Annu. Rev. Psychol. 1998. 49:345–75

SOCIAL CONSTRUCTIVIST PERSPECTIVES ON TEACHING AND LEARNING

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KEY WORDS: teaching, learning, context, collaboration

ABSTRACT

Social constructivist perspectives focus on the interdependence of social and individual processes in the co-construction of knowledge. After the impetus for understanding the influence of social and cultural factors on cognition is reviewed, mechanisms hypothesized to account for learning from this perspective are identified, drawing from Piagetian and Vygotskian accounts. The empirical research reviewed illustrates (*a*) the application of institutional analyses to investigate schooling as a cultural process, (*b*) the application of interpersonal analyses to examine how interactions promote cognition and learning, and (*c*) discursive analyses examining and manipulating the patterns and opportunities in instructional conversation. The review concludes with a discussion of the application of this perspective to selected contemporary issues, including: acquiring expertise across domains, assessment, educational equity, and educational reform.

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0066-4308/98/0201-0345$08.00

INTRODUCTION

Recent chapters in the *Annual Review of Psychology* closely related to the general subject matter of teaching and learning (Glaser & Bassok 1989, Sandoval 1995, Snow & Swanson 1992, Voss et al 1995) have generally examined issues of cognition from an individualistic perspective. Voss et al (1995) indicated that the recent decade has witnessed the "sociocultural revolution," with its focus on learning in out-of-school contexts and on the acquisition of intellectual skills through social interaction (p. 174). In this review, I examine the nature and consequences of this revolution.

The review begins by intellectually situating social constructivist perspectives. Following an explication of the tenets of this approach, I explore issues of teaching and learning that are particularly salient from social constructivist perspectives. These issues are presented using institutional, interpersonal, and discursive levels of analysis. I then proceed to the application of social constructivist views to contemporary issues of importance to education; namely, the acquisition of expertise across subject matter, assessment practices, the education of linguistic and culturally diverse children, and school reform. The review concludes with a critique of this perspective and a discussion of future directions.

INTELLECTUALLY SITUATING THE SOCIOCULTURAL REVOLUTION IN INSTRUCTIONAL RESEARCH

Instructional research in the West was initially informed by behaviorist accounts of learning found in classic writings such as those of Thorndike (1906). Thorndike postulated that learning took place through the differential strengthening of bonds between situations and actions. Teaching, in turn, was a matter of shaping the responses of the learner through using instructional procedures such as modeling, demonstration, and reinforcement of closer approximations to the targeted response. From this perspective, academic tasks were

analyzed to determine their component parts, and the curriculum was carefully sequenced to ensure that students were acquiring the necessary prerequisite skills before the introduction of more advanced material. The instructional model that best reflects the tenets of behaviorism is referred to as direct instruction teaching. The hallmark of direct instruction is the active and directive role assumed by the teacher, who maintains control of the pace, sequence, and content of the lesson (Baumann 1988, p. 714):

> The teacher, in a face-to-face-reasonably formal manner, tells, shows, models, demonstrates, *teaches* the skill to be learned. The key word here is *teacher,* for it is the teacher who is in command of the learning situation and leads the lesson, as opposed to having instruction "directed" by a worksheet, kit, learning center, or workbook.

The research regarding direct instruction suggests that while it is an effective means of teaching factual content, there is less evidence that this instruction transfers to higher order cognitive skills such as reasoning and problem solving, nor is there sufficient evidence that direct-instruction teaching results in the flexibility necessary for students to use the targeted strategies in novel contexts (Peterson & Walberg 1979). In addition to these practical concerns with the limitations of direct instruction, there are significant theoretical limitations of the behavioral perspective; namely, this perspective offers no satisfactory explanation of the mechanisms that account for learning.

With increased interest in human information processing in complex cognitive activity, the cognitive perspective assumed prominence. Bruner (1990) argues that the cognitive revolution was meant to do more than simply be an improvement on behaviorism; it was also meant to promote a psychology that focused on "meaning making." To explain meaning making, cognitive psychologists introduced cognitive structures (such as schemata and heuristics) as the representations of knowledge in memory. These cognitive structures are assumed to underlie such phenomena as problem solving and transfer ability. Virtually all cognitive science theories entail some form of constructivism to the extent that cognitive structures are typically viewed as individually constructed in the process of interpreting experiences in particular contexts. However, there are many versions of constructivism, suggesting a continuum anchored by trivial constructivism at one end, which stresses the individual as constructing knowledge but is concerned with whether or not the constructions are correct representations, to radical constructivism, which rejects the notion of objective knowledge and argues instead that knowledge develops as one engages in dialogue with others.

In this review, I consider research on teaching and learning that has been conducted from postmodern constructivist perspectives (cf Prawat 1996).

What unifies postmodern constructivist perspectives is rejection of the view that the locus of knowledge is in the individual; learning and understanding are regarded as inherently social; and cultural activities and tools (ranging from symbol systems to artifacts to language) are regarded as integral to conceptual development. What distinguishes various postmodern constructivist perspectives is a bit murkier. For example, Cobb & Yackel (1996), distinguishing a perspective they call "emergent" from a sociocultural perspective, argue that while sociocultural approaches frame instructional issues in terms of *transmission* of culture from one generation to the next, the emergent perspective conceives of instructional issues in terms of the *emergence* of individual and collective meanings in the classroom. However, John-Steiner & Mahn (1996) argue that this is not an accurate interpretation of sociocultural theory which, in fact, has as its overarching focus the interdependence of the social and individual processes in the co-construction of knowledge.

While not wishing to trivialize differences among social constructivist perspectives, we also don't wish to become mired in them. Furthermore, given the fairly emergent state of this perspective—especially when considering its implications for teaching and learning, the revolution is perhaps best characterized as under way. Hence, the focus of this review is on the social dimensions of constructivism generally speaking. Where researchers have drawn distinctions among perspectives, these are identified.

Interest in social constructivism has been motivated by a number of factors, many of which were actually informed by cognitive perspectives on teaching and learning (cf Bruer 1994). As psychological research called attention to the strategic activity of experts (e.g. Flower et al 1992), intervention researchers investigated the use of think-alouds as a means of making problem-solving skills public and accessible to those with less expertise. An example is the research of Duffy et al (1986) in which they determined the value of engaging teachers in public modeling, via think-alouds, of the use of reading strategies such as using context for the purpose of figuring out the meaning of an unknown word. They determined that the children of teachers (in third and fifth grades) who were skilled in modeling the mental processing they were using when experiencing difficulty understanding text recalled more from the lessons and indicated a greater awareness of why they were learning particular strategies.

In another line of research, Palincsar & Brown (1984, 1989; Brown & Palincsar 1989; Palincsar et al 1993b) designed an intervention, called reciprocal teaching, in which teachers and children used discussion structured with four strategies—predicting, questioning, summarizing, and clarifying—to engage readers in constructing the meaning of a text and monitoring to determine that they were making sense of the text. While the teachers were encouraged to ex-

plicitly model the strategies, they were also urged to cede control of using the strategies to the children by asking them to take turns leading the discussion. As children led the discussions, the teachers provided whatever support each child needed to use the strategies. This intervention was designed for students who, while fairly adequate decoders, were very poor comprehenders. A program of research indicated that these discussions were a successful means of enhancing comprehension skills; furthermore, the research provided evidence of a relationship between the quality of the interaction between children and teachers, as well as among children, and the nature of the learning that occurred. For example, heterogeneous groups of children with diverse comprehension skills attained competence by using the learning dialogues more quickly than groups of more homogenous ability (Palincsar & Brown 1984). Furthermore, the children of teachers adept at providing specific feedback to children were able to extend children's contributions to the discussions by building upon their ideas. Consequently, these children made greater gains than those of teachers who were less effective at scaffolding children's contributions to the discussions (Palincsar 1986).

As cognitive research clarified the demands of expert reasoning and problem solving, interest emerged in distributing the cognitive work (Bruer 1994). Researchers hypothesized that by drawing upon a larger collective memory and the multiple ways in which knowledge could be structured among individuals working together, groups could attain more success than individuals working alone. Research in writing provides examples. Daiute & Dalton (1993) investigated how children aged seven to nine used diverse capabilities as they taught one another how to write stories. The peer collaboration resembled interactions between teachers and children, resulting in the generation of new story elements and more mature forms of writing than children had demonstrated alone. Furthermore, the researchers speculated that the peer interaction was more facilitative than teacher and child interactions, given the shared perspectives and life experiences that the children were able to bring to the collaborative writing process. This notion will be examined more fully below in discussions of Piagetian and Vygotskian perspectives on learning.

Another explanation for interest in the social dimensions of cognition is derived from awareness of the role that language production plays in promoting learning. Explaining one's thinking to another leads to deeper cognitive processing (Scardamalia & Bereiter 1989).

A final impetus to understanding how social and cultural factors influence cognition is the perspective that thought, learning, and knowledge are not just influenced by social factors but are social phenomena. From this perspective, cognition is a collaborative process (see Rogoff 1997), thought is internalized discourse, and the purpose of inquiry regarding cognitive development is to

examine the transformation of socially shared activities into internalized processes (see John-Steiner & Mahn 1996). In the next section, we explore two perspectives on the mechanisms accounting for learning from social constructivist perspectives.

MECHANISMS ACCOUNTING FOR LEARNING FROM SOCIAL CONSTRUCTIVIST PERSPECTIVES

The Sociocognitive Conflict Theory of Piaget

There are several theoretical perspectives that have been proffered, in fairly well-developed terms, as explanations of the mechanism by which social interaction leads to higher levels of reasoning and learning. The first, sociocognitive conflict, is derived principally from the work of Piaget and his disciples: "Cognitive conflict created by social interaction is the locus at which the power driving intellectual development is generated" (Perret-Clermont 1980, p. 12). From this perspective, contradiction between the learner's existing understanding and what the learner experiences gives rise to disequilibration, which, in turn, leads the learner to question his or her beliefs and to try out new ideas. In Piaget's words, "disequilibrium forces the subject to go beyond his current state and strike out in new directions" (1985, p. 10). Piaget further suggested that the social exchanges between children were more likely to lead to cognitive development than exchanges between children and adults. This observation was premised on the belief that among age peers there is mutual control over the interaction.

Among studies that have investigated sociocognitive conflict theory is the research by Bell et al (1985). Using conservation tasks, they determined that children working with peers showed more cognitive growth than children working alone. However, there were particular conditions that were in place for children who derived the most from this opportunity. For example, the child had to be actively engaged in the problem-solving activity and not merely observing the more advanced peer. In addition, if the partner's cognitive level were too much in advance of the child's, the outcome mirrored that expected of interactions with adults: the partner's answer was merely accepted and did not stimulate the process of "strik[ing] out in directions."

In search of evidence that peer interaction provides greater opportunities for learning than adult-child interactions, Radziszewska & Rogoff (cited in Rogoff 1991) compared children's interactions with adults and peers, using one group of peer partners who had been taught to use an optimal strategy for completing an errand-planning task and another who had received no special preparation. When the children were later asked to plan without assistance,

those children who had collaborated with adults were more successful than those who had worked with prepared or unprepared peers. In an effort to reconcile these differential outcomes of Piagetian studies, Damon (1984) argued that it is important to attend to the nature of the shift the child must make. For example, he suggested that development that requires giving up current understanding to reach a new perspective might best be attained through interaction with peers, whereas learning that does not require a transformation of perspective but rather is characterized as the accretion of a new skill or strategy might be best attained by working with more skillful and experienced partners, such as adults.

Suggesting that verbal interaction is the key to co-construction and cognitive change, Forman & Kraker (1985) cautioned that cognitive conflict may not be enough if there is insufficient verbal interaction or if the social structure permits passive compliance. The importance of considering social status within the group was demonstrated in the research by Russell et al (1990), who observed that social dominance influenced whether a child's conserving answer was adopted by the second child. Merely having the right answer was not consistently enough to persuade the other child.

The Sociocultural Theory of Vygotsky

The role of social processes as a mechanism for learning is usually identified with Vygotsky, who suggested: "The social dimension of consciousness is primary in time and in fact. The individual dimension of consciousness is derivative and secondary" (Vygotsky 1978, p. 30, cited in Wertsch & Bivens 1992). From this perspective, mental functioning of the individual is not simply derived from social interaction; rather, the specific structures and processes revealed by individuals can be traced to their interactions with others. Wertsch (1991) has proposed three major themes in Vygotsky's writings that elucidate the nature of this interdependence between individual and social processes in learning and development.

The first theme is that individual development, including higher mental functioning, has its origins in social sources. This theme is best represented in Vygotsky's "genetic law of development" (Valsiner 1987, p. 67):

> Every function in the cultural development of the child comes on the stage twice, in two respects: first in the social, later in the psychological, first in relations between people as an interpsychological category, afterwards within the child as an intrapsychological category....All higher psychological functions are internalized relationships of the social kind, and constitute the social structure of personality.

From this perspective, as learners participate in a broad range of joint activities and internalize the effects of working together, they acquire new strate-

gies and knowledge of the world and culture. Typically, this tenet has been illustrated by examining the interactions between individuals with disparate knowledge levels; for example, children and their caregivers or experts and novices. Illustrative is the cross-cultural research of Rogoff, who studied the supportive contexts in which Mayan children acquire knowledge and strategies (Rogoff 1991, p. 351):

> The routine arrangements and interactions between children and their caregivers and companions provide children with thousands of opportunities to observe and participate in the skilled activities of their culture. Through repeated and varied experience in supported routine and challenging situations, children become skilled practitioners in the specific cognitive activities in their communities.

Perhaps as a consequence of these research contexts, contemporary critics of a sociocultural perspective argue that it is a "transfer of knowledge model" (e.g. Cobb et al 1993). However, scholars of this perspective have argued that this interpretation is simplistic and misinterprets the transformative nature of internalization that has been described by sociocultural researchers. For example, Leontiev suggested that "the process of internalization is not the transferral of an external activity to a preexisting internal 'plane of consciousness'; it is the process in which this plane is formed" (Wertsch & Stone 1985, p. 163).

In contrast with prevailing views of his time, in which learning was regarded as an external process and development an internal process, Vygotsky was concerned with the unity and interdependence of learning and development. For example, he was critical of Piaget's theory in which "maturation is viewed as a precondition of learning but never the result of it" (Vygotsky 1978, p. 80). In contrast, Vygotsky proposed that (p. 90):

> Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and with his peers....[L]earning is not development; however, properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning. Thus learning is a necessary and universal aspect of the process of developing culturally organized, specifically human, psychological functions.

In support of this perspective, Vygotsky (1978) introduced the construct of the zone of proximal development (ZPD) as a fundamentally new approach to the problem that learning should be matched in some manner with the child's level of development. He argued that to understand the relationship between development and learning we must distinguish between two developmental levels: the actual and the potential levels of development. The actual refers to those accomplishments a child can demonstrate alone or perform independ-

ently. This is in contrast with potential levels of development as suggested by the ZPD—what children can do with assistance: "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 85). The ZPD was regarded as a better, more dynamic and relative indicator of cognitive development than what children accomplished alone. In summary, productive interactions are those that orient instruction toward the ZPD. Otherwise, instruction lags behind the development of the child. "The only good learning is that which is in advance of development" (Vygotsky 1978, p. 89). Hence, from a Vygotskian perspective, cognitive development is studied by examining the processes that one participates in when engaged in shared endeavors and how this engagement influences engagement in other activities. Development occurs as children learn general concepts and principles that can be applied to new tasks and problems, whereas from a Piagetian perspective, learning is constrained by development.

The second Vygotskian theme that Wertsch (1991) has identified is that human action, on both the social and individual planes, is mediated by tools and signs—semiotics. The semiotic means include: "language; various systems of counting; mnemonic techniques; algebraic symbol systems; works of art; writing; schemes, diagrams, maps and mechanical drawings; all sorts of conventional signs and so on" (Vygotsky 1981, p. 137). These semiotic means are both the tools that facilitate the co-construction of knowledge and the means that are internalized to aid future independent problem-solving activity. Leontiev (1981), a colleague of Vygotsky, used the term "appropriation" to characterize this process (quoted in Newman et al 1989, p. 63): "[Children] cannot and need not reinvent artifacts that have taken millennia to evolve in order to appropriate such objects into their own system of activity. The child has only to come to an understanding that it is adequate for using the culturally elaborated object in the novel life circumstances he encounters." It is in this sense that the process of collaboration is at the same time the product of collaboration.

The third theme that Wertsch (1991) proposes from Vygotsky's writing is that the first two themes are best examined through genetic, or developmental, analysis (Vygotsky 1978, pp. 64–65):

> To study something historically means to study it in the process of change; that is the dialectical method's basic demand. To encompass in research the process of a given thing's development in all its phases and changes—from birth to death—fundamentally means to discover its nature, its essence, for it is only in movement that a body shows what it is. Thus the historical study of behavior is not an auxiliary aspect of theoretical study, but rather forms its very base.

There are four aspects essential to developmental analysis from a Vygotskian perspective, all of which are interwoven. *Phylogenetic* development is concerned with what distinguishes humans from other animals. Of particular interest in this analysis is human use of tools—especially the psychological tools of signs and symbols, including language (Vygotsky & Luria 1993). A second level of analysis, *cultural/historical,* calls attention to the profound role that the practices of particular cultures and of the same cultural group play, over time, in development. *Ontogenetic* analysis calls our attention to ways in which individual characteristics, such as physical or mental challenge, age, temperament, and the fruits of individual history influence development. Finally, *microgenetic* analysis deals with the actual processes of interaction between the individual and his or her environment; hence microgenetic analyses take into account the interplay of individual, interpersonal, and social/cultural factors simultaneously.

In summary, from a sociocultural perspective, learning and development take place in socially and culturally shaped contexts, which are themselves constantly changing; there can be no universal scheme that adequately represents the dynamic interaction between the external and the internal aspects of development. There is no generic development that is independent of communities and their practices (Rogoff et al 1995). Hence, it is with the use of genetic analysis that the complex interplay of mediational tools, the individual, and the social world is explored to understand learning and development and the transformation of tools, practices, and institutions.

In the next section, I explicate these tenets by examining research that enhances our understanding of social constructivist perspectives on teaching and learning. Given the highly interactive ways in which social constructivists view the world, the challenge in presenting this research is determining the appropriate grain size. From social constructivist perspectives, separating the individual from social influences is not regarded as possible. The sociocultural contexts in which teaching and learning occur are considered critical to learning itself, and learning is viewed as culturally and contextually specific. Furthermore, cognition is not analyzed as separate from social, motivational, emotional, and identity processes, and the study of generalization is the study of processes rather than the study of personal or situational attributes. Given these complexities, researchers are still developing research methods consistent with the assumptions of this perspective. Commonly used methods include: microgenetic analysis (described above), conversational analysis as opposed to protocol analysis, and the use of activity rather than the individual as the unit of analysis.

Rogoff (1997) suggests that "[t]he parts making a whole activity or event can be considered separately as foreground without losing track of their inher-

ent interdependence in the whole....Foregrounding one plane of focus still involves the participation of the backgrounded planes of focus" (pp. 2–3). In this spirit, the next portion of this review foregrounds institutional, interpersonal, and discursive levels of analysis in turn (cf Cobb et al 1993, Forman et al 1993), examining the literature to determine how research conducted from social constructivist perspectives might contribute to our understanding and improvement of teaching and learning.

ANALYSES OF SOCIAL CONSTRUCTIVIST PERSPECTIVES

Institutional Analyses

It is interesting to consider the extent to which contemporary interest in social constructivist perspectives is propelled by recent educational reform efforts encouraging students to assume a more active role in their learning, to explain their ideas to one another, to discuss disagreements, and to cooperate in the solution of complex problems, while teachers participate in the design of these contexts and the facilitation of this kind of activity (cf Resnick et al 1993). All these notions have enormous implications for the culture of schools: "the meaningful traditions and artifacts of a group; ideas, behaviors, verbalization, and material objects" (Fine 1987; cited in Cole 1996, p. 302).

For example, given the tenets of postmodern constructivism, one of the challenges for those interested in its application to education is the development, among learners, of an *intersubjective attitude* about the joint construction of meaning; a commitment to find a common ground on which to build shared understanding (Crook 1994, Rommetveit 1974). This is a particular challenge in Western societies in which individualistic traditions have prevailed. For example, Ellis & Gauvain (1992) conducted cross-cultural research in which they observed that pairs of nine-year-old Navajo children who were asked to teach seven-year-olds to play a game were much more likely to build on each other's comments than were European-American children who more often gave parallel, unrelated lines of instruction. Furthermore, while the Navajo children stayed engaged observing their partners when they were not controlling the game moves, the European-American children lost interest when they were no longer in control of the game, sometimes even leaving the task.

The study of schooling as a cultural process and the school as a cultural system is a fairly recent endeavor. Illustrative is the research of Matusov et al (1997), in which they studied how children who were attending an innovative public school that was structured around collaboration throughout the day, and throughout the curriculum, approached decision-making and assisted younger children in problem-solving activities. Participants were 48 9–11-year-old

children recruited from two public schools. One was an innovative school, and the second was a traditional school. The innovative school included activity-based learning, parent participation in the classroom, adult and child direction of the lesson plans, and a problem-solving curriculum. In addition, learning to work in small groups was an explicit part of the curriculum. Twelve pairs of children were recruited from each of the two schools. Working in same-sex pairs, consisting of one third grader and one fourth grader, the children completed a card sorting task and three math problems. The fourth grader was asked to help the third grader to solve each problem in such a way that the third grader would be able to solve the problem alone over time. The children's interactions were rated to provide global characterizations of prevalent approaches to (*a*) working together (which ranged from nonshared decision-making to working together through consensus), and (*b*) providing guidance (such as quizzing, directing actions with no rationale, pure instruction, and instruction embedded in collaboration).

Dyads from the traditional school used more quizzing in their interactions with their tutees, and instruction embedded in collaboration was more frequently used by the children from the innovative school.

While the researchers acknowledge the problems inherent in the fact that the children were not randomly assigned to the innovative school, they nonetheless suggest that their work provides useful evidence about how schools must be considered not just in terms of different teaching methods but also in terms of different cultural systems, representing different educational, social, and communicative norms and priorities.

Research on *The Fifth Dimension* conducted by Cole, Griffin, and their collaborators (Cole 1996, Nicolopoulou & Cole 1993) examined institutional and cultural contexts for collaborative activity. The *Fifth Dimension* is a computerized play-world that is constituted by a system of rules. When children join the *Fifth Dimension,* they are provided the rules and embark on a journey through a maze of problems that involve increasing mastery of a sequence of activities. Nicolopoulou & Cole (1993) conducted "cross cultural" research investigating children's engagement in the *Fifth Dimension* across two sites: a Boys and Girls Club and a library. Striking differences observed in the cultures (e.g. norms for interacting, use of time and space) of these two contexts resulted in significant differences in the amount and kinds of learning that occurred in the *Fifth Dimension.* In the Boys and Girls Club, there was no overall growth in the level at which the game was played, whereas in the library there was marked and sustained progress as shared knowledge regarding the game grew in that context.

Another line of research has examined the culture of classrooms. For example, Roth (1996) studied a fourth/fifth grade classroom in which children were

using a curriculum entitled *Engineering for Children: Structures*. This program is designed to engage children in the practical application of science concepts as they work collaboratively on open-ended engineering problems. The study occurred over 13 weeks and involved using extensive data sources, including video, field notes, students' and teachers' documentation, as well as interviews. The focus of this study was on the diffusion of knowledge in the classroom; knowledge was represented in terms of resources, tool-related practices, and intellectual practices. Roth observed that facts and resources readily spread throughout the classroom, principally driven by the students. Tool-related practices also spread, though less readily, and again were principally driven by students. However, intellectual practices (in this case the use of triangular constructions) were relatively slow to suffuse the classroom, and to the extent that they did they were largely promoted by the teacher. It is useful to draw upon constructs introduced in earlier descriptions of sociocultural theory to understand this finding. Specifically, the failure of students to appropriate the use of triangular constructions may have been a function of the fact that their experiences were not sufficient to transform their understanding of the relationship between form and function. Support for this explanation may be found in the fact that some children did indeed appropriate the use of triangles in their constructions, but only for aesthetic purposes.

The critical role of the teacher was captured in another exemplary study of the culture of classrooms, conducted by Cobb et al (1991) as they explored the analogies between scientific communities and the social life in a second grade classroom in mathematics. Their work revealed how the teacher created a classroom where the children were validators of one another's ideas, including establishing norms such as persisting in the solution of personally challenging problems, explaining personal solutions to one's partner, listening to and making sense of the partner's explanation and attempting to achieve consensus about the answer, and a solution process. By the end of five months, these norms were in place, and the teacher had to do less to guide children toward these norms.

Interpersonal Analyses

From social constructivist perspectives, interactions such as those achieved through classroom discussion are thought to provide mechanisms for enhancing higher-order thinking. There are a number of ways in which interpersonal interactions have been studied from this perspective. For example, Forman et al (1995) examined this issue in terms of the activity structures in place in a middle school mathematics class. Their analyses indicated that 71% of the two hours analyzed was spent in student-centered activity structures (15% devoted to student presentations and 55% devoted to pair or small group work). Furthermore, of the 29% of the time that was rated as teacher-centered, the teach-

er's interactions were facilitative rather than directive. These findings are a striking contrast with the use of time in more traditional settings. For example, Stodolsky (1988) reported that 40% of instructional time in a fifth grade math class was spent on independent seatwork, 29% was spent on whole class, teacher-directed recitations, and 1% was devoted to small group work.

Taylor & Cox (1997) were also interested in characterizing the learning of mathematics as a social enterprise. They hypothesized that children construct and invent mathematical competence rather than learn it through modeling or imitation. In their study, conducted with fourth graders, there were two peer interaction conditions (socially assisted learning and modeling) as well as a classroom control. The researchers selected word problems that would encourage students to focus on the underlying problem representation rather than to simply "graft numbers onto words." Included in the socially assisted learning were: (*a*) use of a reflection board in which members could share publicly their representation of the problem; (*b*) peer collaboration; (*c*) reflective questioning; (*d*) scaffolding; (*e*) shared ownership; (*f*) quizzes, feedback, and rewards; and (*g*) daily math lessons in the regular classroom. The modeling condition was identical but did not include reflective questioning, scaffolding, or shared ownership. Results indicated that the quiz scores for both interactive groups were superior to the control group, but the scores for the socially assisted were better than the scores of students in either the modeling or control conditions. Furthermore, children in the modeling group had difficulty linking the number quantities to the quantities of objects mentioned and in applying the appropriate operations; that is, they were not as adept at constructing a representation that linked numbers to world knowledge. Finally, in a microanalytic study of the interactions of the tutors with the groups, the researchers determined that the support offered by the tutor was not a function of the number of statements that the tutor made but rather that the statements came at the right time, when they would indeed serve to scaffold understanding.

In explaining the different outcomes, Taylor & Cox (1997) speculated that success with this type of learning was a function of the extent to which there was shared ownership of the learning, which discouraged the division of labor in favor of the negotiation of shared meaning. Instrumental to promoting the negotiation of shared meaning were expectations that: (*a*) all members of the group work on the same aspect of the problem at the same time, (*b*) members externalize their thoughts, including possible wrong procedures and answers, (*c*) members come to agreement among themselves before proceeding, and (*d*) as instruction moves forward, more of the regulative activity be transferred from the adult to children.

In the work of Taylor & Cox, there are integral relationships between cognitive and social processes. These relationships can raise a host of thorny issues.

For example, social relationships can work against group sense making and the negotiation of meaning. O'Connor (1998) examined this issue in the research that she conducted as a participant observer in a sixth grade mathematics class over two years. Her close study of students' interactions revealed the ways in which ideas were often subordinated to social processes that arose from past interactions among students, suggesting ways in which learning opportunities were filtered through complex interpersonal contexts. Specific phenomena included: discounting or dismissing individual contributions and resistance to the spirit of the entire enterprise. Anderson et al (1997) reported a similar set of findings in their study of sixth graders engaged in collaborative problem solving. Research of this nature reveals the increased complexity for the teacher who must attend to socializing students into new ways of dealing with peers as intellectual partners, as well as new ways of thinking about subject matter learning (see also, Hatano & Inagaki 1991).

The research of Chan et al (1997) refines our understanding of conditions likely to enhance the effectiveness of peer interaction to promote learning. Students from grades 9 and 12/13 were randomly assigned to one of four conditions: (*a*) individual assimilation, (*b*) individual conflict, (*c*) peer assimilation, and (*d*) peer conflict. Assimilation in this research refers to the presentation of probe statements that were maximally congruent with the participants' conceptual understanding of the topic of evolution. Conflict refers to the presentation of probes that maximally contradicted the students' understanding. The presentation of probes was accompanied by the opportunity for participants to revise original ratings of agreement or disagreement with factor statements. In the peer conditions, the students had to negotiate and attain consensus on any changes in their ratings.

While there were a number of interesting findings, I focus on those most central to this review. Older students performed better in the peer condition, while younger students performed better in the individual condition. In addition, students in the conflict condition earned higher scores on quality of posttest knowledge building and experienced greater conceptual changes than students in the assimilation condition. However, conflict was instrumental only to the extent that the learner engaged in some form of knowledge building that aided the restructuring of understanding. Examples of knowledge building included: (*a*) treating new information as something problematic that needs explaining (such as constructing explanations that would reconcile knowledge conflict), and (*b*) using new information to construct coherence in understanding (for example, seeking connections among diverse pieces of information).

By examining the discourse that occurred in the peer conditions, the researchers contribute to our understanding of the differential effects of peer interaction. In discourse that the researchers identified as "[debilitating]," state-

ments that should have caused conflict were simply ignored or treated superficially, whereas in "productive" discourse, there was careful uptake and problematizing of statements that were conflictual in nature.

Webb & Farivar (1997), extending Webb's program of research regarding peer interactions in cooperative learning contexts, used an experimental design to systematically examine the processes of preparing students to work in collaboration with one another. The components of the intervention included: (*a*) engaging the students in activities to ensure that they knew one another; (*b*) teaching communication skills, such as norms for interaction; (*c*) devising activities designed to develop students' abilities to help one another while working on problems, and (*d*) developing skills for generating explanations. The experimental program was implemented in six seventh grade general-math classes. Two teachers taught three grades each. In one condition, the classes received all the preparatory activities and worked in collaborative arrangements for a semester. In the second condition, the students did not receive preparation to develop skills of explanation. Students who received the three phases of preliminary instruction were more effective in using communication skills, helping behaviors, and explaining skills. Mirroring the findings of Chan et al (1997), Webb & Farivar (1997) found that while the level of help peers received was an important predictor of achievement, this was predicated on the help leading to constructive activity. Furthermore, while there was some improvement in explanations over time, they were not explanations of a high level, raising the question about whether it is perhaps necessary to teach ways of supporting explanations that are specific to the cognitive demands of the domain in which the students are working [see Coleman (1992) and Palincsar et al (1993a) below].

Using a case study approach, Cobb et al (1993) investigated the extent to which children engaged in inquiry mathematics when they worked together in small groups. They also examined the extent to which small group collaborative activity facilitated children's mathematical learning. Stable groups' interactions were studied over 10 weeks to determine the relationship between learning opportunities and the different types of interactions in which the children engaged. Their findings suggested that the stability in the children's small group relationships across the 10 weeks of study was matched by the stability in each pair of children's cognitive capabilities relative to those of the partner. Children's cognitive capabilities and social relationships may have constrained each other in the sense of limiting possibilities for change. Furthermore, interactions in which one child routinely attempted to explain his or her thinking were not necessarily productive for either child's learning. Finally, harmony in a group's relationship did not appear to be a good indicator of learning opportunities. In fact, contentious relationships in which the chil-

dren's expectations for each other were in conflict were often productive. What led to productive relationships was the development of taken-as-shared bases for mathematical communication and the routine engagement in interactions in which neither child was the authority.

Discursive Analyses

From a social constructivist perspective, discourse is the primary symbolic, mediational tool for cognitive development. This notion is captured by Bakhtin (1981, p. 293): "[A]s a living, socio-ideological thing, language for the individual consciousness lies on the borderline between oneself and the other." For discourse to be an effective context for learning, it must be communicative. Much research has been conducted to understand the qualities of discourse that enhance its effectiveness. In this section I consider a subset of this research, drawing from various subjects. There are at least two approaches to the study of discourse. One is the investigation of naturally occurring instructional discourse to examine its patterns and opportunities, and the other is the systematic manipulating of features of discourse to determine the effects on learning.

We begin with Roschelle's (1992) inquiry on the processes by which individuals achieve convergence in collaborative activity. There is considerable research in science education examining the tendency of students to construct naive or alternative conceptions. Roschelle has argued that any serious account of science learning must provide an analysis of how convergence is achieved despite these tendencies. Toward this end, Roschelle conducted a microgenetic study of two high school students engaged in discovery learning with *The Envisioning Machine,* which is a software program that enables direct manipulation and graphical simulation of velocity and acceleration. His analyses of two one-hour sessions revealed how these students cooperatively constructed an understanding of acceleration that represented a significant conceptual change from their previous understanding and approximated the scientific meaning of acceleration.

Roschelle asserts that the students attained convergent conceptual change to the extent that, by the end of the session, important aspects of velocity and acceleration were shared, including: change of speed, change of direction, and the implications of these changes in application. Furthermore, the conversation revealed how the students responded to one another with mutual concern for shared knowledge, exerting a deliberate effort to create convergence and avoid divergence. How did this convergence happen? Roschelle suggests that it included the construction of situations at an intermediate level of abstraction from the literal features of the physical world, which was achieved through (*a*) the interplay of metaphors in relation to each other and in reference to the constructed situation, (*b*) iterative cycles of displaying, confirming, and repairing

meanings, and (*c*) the application of progressively more stringent standards of evidence. Furthermore, Roschelle suggests that *The Envisioning Machine* played an essential role, simultaneously supporting individual reasoning and facilitating the negotiation of meaning.

The program of research by Raphael and her colleagues, studying elementary-aged students engaged in Book Club discussions (Raphael et al 1992), reveals the value of naturalistic study of discourse in another complex learning environment. The leading question of this research was: How do book club discussions influence fourth and fifth grade students' abilities to discuss literature? By studying children's conversations across time and across texts, we learn about the role of the constitution of the groups, literature selection, and assigned writing activities. For example, in the selection of a text, it needed to have the potential for controversy and the power to elicit emotional responses—in addition to high quality, the proper reading level, availability, and suitability for meeting curricular goals. Furthermore, writing activities that offered more flexibility in responses were more beneficial and led to more interesting discussions than did more carefully structured responses. Finally, the research speaks to the multiple roles played by the teacher in Book Club discussions: guiding students in using text comprehension strategies, modeling ways to articulate personal responses to literature, and illustrating interaction patterns that would promote improved interactions in Book Clubs.

The crucial role that the teacher plays in promoting the co-construction of knowledge in classrooms was also demonstrated in the research of Forman et al (1995). In the micro-analytic study of the discourse of middle school children and their teacher (introduced above), these researchers captured the dynamic role of the teacher in guiding classroom discussions in the context of mathematical problem solving. In addition to evaluating the frequency of teacher and student contributions, they analyzed the functions of these contributions. The scheme that they devised revealed a broad range of conversational turns. For example, there were *initiations* in the service of requesting an answer or explanation; *responses;* and *reconceptualizations* that included restatements, rephrasing, expansion, and evaluation. The research of Forman et al suggests the importance of moving beyond the traditional static treatments of I-R-E (initiation-response-evaluation) patterns in classroom discourse. While an initial pass at the discourse in this classroom might suggest it fit the I-R-E framework, the students rather than the teacher were engaged in significant evaluative activity, and the responses of the teacher expanded on students' contributions to the discussion. Forman et al also note another crucial feature of the teacher's role, which they refer to as "discussion orchestration," which served to focus student attention and facilitate negotiation in the interest of consensus building.

Lampert (1990), reflecting on her own teaching activity in mathematics, captures the role that she has played in this negotiation process (p. 41):

> The role I took in classroom discourse, therefore, was to follow and engage in mathematical arguments with students; this meant that I needed to know more than the answer or the rule for how to find it, and I needed to do something other than explain to them why the rules work. I needed to know how to *prove* it to them, in the mathematical sense, and I needed to be able to evaluate their proofs of their own mathematical assertions. In the course of classroom discussions, I also initiated my students into the use of mathematical tools and conventions.

In this manner, Lampert clearly joins the dialogue as a knowing participant, but she is not the arbiter of truth. The burden of mathematical judgment is distributed to the classroom as a community of mathematical thinkers.

Naturally occurring differences across four classrooms enabled Smagorinsky & Fly (1993) to determine how the discourse in teacher-led discussion groups influenced the nature of subsequent small group discussions. The discussions were in the service of interpreting short coming-of-age stories and took place in four sophomore high school classes. By examining transcripts of discussion across whole class and small group contexts, the researchers were able to determine that the skill with which students engaged in productive discussions during small group discussions was related to the experiences of the students in the whole-class work. Specific teacher moves in whole-class discussion that subsequently served to scaffold small group discussions included: posing questions that encouraged students to make connections between the text and their own life experiences, and stepping outside the discussion for the purpose of making analytic/interpretive procedures explicit (for example, the need to pose a question, the need to support a generalization with evidence).

Finally, we report on two studies of small groups engaged in peer-editing activities, unassisted by a teacher. Daiute & Dalton (1993) studied the interactions between 14 seven-to-nine–year-old children in an urban setting and the impact of collaboration on their abilities to write stories. The study traces how the children internalized the fruits of their collaboration by examining individually generated written work before, during, and following collaboration. This study was conducted in an urban school over eight weeks. The researchers found that the children brought diverse areas of expertise related to story structure knowledge, style, and schema to the story-writing activity. Furthermore, they described the writing processes in terms of initiating and contesting. Analyses of independent writing samples indicated that the participants used significantly more story elements following collaboration.

In another study of peer collaboration in writing, Nystrand (1986) found that students who worked in groups demonstrated greater gains than those who did

not. Furthermore, students who had experienced group work came to think of revision as reconceptualization, whereas those who worked alone continued to think of revision as principally editing. However, he also found remarkable variability in the discourse across groups. For example, some groups felt they had accomplished their task if they labeled the problem, failing to examine the trouble source in any detail, while other groups would talk at length about ideas. Successful groups focused on issues of genre and the most successful groups engaged in "extensive collaborative problem solving," in which members joined together to address rhetorical problems in concrete, cooperative ways.

Next we turn to those studies that have been designed to manipulate features of discourse to learn more about how they operate to promote learning. We begin with a study by Teasley (1995), which was designed to study *collaboration* and *talk* as separate variables. Questions driving this research asked: Does the production of talk affect performance? What kinds of talk affect performance? Does the presence of a partner affect the kinds of talk produced? Teasley used a microworld (designed by Klahr and his colleagues) to investigate scientific reasoning. The task required figuring out the effect of a mystery key and then designing experiments to test the hypotheses. The 70 fourth grade participants were assigned to work alone or with a same-sex partner for one 20-min session. Within each condition, half of the children were asked to talk as they worked and half were asked not to talk. There was a main effect for talk that was more pronounced for talk-dyads than for talk-alones. Talk-dyads produced more talk and more specific types of talk than talk-alones. However, neither simply having a partner nor talking a lot improved learning. What was crucial was that children produced interpretive types of talk; that is, talk that supported reasoning about theories and evidence. Furthermore, while dyads directed more of their talk to evaluating and explaining the program outcomes, students working alone simply remarked on the behavior of the spaceship without making any assessment of that behavior.

Teasley's findings are supported by research on reasoning indicating that children's performance on reasoning tasks is significantly affected by their ability to coordinate hypotheses and evidence (Klahr et al 1993, Kuhn et al 1988, Schauble 1990). Findings of this nature informed the design of an intervention study conducted by Coleman (1992), in which she sought to define the merits of collaborative learning more precisely; that is, to describe some of the specific mechanisms of group learning that appear to be more successful than others for promoting conceptual understanding.

Coleman's findings are mirrored in a study by King (1990) who did research altering group discourse to determine whether it would affect reading comprehension. The intervention was called "guided reciprocal peer questioning" and involved teaching students question stems (such as "How does...af-

fect...?", "What would happen if...?"). King reported that students who used this procedure generated more critical thinking questions, gave more high-level explanations, and demonstrated higher achievement than students using discussion or an unguided reciprocal questioning approach.

In summary, studies of discourse are generally quite supportive of the benefits of instructional conversation. However, the benefits depend upon the types of talk produced. Specifically, talk that is interpretive (generated in the service of analysis or explanations) is associated with more significant learning gains than talk that is simply descriptive. Furthermore, teachers play an important role in mediating classroom discourse by seeding the conversation with new ideas or alternatives to be considered that push the students' thinking and discussion and prepare them for conversation. Finally, it is important to attend to the structure of group activity so that responsibility is shared, expertise is distributed, and there is an ethos for building preceding ideas.

In the next section, I consider the contributions of social constructivist perspectives to selected contemporary educational issues; namely, acquiring expertise across domains, assessment practices, equity in education, and the transformation of schools.

THE APPLICATION OF SOCIAL CONSTRUCTIVIST PERSPECTIVES TO CONTEMPORARY EDUCATIONAL ISSUES

Acquiring Expertise Across Domains

Writing from a traditional psychological perspective, Gallagher, in a 1994 *Annual Review* chapter on teaching and learning, wrote that "[E]ducators are increasingly viewing learners as bundles of knowledge structures that become increasingly sophisticated and hierarchical as they gain experience" (p. 172). In contrast, from social constructivist perspectives, expertise is characterized not in terms of knowledge structures but rather in terms of facility with discourse, norms, and practices associated with particular communities of practice (Lave & Wenger 1991). While from cognitive perspectives knowledge is generally represented in terms of cognitive structures that are acquired and organized in memory, social constructivists generally regard learning as the appropriation of socially derived forms of knowledge that are not simply internalized over time but are also transformed in idiosyncratic ways in the appropriation process. Furthermore, learning is thought to occur through processes of interaction, negotiation, and collaboration (cf Billet 1995, Hicks 1995–1996).

The influence of social constructivist perspectives has led to reexamining what it means to teach and learn across subject matters. From social construc-

tivist perspectives, researchers have asked what it means to "talk science" (Lemke 1990) or to participate in the discourse of mathematics (Cobb & Bauersfeld 1995). For example, Lemke (1990) suggests that talking science means: "observing, describing, comparing, classifying, analyzing, discussing, hypothesizing, theorizing, questioning, challenging, arguing, designing experiments, following procedures, judging, evaluating, deciding, concluding, generalizing, reporting, writing, lecturing, and teaching in and through the language of science" (p. ix). Furthermore, drawing upon anthropological research (e.g. Latour & Woolgar 1986), it is clear that scientific practice in the world is heterogeneous rather than unitary to the extent that practitioners orchestrate a variety of means (tools, discourses) to construct scientific meaning.

In turn, educational researchers have pursued the connection between scientific practice in professional communities and in schools, testing out the implications of this view for curriculum and pedagogy. Illustrative is the research of Rosebery et al (1992) in elementary classrooms where science is organized around students' own questions and inquiries. Students design studies to explore questions that they find compelling; collect, analyze, and interpret data; build and argue theories; establish criteria and evaluate evidence; challenge assumptions; and take action on the basis of their results. Among the many outcomes that Rosebery et al report are: the generative nature of children's thinking in this context and the deepening of scientific thinking (for example, students came to understand that hypotheses are springboards for inquiry rather than explanations). Finally, the researchers report that participants became comfortable identifying with scientific activity and not simply attributing scientific activity to others.

Assessment

Assessment practices informed by social constructivist perspectives stand in striking contrast with assessment procedures informed by the psychological theory that prevailed in the 1960s, in which testing contexts (e.g. Wisconsin General Test Apparatus) were designed to reduce social influences (Brown 1994). Assessment informed by social constructivist perspectives is frequently referred to as "dynamic assessment" (Feuerstein 1979) and characterizes approaches in which the performance of the individual being assessed is mediated or guided by another individual to determine the individual's potential to profit from assistance or instruction.

Dynamic assessment provides a *prospective* measure of performance, indicating abilities that are developing and is *predictive* of how the child will perform independently in the future. Furthermore, the response of the child to the assistance is intended to inform instruction. In Vygotskian terms, while traditional static measures at best inform us about an individual's actual level of de-

velopment, dynamic assessment is designed to reveal the child's potential level of development (Vygotsky 1986, pp. 203):

> The state of development is never defined alone by what has matured. If the gardener decides only to evaluate the matured or harvested fruits of the apple tree, he cannot determine the state of his orchard. The maturing trees must also be taken into consideration. Correspondingly, the psychologist must not limit his analysis to functions that have matured; he must consider those that are in the process of maturation...the zone of proximal development.

There are a number of models of dynamic assessment (Lidz 1987, Palincsar et al 1991) that vary in terms of the nature of the task, the type of assistance that is provided, and the outcomes that are reported. For example, the model pioneered by Feuerstein (1980), the Learning Potential Assessment Device (LPAD), is organized around tasks that Feuerstein argues require higher mental processes that are amenable to change, such as matrix problems, digit span tests, and embedded-figures problems. Hence, they bear a strong resemblance to the kinds of tasks used in traditional measures of IQ. However, when administering the LPAD, the examiner interacts in a flexible and individualized manner, anticipating where the child might experience difficulty and noting how the child uses reminders and other prompts. The outcome of the assessment is a cognitive map that is designed to specify the nature of the child's problem in terms of familiarity with content, strategies attempted in problem solving activity, and modifiability of the learner.

Test-train-test is another model of dynamic assessment that has been used in the research of Budoff (1987), Carlson & Wiedl (1979), and Campione & Brown (1984) and colleagues. Some form of guided learning occurs between pre- and posttesting. These programs of research indicate that dynamic assessment procedures do reveal a different picture of competence than do static measures, which typically underestimate many children's abilities to learn in a domain in which they initially performed poorly. The use of transfer tasks in dynamic assessment indicates that learning and transfer scores are better predictors of gain than are static measures.

It has been only recently that the principles of dynamic assessment have been explored within academic contexts. An excellent example is the research reported by Magnusson et al (1997). Magnusson et al were interested in children's conceptual understanding of the flow of electricity and devised a context that would allow the fourth graders in their research to test out their conceptions and then revise their ideas on the basis of the outcomes of their tests. They used the same basic circuit in three tasks, with each circuit differing only in the number of switches, which in turn determined which lightbulbs were lighted as well as the brightness of the bulbs. Hence the students had multiple opportuni-

ties to construct, test out, and revise explanations for the flow of electricity. The role of the interviewer in this assessment context was to elicit and probe predictions and explanations that would reveal the conceptions of the student participants. This dynamic science assessment proceeded by engaging the students in (*a*) predicting what they thought would happen, given a specific circuit, along with their reasons for making these predictions; (*b*) describing their observations; (*c*) comparing predictions with observations and discussing differences between them; and (*d*) explaining the result, focusing on underlying causes.

The use and outcomes of microgenetic analysis are illustrated by Schauble's (1996) research in which she examined the development of scientific reasoning as participants completed two experimentation tasks involving the use of fluids and immersed objects. Given recent calls for reexamining the usefulness of high-stakes assessment practices and questioning the extent to which these practices truly inform curriculum and pedagogy, these forms of dynamic and microgenetic assessment offer potentially powerful alternatives to traditional measurement procedures to the extent that they reveal not only what has been learned but also how and why learning has occurred.

Providing Meaningful Education for All Children

It is hard to imagine a more significant challenge to social constructivism than promoting meaningful learning for all children, especially for those who are linguistically and culturally diverse. Moll (1992) speaks to this possibility when he argues that "[i]n studying human beings dynamically, within their social circumstances, in their full complexity, we gain a more complete and...a much more valid understanding of them. We also gain, particularly in the case of minority children, a more positive view of their capabilities and how our pedagogy often constrains, and just as often distorts, what they do and what they are capable of doing" (p. 239).

A number of sociocultural explanations have been tendered for the failure of schools to serve all children. Examples include: (*a*) discontinuities between the culture (values, attitudes, and beliefs) of the home and school (Gee 1990, McPhail 1996), (*b*) mismatches in the communicative practices between nonmainstream children and mainstream teachers that lead to miscommunication and misjudgment (Heath 1983), (*c*) the internalization of negative stereotypes by minority groups who have been marginalized and may see school as a site for opposition and resistance (Steele 1992), and (*d*) relational issues, such as the failure to attain mutual trust between teachers and students (Moll & Whitmore 1993) and a shared sense of identification between the teacher and the learner (Cazden 1993, Litowitz 1993).

These possibilities have been pursued both in describing the performance of children in schools and in prescribing appropriate instruction. For example, Anderson et al (1997) drew upon these explanations to explore how sixth grade students participated in collaborative problem-solving activities in science. For a prescriptive example, we turn to the research of Needles & Knapp (1994), who conducted a study comparing three approaches to the teaching of writing. The first approach was *skills-based,* as characterized by systematic exposure and mastery of discrete skills (such as spelling and sentence structure). The second approach was *whole language,* which advocates that language is best learned in the context of use, should not be broken into discrete skills, and prescribes a minimal role for the teacher. The third approach reflected a social constructivist perspective, which Needles & Knapp described using the following principles: (*a*) component skills are best learned in the context of the writing task, (*b*) the quality of writing increases when children are writing what is meaningful and authentic, (*c*) fluency and competence are influenced by the extent to which the task connects with the child's background and experience, (*d*) involvement increases when children are encouraged to interact while performing writing tasks, (*e*) children develop competence if they approach the task as a problem solving process, and (*f*) children need ample opportunities to write extended text. They found that writing instruction that reflected these six principles accounted for a substantial proportion of children's improved abilities to write, once initial proficiency was considered.

Educational Reform

Exciting educational innovations are under way that draw generously upon (and are contributing generously to) the social constructivist perspectives introduced in this review. Perhaps the most striking example is a collection of efforts designed to reconceptualize classrooms—and schools—as learning communities. For example, the Computer Supported Intentional Learning Environments (CSILE), a project led by Scardamalia & Bereiter and their colleagues (Scardamalia et al 1994) places "World 3" knowledge at the center of classroom activity. As described by Popper (1972), World 3 knowledge refers to the public construction of understanding and stands in contrast to "World 2" knowledge, which exists in individual minds. The features of CSILE include a communal data base that students use to generate World 3 knowledge, a curriculum that permits the sustained pursuit of topics of inquiry, a classroom culture that fosters collaboration among peers, and a teacher who engages in instructional design work. The researchers note that the successful implementation of CSILE engages the teacher in moving flexibly between World 2 and

World 3 knowledge, tacking between what is in children's heads and what is taking shape in the public domain.

In the project Guided Discovery in a Community of Learners, Brown & Campione and their colleagues (Brown & Campione 1990, 1994) engage children in the design of their own learning and encourage students to be partially responsible for the design of their own curricula. Working on assigned curricular themes, students form separate research groups to become experts on subtopics of the theme. The students conduct seminars in which they share their expertise so that all members of the group can master the entire theme. Essential characteristics of Community of Learner classrooms include individual responsibility coupled with communal sharing; the use of select participation frameworks that are practiced repeatedly and that are compatible with the work of these communities; classroom discourse that is marked by constructive discussion, questioning, and criticism; conceptions of classrooms as comprised of multiple zones of proximal development (explained above), which include both children and adults at varying levels of expertise, as well as artifacts (such as texts and tools) that support learning; and the expectation that learning occurs as individuals contribute to and appropriate ideas (Brown & Campione 1994). Multifaceted assessments indicate that children in these learning communities retain domain-specific content better than youngsters in control groups, are able to think critically about knowledge, and demonstrate significant progress with an array of literacy skills such as reading comprehension and oral argumentation.

The demands of the types of teaching and classroom organization described throughout this review have special implications for the professional development of teachers. This is an area that has been virtually neglected in earlier educational reform efforts, which may well explain the efforts' demise. An educational innovation of particular importance is the application of the tenets of social constructivism to the design of professional development contexts with teachers. For example, Englert and her colleagues (Englert & Tarrant 1995) have brought teachers together in learning communities to examine their own practices in literacy instruction. This community of teachers works to translate the tenets of a sociocultural perspective into curriculum and pedagogy for students with serious learning difficulties. The teachers, informed by this perspective, systematically try out new practices, conduct their own inquiry regarding the outcomes of these innovations, and share their accumulated wisdom with one another. Additional professional development research, conducted in a similar spirit, has been reported by Grossman & Weinberg (1997; working with secondary literature teachers), Schifter (1996; working with elementary teachers in mathematics), and Palincsar & Magnusson and their colleagues (1997; working with elementary teachers in science).

Future Directions for Inquiry

The major theoretical contributions to the social constructivist perspective described in this chapter were developed and applied in the 1920s and 1930s by Vygotsky and his collaborators. Based on the notion that human activities take place in cultural contexts, are mediated by language and other symbol systems, and are best understood when investigated in their historical development, this is a complex and multifaceted perspective. Moreover, Vygotsky died at a very young age, with many of his ideas only partially developed. John-Steiner & Mahn (1996) caution that because the theory is complex and breaks radically with traditional educational and psychological theory, there is the tendency to abstract parts of the theory from the whole, which results in distorted understandings and applications. One direction for future inquiry is to continue the development of this theory.

Toward this end, it will be helpful to coordinate constructivist perspectives, informed primarily by cognitive psychology and socioculturalism. How might these perspectives be coordinated? Where constructivists give priority to individual conceptual activity, sociocultural theorists tend to assume that cognitive processes are subsumed by social and cultural processes. Where social constructivists emphasize the homogeneity of thought among the members of the community engaged in shared activity, cognitive constructivists stress heterogeneity of thought as individuals actively interpret social and cultural processes, highlighting the contributions that individuals make to the development of these processes.

It is important that inquiry conducted within this perspective shares a dual orientation to theory and practice (Cole 1996), designed to deepen our understanding of cognitive development as well as to produce change in everyday practice. As the research reviewed above suggests, social constructivist perspectives, which regard schooling as a system rather than as a set of isolated activities, have been extremely useful to understanding and describing the complexities of teaching, learning, and enculturation into schools. However, they have had little influence on the practices of schooling.

The genetic levels of analysis suggested by this perspective, as well as the methodologies that are drawn from this perspective, offer powerful tools for advancing both theory and practice. However, many educational researchers are unfamiliar with these tools. Finally, just as this perspective has been developed through the contributions of many disciplines (psychology, semiotics, linguistics, anthropology, etc), it would seem especially fruitful to promote interdisciplinary collaborations in the quest to advance this scholarship so that it might realize its potential and make a difference for children.

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