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An Exposition of Constructivism Account to Construct Knowledge and to Create Meaningful Learning Environment for Teacher Education

Fadzilah Abd Rahman, Habibah Abd Jalil & Aminuddin Hassan



ABSTRACT: *Since last ten years, it becomes indispensable to talk about constructivism in relation to the teaching and learning process. Yet the term of constructivism is still not well defined and contradicts. Generally constructivism refers to a set of views about how individuals learn and about how those who help them to learn ought to facilitate, which in this paper referred as Constructivist Learning Account (CLA). CLA holds an assumption that learners actively construct their own sets of meanings and understandings; knowledge is not a mere copy of the external world, nor is knowledge acquired by passive absorption or by simple transference from one person (educator) to another (a learner or knower). Clearly, knowledge is constructed not acquired. CLA also stresses that we cannot be certain that any two individuals will construct the same understandings. Even if they use the same linguistic formulations to express what they have learned, their deep understandings might be quite different. Hence, a better understanding of constructive learning accounts as a component of a long life learning process and how teacher education programme should engage with it is needed to create a meaningful learning environment.*
KEY WORDS: *Constructivist Learning Account, knowledge is constructed, and meaningful learning.*

Introduction

> *"Learning is an active process of knowledge construction in which learners build on prior knowledge and experience to shape meaning and construct new knowledge"* (Walker & Lambert, 1995).

Since last ten years, it becomes indispensable to talk about *constructivism* in relation to the teaching and learning process. Yet the term of *constructivist teaching* is still not well defined and contradicts. What is *constructivism* and why currently it seems to

Dr. Fadzilah Abd Rahman, **Dr. Habibah Abd Jalil**, and **Dr. Aminuddin Hassan** are lecturers at the Faculty of Educational Studies, *Universiti Putra Malaysia* (UPM), 43400 Serdang, Malaysia. One of them could be reached at: fadzilah@educ.upm.edu.my

be the most significant word particularly in the world of teaching and learning? Thus, it is believed that it makes sense to talk about a *constructivist learning account* in order to construct knowledge and to create meaningful learning environment for teacher education programme.

According to R.E. Mayer (1992), since the late 1800s three learning paradigms have dominated education, as a whole: learning as the acquisition of stimulus-response pairs (*behaviourism*); learning as the processing of information (*information processing*); and learning as the construction of knowledge (*constructivism*). *Behaviorists* subscribe to an objectivist epistemology that posits knowledge as separate from and external to the knower, and so centres on the student's efforts to accumulate that knowledge and on the teacher's efforts to transmit it. It relies on teacher-directed and controlled education, and a transmission approach which renders learners largely passive (Tiene & Ingram, 2001). *The Information Processing* paradigm focuses on the cognitive nature of the human thought process, particularly on how the mind senses, processes, stores and recalls information. It claims that the various internal processes by activating mental sets such as memory, attention and recall process (Gagne & Medsker, 1996), should support learning. By contrast, *Constructivism* has its roots in both philosophy and psychology. The essential core of constructivism is that learners actively construct their own knowledge and meaning from their experiences (Steffe & Gale, 1995; and Fosnot, 1996).

The verb *to construct* comes from the Latin *con struere*, which means to arrange or give structure. Ongoing structuring (organizing) processes are the conceptual heart of constructivism (Mahoney, 2003). Accordingly, teachers who have had more preparation for teaching are more confident and successful with students than those who have had little or none. Recent evidence also indicates that constructive reforms of teacher education creating more tightly integrated programmes with extended clinical preparation interwoven with coursework on learning and teaching produce teachers who are both more effective and more likely to enter and stay in teaching. Suggestions to redesign teacher education to strengthen its knowledge base, its connection to both practice and theory, and its capacity to support the development of effective teaching also have been raised (Fosnot, 1996).

How can constructivism provide an applicable theoretical framework to explain the process of student teachers (ST) learning, and how can it influence instructional design or a curriculum for a teacher education? To consider those questions, the basics of a learning paradigm and constructivist perspective should first be understood.

Historical Perspective of Constructivism

Authors would like to excerpt M.J. Mahoney (2003, 2004, and 2007) views in relation to the historical aspect of constructivism. According to M.J. Mahoney, among the earliest recorded proponents of some form of constructivism are Lao Tzu (6th century BC) and Heraclitus (540-475 BC). In Western cultures, constructivists often trace their intellectual genealogy to Giambattista Vico (1668-1744), Immanuel Kant (1724-1804), Arthur Schopenhauer (1788-1860), and Hans

Vaihinger (1852-1933). Giambattista Vico had emphasized the role of fantasy and myth in human adaptation. Immanuel Kant emphasized the power of patterns in our thinking, and he regarded ideas as regulative principles in our experiencing. His *categories* were predecessors of what are now called *constructs* and *schema.* Hans Vaihinger's work would also influence the later writings of personal *construct* theorist such as William James. William James also explored several constructivist themes, and he carried the curiosity of constructivism across the transition from the 19th to the 20th centuries.

Furthermore, Jean Piaget developed a model of cognitive development in which Piaget described knowing as a quest for a dynamic balance between what is familiar and what is novel. He noted that we organize our worlds by organizing ourselves. This theme of developmental self-organization pervades constructive views of human experience. Another theoretical presentation of constructivism was offered in Friedrich A. Hayeks (1952) book, *The Sensory Order*. In this book, Friedrich A. Hayek showed that much that we believe to know about the external world is, in fact, knowledge about ourselves (p.6-7).

Constructivism continued to grow throughout the second half of the 20th century, and it is now the focus of numerous books and two international journals. The rapidity of its growth has sometimes made constructivism seem like a recent development, when in fact it has been emerging for centuries. In 1996 the Society for Constructivism in the Human Sciences was formed to encourage and communicate developments in theory, research and practices that reflect an appreciation for *human beings as actively complex, socially-embedded, and developmentally dynamic self-organizing systems*. Honored contributors to this Society include Walter Truett Anderson, Albert Bandura, Jerome S. Bruner, James F.T. Bugental, Donald H. Ford, Viktor E. Frankl, Kenneth J. Gergen, Vittorio F. Guidano, Hermann Haken, Humberto R. Maturana, Joseph F. Rychlak, Francisco J. Varela, Heinz von Foerster, Ernst von Glasersfeld, and Walter B. Weimer (Mahoney, 2007).

Fundamental Works on Constructivism

Jean Piaget developed the key idea of cognitive constructivism about 60 years ago (von Glasersfeld, 1996:3). Piaget has been referred to as a constructivist because of his views that knowledge is constructed by learner activity. His central concern was about methods by which humans construct their knowledge of the world. These ideas later provide part of the foundation for the constructivist learning theory (von Glasersfeld, 1989; Driver *et al.*, 1994; and Bliss, 1995).

A. Woolfolk (2000:329) mentioned that beside Jean Piaget, theorists such as John Dewey (1963), Jerome S. Bruner (1990) and Lev S. Vygotsky (1978) also proposed some of the fundamental premises of constructivist thinking. For example, several of Dewey's ideas support a constructivist model of teaching and learning. Some of the principles associated with the educational theorist Bruner (1990) such as *scaffolding* seem to coincide with those of Vygotsky and Piaget, and provide further theoretical support for the constructivism theory (Slavin, 2000). Moreover,

E. von Glasersfeld proposed "radical constructivism" as one of the versions of psychological constructivism (in Phillips, 2002:10).

According to P.E. Doolittle & W.G. Camp (1999), there is no single constructivist position in the field of education or, in other words, constructivism does not represent a distinct theoretical position. Rather, constructivist types or forms are frequently described as a continuum (Moshman, 1982; and Phillips, 1995). The assumptions that underlie the constructivism continuum are various and consequently resulted in the development of a variety of types of constructivism. In general, it divided into three broad categories: *Cognitive Constructivism, Social Constructivism* and *Radical Constructivism* (Pountney, Parr & Whittaker, 2002).

As described, it is worthwhile to note that though the work of constructivists is separated by few categories, the idea of learning and knowing by these constructivists overlapped and complemented each other. For example, by 1933, Piaget and Vygotsky's work became almost identical (Shayer, 2002). What happened was that people had known about Piaget's work for over 50 years, and then Vygotsky's work appeared slowly in the West in the 1970s and 1980s. People then raised a different idea of Vygotsky's works, and did not focus on the ideas that had been highlighted by Piaget. As a result, most people treat Vygotsky as in conflict with Piaget, which is inappropriate (Shayer, 2002).

In linking constructivism with STs' learning of knowledge of teaching, scholars' works from each category will be discussed briefly. That is, Cognitive Constructivism (Piaget, 1973 and 1977); Radical Constructivism (von Glasersfeld, 1991 and 1995); and Social Constructivism (Vygotsky, 1978).

A. Cognitive Constructivism

It is well known that J. Piaget was interested in how an organism adapts to its environment (which Piaget described as *intelligence*). He believed that behaviour (that is an *adaptation to the environment*) was controlled through mental organisations called schemas that the individual uses to represent the world and designate action. This adaptation is driven by a biological drive to obtain balance between schemas and the environment (Piaget mentioned as *equilibration*). J. Piaget (1973 and 1977) hypothesized that infants are born with schemes operating at birth that he called *reflexes*. However, learning is not just the domain of infants or children, but of all learners. In other animals, these reflexes control behavior throughout life. In human beings as the infant uses, these reflexes to adapt to their surroundings these reflexes are quickly replaced with constructed schemas.

J. Piaget was most concerned about the "process of learning"; therefore, he proposed two processes of learning used by the individual in its attempt to adapt *assimilation* and *accommodation*. Both of these processes are used throughout life as the person increasingly adapts to the environment in a more complex manner.

Assimilation is the process of using or transforming the environment so that it can be placed within a pre-existing cognitive structure. For example, when someone wanted to mend a wooden box with some nails but forgot to bring the hammer, he or

she then looks around to find something that could replace the hammer. In this situation, he or she might see a few things around her or him like stones, books, a water bottle, or a pencil, which he or she then needs to decide which is appropriate to replace the hammer. He or she then chooses a stone to replace the hammer (Scaife, personal communication, July 7, 2006). The process that he or she used to create the new conception of the stone (or expanding the conception of stone) into the conception of hammer is known as assimilation. The process of assimilation also could happen when he or she saw somebody else hit the nail with the stone, and get the idea of the new conception of the stone. The former is referred to as "discovery learning" and the later is "learning by imitation".

Accommodation is the process of changing a way of thinking when the previous knowledge does not work to treat something new. The cognitive organism perceives (assimilates) only what can fit into the structures it already has. The implication is that when an organism assimilates, it remains unaware of, or disregards, whatever does not fit into the conceptual structures it possesses (von Glasersfeld, 1995:3). For example, when he or she failed to assimilate their previous knowledge to open a new water bottle as he or she finished the old one, he or she needs to construct a new knowledge or idea to solve that problem. In other words, accommodation is a process when new knowledge is constructed to treat something new (Scaife, personal communication, July 7, 2006).

In the context of teacher education, the example of *assimilation* would be when STs use a schema of knowledge of teaching that was developed during microteaching when attempting to teach in a real classroom during teaching practices. The example of *accommodation* would be when the STs modify a teaching skill developed during teaching practices to one that would be a successful teaching stage of her or his teaching experiences to resolve a problem, or attempt to achieve a goal. Students, therefore, become active participants in the learning process and set their own learning goals. Both processes are used simultaneously and alternately throughout the process of learning to teach.

Based on Piaget's works of cognitive constructivism, it can be concluded that: (1) We "come to know" things as a direct result of our personal experiences, but we make sense of those experiences in different ways at different stages of our lives; (2) Developing one's mind is a balance between what is known, and what is currently being experienced; and (3) The processes of learning is a complementary one where oncoming information is changed or modified in our mind to fix with what we already know (assimilation) and when we modify what we already know to take into account new information (accommodation).

B. Radical Constructivism

Generally, radical constructivism is a grounded on the work of E. von Glasersfeld. Radical constructivism starts from the assumption that knowledge, no matter how it is defined, is in the heads of people. The thinking subject has no alternative but to construct what he or she knows on the basics of his or her own experience (von

Glasersfeld, 1995:1). According to E. von Glasersfeld (1995:15), this is a way of thinking about knowledge and the act of knowing. It is opposite to the traditional assumption that knowledge may be called "true" only if it can be considered as a more or less accurate representation of a world that exists "in itself" prior to and independent of the knower's experience of it (von Glasersfeld, 1991:2). The main philosophical view of radical constructivism is that "*human knowledge cannot consist in accurate illustration or realistic copying of external reality, that is, of a reality which is non-phenomenal; existing apart from the subject's experiences*" (McCarty & Schwandt, 2000:43). By definition, knowledge construction is an active, rather than a passive process as E. von Glasersfeld (1988:83) claims: "*knowledge is not passively received either through the senses or by way of communication, but actively built up by the cognising subject*".

Moreover, according to E. von Glasersfeld (1995 and 1998) absolute reality is unknowable since our experience with external forms is mediated by our senses, and our senses are not able to perceive a description of the truthful representation of these external forms (e.g. objects, social interactions). Thus, "*knowledge is knowledge of the knower, not knowledge of the external world; improving knowledge means improving its practicability or fit in, but not match with, an external world*" (Staver, 1995:126). And that the thinking subject has no alternative but to construct what he or she knows based on her or his own experience. What we make of experience constitutes the only world we consciously live in. It can be sorted into many kinds, such as things, self, others, and so on. However, all kinds of experience are essentially subjective, and though we may find reasons to believe that our experience may not be unlike others, we have no way of knowing that it is the same.

C. Social constructivism

The social constructivism perspective discussed in this chapter is grounded in the view of Lev S. Vygotsky. He views education as learner centred, and proposes that knowledge is constructed by the learner as an active participant within a community of learners in building understanding and making sense of information. He also claims that learning is something that learners do, not something that is done to them (in Woolfolk, 2000).

According to Lev S. Vygotsky, all fundamental cognitive activities take shape in a matrix of social history and form the products of socio-historical development (in Luria, I976). That is, cognitive skills and patterns of thinking are not primarily determined by innate factors, but are the products of the activities practiced in the social institutions of the culture in which the individual grows up. Moreover, according to Lev S. Vygotsky, the history of the society in which a learner is reared, and the learner's personal histories are crucial determinants of the way in which that individual will think. In this process of cognitive development, language is a crucial tool for determining how the learners will learn how to think (Murray, 1993). According to Lev S. Vygotsky, learning is not a purely internal process, nor is it a passive shaping of behaviours. He claims that "higher" learning is mediated by language, via social discourse.

Lev S. Vygotsky (1985) also highlighted the importance of language as a tool in learning. To him, language becomes essential in forming thought and determining personality features, as there is a fundamental connection between thought and speech in terms of one providing resource to the other. In supporting Lev S. Vygotsky (1985), M. Williams & R.L. Burden (1997) claim that the development of thinking and its relationship to language and experience becomes a central focus in constructivist learning. In this process, language is a crucial tool for determining how people think, because advanced modes of thought are constructed by means of words (Murray, 1993).

Social constructivism also places emphasis on teachers and any others who can support students' learning. The idea of "help and support" is compatible with Lev S. Vygotsky's concept of a *Zone of Proximal Development* (ZPD). ZPD is the difference between the learner's capacity to solve problems on his or her own, and his or her capacity to solve them with assistance. The ZPD includes all the functions and activities that a learner can perform only with the assistance of someone else. The person in this process, providing non-intrusive intervention, could be an adult (parent, teacher, educator, caretaker, language instructor) or another peer who has already mastered that particular function. Lev S. Vygotsky's ZPD has many implications for those in the educational surroundings. According to Lev S. Vygotsky (1978), an essential feature of learning is that it awakens a variety of internal developmental processes that are able to operate only when the learner is in the action of interacting with people in his or her environment and in cooperation with his or her peers.

Based on the discussion of social constructivism proposed by Lev S. Vygotsky, it can be concluded as: (1) Learning is best achieved in an interactive setting such as discussion and activities; (2) There is a difference between the learner's capacity to solve problems on her or his own, and her or his capacity to solve them with assistance or ZPD; and (3) "Mediation" or "tools" played central roles in solving a problem or achieving a goal.

In summary, it can be said that constructivism tends to be more holistic than traditional information processing theories (Cunningham, 1992). People make sense out of their world by constructing information from the environment and assimilating it into their pre-existing schemas and understandings (Bransford & Vye, 1989). Constructivism also claims learners undergo conceptual change by directly confronting misconceptions (Wilson & Cole, 1991). In our view, constructivism represents enormous implications for how STs construct knowledge of teaching and how they should be facilitated, particularly as part of a teacher education programme. While it is important for this study to understand constructivism, it is equally important to understand the implications of this theory on how knowledge and learning should be viewed.

The Implication for the Teacher Education

What are the implications of constructivism for teacher education programme, in relation to facilitating STs' learning and in determining the knowledge base for

teaching? Although constructivism is a theory about knowing and learning, it has many practical applications and implications, some of which concern the classroom (Zemelman, Daniels & Hyde, 1993). Rather than teaching by telling, the constructivist approach to teaching would provide support for the knowledge construction process. A constructivist approach to teacher education must deal with the issues of content and process, acknowledging the vital link between content and its construction (Guba & Lincoln, 1983).

According to L.D. Alkove & B.J. McCarty (1992), constructivism asserts that significant education must present the learner with relevant problematic situations in which the learner can experiment, that is, manipulate objects to see what happens, question what is already known, compare findings and assumptions with those of others, and search for their own answers. Because learning is viewed as a lifelong process, learners (in this paper STs) are encouraged to continue learning through observation, literature review, and reflection on their own practices. Reflection is particularly important since it plays an important role in a teacher's search for congruency between her or his beliefs and practice.

Based on the above view, teachers or STs use their experiences to construct understandings that make sense to them, rather than having understanding delivered to them in an already organized form. Learning activities should put STs in the context of what they already know, and apply their understanding to authentic situations. According to R.H. Bruning, G.J. Schraw & R.R. Ronning (1995), what STs do to enrich information, in the view of constructivism, determines the level of understanding they ultimately achieve. It portrays STs as active processors of information, and assigns critical roles to the knowledge and perspective they bring to their learning.

Error in learning can be seen in a positive light and as a means of gaining insight into how the learner is organizing their experiential world. The notion of doing something "right" or "correctly" is to do something that fits with "an order one has established oneself" (von Glasersfeld, 1988:15). Constructivism also cannot tell STs new things to do, but it may suggest why certain attitudes and procedures are fruitless or counter-productive (von Glasersfeld, 1995:177). In this manner, the cyclical process through adaptation and reflection towards environments and experiences are very important.

Teacher educators, therefore, should make teaching an educational activity that gives purposeful instruction or lessons to the STs to lead and support them toward self-reflection. Teaching should also be concerned with teachers or educators making sense of, or meaning from, the situation in which they find themselves. Thus, the process of learning to teach should not be viewed as a transmission process (when knowledge of teaching was thought to be handed from teacher educators to STs). In this manner, active involvement in constructing knowledge of teaching assumes that teacher educators are to be a "partner in the construction of knowledge" rather than a "giver of knowledge" (Prawat, 1992). Lists the processes that should be encouraged in constructive learning are: (1) Active – learners process information meaningfully; (2) Cumulative – new learning builds on prior knowledge; (3)

Integrative – learners elaborate on new knowledge and interrelate it with their current knowledge; (4) Reflective – learners consciously reflect on and assess what they know and need to learn; and (5) Goal – directed and intentional – learners subscribe to goals of learning.

R.T. Putnam & H. Borko (1996) discussed several assumptions underlying a cognitive constructivist perspective on knowledge and learning in teacher education. Among them are:

First, *the Central Role of Knowledge.* STs existing knowledge plays a central role in thinking, acting and learning. This has resulted in a multitude of ways of characterising how knowledge might be structured in the mind of the individual (for example schemata, procedural or declarative knowledge) and the nature of that knowledge in a particular domain of expertise. The construction of structured and accessible bodies of knowledge allows the ST to engage in expert thinking and action. This understanding of expertise has led researchers to devote increased attention to teachers' knowledge and how it is was organised. According to R.T. Putnam & H. Borko (1996), L.S. Shulman (1986 and 1987) catalysed much of this interest, especially in elaborating knowledge of teaching.

Second, *Learning is an Active Constructive Process.* Learning, according to Resnick (1989), occurs not by recording information but by interpreting it (as cited in Putnam & Borko, 1996). The learning of individuals, including teachers and STs, is a constructive and interactive process in which the person interprets events on the basis of existing knowledge, beliefs, and dispositions. Learning outcomes are the changes in mental organisation, structures, and processes that result from this active constructive process. Teaching from these perspectives is a matter of creating environments that supports the ST's effort to construct meaning.

Third, *Knowledge and Learning are Situated in Physical and Cultural Contexts.* Rather than thinking of knowledge of teaching as abstract and detached from the external world, constructivism emphasises the situated nature of cognition. Knowledge of teaching, they argue, cannot be thought of as independent from the contexts or situations in which individuals construct and use it. For instruction, this perspective implies that STs should learn knowledge, skills, and disposition as they occur in meaningful contexts. This perspective may be associated with providing STs with educational theories and imposing them in various components of knowledge of teaching. For example, STs often enroll in a foundations course (e.g. philosophy, sociology, and psychology of education) and instruction course (e.g. teaching method, testing, and evaluation) with few opportunities to integrate or coordinate content across courses. They are then expected to put these theories and skills together into an instructional programme for their classroom.

Fourth, *the Role of Prior Knowledge and Beliefs in Learning to Teach.* Learning is an active and constructive process that is influenced by the STs' existing knowledge, and is situated in particular contexts. STs' existing knowledge is critical in shaping what and how they learn from teacher education experiences (Confrey, 1990). Thus, STs' learning should be integrally linked or situated in the contexts in which it is to be used.

While R.T. Putnam & H. Borko (1996) discussed some cognitive implications, P. Ernest (1995) outlines some pedagogical implications of constructivism: (1) The focus of concern with the STs or teacher educator is not just with their knowledge of subject matter, but also with the teacher's belief, conceptions, and personal theories about teaching and learning; (2) Although we can tentatively come to know the knowledge of teachers by interpreting their language and actions through our own conceptual constructs, the others have realities that are independent of ours. It is the realities of others along with our own realities that we strive to understand, but we can never take any of these realities as fixed; and (3) An awareness of the social construction of knowledge suggests a pedagogical emphasis on discussion, collaboration, negotiation, and shared meanings.

Conclusion

Implications of a CLA in educating STs can be summarized as follows:

ST learning is comparable to other student's learning in which they actively construct knowledge about teaching and learning based on personal experiences and prior knowledge. Thus educating STs does conceptualizing STs as learners who continuously construct the new understand of their subject, and of other aspects of knowledge in teaching.

Knowledge of teaching is personally created as STs make sense of their learning environments in the light of tacit knowledge they already hold about teaching and learning.

A constructive way to approach the education of STs is to provide experiences that challenge STs in learning and teaching. This can be possible with offering STs the chance to construct multiple conceptions of teaching, such as the idea that learning is for meaningful understanding, and the notion of learners as constructors of their own learning. In this case, to promote to STs that to teach lessons that only emphasize the recall of facts is unlikely to achieve "meaningful learning". Instructional strategies such as cooperative learning or experiential learning are likely to result in meaningful learning.

Teacher educators should shift from being seen as presenters of information towards a focus on STs' developmental needs to learn with understanding. Teacher educators need to take into account STs' inexperienced conception of knowledge of teaching. Teacher educators also need to have a clear understanding of what STs should know and be able to do.

STs' prior knowledge about teaching, learning and developmental processes, about the nature and needs of diverse and developing learners, and about the subject matter has come to be recognized as an important influence on the construction of teacher knowledge, and must become the focus of teacher education practices and programmes (Dana, Campbel & Lunetta, 1997). In this case, teacher educators should focus not only on subject knowledge, but also on knowledge of learners, curriculum, and context of the discipline in order to promote meaningful learning.

STs also should be assisted with constructing and reconstructing the whole structure about the process of teaching and learning. This stance is a shift from the position that the purpose of a teacher education programme is to provide advice to STs mastering just technical skill such as writing behavior objectives, using proper lesson plan formats, or mastering a particular instructional model.

Reflective practice is an important component of effective teaching, as teachers are continually confronted with problematic situations that require consideration of many factors before a pedagogical decision can be made and appropriate action carried out (Clift, Houston & Pugach, 1990). STs are encouraged to develop a critical understanding of their conceptions of how students learn and the appropriateness of instructional strategies. By critically reflecting on and taking action, STs may continually improve their teaching practices.

In conclusion, CLA suggests that the role of the teacher or educator is to facilitate active learning, during which learners construct their own holistic understandings. In other words, teachers cannot transfer meanings or concepts directly to passive learners but can only orientate their learning. More importantly, the teacher education programme is a process concerned with helping STs to formulate their own meanings and experiences about teaching.

References

Alkove, L.D. & B.J. McCarty. (1992). "Plain Talk: Recognizing Positivism and Constructivism in Practice" in *Action in Teacher Education,* 14(2), p.16-21.

Bliss, J. (1995). "Piaget and After: The Case of Learning Science" in *Studies in Science Education*, 25, p.139-72.

Bransford, J. & N.J. Vye. (1989). "A Perspective on Cognitive Research and its Implications for Instruction" in L.B. Resnick & L.E. Klopfer [eds.]. *Towards the Thinking Curriculum: Current Cognitive Research.* Alexandria, WV: Association for Supervision and Curriculum Development, p.173-205.

Bruner, J. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.

Bruning, R.H., G.J. Schraw & R.R. Ronning. (1995). *Cognitive Psychology and Instruction*. Englewood Cliffs, N.J.: Prentice Hall.

Clift, R.T., W. Houston & M. Pugach. (1990). *Encouraging Reflective Practice in Education.* New York: Teacher's College Press.

Confrey, J. (1990). "A Review of the Research on Student Conceptions in Mathematics, Science, and Programming" in C.B. Cazden [ed.]. *Review of Research in Education*. Washington, D.C.: American Educational Research Association, p.3-56.

Cunningham, D. (1992). "Beyond Educational Psychology: Steps Towards an Educational Semiotic" in *Educational Psychology Review*, 4(2), p.165-194.

Dana, T.M., L.M. Campbell & V.N. Lunetta. (1997). "Theoretical Bases for Reform of Science Teacher Education" in *The Elementary School Journal,* 97(4), p.419-432.

Dewey, J. (1963). "The Relation of Theory to Practice in Education" in M. Borrowman [ed.]. *Teacher Education in America.* New York: Teachers College Press, p.140-171.

Doolittle, P.E., & W.G. Camp. (1999). "Constructivism: The Career and Technical Education Perspective" in *Journal of Vocational and Technical Education,* 16(1), p.23-46.

Driver, R. *et al.* (1994). "Constructing Scientific Knowledge in the Classroom" in *Educational Researcher*, 23(7), p.5-12.

Ernest, P. (1995). "The One and the Many" in L.P. Steffe & J. Gale [eds.]. *Constructivism in Education.* Hillsdale, NJ: Erlbaum, 459-486.

Fosnot, C.T.E. (1996). *Constructivism, Theory, Perspectives and Practice*. Columbia University: Teachers College.

Gagne, R.M. & K.L. Medsker. (1996). *The Conditions of Learning Training Applications*. Florida: Harcourt Brace and Company.

Guba, E.G. & Y.S. Lincoln. (1983). *Effective Evaluation*. San Francisco, CA: Jossey-Bass.

Hayek, F.A. (1952). *The Sensory Order*. Chicago: University of Chicago Press.

Luria, A.R. (1976). *Cognitive Development: Its Cultural and Social Foundations*. Cambridge, MA: Harvard University Press.

Mahoney, M.J. (2003). *Constructive Psychotherapy: Practices, Processes and Personal Revolutions*. New York: Guilford.

Mahoney, M.J. (2004). *Scientist as Subject: The Psychological Imperative*. Clinton Corners, NY: Percheron Press.

Mahoney, M.J. (2007). "What is Constructivism and Why it is Growing". Retrieved on 17th July from: http://constructingworlds.googlepages.com/what

Mayer, R.E. (1992). "Teaching of Thinking Skills in the Sciences and Mathematics" in D.F. Halpern [ed.]. *Enhancing Thinking Skills in the Sciences and Mathematics.* Hillsdale, NJ: Lawrence Erlbaum, p.95-115.

McCarty, L.P. & T.A. Schwandt. (2000). "Seductive Illusions: Von Glasersfeld and Gergen on Epistemology and Education" in D.C. Phillips [ed.]. *Constructivism in Education: 99th Yearbook of the National Society for the Study of Education.* Chicago: NSSE, p.41-85.

Mosham, D. (1982). "Exogenous, Endogenous and Dialectical Constructivism" in *Developmental Review,* 2, p.371-384.

Murray, T.R. (1993). *Comparing Theories of Child Development.* Belmont, California: Wadsworth Publishing, 3rd edition.

Personal communication with Dr. Jon Scaife, a lecturer at the School of Educational Studies, University of Sheffield, United Kingdom, on July 7, 2006.

Phillips, D.C. (1995). The good, the bad, and the ugly: The many faces of constructivism. *Educational Researcher*, 24 (7), 5-12.

Phillips, D.C. (2002). "From Radical Empiricism to Radical Constructivism or William James Meets Ernst von Glasersfeld" in J. Garrison, R. Podeschi & E. Bredo [eds.]. *William James and Education*. New York: Teachers College Press, 115-129.

Piaget, J. (1973). *The Child's Conception of the World*. St. Albans: Paladin.

Piaget, J. (1977). *The Development of Thought: Equilibrium of Cognitive Structures*. New York: Viking Press.

Pountney, R., S. Parr & V. Whittaker. (2002). "Communal Constructivism and Networked Learning: Reflections on a Case Study". *Paper* presented at the International Conference on Networked Learning in the University of Sheffield, England.

Prawat, R.S. (1992). "Teachers' Beliefs about Teaching and Learning: A Constructivist Perspective Views of Learning" in *American Journal of Education,* 100(3), p.354-395.

Putnam, R.T. & H. Borko. (1996). "Learning to Teach" in R.T. Putnam [ed.]. *Handbook of Educational Psychology*. New York: Macmillan.

Shayer, M. (2002). "Not Just Piaget, Not Just Vygotsky, and Certainly Not Vygotsky as an Alternative to Piaget" in M. Shayer & P. Adey [eds.]. *Learning Intelligence: Cognitive Acceleration Across the Curriculum from 5-15 Years.* Buckingham: Open University Press, p.179-195.

Shulman, L.S. (1986). "Paradigm and Research Programs in the Study of Teaching: A Contemporary Perspective" in M.C. Wittrock [ed.]. *Handbook of Research on Teaching*. New York: McMillan.

Shulman, L.S. (1987). "Knowledge and Teaching: Foundations of the New Reform" in *Harvard Educational Review,* 57(1), p.1-22.

Slavin, R.E. (2000). *Educational Psychology: Theory and Practice.* Boston: Allyn and Bacon, 6th edition.

Staver, J.R. (1995). "Scientific Research and Oncoming Vehicles: Can Radical Constructivist Embrace One and Dodge the Other?" in *Journal of Research in Science Teaching*, 32(10), p.1125-1128.

Steffe, L.P. & J. Gale. (1995). *Constructivism in Education*. Hillsdale: NJ: Erlbaum.

Tiene, D. & A. Ingram. (2001). *Exploring Current Issues in Educational Technology.* New York: McGraw-Hill.

von Glasersfeld, E. (1988). "The Reluctance to Change a Way of Thinking" in *The Irish Journal of Psychology*, 9(1), p.83-90.

von Glasersfeld, E. (1989). "Cognition, Construction of Knowledge and Teaching" in *Synthese*, 80, p.121-140.

von Glasersfeld, E. (1991). "Knowing Without Metaphysics: Aspects of the Radical Constructivist Position" in F. Steier [ed.]. *Research and Reflectivity.* London: Sage Publications, p.553-571.

von Glasersfeld, E. (1995). "A Constructivist Approach to Teaching" in L.P. Steffe & J. Gale [eds.]. *Constructivism in Education*, Hillsdale, NJ: Erlbaum, p.3-16.

von Glasersfeld, E. (1996). "Introduction: Aspects of Constructivism" in C.T. Fosnot [ed.]. *Constructivism, Theory, Perspectives and Practice*. Columbia University: Teachers College.

von Glasersfeld, E. (1998). "Why Constructivism Must be Radical?" in M. Larochelle, N. Bednarz & J. Garrison [eds.]. *Constructivism and Education.* Cambridge: Cambridge University Press, p.23-28.

Vygotsky, Lev S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Vygotsky, Lev S. (1985). *Thought and Language.* Cambridge: M.I.T. Press.

Walker, D. & L. Lambert. (1995). "Learning and Leading Theory: A Century in the Making" in L. Lambert *et al*. [eds.]. *The Constructivist Leader.* New York, NY: Teachers College Press, Columbia University, p.1-27.

Williams, M. & R.L. Burden. (1997). *Psychology for Language Teachers: A Social Constructivist Approach.* Cambridge: Cambridge University Press.

Wilson, B. (1997). "The Post-Modern Paradigm" in C.R. Dills & A. Romiszowski [eds.]. *Instructional Development Paradigms*. Englewood Cliffs NJ: Educational Technology Publications.

Wilson, B. & P. Cole. (1991). "A Review of Cognitive Teaching Models" in *Educational Technology Research and Development*, 39(4), p.47-64.

Woolfolk, A. (2000). "Changes in Efficacy during the Early Years of Teaching". *Paper* presented at the American Educational Research Association, New Orleans, LA.

Zemelman, S., H. Daniels & A. Hyde. (1993). *Best Practice: New Standards for Teaching and Learning in America's Schools*. Portsmouth, NH: Heinemann.

Constructivism refers to a set of views about how individuals learn and about how those who help them to learn ought to facilitate.