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The Impact of Constructivism on Education: Language, Discourse, and Meaning

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Constructivism has emerged as one of the greatest influences on the practice of education in the last twenty-five years. Teachers have embraced constructivist-based pedagogy with an enthusiasm that is rare in these days of quick fixes and a shopping mall approach to school improvement (Powell, Farrar & Cohen, 1985). For many teachers, the focus on constructing meaning in the teaching-learning process resonates with prior beliefs because constructivist-based instruction firmly places educational priorities on students' learning.

Constructivism in Education

The recent interest in constructivism in education follows an almost religious dedication to behaviorist pedagogy by administrators and educational psychologists in the United States (Duit & Treagust, 1998; Jenkins, 2000). Constructivism's success may be due in part to the frustrations that educators experienced with behaviorist educational practices. Beginning in the 1960s, behaviorism swept from the arena of psychology into education with an air of authority that was startling. Schooling became structured around the premise that if teachers provided the correct stimuli, then students would not only learn, but their learning could be measured through observations of student behaviors. The behaviorist movement led to a long series of strategies for schools such as management by objective, outcome-based education, and teacher performance evaluation systems. Behaviorism in schools placed the responsibility for learning directly on the shoulders of teachers. Teachers were led to believe that if learning was not occurring, then it was their responsibility to restructure the environment, determine the most appropriate reinforcement to promote the desired student behavior, or provide a negative reinforcement to extinguish unwanted behaviors.

After years of implementation, behaviorism fell short of producing positive effects within the complex context of the classroom and left teachers feeling shortchanged and cheated by a system that placed the guilt for students' failure to learn in their hands. We experienced the impact of behaviorism while working as teachers in public schools when all teachers were required to participate in two behaviorist-based programs: Effective Teacher Training and the Teacher Performance Appraisal System. The first program was a series of behaviors that teachers were expected to perform in the classroom. Although the Effective Teacher Training program was based on research of effective practices (e.g. wait time of at least 4 seconds between asking questions during class discussions raises achievement), the program failed to take into account the complexity of student cognition and the dynamics of modern classrooms. The Teacher Performance Appraisal System was an evaluation system that principals used to evaluate teachers. A principal would observe a teacher during instruction while checking off a series of behaviors that demonstrated effective teaching (e.g. teacher movement around the room). Like Effective Teacher Training, the teacher evaluation program was based on discrete studies of effective teaching practices, but

the sum of the behaviors did not necessarily make one a good teacher. It became commonly known that a teacher could exhibit the desired behaviors, get good ratings on the instrument and the corresponding positive evaluation by the principal, but not necessarily teach a lesson where students would develop meaningful understandings. Teachers knew that the programs failed to explain why students weren't learning and why instruction wasn't effective. Following the legacy of behaviorism, constructivism has been welcomed as a *theory of knowing* that more fully explains the complexity of the teaching-learning process.

Defining Constructivism

The meaning of constructivism varies according to one's perspective and position. Within educational contexts there are philosophical meanings of constructivism, as well as personal constructivism as described by Piaget (1967), social constructivism outlined by Vygtosky (1978), radical constructivism advocated by von Glasersfeld (1995), constructivist epistemologies, and educational constructivism (Mathews, 1998). Social constructivism and educational constructivism (including theories of learning and pedagogy) have had the greatest impact on instruction and curriculum design because they seem to be the most conducive to integration into current educational approaches. Table 1 shows the variation of definitions for constructivism in education.

Table 1. Defining Contructivism

(The mind can) "put together those ideas it has, and make new complex ones." (Lock, 1947, p. 65).

"It is assumed that learners have to construct their own knowledge-- individually and collectively. Each learner has a tool kit of concepts and skills with which he or she must construct knowledge to solve problems presented by the environment. The role of the community-- other learners and teacher-- is to provide the setting, pose the challenges, and offer the support that will encourage mathematical construction." (Davis, Maher, Noddings, 1990, p. 3)

"Constructivism is not a theory about teaching…it is a theory about knowledge and learning… the theory defines knowledge as temporary, developmental, socially and culturally mediated, and thus, non-objective." (Brooks & Brooks, 1993, p. vii)

"(K)nowledge, no matter how it be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience." (von Glasersfeld, 1995)

"The doctrine itself holds that 'language users must individually construct the meaning of words, phrases, sentences and texts.'" (Suchting, 1998, p. 61-62; von Glasersfeld, 1989, p. 132)

"Constructivists allege that it is we who constitute or construct, on the basis of our theorizing or experience, the allegedly unobservable items postulated in our theories." (Nola, 1998, p. 32)

"The central principles of this approach 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." (Naylor & Keogh, 1999, p.93)

"(C)onstructivists of different persuasion (hold a) commitment to the idea that the development of understanding requires active engagement on the part of the learner." (Jenkins, 2000, p.601)

One of the common threads of constructivism that runs across all these definitions is the idea that

development of understanding requires the learner actively engage in meaning-making. In contrast to behaviorism, constructivists argue that "knowledge is not passively received but built up by the cognizing subject" (Von Glasersfeld, 1995). Thus, constructivists shift the focus from knowledge as a product to knowing as a process.

Within constructivist theory, knowledge isn't something that exists outside of the learner. According to Tobin and Tippins (1993), constructivism is a form of realism where reality can only be known in a personal and subjective way. Von Glasersfeld notes that constructivist theory acknowledges reality but he goes on to say, "I define to exist only within the realm of our experiential world and not ontologically…" (Tobin, 1993, p. 4). While constructivism takes on different philosophical meanings with different theorists and contexts, the over arching concept hinges itself upon the nature of knowing and the active role of the learner.

Although the roots of constructivism are most often attributed to the work of Jean Piaget, constructivist tenets emerged much earlier in history as seen in the writings of Giambattista Vico, who declared in 1710, "The human mind can know only what the human mind has made" (von Glasersfeld, 1995, p. 21). Noddings (1990) maintains that constructivism also emerged from the work of Neisser (act psychology), and Chomsky (innate linguistic structures of mind). Noddings argues that constructivist emphasis on the learner as central emerges from Chomsky's and Piaget's theories of an epistemological subject: "an active knowing mechanism that knows through continued construction" (Noddings, 1990, p. 9).

Although Piaget's theories tended to focus primarily on the development of the individual while ignoring the greater socio-cultural context, the roots of constructivism are clearly present in Piaget's focus on the active role of the individual in learning: "… all knowledge is tied to action, and knowing an object or an event is to use it by assimilating it to an action scheme…" Piaget, 1967, pp. 14-15). For Piaget, knowledge construction takes place when new knowledge is actively assimilated and accommodated into existing knowledge. Furthermore, Piaget's constructivist stances are seen in his belief that our understandings of reality are constantly being revised and re-constructed through time and with respect to exposure to new experiences. "What remains is construction as such, and one sees no ground why it should be unreasonable to think it is ultimate nature of reality to be in continual construction instead of consisting of an accumulation of ready-made structures" (Piaget, 1970, pp. 57-58).

One of the misconceptions of constructivism is the notion that because individuals make meaning based on their prior experiences, that anything and everything counts equally as knowledge. Von Glasersfeld effectively points out the inadequacy of this perspective: "truth in constructivism. . . . is replaced by viability" (von Glasersfeld, 1998, p. 25). In other words,

> Viability. . . . is relative to a context of goals and purposes. But these goals and purposes are not limited to the concrete or material. In science, for instance, there is, beyond the goal of solving specific problems, the goal of constructing as coherent a model of the experiential world as possible. (von Glasersfeld, 1992, p. 7)

Social constructivists take von Glasersfeld's concept of viability further defining viability as that which fits not only the individual's scheme of the world, but also fits within the larger social context. It is through checking out our understandings and perspectives with others that we develop a sense of the viability of ideas. This process of idea testing can be seen in the classrooms of teachers who value students' ideas and promote the process of critical thinking.

Constructing Meaning

Constructivism's perspectives on the role of the individual, on the importance of meaning-making, and on the active role of the learner are the very elements that make the theory appealing to educators. Teachers are typically acutely aware of the role of prior knowledge in students' learning, recognizing that students are not blank slates or empty vessels waiting to be filled with knowledge. Instead, students bring with them a rich array of prior experiences, knowledge, and beliefs that they use in constructing new understandings. To illustrate, we recently asked fifth-graders to construct concept maps of the concept "heat" prior to

instruction on convection currents (Jones, Carter, & Rua, 1999). The resulting student maps reflected a huge array of experiences and prior knowledge. For example, the term "heat" elicited descriptions of colors that represent heat (like red or orange), objects that generate heat (furnaces, microwaves, cars, curling irons, and grills), processes associated with heat (such as boil, melt, fever), products of heat (sweat, smoke, melted metal, evaporated water), events associated with heat (summer, pool party, ice cream, swimming), objects used with heat (lemonade, light clothes, suntan lotion, peaches) and hot places (Mexico, topics, volcanos, and Satan's home). The diversity of students' prior concepts of heat in this one example provides evidence that students do not enter instruction as blank slates, but instead possess a variety of pre-conceptions tied to prior experiences that teachers must take into account during curriculum planning and instruction.

Student preconceptions, or naïve conceptions, have been shown to be very resistant to change (Driver, 1989; Osborne & Freyberg, 1985). Preconceptions are typically based on a child's early experiences, are intuitive, and form a filter for later learning. For example, research has shown that children in different parts of the world believe the world is flat (Mali & Howe, 1980). Although teachers may tell children the world is round, children often cling to their naïve belief of the world as flat even after instruction. This mismatch between what is taught and what is learned is evidence of the need for constructivist pedagogy that considers the student's conceptual ecology. In order for understanding to take place, teachers must not only *elicit* students' prior concepts, but must also *build* on these concepts during instruction. Several instructional strategies (such as the learning cycle, e.g., Atkin & Karplus, 1962; Rubba, 1992) advocated by educators start with finding out what students know, then providing educational experiences that will confront prior conceptions (or provide a cognitive conflict) in order to promote conceptual development. The use of a cognitive conflict involves "placing a student in a position in which the application of his or her own understanding of a problem leads to cognitive difficulties which the student must then resolve" (Jenkins, 2000, p. 605). Strike and Posner (1985) argued that in order for conceptual change to take place at all the learner must first be dissatisfied with the current conception. It is this dissatisfaction (that sometimes arises from cognitive conflict) that drives the learner to consider alternative conceptual views. So "telling" has limited value for students, meaningful classroom experiences require much more of teachers.

Research has also shown that students do not always replace preconceptions with new conception. Instead, there is evidence that students may hold original intuitive views simultaneously with newly constructed formal science concepts (Hewson & Hewson, 1992; Scott, 1992; Strike and Posner, 1985). More recent work by Strike and Posner (1992) suggests that conceptual change is less a case of replacement and more a part of a developmental process that involves concepts embedded within a broader conceptual ecology that consists of "anomalies, analogies, metaphors, epistemological beliefs, metaphysical beliefs, knowledge from other areas of inquiry, and knowledge of competing conceptions" (Strike & Posner, 1992, p. 150).

Constructivism offers teachers instructional approaches that are congruent with current research on learning. By viewing learning as an active process, taking students prior knowledge into consideration, building on preconceptions, and eliciting cognitive conflict, teachers can design instruction that goes beyond rote learning to meaningful learning that is more likely to lead to deeper, longer lasting understandings.

The Role of Language in Knowledge Construction

Language forms the foundation of an individual's conceptual ecology as well as the means of conceptual growth. Furthermore, Vygotsky's argument that language serves to mediate higher order thinking (Vygtosky, 1978; Wertsch, 1979) has challenged educators to reconsider the critical role of language in the teaching-learning process. According to Vygotsky, language serves as a psychological tool that causes a fundamental change in mental functions. Signaling, significative, social, individual, communicative, intellectual, nominative, and indicative are all functions of spoken language according to Vygotsky (Wertsch, 1985). But of all of these language functions, those related to the intellectual functions of language have provided educators, particularly mathematics and science educators, with the greatest insight. Vygtosky believed that speech served not only as a way for children to communicate about their actions, but also served to direct active learning.

> A child's speech is as important as the role of action in attaining the goal. Children not only speak about what they are doing; their speech and action are part of one and the same complex psychological function, directed toward the solution of the problem at

> hand. (Vygtosky, 1978, p. 25)

Long before the emergence of current educational research on students' misconceptions, Vygotsky recognized that children simultaneously hold different concepts for the same phenomena. He described the formal or scientific concepts that children hold as well as the informal or spontaneous concepts that children develop through experience. "Vygtosky argued that experience in educational activity is an important force that guides the development of genuine concepts, hence his distinction between the genuine or 'scientific' concepts learned as a result of schooling and the 'everyday' or 'spontaneous' concepts learned by the child elsewhere." (Wertsch, 1985, p. 102). The link between formal and informal concepts, according to Vygotsky, takes place through the use of the *psychological tool of language*. Wertsch (1985) stated:

> For Vygotsky, a further criterion that distinguishes scientific from everyday concepts is the fact that the former are learned in formal schooling setting whereas the latter emerge on the basis of children's experience in the everyday world. He argued that schooling's emphasis on using language to talk about language (that is, on decontextualized, metalinguistic reflection), as opposed to talking about nonlinguistic reality, is an important force in the emergence of scientific concepts. (Wertsch, 1985, p. 103)

Constructivism's emphasis on the role of language in learning, in contrast to behaviorism's focus on language as a stimulus, has shifted educators' teaching strategies toward the use of language as a tool in students' meaning-making processes.

Social Constructivism

Vygotsky's work has formed the foundation of social constructivism in educational settings. In particular, Vygotsky's emphasis on the role of others, or the social context, in learning has pushed educators to re-examine the extent to which learning is an individual process. As explained earlier, prior to the recent interest in social construction of knowledge, the attention was placed almost exclusively on the individual through behaviorist and Piagetian educational applications. Vygotsky's theories have turned this focus upside down by emphasizing the role of the greater community and the role of significant others in learning.

Vygotsky argues that language is first interpersonal, between the child and the external world, and then becomes intrapersonal:

> The greatest change in children's capacity to use language as a problem-solving tool takes place somewhat later in their development, when socialized speech (which has previously been used to address an adult) is turned inward. Instead of appealing to the adult, children appeal to themselves; language thus takes on an intrapersonal function in addition to its interpersonal use. (Vygtosky, 1978, p. 27)

Furthermore, Vygotsky argues that the path between objects and thought is mediated by other people through the use of signs or the symbols of language (Veer & Valsiner, 1993).

> Human history is, then, on the one hand the history of man’s growing domination over nature through the invention of tools and the perfection of technology, and on the other hand, it is the history of man’s gradual control of the self through the invention of the cultural technique of signs. (Veer & Valsiner, 1993, p. 220)

In addition, Vygotsky extended the emphasis on culture and society in his argument that all higher mental functions are social in origin and are embedded in the context of the sociocultural setting.

> From the very first days of the child's development, his activities acquire a meaning of their own in a system of social behavior and, being directed towards a definite purpose, are frequently refracted through the prism of the child's environment. The path from object to child and from child to object passes through another person. This complex

> human structure is the product of a developmental process deeply rooted in the links between individual and social history. (Vygotsky, 1978, p. 30)

The higher mental functions that Vygotsky refers to are primarily interpsychological (group, dyad) processes and originate between and among individuals. These functions move to an intrapsychological (individual) plane by a series of mechanizations determined by the individual's mental processes. That is, learning may be viewed as being first developed in small group settings that are precursors to the intrapsychological, that is, individual processes (Wertsch, 1979).

Learning, according to Vygtosky, is best understood in light of others within an individual's world. This continual interplay, between the individual and others, is described by Vygotsky as the zone of proximal development (ZPD) (Vygotsky, 1978). He defined the zone of proximal development as the intellectual potential of an individual when provided with assistance from a knowledgeable adult or a more advanced child. During this assistance process, an individual is "other regulated" by a more capable peer or an adult. "Other regulation" refers to cues and scaffolding provided by the more capable peer or adult. The individual, by means of this assistance, is able to move through a series of steps that eventually lead to "self-regulation" and intellectual growth. Vygotsky stressed the importance of the zone of proximal development because it allows for the measurement of the intellectual <u>potential</u> of an individual rather than on what the individual <u>has achieved</u>.

For social constructivists, the process of knowing has at its roots social interaction (von Glasersfeld, 1992). That is, an individual's knowledge of the world is bound to personal experiences and is mediated through interaction (language) with others (von Glasersfeld, 1989). Thus, learning from a social constructivist perspective is an active process involving others:

> Knowledge is never acquired passively, because novelty cannot be handled except through assimilation to a cognitive structure the experiencing subject already has. Indeed, the subject does not perceive an experience as novel until it generates a perturbation relative to some expected result. Only at that point the experience may lead to an accommodation and thus to a novel conceptual structure that reestablishes a relative equilibrium. In this context, it is necessary to emphasize the most frequent source of perturbations for the developing cognitive subject is the interaction with others. (von Glasersfeld, 1989, p. 136.)

<u>Constructivism in Educational Practices</u>

The influence of constructivism in education today can be seen in a variety of published curricula as well as instructional practices. Social constructivist applications are commonly found in schools through the widespread use of cooperative and collaborative teaching strategies such as: Teams-Games-Tournament, Student Teams Achievement Division, Jigsaw, Numbered Heads Together, and Peer-Peer Tutoring (e.g. Slavin, 1980; 1990). In each of these, the emphasis is on having students working together while sharing ideas and challenging each other's perspectives.

The emphasis on "significant others" has led some educators to question the usefulness of homogeneous ability grouping (Carter & Jones, 1994). Grouping by ability has come under fire as a traditional strategy that fails to build on the strengths of diverse student abilities and perspectives. As a result, teachers are increasingly using older student tutors, adult tutors, and more advanced students in instruction.

One of the most obvious places that the impact of social constructivist theories can be seen is in the design and organization of classrooms. Gone are the individual study carrells that appeared with behaviorism. Teachers today tend to recognize the power of peer-peer interactions and the greater classroom community in learning. Many classrooms in the United States have designated spaces for small group work, as well as arrangements for whole class discussions. Elementary classrooms often include small group reading areas, mathematics centers, and science stations. Middle and high schools have moved away from unmovable desks to seating arrangements that are flexible and allow for small group work.

The impact of constructivism has extended into national reform documents that are produced by professional education groups such as the National Council of Teachers of Mathematics and the National Research Council. For example, the National Science Education Standards state:

> An important stage of inquiry and of student science learning is the oral and written discourse that focuses the attention of students on how they know what they know and how their knowledge connects to larger ideas, other domains, and the word beyond the classroom. . . . Using a collaborative group structure, teachers encourage interdependency among group members, assisting students to work together in small groups so that all participate in sharing data and in developing group reports. (National Research Council, 1996, p.36)

This statement reflects the constructivist values of small group work, cooperative development of ideas, and the role of written and spoken language in learning. In a similar manner, the National Council of Teachers of Mathematics (1991) includes a focus on other students as part of the Professional Standards for Teaching, Standard 5: The Learning Environment:

> This standard focuses on key dimensions of a learning environment in which serious mathematical thinking can take place: a genuine respect for others' ideas, a valuing of reason and sense-making, pacing and timing that allow students to puzzle and to think, and the forging of a social and intellectual community. (NCTM, 1991)

Embedded within this mathematics standard are beliefs in the value of the ideas of others, as well as the importance of the larger social community in learning mathematics.

Summary

Constructivism in education emerged after the behaviorist movement as a welcome and refreshing view of learning that centers on the active learner within the teaching-learning process. This emphasis on the individual (within the greater social context) during instruction has drawn attention to the prior beliefs, knowledge, and skills that individuals bring with them. Prior knowledge has been shown to significantly influence the ways individuals make meaning out of instruction. The constructivist focus on the social context and larger community of learners has resulted in a major shift away from individually-based instruction to instruction that incorporates and embeds teaching within the larger community of peers, younger students, as well as those who are older. Finally, contructivism's greatest contribution to education may be through the shift in emphasis from knowledge as a product to knowing as a process. This legacy of constructivism will likely prove to be a lasting and meaningful shift in the structure of schooling.

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