the individual's biological mechanism that constructs mind. "Vygostky's theory focused attention on mental growth which takes place as a consequence of social intervention without any corresponding psychological, neurological, or biological changes" (Moll, 1994:335).

Wertsch (1985) argues that, for Vygotsky, the social dimension of consciousness is primary in time and fact, the individual dimension is derivative and secondary. Thus, a child's development cannot be understood only by a study of an individual. We must also examine the external social world in which that individual's life has developed. Children rise and advance to higher stages of development by being stimulated and

guided at the outside limits of their skill and ability. For Vygotsky, all human cognitive operations constructed during the course of development are instances of the internal reconstruction of external (social) operations (1978).

Scaffolding is another concept that comes from Vygotsky's theory. Scaffolding refers to the guidance and interaction support given by a tutor in the zone of proximal development. Bruner (1985) explains scaffolding as permitting children to do as much as they can by themselves while what they cannot do is filled in by mother, peers or other tutors' activities. In the process of learning, the tutor provides "a vicarious form of consciousness" (Bruner, 1985) which children take over for themselves after the task has been mastered.

Learners must be able to recognize a solution to a particular class of problem before they are able to produce the steps leading to it without assistance. Because the child is viewed as building or actively constructing, the social environment is part of the necessary scaffold or support system that allows the child to move forward and continue to build new competencies. Seen in the light of scaffolding theory children do not passively absorb new strategies directly from adult assistance. They need to take an active inventive role and reconstruct the task in terms of their own understanding, simultaneously extending their own understanding.

The starting point of learning according to the Vygotsky's model is intersubjectivity where tutor and learner need to have a shared understanding of the purposes, goals, tools, and contexts of the task since dialogue is the starting point of thought (Wertsch, 1984). Intersubjectivity is achieved through shared meaning for signs and symbols that develop in the context of interaction over joint teaching-learning activity. When intersubjectivity is achieved, the child redefines a problem situation in terms of an adult perspective. Once the child understands and shares an adult's perspective, responsibility can be gradually transferred to the child (Diaz, Neal and Amaya-Williams, 1990). Thus, it is impossible for a tutor to be effective without considering the child's interests, knowledge and point of view. When the tutor and learner have already achieved intersubjectivity, the tutor and learner do not misunderstand each other and contribute reciprocally to the interaction so that children can gradually become the initiators of their learning.

It is only through communication within a shared frame of reference that children can internalize and construct their own understandings. Vy-

gotsky saw communication and learning as arising out of shared actions. Child development is the result of child's competence being challenged and extended with the help of others. This help, then, is gradually withdrawn and the child becomes able to perform more and more with his/her own competencies. Instructional methods based on the Vygotsky's theories offer an alternative to the traditional way by emphasizing the need for social interaction and experts' guidance within the zone of proximal development. By taking part in group activities, an individual learner internalizes the goals and methods of more expert problem solvers. Vygotsky highlighted the dialogue that occurs between mother and child, or between teacher and student.

CONSTRUCTIVIST LEARNING THEORY

Behavior and cognitive learning theory have been important influences in education over the years (Noddings, 1990). However, as Cobb states, approaches that characterize thinking as a sequence of cognitive behavior that manipulates incoming information to generate responses have fallen from favor (Bennet, 1989; Cobb, 1994; Lerman, 1989; Noddings, 1990).

Constructivist learning theory is linked with Piaget's theories of assimilation and accommodation that have been discussed earlier in this chapter. Hawkins (1994) states that "constructivist philosophy has its origin in Kant's work", and Piaget's theory of genetic epistemology (Hendry, 1996). Piaget's genetic epistemology is a reformation, in dynamic, evolutionary terms, of Kant's epistemology (Wartofsky, 1983). Boden (1979) states:

> Like Kant, Piaget stresses the constructive activity of the mind in the formation and interpretation of experience, and believes that we must experience in terms of certain general structural principles if we are to experience at all. But whereas Kant ignored questions about the development of the forms and categories of space, time, identity, and cause all of which are essential to adult subjective experience and objective knowledge-Piaget does not. He argues that the baby does not have concepts of cause or identity equivalent in organizational power to the adult's but has to develop them from primitive beginnings by successive cycles of interaction with the environment (Boden, 1979:91).

Human interaction with environment is a central concern of Piaget. Cognitive development is seen as the product of interaction in which objects of cognition are not passively received but actively constructed. Learning is a constructive process; learners do not passively receive information but actively construct knowledge as they strive to make sense of their worlds.

The theory of constructivism rests on two main principles. Von Glassersfeld (1989) argues that knowledge is not passively received but actively built up by the cognizing subject and [secondly] the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality. Thus, knowing is active, individual and personal, and is based on previously constructed knowledge. The second principle of constructivism means that the function of cognition does not discover an existing reality, but adapts a proposed theory of reality to the experiential world. Thus the meaning of knowledge exists only within the realm of our experiential world, but this knowledge is not supposed to represent a reality independent of our experiencing (i.e., an ontological world). Constructivism holds that learning is a process of building up structures of interpreted experience. Learners do not transfer knowledge from the external world into their experience. Learners do not transfer knowledge from the external world into their memories as in traditional views; rather, they create interpretations of the world based upon their experiences and their interactions in the world. How someone construed the world, the existing metaphors, is at least as powerful a factor influencing what is learned as an characteristic of that world. Some would even argue that knowledge that is incompatible with or uncounted for in an individual's interpretation cannot be learned.

Lerman (1989), suggests the term weak constructivism for the first principle, and radical constructivism for both principles. Ernest (1994) agrees with Lerman's suggestion, but he uses trivial constructivism instead of the term weak constructivism. Ernest (1994) distinguishes four educational paradigms in discussing constructivisms: information processing theory, trivial constructivism, radical constructivism, and social constructivism.

Information processing theory is regarded as the simplest form of constructivism according to Ernest. This theory appears to accept Von Glasersfeld's first principle and reject the second principle of construc-

tivism. Information processing theory is largely based on the metaphor and sometimes the conscious model of the mind as computer. This actively processes information and retrieval of data. It is evidently close to the first principle of constructivism because knowledge is not passively received but actively built up. However, in his analysis Ernest argues that information-processing theory is not a form of constructivism (Ernest, 1994).

Trivial constructivism is a form of constructivism named by Ernest that rejects the second of Von Glasersfeld's principle. The underlying metaphors of mind and world are almost the same as in information theory. However, the difference is that the mind is not seen as a computer, but as the brain (Ernest, 1994).

Like Lerman, Ernest (1994) calls constructivism radical when it is based on both of Von Glasersfeld's principles. The second principle of constructivism profoundly affects the world metaphor, as well as that of the mind. The function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality. Cooper (1993) states that "constructivists (i.e. radical constructivists) view reality as personally constructed, and state that personal experiences determine reality, and not the other way round". Thus, for the constructivists, the so called reality is determined by the experiences of the knower. Mind is viewed as a builder of symbols and the tools used to represent the knower's reality. Therefore, external phenomena are meaningless unless the mind perceives them.

A similar conception concerning constructivism has been suggested by Confrey (1990). He stated "the radical constructivist view has two principles-it rejects a picture theory of knowledge, and it consists of actions and reflection on those actions" (Confrey, 1990:108). All knowledge is constructed by an individual on the basis of the individual's cognitive processes, and, in dialogue with the individual's experiential world, learners construct increasingly sophisticated ways of knowing solely on the basis of their personal experiences.

Another form of constructivism is social as indissolubly interconnected (Ernest, 1994). Vygotsky described the development of self through the process of internalizing social norms. As discussed earlier, Vygostky views mental-functioning as a kind of action that may be carried out by individuals or by dyads (pairs) and larger groups. Thus, Vygotsky sees

mind as part of a broader context, including the social construction of meaning. Social interchange between people is the beginning of thought. Likewise, the social constructivists, model of the origins of thinking, are deeply embedded in the structure of society as cultural meanings and understandings are inherent in the language.

THE ROLES OF TEACHERS ACCORDING TO THE THEORIES

Dewey (1938) argues "basing education on personal experience may mean more intimate contacts between the mature and the immature than ever existed in the traditional education, consequently more, rather than less, guidance by the teacher". Dewey compared children's participation in an active learning classroom to their participation in game. Games usually involve rules which are unquestioned by children. These rules, if thought about, are seen as fixed, and coming from outside the games. Children playing a game do not feel that the supervising teacher is inventing the rules. Similarly, in an active learning classroom children learn through active thinking and possibly hands-on experience in an enjoyable way, and they are not aware of external controls or the way teacher actually directs the experiences in the classroom.

Classroom control develops through the relationship between students and teacher. There are two elements to this. The first is the communication system and the other is the teacher/student role. Dewey and Piaget's theories imply that in the new learning model, in order for students to be more active, the communication between student and teacher is reciprocal, where teacher and students are both senders and receivers, and both function as teachers and learners. The students' role is to direct and do their own learning. They do not have license to do whatever they want to do: and the teacher's role is to guide and suggest (Dewey, 1938), developing the environment in order for students to discover, continually evaluating the progress of student learning, creating cognitive conflicts to induce thinking, and promoting social interaction (Piaget, in Weil & Murphy, 1982).

The role of teachers in Vygotsky's framework can be considered in terms of the concepts of the zone of proximal development, intersubjectivity, and scaffolding. Vygotsky showed that working with assimilation in their zone of proximal development children could perform much more skillfully with others (teachers, adults) than by themselves. Hence, until

children (or older learners) acquire competence in these developing skills, they require help and supervision from teachers or knowledgeable adults. Teachers have a highly interactive role in a Vygotskian framework. The children's development will be static (that is, they will not develop) unless they are able to work in their zone of proximal development. In Vygotsky's framework teaching does not wait upon development but propels it. Teachers need to know learners well, so they can provide the right level of guidance, and gradually withdraw it as the child comes to understand and perform the task alone. Teachers cannot leave children to discover the world alone in free play. It is through participating and sharing another's frame of reference that children learn. Furthermore, teachers have to be aware of student's behavior, be attentive to and evaluate the student's work, and keep the process heading to a relevant and meaningful conclusion.

Page says that teaching as a guide or coach and communicating in a reciprocal model require and intuitive sense about what intervention is necessary at what time and with whom, since every activity, every class, and every student is different. Teachers need to have time for interaction and conversation with children in one-to one situations and in relatively small groups. They also need the opportunity to observe children so that they can see how to adjust their support to the children's current level of understanding. In order to acquire intersubjectivity teacher has to be able to see things from the child's point of view and try to understand the meanings from the culture or the family.

When teachers are working with a group, it is possible to work within the shared or overlapping zone of proximal development of the individuals within the group. Similarly, the intersubjectivity used in group work will be the shared or overlapping intersubjectivities of the teachers and each individual in the group. Thus, group learning has an important role in Vygotsky's framework. It is important for teachers, particularly lower primary teachers, to be able to participate in such shared contexts with children. Children will not be able to advance in their zone of proximal development unless they have an opportunity to share in joint interactions with a teacher who has sensitivity to children's changing knowledge. Therefore, in the Vygotskian classroom, teacher doesn't simply wander around the classroom scanning children's activities and making occasional comments or directing questions to a child. Instead teacher

also participates actively in tasks with children on a sustained basis, especially in the initial stages of learning. Later, with older learners, it is not so important for teacher to be actively involved as knowledgeable peer. It is not always necessary for an adult to be the person who encourages learning in the zone of proximal development. Forman and Cazden quoting Vygotsky's pupil, Levina, show that children can provide scaffolding for each other very effectively in peer tutoring situations. Sometimes one child knows more than the other and acts as a tutor. Children of equal levels of competence can, however, also collaborate in a reciprocal way. They may alternate roles such as questioner, modeller (showing how something works), experimenter or critic, while the others can take the role of listener, respondent, or observer.

CONCLUSION

In summary, the four theories have shown that change from traditional learning and teaching to the active learning model of learning and teaching involves three aspects of education, that is, a change in our view of the nature of knowledge, learning, and teaching. In active learning, knowledge is the accumulation of experience constructed by children through learning activities. The term active in active learning semantically implies that students are active, that is , actively constructing their own knowledge not just passively receiving ready-made knowledge from other people. Active learning reemerged in the 80s and 90s in the form of constructivism, which has two principles: knowledge is not passively received but actively built up by the learner and the function of cognition is adaptive and serves the organization of the experiential world.

When a student is involved in active learning, the student's task is to construct his or her own knowledge through classroom activities. The role of the teacher changes from dispenser of ready-made knowledge to that of a facilitator of learning. The discussion at the beginning of this article shows that Dewey emphasized the learner's interaction with the physical environment, and Piaget explored the adaptive process by which humans construct their knowledge of the world. Vygotsky developed a theory of the role of social interaction as a dimension of learning. For learning to take place teachers should consider the physical environment as well as the social learning environment.

REFERENCE

Bennett, N. 1989. Teaching and Learning Mathematics in the Primary School. In P. Ernest (Ed.), *Mathematics Teaching: The State of the Art* (pp. 107-118). New York: The Falmer Press.

Blanck, G. 1990. Vygotsky: The Man and His Cause. In L.C. Moll (Ed.), *Vygotsky and Education: Instructional Implications and Applications of Sociohistorical Psychology*. Cambridge, New York: Syndicate of University of Cambridge.

Boden. M. 1979. *Jean Piaget*. New York: The Viking Press.

Bruner, J. 1985. Vygotsky: A Historical and Conceptual Perspective. In J.V. Wertsch (Ed.), *Culture, Communication and Cognition: Vygotskian Perspectives* (pp. 21-35). Cambridge: Cambridge University Press.

Cobb, P. 1994. Constructivism and Learning. In T. Husen and T. Postlethwaite (Eds.), *The International Encyclopedia of Education*. Oxford: Pergamon Press.

Confrey, J. 1990. What Constructivism Implies for Teaching. *Journal for Research in Mathematics Education*, 4: 104-122.

Cooper, C. 1997. *Learner-centered Assessment*. Launceston: Global Learning Communities.

Dewey, J. 1933. *How We Think*. Boston: D.C. Heath.

Dewey, J. 1938. *Experience and Education*. New York: Collier Books.

Diaz, R., Neal, C. & Amaya-Williama, M. 1990. The Origins of Self-regulation. In L. C. Moll (Ed.), *Vygotsky and Education: Instructional Implications and Applications of Sociohistorical Psychology* (pp. 127-154). Cambridge, New York: Cambridge University Press.

Ernest, P. 1994. Varieties of Constructivism: Their Metaphors, Epistemologies, and Pedagogical Implications. *Hiroshima Journal of Mathematics Education*, 2: 1-14.

Hawkins, D. 1994. Constructivism: Some History. In P. Fensham, R. Gunstone & R. White (Eds.), *The Content of Sciene: A Constructivist Approach to Its Teaching and Learning*. London: Falmer Press.

Hendry, G. 1996. Constructivism and Educational Practice. *Australian Journal of Education*, 40 (1): 19-45.

Labinovicz, E. 1980. *The Piaget Primer: Thinking, Learning, Teaching*. Ontario: Addison-Wesley.

Lerman, S. 1989. Constructivism, Mathematics and Mathematics Education. *Educational Studies in Mathematics*, 20: 211-215.

Lloyd, D.I. 1976. Traditional and Progressive Education. In D.I. Lloyd (Ed.), *Philosophy and the Teacher*. London: Routledge & Kegan Paul.

Ministry of Education and Culture. 1993. *Kurikulum Pendidikan Dasar: Landasan Program dan Pengembangan*. Jakarta: Ministry of Education and Culture.

Moll, I. 1994. Reclaiming the Natural Line in Vygotsky's Theory of Cognitive Development. *Human Development*, 37: 333-342.

Noddings, D. 1990. Costructivism in Mathematics Education. *Journal for Research in Mathematics Education*, 22 (1): 7-8.

Pardjono. 2000. *The Implementation of Student Active Learning in Primary Mathematics in Indonesia*. Unpublished Ph.D thesis. Burwood Campus, Australia: Deakin University.

Piaget, J. 1953. *Origins of Intelligence in the Child*. London: Routledge & Kegan Paul.

Piaget, J. 1971. *The Psychology of Intelligence: Sixth Impression*. London: Routledge & Kegan Paul.

Van Geert, P. 1994. Vygotskian Dynamics of Development. *Human Development*, (37): 346-365.

Von Glasersfeld, E. 1989. Learning as Constructive Activity. In T. Husen & N. Postlethwaite (Eds.), *International Encyclopedia of Education (Supplementary Vol.)* (pp. 162-163). Oxford: Pergamon Press.

Vygotsky, L. 1978. *Mind and Society: The Development of Higher Psychological Processes*. Cambridge, Massachusetts: Harvard University Press.

Wartofsky, M. 1983. From Genetic Epistemology to Historical Epistemology: Kant, Marx, and Piget. In Lben (Ed.), *Piaget and the Foundation of Knowledge* (pp. 1-17). New Jersey: Lawrence Erlbaum.

Wertsch, J. 1985. Vygotsky and Contemporary Developmental Psychology. *Developmental Psychology*, 28 (4): 548-557.