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Framing Constructivism in Practice as the Negotiation of Dilemmas: An Analysis of the Conceptual, Pedagogical, Cultural, and Political Challenges Facing Teachers

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Classroom teachers are finding the implementation of constructivist instruction far more difficult than the reform community acknowledges. This article presents a theoretical analysis of constructivism in practice by building a framework of dilemmas that explicates the conceptual, pedagogical, cultural, and political planes of the constructivist teaching experience. In this context, "constructivism in practice" is a concept situated in the ambiguities, tensions, and compromises that arise among stakeholders in the educational enterprise as constructivism is used as a basis for teaching. In addition to providing a unique theoretical perspective for researchers, the framework is a heuristic for teachers, providing critical questions that allow them to interrogate their own beliefs, question institutional routines, and understand more deeply the forces that influence their classroom practice.

In his historical analysis of educational reforms, Cremin (1961) asserted that progressive pedagogies required "infinitely skilled teachers" who, if prepared in sufficient numbers, could effect change nationwide. At the turn of this new century, progressive pedagogies are likely to be based on the rhetoric of constructivism—a theory and philosophy of learning that has been embraced by the K–12 science, social studies, and mathematics education communities as a foundation for reform-oriented teaching.[1] And, consistent with historical precedent, educators are struggling to develop new and more sophisticated repertoires of practice to realize the vision of children "constructing their own knowledge."

Implementing constructivist instruction, however, has proved even more difficult than many in education realize. The most profound challenges for teachers are not associated merely with acquiring new skills but with making personal sense of constructivism as a basis for instruction, reorienting the cultures of classrooms to be consonant with the constructivist philosophy, and dealing with the pervasive educational conservatism that works against efforts to teach for understanding (Apple, 1982; Little, 1993; Purpel & Shapiro, 1995). There is little literature that probes, systematically or in depth, the full scope of challenges faced by teachers in creating constructivist classrooms. And there has been no examination of the

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articulations between the conceptual, pedagogical, cultural, and political planes of the constructivist teaching experience.

This article presents a theoretical analysis of constructivism in practice by building a framework of dilemmas[2] that examines constructivist teaching from a phenomenological perspective (describing the range and structure of experiences that make up constructivist teaching). Within this perspective, "constructivism in practice" does not refer to the simple application of instructional strategies in which the teacher is the principle actor and the students are objects upon whom action is taken. Although it is described from the perspective of the teacher, constructivism in practice involves phenomena distributed across multiple contexts of teaching. It is the complex of concerns and invested activity that binds together teachers, students, administrators, parents, and community members as they participate, in various ways, in reform-oriented education. Constructivism in practice includes the ambiguities, contradictions, and compromises that are part of implementing constructivist instruction—it represents a highly problematized view that takes into account the tensions that characterize reform teaching in general and teaching for understanding in particular. As more specific phenomena of interest, "dilemmas" are aspects of teachers' intellectual and lived experiences that prevent theoretical ideals of constructivism from being realized in practice in school settings.

Four frames of reference are used to describe these dilemmas. *Conceptual dilemmas* are rooted in teachers' attempts to understand the philosophical, psychological, and epistemological underpinnings of constructivism. *Pedagogical dilemmas* for teachers arise from the more complex approaches to designing curriculum and fashioning learning experiences that constructivism demands. *Cultural dilemmas* emerge between teachers and students during the radical reorientation of classroom roles and expectations necessary to accommodate the constructivist ethos. *Political dilemmas* are associated with resistance from various stakeholders in school communities when institutional norms are questioned and routines of privilege and authority are disturbed. These dilemmas, which take the form of conceptual entities for researchers, often exist as concerns or implicit questions posed by teachers who attempt constructivist instruction (Table 1). The four-part descriptive model reflects a continuum from the personal and intellectual concerns of the teacher to the structural and public concerns of the school and community. In order of presentation, the four levels involve increasing numbers of participants in a broadening network of interactions, worldviews, and possibilities for change.

The literature on constructivism in classrooms indicates that the four dimensions of this model reasonably circumscribe the range of challenges faced by teachers. Furthermore, a number of case studies of reform efforts in schools suggest that failure to attend to any one of these dimensions can compromise or doom teachers' attempts to implement progressive pedagogies in their classrooms. Addressing each of the dimensions is necessary but insufficient by itself to realize new visions of learning.

In addition to examining these theoretical categories, this article illuminates the critical junctures at which the four planes overlap. Those intersections illustrate how difficulties in the lived experiences of constructivist teachers cannot be neatly packaged under the labels *conceptual, pedagogical, cultural,* or *political.* Rather,

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TABLE 1
The four dilemma categories of constructivism in practice and representative questions of concern

Teachers' dilemma category	Representative questions of concern
I. *Conceptual dilemmas:* Grasping the underpinnings of cognitive and social constructivism; reconciling current beliefs about pedagogy with the epistemological orientations necessary to support a constructivist learning environment.	Which version of constructivism is suitable as a basis for my teaching? Is my classroom supposed to be a collection of individuals working toward conceptual change or a community of learners whose development is measured by participation in authentic disciplinary practices? Do all activities result in knowledge "construction" by learners? If certain ideas are considered correct by experts, should students internalize those ideas instead of constructing their own?
II. *Pedagogical dilemmas:* Honoring students' attempts to think for themselves while remaining faithful to accepted disciplinary ideas; developing deeper knowledge of subject matter; mastering the art of facilitation; managing new kinds of discourse and collaborative work in the classroom.	Do I base my teaching on students' existing ideas rather than on learning objectives? What does it mean for me to become a facilitator of learning? What skills and strategies are necessary? How do I manage a classroom where students are talking to one another rather than to me? Should I place limits on students' construction of their own ideas? What types of assessments will capture the learning I want to foster?
III. *Cultural dilemmas:* Becoming conscious of the culture of one's own classroom; questioning assumptions about what kinds of activities should be valued; taking advantage of experiences, discourse patterns, and local knowledge of students with varied cultural backgrounds; managing the collective transformation of students' beliefs and practices in accordance with constructivist norms.	How can we contradict traditional, efficient classroom routines and generate new agreements with students about what is valued and rewarded? How do my own past images of what is proper and possible in a classroom prevent me from seeing the potential for a different kind of learning environment? How can I accommodate the worldviews of students from diverse backgrounds while at the same time transforming my own classroom culture? Can I trust students to accept responsibility for their own learning?
IV. *Political dilemmas:* Confronting issues of accountability with various stakeholders in the schoolcommunity; negotiating with key others the authority and support to teach for understanding.	How can I gain the support of administrators and parents for teaching in such a radically different and unfamiliar way? Should I make use of approved curriculums that are not sensitive enough to my students needs, or should I create my own? How can diverse problem-based experiences help students meet specific state and local standards? Will constructivist approaches adequately prepare my students for high-stakes testing for college admissions?

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teachers' day-to-day challenges are products of the interplay of the four domains. The practical connections among the domains may be a key to helping teachers understand how attempts to resolve dilemmas in one category influence their capacity to address dilemmas in others.

In addition to providing a theoretical perspective for researchers, the dilemmas framework has significant implications for teachers in examining their own practice. As a heuristic, the framework involves a number of critical questions that can prompt teachers to interrogate their own beliefs, question institutional routines, and understand more deeply the forces that influence their classroom practice.

Background

Before presenting the dilemmas framework, it is helpful to place constructivist instruction in historical perspective by asking whether contemporary challenges are different from those that have faced teachers implementing previous progressive pedagogies.[3] In many ways, the answer to this is no. Early progressive movements championed "child-centered" approaches[4] and advocated much the same instructional philosophy as constructivism does today. In the late 1800s, Francis Parker led reforms in Quincy, Mass., and at Chicago's Cook County Normal School based, in part, on the child-centered theories of Rousseau, Froebel, and Pestallozi (Farnham-Diggory, 1990). He emphasized learning in context, for example, by taking his students on trips across the local countryside during geography classes rather than having them recite countries and capitals. His students created their own stories for "Reading Leaflets," which replaced both the primers in his grammar schools and the rote learning that went with them (Stone, 1999). In 1919, Helen Parkhurst founded the Dalton School on the principles (among others) that school programs should be adapted to the needs and interests of the students and that students should work to become autonomous learners (Semel, 1999). Similarly, John Dewey routinely used the common experiences of childhood as starting points for drawing his students into the more sophisticated forms of knowledge represented in the disciplines (Dewey, 1902/1956). He intended that educative experiences be social, connected to previous experiences, embedded in meaningful contexts, and related to students' developing understanding of content (Dewey, 1938).

Accounts of these and other attempts at progressive schooling portray challenges for teachers that are much the same as those of today: creating and adapting curricula to meet the needs of learners, managing more active classrooms, and dealing with accountability issues regarding student learning. Such conditions, then as now, have often overwhelmed educators. For example, faculty at several schools involved in the Eight-Year Study (a 1930s experiment in progressive education involving 30 secondary schools) eventually became "exhausted by the demands made on them, [because] challenges came too thick and fast for the faculty to digest them" (Tyack & Cuban, 1995, p. 101). Describing progressivism in the 1950s, Cremin (1961) noted how child-centered instruction and integrated studies required of teachers

> familiarity with a fantastic range of knowledge and teaching materials, while the commitment to build upon students' needs and interests demanded extraordinary feats of pedagogical ingenuity. In the hands of first-rate instructors, the innovations worked wonders; in the hands of too many average teachers, however, they led to chaos. (p. 348)

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Moreover, problems with progressive pedagogy have not been restricted to teacher competence. Historically, resistance from conservative parents, school boards, and even colleges have confounded efforts to sustain progressive programs in schools. Referring again to the Eight-Year Study, Frederick Redefer and 29 other participants decided that their experiment had been "too intramural . . . and failed to anticipate resistance from parents and trustees" (Redefer, 1950, p. 36).

Although challenges associated with constructivist teaching have precedents, the nature of constructivism itself (as a learning theory) and the general character of schools today combine to form a context for teaching that is unique in several ways. As the basis for progressive pedagogy, constructivism is heavily grounded in psychology and social science research (National Research Council, 2000), both of which have intellectualized the perception of learning (Ayers, 1991) and have helped to distinguish between teaching approaches based on constructivism and those more generally labeled as "student-centered" or "child-centered." Since the 1960s, constructivism's research base has grown to include a substantial body of work on learners' alternative conceptions (Andersson, 1991; Carey, 1985; Vosniadou & Brewer, 1989), thinking and problem solving in the various disciplinary domains (Bransford & Stein, 1984; Hiebert et al., 1996), the use of representations in learning and teaching (Latour, 1990; Suchman, 1990), and metacognition (Brown, 1980; Flavell, 1991; White & Frederiksen, 1998). Additionally, the recent contributions of interpretive research paradigms have provided important insights into the social and cultural influences on knowledge construction. In line with findings from these research areas, theorists have proposed new ways of framing the act of teaching, for example, as co-constructing knowledge *with* students, acting as conceptual change agent, mentoring apprentices through the zone of proximal development, and supporting a community of learners.

Other distinctions between historical and contemporary education have to do not with constructivism itself but with conditions in schools and society. Until recently, most classrooms have been relatively impoverished resource environments, in which the "raw materials" of information and ideas were restricted to those found in texts. Students today, however, have access to a world of ideas and experiences through the Internet, which places almost unlimited information at their disposal. Other computer technologies provide powerful organizational, computational, and visualization tools to support learning. Although the use of these technologies in schools remains sparse and instructionally conservative (Cuban, 2001; Riel & Becker, 2000), many students have the information and tools available to investigate a universe of ideas in ways that were inconceivable just a few years ago.

In addition to the influences of technology, teaching today plays out against a unique backdrop of social and economic conditions. A greater percentage of learners than ever before will be going on to some form of higher education, which is significant because the widespread use of standardized testing at all grade levels and the specter of high-stakes testing for college admission continue to reinforce traditional views of learning and teaching. Paradoxically, the business community, into which many college graduates will matriculate, is now placing a premium on employees who can think creatively, adapt flexibly to new work demands, identify as well as solve problems, and create complex products in collaboration with others—all supposed benefits of constructivist learning environments.

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There are, of course, other social and economic forces at work that influence the receptivity of today's educational stakeholders to the notion of constructivist teaching. However, the point of the previous examples is simply to argue that, although many of the challenges that face today's teachers have presented themselves to progressive educators of the past, the rapidly expanding psychological and socio-cultural knowledge bases on learning, together with the unique technological, economic, and social contexts of education today, warrant a fresh and disciplined examination of the dilemmas of constructivist teaching.

Finally, before any discussion of dilemmas can be taken up, the contentious notion of what it means to be a "constructivist teacher" must be addressed. This is a difficult task, in part because all mental activity is constructive and thus, in a sense, all teaching is constructivist. Even when students are in what seem to be rote learning situations such as drill and practice, or in passive situations such as lecture classes, they are constructing knowledge because that is the way the mind operates (von Glasersfeld, 1993). Some theorists have suggested that we talk about "weak" or "strong" acts of construction rather than whether or not a learning environment is constructivist. During "strong" acts of construction learners connect new information with existing ideas to form meaningful knowledge that has a measure of internal coherence, can be integrated across topics, and can itself act as a tool for further constructions (Confrey, 1990; Noddings, 1990). "Weak" acts of construction are more arbitrary, only loosely connecting new information with existing ideas; those constructions are fragile, transient, and applicable only within a narrow range of contexts, and they often sustain themselves only through brute force of memorization. Because all pedagogy results in some kind of "construction" by learners, it is technically inappropriate to identify particular approaches to teaching as "constructivist." However, there are pedagogical approaches and strategies *based on what we know about meaningful learning* that consistently cultivate deep understandings in (or between) learners. Still, "constructivist pedagogy" is less a model than a descriptor for instructional strategies. A host of labels for general teaching approaches are premised on a constructivist philosophy. Among these are "teaching for understanding" (Elmore, Peterson, & McCarthey, 1996; McLaughlin & Talbert, 1993; National Research Council, 2000; Wiggins & McTighe, 1998; Wiske, 1997), "teaching for meaning" (Knapp & Associates, 1995), "authentic pedagogy" (Newmann & Associates, 1996), "progressive pedagogy" (Semel & Sadovnik, 1999), "child-centered teaching" (Chung & Walsh, 2000), and "transformative teaching" (Jackson, 1986). Within subject areas, some specific approaches (models) have been developed that are based on children's thinking and active instruction. Among these, for example, are Fostering a Community of Learners (Brown & Campione, 1994) and The Learning Cycle (Atkin & Karplus, 1962) in science, Cognitively Guided Instruction in mathematics (Carpenter, Fennema, & Franke, 1996; Schifter, Bastable, & Russell, 1999), and the Kamehameha Approach to reading comprehension (Au, 1990).

Another reason that "constructivist teaching" is difficult to characterize is that constructivist learning is conceptualized differently by various groups of theorists (see Marshall, 1996; Matthews, 2000), depending on whether the emphasis is on individual cognitive processes or the social co-construction of knowledge. Constructivisms that primarily describe cognitive processes adhere to a system of explanations of how learners, as individuals, impose intellectual structure on their worlds (Piaget, 1971). Constructivisms that emphasize social processes, on the

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other hand, view knowledge as having both individual and social components and hold that these cannot be viewed as separate in any meaningful way (Cobb, 1994; Cobb, Wood, & Yackel, 1990; Saxe, 1992). Whereas social constructivists see learning as increasing one's ability to participate with others in meaningful activity, cognitive constructivists focus on how individuals create more sophisticated mental representations and problem-solving abilities by using tools, information resources, and input from other individuals (Wilson, 1996).

This may be an oversimplification of a complex field of study (see Cole & Wertsch, 1996, and DeVries, 1997, for more comprehensive descriptions), but both researchers and teachers need some sensible intellectual anchors to support their thinking on how constructivist learning theory can be applied to classroom practice. Some scholars have proposed a useful synthesis of cognitive and social constructivist perspectives, claiming that knowledge is personally constructed and socially mediated (Driver, Asoko, Leach, Mortimer, & Scott, 1994; Shepard, 2000; Tobin & Tippins, 1993). Along these theoretical lines, Phillips (1995) describes the current reform vision of learning as a moderate version of cognitive constructivism nested within a moderate version of social constructivism. This hybrid view forms the basis of a general set of instructional guidelines that combine, with reasonable complementarity, aspects of both the cognitive and the social traditions. To ground the dilemmas framework of this article, I suggest that the following features characterize teacher and student activity in a constructivist classroom. They are derived from the broader literature on constructivism and connect what we know about how people learn with the kinds of classroom conditions that optimize opportunities to learn in meaningful ways:

- Teachers elicit students' ideas and experiences in relation to key topics, then fashion learning situations that help students elaborate on or restructure their current knowledge.
- Students are given frequent opportunities to engage in complex, meaningful, problem-based activities.
- Teachers provide students with a variety of information resources as well as the tools (technological and conceptual) necessary to mediate learning.
- Students work collaboratively and are given support to engage in task-oriented dialogue with one another.
- Teachers make their own thinking processes explicit to learners and encourage students to do the same through dialogue, writing, drawings, or other representations.
- Students are routinely asked to apply knowledge in diverse and authentic contexts, to explain ideas, interpret texts, predict phenomena, and construct arguments based on evidence, rather than to focus exclusively on the acquisition of predetermined "right answers."
- Teachers encourage students' reflective and autonomous thinking in conjunction with the conditions listed above.
- Teachers employ a variety of assessment strategies to understand how students' ideas are evolving and to give feedback on the processes as well as the products of their thinking.

Proceeding on the assumptions outlined in this section, let us now turn to the first of the four challenges, or dilemmas, facing the classroom teacher.

I. Conceptual Dilemmas: Understanding Constructivism

Disconnections Between Theory and Practice

One of the most powerful determinants of whether constructivist approaches flourish or flounder in classrooms is the *degree to which individual teachers understand the concept of constructivism.* Without a kind of working understanding, teachers cannot be expected to link constructivist objectives for learning with appropriate types of instruction and assessment or to adapt constructivist principles to their particular classroom contexts. For example, in a study of middle school teachers participating in reforms (Oakes, Hunter-Quartz, Ryan, & Lipton, 2000), researchers found that "efforts to employ student-centered, constructivist pedagogy were routinely thwarted by the lack of opportunity for teachers to delve into the theoretical underpinnings of the practices they were expected to enact" (p. xxii). The researchers added that "[t]he superficial attention paid to the foundational theories of learning and citizenship guaranteed that many of the changes in school would remain superficial" (p. 70).

Unfortunately for teachers, principles of instruction that derive from constructivist explanations for learning have not cohered into any comprehensible, widely applicable models (Fosnot, 1996; Noddings, 1990). Cobb, Yackel, and Wood (1988) have warned that, "[a]lthough constructivist theory is attractive when the issue of learning is considered, deep-rooted problems arise when attempts are made to apply it" (p. 87). This is not only because constructivism is a theory of learning rather than of teaching, but also because the implied precepts for instruction break radically from the traditional educational model in which teachers themselves were schooled, making it especially difficult for them to visualize constructivist pedagogy.

Many educators, in their early stages of understanding, create for themselves a kind of naive constructivism whereby they place an inordinate amount of faith in the ability of students to structure their own learning—a faith that interferes with the development of more sophisticated views of constructivist teaching (Prawat, 1992). This problem of equating activity with learning can be attributed to a belief on the part of many teachers that student interest and involvement in the classroom are sufficient as well as necessary conditions for worthwhile learning. For many teachers, activities, as opposed to ideas, are the starting points and basic units of planning, and little thought is given to the intellectual implications of an activity (Yinger, 1977). For example, in a study of elementary schools undergoing reforms, Elmore et al. (1996) documented the efforts of a fourth-grade teacher who used an "inquiry approach" in science class. In her classroom, students were asked to brainstorm about where ants might be found; later, students went out to the playground to count ants in various locations. After students gathered their data, however, there were no classroom conversations about the purposes of the investigation, the method, or the final results. The researchers observed that the students had engaged in "an exciting, hands-on activity that consisted of counting ants and reporting the numbers, but without written or oral discourse on possible big ideas about . . . the relationship of animals to their environment or . . . the scientific method" (p. 41).

In connection with this tendency to rely on activity for its own sake, teachers also tend to abstract parts of a constructivist approach from the whole, which results in distorted understandings of its applications (Cobb & Yackel, 1996). In general, the more easily imported practices (for example, the use of manipulatives

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in mathematics teaching in the elementary grades) have become part of teacher's repertoires, but the full understanding of what the practices mean has not. Thus the implementation of progressive reforms in the classroom is often piecemeal rather than forming a coherent whole (Knapp, 1997). In Cohen's (1990) noted study of a California teacher who attempted to introduce reform principles into her classroom, he found that "Mrs. Oublier" had adopted some features of the practices advocated by California's new mathematics framework. However, she combined the new approaches with traditional activities in "an extraordinary mélange" of practices that took no account of the conflict between elements traceable to her earlier training in direct instruction models and the new ideas she had recently adopted. Cohen's colleagues found similar intermingling of new and old practices without much teacher recognition of the contradictions among the conceptions of content, teaching, and learning that undergirded the disparate elements (Ball, 1990; Peterson, 1990; Wiemers, 1990). Fullan (1991) concludes that, for teachers aspiring to implement reform-based instruction,

> it is possible to change "on the surface" by endorsing certain goals, using specific materials, even imitating the behavior *without specifically understanding* the principles and rationale for change. Moreover, . . . it is possible to value and even articulate about the goals of change without understanding the implications for practice. (p. 40; emphasis in original)

Huberman uses the terms "bricolage" and "tinkering" (1993, 1995) to describe many teachers' ways of changing their practice. These teachers play the role of artisans, picking up a new technique here, a new activity or piece of curricular material there. Teachers choose techniques, activities, and materials that seem to fit their own styles, settings, and students, then adjust them on the basis of their own goals and experiences. Huberman (1993) claims that this type of tinkering is quite practical but also quite conservative. It enables a teacher to adopt apparently novel dimensions in instruction while preserving fundamental ideas about subject matter, teaching, and learning. Hargreaves (1994) observed that teachers often rely on "safe simulations" when testing out new instructional approaches. These are superficial imitations of new practices, which do not disrupt the cultural norms of the classroom. They include, for example, cooperative learning activities or student projects that are executed in overly controlled settings, bearing little resemblance to the conditions required for educativity (Hargreaves).

For many in the broader education community, fragmented teaching strategies based on superficial understandings of the reform literatures have mutated into the pernicious, now-predictable mythology that has attached itself to constructivism. A list of common pseudoprinciples has distorted the very concept of constructivist teaching. Among these are the notions that direct instruction has no place in the constructivist classroom; that constructivism is nothing more than discovery learning; that students must always be physically or socially active to learn; that all ideas, conjectures, and interpretations by students are equally legitimate; and that there are no rigorous assessment strategies associated with constructivist teaching. One math teacher, expressing dissatisfaction at an inservice on constructivism, expressed the belief that an uncritical relativism characterized constructivist learning:

> The way I have been taught math, it's supposed to be cut and dry. Two and two equals four all the time. With this new program, if you want to say two

and two equals five, it's fine as long as everybody agrees it's going to be five. (Prawat, 1992, p. 365)

It is hard to imagine that teachers will be compelled to explore the depths of constructivist teaching if they accept such premises.

Which Constructivism?

Multiple literatures within the domain of constructivism support various conceptions of learning and instruction. Philosophers have suggested more than a dozen different "constructivisms" (Nola, 1997); however, the literature relevant to educators can sensibly be categorized in terms of *cognitive* and *social or cultural* emphases. Depending on which paradigm a teacher prefers, the goals, learning activities, and even the culture of the classroom can differ dramatically.

Cognitive constructivism is a system of explanations of how learners, as individuals, adapt and refine knowledge (Piaget, 1971). In this view, learners actively restructure knowledge in highly individual ways, basing fluid intellectual configurations on existing knowledge, formal instructional experiences, and a host of other influences that mediate understanding. Cognitive constructivism posits that meaningful learning is rooted in and indexed by personal experience (Brown, Collins, & Duguid, 1989) and that learners maintain ideas (for example, about the workings of the human body, how governments operate, and the meaning of fractions) that seem intuitively reasonable to them. The ideas, however, are often at odds with canonical knowledge held by the various disciplines; they typically lack explanatory power or application across various situations and exhibit little internal coherence. These inaccurate conceptions significantly influence how learners respond to formal instruction and often hinder the development of conceptions and interpretations held as acceptable by scientists, mathematicians, or historians.

Within this framework, the teacher's task is to help students move from their inaccurate ideas toward conceptions more in consonance with what has been validated by disciplinary communities. Below is a sample of key instructional principles presented during a science teaching inservice that reflects the cognitive constructivist approach (Appleton & Asoko, 1996):

A teacher who holds a constructivist view of learning might be expected to show the following characteristics in the classroom:

- A prior awareness of ideas that children bring to the learning situation, and/or attempts to elicit such ideas
- Clearly defined conceptual goals for learners and an understanding of how learners might progress toward these
- Use of teaching strategies which involve challenge to, or development of, the initial ideas of the learners and ways of making new ideas accessible to them
- Provision of opportunities for the learners to utilize new ideas in a range of contexts
- Provision of a classroom atmosphere which encourages children to put forth and discuss ideas (p. 167)

Clearly, cognitive constructivism suggests a set of instructional commitments for teachers that differ from traditional subject-centered approaches. This perspective foregrounds the mental activity of individuals and, as existing ideas are challenged, casts other learners as sources of intellectual perturbation (Piaget, 1985).

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In contrast to cognitive constructivism, *social constructivism*[5] views knowledge as primarily a cultural product (Vygotsky, 1978). From this theoretical perspective, originating in the work of Lev Vygotsky and elaborated by members of the sociohistorical school (Leontiev, 1930; Luria, 1928, 1932), knowledge is shaped by micro- and macro-cultural influences and evolves through increasing participation within different communities of practice (Cole, 1990; Scribner, 1985). Whereas cognitive constructivism focuses on the internal structure of concepts, social constructivism focuses on the context of their acquisition (Panofsky, John-Steiner, & Blackwell, 1990). Vygotsky emphasized meaningful, "whole" activities (e.g., conducting scientific inquiries, solving authentic mathematical problems, and creating and interpreting literary texts), as opposed to decontextualized skill-building, as the fundamental units of instruction in educational settings; he viewed thinking as a characteristic not only of the child but of the "child-in-social-activities" (Moll, 1990, p. 12). Vygotsky also introduced the "zone of proximal development"—the notion that developing mental functions must be fostered and assessed through collaborative activities in which learners participate in constructive tasks or problem solving, with the assistance of more knowledgeable others. Through this assistance the child internalizes the supportive talk and tactics used on the social plane and becomes able to accomplish such tasks independently. From the social constructivist perspective, a major role of schooling is to create the social contexts (zones of proximal development) for mastery and the conscious awareness of the use of cultural tools (e.g., language and technologies of representation and communication) so that individuals can acquire the capacity for higher-order intellectual activities (Olson, 1986).

From these premises follow pedagogically relevant assumptions that are different from those suggested by cognitive constructivism. Teachers become representatives of canonical science, mathematics, or history in the classroom. As such, they are disciplinary practitioners who must model intellectual skills and dispositions for students and thus engage them in scientific, mathematical, or historical discourse. Students participate in activities relevant to the discipline, using tools commonly available to practitioners as they carry on their work. Tools are seen as powerful mediators of learning. They include language itself, computers, diagrams, maps, math symbols—anything that can facilitate the co-construction of knowledge among learners (Roth, 1995; Wertsch, 1991).

Several innovations draw on social constructivist perspectives to reconceptualize schools as learning communities. In the project Guided Discovery in a Community of Learners (Brown & Campione, 1990, 1994), students work on an assigned science theme (such as interdependence among animals) and form research groups to become experts on subtopics of the theme. They then conduct small seminars in which they share their expertise with other members of the group, so that everyone has an opportunity to master the entire theme. Characteristics of these classrooms include individual responsibility linked with communal sharing, and the use of participation routines that are practiced repeatedly. Classroom discourse includes questioning, critiques, and discussion among children and adults at various levels of expertise. The expectation is that learning occurs as individuals contribute to and appropriate public ideas (Brown & Campione, 1996).

The cognitive and social perspectives, although not irreconcilable, present teachers with the possibility of understanding how students learn, designing learning

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activities, and conceptualizing the role of the teacher in very different ways. The generic use of the phrase "constructivist teaching" in practitioners' literature obscures critical differences between cognitive and social constructivisms and the implications of each for methods of instruction. Reviews or summaries of literature aimed at practitioners that make generalizations about the character or effectiveness of constructivist teaching without acknowledging these critical differences undoubtedly contribute to the confusion of the teacher audience.

Internalizing a Constructivist Epistemology

Although some fundamental understanding of constructivism is critical for practitioners, it is equally important for practitioners to develop an epistemology of classroom learning that is congruent with constructivism. The epistemological assumptions underpinning constructivism suggest that the world does not harbor unambiguous "truths" independent of human perception, revealed to us through instruction; rather, the world is knowable only through the interaction of knower and experienced phenomena (von Glasersfeld, 1987). Learning is an act of both individual interpretation and negotiation with other individuals. Knowledge in the various disciplines, then, is a corpus of constructions that are subject to change as different kinds of evidence are discovered and members of disciplinary communities debate about new ideas becoming part of the canon.

Unfortunately, the default epistemology of Western schooling is objectivism, which in many ways is the antithesis of constructivism (Roth & Roychoudry, 1994). In this view, language can be used as a precise, neutral tool to describe the "real" world—to map knowledge as an unchanging object—and to transfer it from the minds of teachers to the minds of learners. Congruent with this perspective are the transmission models of instruction, in which lecture and demonstration are the preferred modes of "delivering" such knowledge to learners. Teachers instruct the entire class and present "right answers" as well as the "right ways" to solve problems; students' existing knowledge has little relevance in such environments. The instructional philosophy stemming from objectivism (which has contributed heavily to classroom practices throughout the 20th century) can be summed up by the Benedictine monastic rule: "It belongeth to the master to speak and to teach; it becometh the disciple to be silent and to listen" (Benedict, 1987, p. 11). Maintaining such an epistemology is a significant impediment to the conceptualization of student-centered learning. Teachers with absolutist conceptions about the nature of knowledge are more traditional in their approach to instruction because they see no reason not to transmit directly what is perceived to be a collection of substantiated facts (Pope & Scott, 1984). Smith and Neale (1989) have documented negative relationships between teachers' objectivist views of science (the extent to which they see content as lying outside the child) and their attentiveness to children's ideas and explanations during instruction. Similarly, Pope and Gilbert (1983) found that science educators who had absolutist views of truth and knowledge tended to place little emphasis on students' conceptions during instruction. In a study of three junior high school mathematics teachers, Thompson (1984) found a strong relationship between their conceptions of mathematical knowledge and their classroom practice. One of the three teachers held a dynamic view of mathematics, seeing it as a discipline that is continually undergoing revisions; the other two conceived of it as a static body of knowledge. Only the teacher with a

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dynamic view emphasized the importance of student reasoning. She felt that teachers should encourage students to make sense of the content, and it was only she who showed perceptiveness of the students' needs during the lesson, capitalizing on their unexpected remarks and incorporating their ideas into the body of the lesson. In a study of the California Mathematics Curriculum Framework, Ball (1990) observed a teacher who seemed to actively engage her students, consistent with the goals of reform. Upon closer examination, however, it became clear that the teacher understood mathematics not as a living, growing domain of inquiry but as a set of low-level strategies to be learned. She overlooked the possibility of children's formulating problems themselves or evaluating conjectures raised in class; instead, there was always a "right answer" out there (p. 256). The teacher structured instructional activity to instill these answers in her students.

Even teachers who explicitly profess a constructivist epistemology often find themselves drawn back to more familiar recitation scripts. Tobin (1993) describes Rod, a high school teacher, who claimed that he maintained a constructivist epistemology and yet found himself inextricably bound to teacher-centered routines in which he solicited correct answers to convergent questions, provided immediate feedback on the adequacy of student responses, and searched for students who could provide correct answers to his questions.

In summary, to understand constructivism, knowledge of its underlying principles is a necessary but insufficient condition. Teachers hoping to teach for understanding should be prepared not only to learn how constructivist fundamentals translate into classroom strategies but also to undergo a major transformation of thinking about teaching and learning. In this context, epistemology must become an explicit target of change. Without such change as a priority, efforts directed at teacher development become narrowly focused on changing the kinds of attributes and skills that may be added to, subtracted from, or modified. Knowledge is commonly thought to be at the heart of school reform, but it is too often treated as an attribute that teachers and others can "pick up." From an epistemological point of view, knowledge is much more than that (Clandinin & Connelly, 1998). The fundamental changes in worldviews required for constructivist teaching are not easily realized; they are akin to conversions or gestalt shifts (Nespor, 1987). To *know about* constructivism, then, is difficult enough, but transforming classroom practice in meaningful, coherent ways requires that one also come to *think as* a constructivist.

II. Pedagogical Dilemmas: Developing New Dimensions of Instructional Expertise

Student Understanding as the Focus of Classroom Practice

Constructivist classroom approaches involve fundamental shifts in how teachers typically think about instruction, from focusing exclusively on dispensing content to placing students' efforts to understand at the center of the educational enterprise. The traditional didactic relationship between teacher and student is replaced by one that is more interactive, complex, and unpredictable (Darling-Hammond, 1996; Glaser, 1990). Consequently, "teachers who take this path must work harder, concentrate more, and embrace larger pedagogical responsibilities than if they only assigned text chapters and seatwork" (Cohen, 1988, p. 255).

Such teaching is not easily accomplished, even among serious advocates of constructivist instruction. Consider the following quote from a faculty member in

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teacher education. This faculty member's department attempted to help student teachers understand Brown and Campione's (1994) instructional model Fostering a Community of Learners by involving them in a year-long seminar:

> None of the [35] student teachers reached a level at which they could handle [Fostering a Community of Learners] in all its complexity. It is safe to say that almost none of the teachers we had the opportunity to observe were able to create the kind of learning community envisioned by the pedagogy. Moreover, project facilitators felt compelled to simplify the model gradually from year to year. The model requires both enormous savvy and craft in the fields of both curriculum and classroom management that seem to *eclipse the resources of beginning teachers and often the skills of the project facilitators as well.* (Mintrop, 2001, p. 234; emphasis added)

Even among experienced educators, this type of instruction is difficult to put into practice. In a study of 24 schools (elementary, middle, and high schools) that were engaged in teaching reforms, Newmann and Associates (1996) found that the most progressive teachers scored considerably below the researchers' highest levels for constructivist pedagogy and that mean scores by subject area and grade level and overall mean scores were considerably lower than the midpoint of the researchers' index.

The first of several specific challenges in designing constructivist lessons is that teachers must include conjectures about student thinking (Lampert, 1989; Noddings, 1990), as well as the "incomplete understandings, and naive renditions of concepts that learners bring with them to a given subject," as key elements of instructional decision making (National Research Council, 2000, p. 10). This is not a straightforward task. For example, in a study of teachers' efforts to help 10- and 11-year-olds develop an understanding of taxonomic categories of animals, Panofsky et al. (1990) found that children would actively engage in sorting and grouping but that their particular categorizations were frequently unavailable to teachers. In the language arts, McLane (1990) found that teachers routinely have difficulty in discerning the communicative intentions of a beginning writer. In working with young learners on geometric concepts (Bastable, Schifter, & Russell, in press) a second-grade teacher needed to use extensive conversations and deep probing to discover that her students would identify a three-sided shape as a triangle only if it was sitting on its "base." In the widely viewed video series *A Private Universe* (Schneps & Sadler, 1997), a middle school science teacher is baffled by a top academic student whose complex alternative conceptions about the celestial movements of the earth, moon, and sun have origins that are incomprehensible to the teacher, as well as to the student herself. Heath (1983) suggests that, when children are involved in active explorations, they move toward systematization of their knowledge but according to the parameters of their own conceptions—conceptions that are not well defined even in the mind of the child.

If they can get a sense of students' conceptions, frames of reference, and rules for organizing the world, teachers then must employ a range of facilitative strategies to support students' understandings as they engage in the problem-based activities that characterize constructivist classrooms. These strategies can include gradual approximation of practice, in which the most difficult components of complex tasks are strategically facilitated by the teacher; modeling, in which the teacher either thinks aloud or acts out how she would approach a problem; coaching, guiding, or advising, which are loosely defined as providing prompts, probes, or suggestions to learners at

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varying degrees of explicitness; providing heuristics or conceptual structures for learners to use in approaching problems; and using various technologies that help learners select, organize, and represent information and ideas (Choi & Hannafin, 1995). In many traditional classrooms, where unambiguous right answers are the coin of the realm, "giving hints" is one of the few ways teachers act as facilitators of students' learning. In the constructivist classroom, however, facilitation becomes an elaborate set of strategies from which teachers select to support the increasingly autonomous intellectual work of students. For example, Darling-Hammond, Ancess, and Falk (1995) tell how a group of expert language arts teachers "scaffolded" their students' learning through successive conversations about the purposes of writing and collaborative experiences that took them from their various starting points to proficient writing performances. Facilitative strategies in this case included providing opportunities for approximation and practice, debriefing and conversing, sharing works in progress, and guiding the revision of work. Similarly, Tharp and Gallimore (1988) describe how a skillful third-grade teacher elicited ideas from students about people they admired, then helped mediate classroom conversations through careful questioning strategies so that the students built on their original ideas to develop more sophisticated understandings of the concept of "hero."

Supporting student learning in these ways, however, requires special skills and conditions. Gallimore and Tharp (1990) claim that teachers cannot provide assistance unless they know where learners are in the developmental process; these researchers caution that "opportunities for such careful observation of the child's in-flight performance are rarely available in typical American classrooms" (p. 198). They go on to say that most teachers cannot conduct instructional conversations because they do not know how, having never had opportunities to observe effective models in action or to receive competent coaching by a mentor. Like all learners, teachers themselves must at some time have their own performances assisted if they are to acquire the ability to assist the performances of their students.

Yet another pedagogical challenge involves students' self-determination in their work. Depending on the degree of structure that the teacher imposes in a constructivist classroom, students have varying latitude in choosing problems or tasks that relate to a theme under study. Ideally, students develop, with the teacher, suitable criteria for problems and the kinds of evidence of learning that they will provide. This negotiation about criteria prompts questions such as, Is the problem meaningful? Is it important to the discipline? Is it complex enough? Does it relate to the theme under study? Does it require original thinking and interpretation or is it simply fact finding? And will the resolution of this problem help us to acquire the concepts and principles fundamental to the theme under study? Because curricular materials routinely supply prepared questions and tasks, teachers seldom accompany their students to this meta-level of "problems about problems." Teachers, then, must have some understanding of the disciplinary nature of their subject matter to develop a philosophy about worthy instructional problems and to offer guidance to students as they contemplate problems and tasks for themselves.

Giving students choices about what they will study, however, even if it is constrained to particular topic areas, can be difficult to manage. Teachers in a study of elementary social studies classes by Elmore et al. (1996) wrestled with when and how to bring the experiences and understandings they had gained to their students without displacing their students' own knowledge and experiences. During a unit

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on ancient Greece, for example, one teacher agonized over whether she should require all of her students to read the *Iliad* and explore mythology through a primary source. According to the teacher, when left to select their own readings, her students made selections that "were not that terrific" (p. 183). The researchers go on to describe what they refer to as "the constructivist dilemma":

> On one hand, it is the teacher's responsibility to provide structure and guidance for students to learn in ways that ultimately lead to their taking responsibility for their own learning; but on the other hand, the structures and guidance that teachers provide often prevent students from taking this responsibility. On one hand, teachers are supposed to understand in a deep way the content and pedagogical knowledge necessary to teach students; but on the other hand, teachers' knowledge can overwhelm students struggling to understand for themselves. (p. 210)

Managing Classroom Interaction and Discourse

Problem-based activities used in many constructivist classrooms are supported by an instructional strategy that is at once productive and destabilizing: collaborative learning, in which students witness and participate in each other's intellectual activity. In collaborative activities, discourse is valued as a way to help students make ideas explicit, share ideas publicly, and co-construct knowledge with others. Studies of discourse generally are supportive of the benefits of instructional conversation; however, the benefits depend on the types of talk produced (DiBello & Orlich, 1987). Specifically, talk that is interpretive—generated in the service of analysis or explanations—is associated with more significant learning gains than talk that is merely descriptive (Palincsar, 1998).

Despite the potential benefits, research on group learning brought a number of practical problems to the surface. Learners are exposed to examples of the clear, cogent thinking of some peers as well as to the inevitable meandering, unreflective thought of others. Students require training to function effectively in these groups. However, even with training, many capable students are patently uninterested in helping their peers; and negative consequences of group work such as bickering, exclusion, and academic freeloading are common (Slavin, 1995). Because working with others involves social as well as cognitive processes, interpersonal dynamics can work against group sense-making and the negotiation of meaning (Taylor & Cox, 1997). O'Connor (1998) examined this issue in a sixth-grade mathematics class. She found that ideas were often subordinated to social processes that arose from past interactions among students and that, as a result, learning opportunities were diminished as they were filtered through complex interpersonal contexts. Other researchers have found various examples of students' discounting or dismissing the individual contributions of others and resisting the spirit of the entire collaborative enterprise (Anderson, Holland, & Palincsar, 1997). In studies of young children (5 to 8 years old) working with science ideas, Tudge (1990) found that peers could actually get their partners to regress in their thinking about concepts of "balance" during collaborative tasks. He claims that to simply generate "cognitive conflict" or provide information in the child's zone of proximal development is insufficient. Tudge goes on to say, "[I]t may be inadequate if the more competent of the children is not the more confident. The implication for teachers is that they must do more than merely ask children to collaborate to solve a problem, or even . . . pair a child who is more

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advanced in his thinking with one who is less advanced" (p. 167). Research of this kind indicates that teachers must develop strategies for socializing students into new ways of dealing with peers as intellectual partners (Hatano & Inagaki, 1991) and be vigilant about students' influences on one another's thinking.

In whole class discourse, teachers play a critical role in mediating learning by seeding students' conversations with new ideas or alternatives that push their thinking. One key, for teachers who want to structure discourse in this way, is to convince students that they can defend a view or opinion without feeling that they have to defend themselves. In this approach, "opposing views become alternatives to be explored rather than competitors to be eliminated" (Roby, 1988, p. 173). The teacher's role in this regard is not unlike that of a dance instructor, "requiring some telling, some showing, and doing it with them along with regular rehearsals" (Lampert, 1989, p. 58). The emphasis on dialogue in constructivist classrooms has also led to a reexamination of the relationship between student talk and the discourse of the disciplines that underlie school subjects. Researchers have asked, for example, what it means to "talk science" (Latour & Woolgar, 1986; Lemke, 1990) or to participate in mathematical conversations (Cobb & Bauersfeld, 1995). Lemke suggests that talking science means hypothesizing, questioning, challenging, arguing, concluding, generalizing, and also, teaching *through* the language of science. Consequently, in addition to the need for teachers to understand how the various disciplines create knowledge, they must be familiar with how language is used within the disciplines as a tool for communicating and negotiating ideas.

Understanding Content

As Shulman (1987) has observed, "Teacher comprehension is even more critical for the inquiry-oriented classroom than for the didactic alternative" (p. 7). Much of constructivist instruction is based on student activities such as problem solving, inquiry, or design tasks. In these kinds of activities, teachers must not only be familiar with the principles underlying a topic of study but also be prepared for the variety of ways in which these principles can be explored by learners. For example, if students want to elaborate on their understanding of "density" in science class, a teacher might find herself supporting a group of learners who approach the concept from a purely abstract, mathematical perspective as they work with models in the form of tables, equations, and graphs. In this case, to facilitate sense-making, the teacher must understand these various representations and how they relate to concrete phenomena. On the other side of the same classroom, another group of students may plan to analyze the sinking of the *Titanic,* emphasizing the role that density played in the visibility of the iceberg, the ballast of the ship, and the sinking itself. In this case, the teacher must be intellectually facile, able to apply her mathematical understanding of density to a real-life, complex, and perhaps even "messy" example.

In an example of the necessity for greater knowledge of subject matter, Appleton and Asoko (1996) describe an elementary science teacher who wanted to give his children some voice in an outdoor studies curriculum while at the same time maintaining a measure of control. He resolved the problem by planning several activities, any one of which could be selected by the children. One group of students expressed interest in growing seedlings under various light conditions. As the experiment progressed, the children observed something counterintuitive: that the seedlings grown under the least light were the tallest. This phenomenon and

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the interest it generated represented a special opportunity to explore important ideas of plant growth; unfortunately, however, the teacher did not have the content background to help his students understand the results of their own experiment. In a similar situation in mathematics, Elmore et al. (1996) found that elementary teachers who lacked content knowledge were unable to coordinate their teaching with more reform-oriented goals espoused by the school. Faced with uncertainties about how to teach place value in mathematics, one teacher reverted to a lesson on roman numerals that she had developed from a textbook ten years earlier; that lesson was "clearly at odds with both the conventional mathematics thinking and . . . the curriculum she was using" (p. 134).

Although all instructional approaches require some knowledge of the subject matter to be taught, constructivist approaches, in which children's varied interests and experiences in relation to a subject are involved, demand an even more extensive content background. Insufficient knowledge of the subject matter can lead to misconceptions by both teachers and students; and, perhaps just as problematic, teachers who do not have a thorough understanding of what they are teaching tend to control classroom discourse by privileging facts rather than treating concepts in a dialogic and interactive manner (Carlsen, 1991, 1992; McLaughlin & Talbert, 1993).

Assessing Students' Knowledge

Constructivist instruction is intended to cultivate understandings in learners that are grounded in meaningful contexts and that may be arrived at through different developmental trajectories depending on the student. To accomplish this requires assessments that focus on the processes as well as on the products of learning and that involve students as participants in determining criteria of excellence for the work. These are not the post hoc, paper-and-pencil tests in which learners recognize answers rather than generate ideas, or in which they create brief, fact-based responses to questions that are devoid of meaningful context. Rather, the assessment methods are as rich (complex) and interpretive (potentially subjective) as the learning activities themselves, in part because they are often embedded in the learning activities. Such assessments include clinical interviews, observations, student journals, peer reviews, research reports, building of physical models, performances in the forms of inquiries, plays, debates, dances, or artistic renderings (Shepard, 2000). Such artifacts and performances require well-designed, flexible rubrics for evaluation. Designing these rubrics *with* students makes explicit what is valued in the learning process and how evidentiary criteria are linked to these values. Frederiksen and Collins (1989) use the term "transparency" to express the idea that students must have a clear understanding of the criteria by which they will be assessed. If approached skillfully, these processes can engender greater student ownership, less distrust, and more appreciation that standards are not arbitrary (Gipps, 1999; Wiggins, 1992). However, as with the skills of scaffolding, managing student discourse, and connecting students' ideas with disciplinary canons, the task of negotiating criteria for assessment with learners is often an unfamiliar and complex task for the classroom teacher.

As Doyle (1979) has pointed out, "classrooms that require the generation of original solutions to previously unencountered problems tend to be high in both ambiguity and risk, assuming the teacher holds students accountable for the quality of their solutions" (p. 194). This can result in classroom tensions as students, who are used to activity structures that are both familiar and rote, struggle to re-learn what

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it means to "be successful" in a classroom. In his year-long case study of Rory, an earth science teacher who attempted to redesign his course around the principles of project-based student work, Polman (2000) observed the "impossibility of providing crystal clear instructions" about creating research reports and the impact this had on students' attempts to make sense of the teachers' assessment strategies:

> Today was for arguing, two periods' worth. [The teacher] sits down and tries to fix his inconsistencies when the students challenge him. In this way, Rory "gives the students a voice", encouraging them to break out of their passive roles and take some control. . . . Rory also indicates that he respects their well-reasoned arguments. But in the case of producing such ill-defined and organic documents as scientific research reports, the notion that Rory's commentary on a draft can serve as a detailed contract specifying the necessary and sufficient conditions for a quality revision is absurd. . . . For Julie, however, the strategy of holding Rory to "the terms" laid out in the original markup [of her first draft] proves a fruitful strategy for raising her group's grade—with a curve they have received the highest grade in the class—102%. (p. 131)

In addition to the challenges of design and the application of nontraditional forms of assessment in constructivist classrooms, there are philosophical issues involved. If the task of the students is to generate their own understandings, what are the limits of the meanings that the students might make? Although constructivist teachers are not wellsprings of unchallenged knowledge, constructivism does not preclude their acting in other epistemologically authoritative ways in supporting a community of inquiry in the classroom. In a history class, for example, this means establishing criteria for historical evidence, methods of determining historical significance, and limits on interpretive license (Sexias, 1993). It is equally important, however, for the teacher to honor student's efforts at meaning-making, even when it reflects immature understanding. As teachers try to strike a balance between their obligation to the discipline and their obligation to the learner, they must frequently settle for partial understandings on the part of learners. Carlsen (1987) provides an example from science: In guiding students toward an understanding of photosynthesis, a teacher might target an intermediate level of understanding (e.g., "plants make food using sunlight, water, air, and minerals") but only after carefully weighing where students are in their thinking (e.g., "plants get food from their roots") and judging what would be considered a more adequate explanation from a disciplinary perspective (e.g., "plants make their food from carbon dioxide and water using sunlight as an energy source for this process").

Perhaps the best example of the tension between honoring students' efforts at understanding and helping them to grasp accepted ideas comes from Ball (1997) as she describes how one young girl in her elementary mathematics class argued convincingly that $\frac{5}{5}$ had to be more than $\frac{4}{4}$. The girl presented a persuasive explanation, drawing two circular cookies, dividing them into four and five pieces, and showing that with $\frac{5}{5}$ there was enough to pass out a piece to each of five friends, but with $\frac{4}{4}$ one friend would not get any cookie. Ball reflected,

> As I listened to Sheena, I knew that next year's teacher might not be charmed by Sheena's way of thinking about this. She might see Sheena as lacking mathematical skills. Was she? Sheena could complete standard fraction worksheet items correctly, (e.g., shade $\frac{3}{4}$ of a rectangle) and she got the fraction items right on the end-of-year standardized test. Yet this nonstandard part of

> Sheena's thinking made me wonder . . . some aspects of her answer were
> right. But her nonstandard approach had actually changed the question. And
> her response to the original question was wrong. What should be the right
> answer for me here? To this day, that remains uncertain. (pp. 82–83)

These and other classroom examples suggest that implementing student-centered
and discourse-oriented teaching "that represents content faithfully, respects students'
ideas, and creates community are aims not simply resolved" (Ball, 1993, p. 395).

III. Cultural Dilemmas: Transforming the Culture of the Classroom

Understanding Classroom as Culture

The day-to-day routines that unfold in classrooms are always situated in a larger
context—a tacitly understood framework of norms, expectations, and values that
give meaning to all activities occurring in schools. In recent years, educational the-
orists have recognized the influence of these often-transparent frameworks on class-
room learning and studied how teachers contribute to and are influenced by the
culture of the classroom (Bruner, 1996; Mehan, 1997; Rogoff, 1990). Using the con-
cept of "culture" to make sense of what happens in schools, researchers have asked,
In what practices do people participate? What behaviors and attitudes are encour-
aged or discouraged? What is the relationship between students and teacher? Who
has power to make decisions, who does not, and how are these power relationships
maintained? What systems of thought are valued and modeled? What undertakings,
what talents, are prized and rewarded? (Joseph, Bravmann, Windschitl, Mikel, &
Green, 2000). From the cultural perspective, teaching is more than addressing con-
tent, it is also about bringing all students to a shared understanding of what a lesson
"is" and how to participate in it (Florio, 1978; Jackson, 1968). Being a competent
member of the classroom involves learning when, with whom, and in what ways to
talk and knowing when and where to act in certain ways (Mehan; Nguyen, 2002).
Although, as Atkinson (1982) points out, there is "no script to be memorized," class-
rooms ultimately assume orientations that serve as frames of reference for "being
students and teacher" (Heap, 1991; Kantor, Green, Bradley, & Lin, 1992).

For teachers, creating patterns of beliefs and practices consonant with a con-
structivist philosophy is especially difficult when one considers the entrenched
school culture that it must usurp. The predominant images of "being students and
teacher" are some of the most persistent known in the social and behavioral sci-
ences (Sirotnik, 1983; Tyack & Cuban, 1995). In a study of more than a thousand
classrooms, Goodlad (1984) found "an extraordinary sameness of learning envi-
ronment featuring bland, repetitive procedures of lecturing, questioning, monitor-
ing, and quizzing" (p. 249). In "Understanding School Culture," Heckman (1987)
further describes the prevailing conditions of American classrooms:

> Most teachers talk most of the time; students sit, listen, do seatwork, and take
> tests. This occurs for approximately 85% of the 75% of the class time devoted
> to instruction. These findings approximate those reported in a study done at
> the turn of the century. (p. 70)

More recently, in a study of middle schools undergoing reforms, Oakes et al. (2000)
found that most teachers, administrators, and parents expected an educative class-
room to be quiet and orderly, with students seated and not talking to each other.
Engagement meant that students were attentive but without speaking, gesturing,

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building things, or moving about. Heterogeneous grouping was heavily resisted. From these studies and from common experience, it is not difficult to infer that the dominant culture in schools is one of coping and compliance, where teachers control the intellectual activity to ensure uniform "exposure" to the curriculum and to maintain discipline. In response, students over time grow into the role of passive observers rather than active participants in their own education.

These overly controlled environments are supported, in part, by implicit epistemological orientations, according to which knowledge exists outside the learner, disciplines generate immutable truths, and discrete facts and concepts are favored over engagement with big ideas. These orientations have given rise to the simple yet seductive experience for students, known as "being right." Recognizing or rendering "right answers," rather than thinking well, is the goal of most classrooms cultures. Students are inculcated early into this notion by working individually and often competitively on identical, skill-based assignments to ensure uniformity of learning—a condition that, if used to excess, can displace opportunities to achieve deep understanding of subject matter. McLane and Graziano (1987), for example, found that even in an informal after-school writing program, based on whole-language instruction and authentic writing tasks, elementary students were so concerned about being "wrong" with poor penmanship and misspellings that they resisted writing at all until months after the start of the program. The students eventually would write only if they could determine their own assignments and if an adult was available to encourage them as they wrote. Similarly, Windschitl (2001) found that high school science students were unwilling to draw initial designs for technological constructions such as electrical circuits or catapults as a way to mediate their groups' building plans. In spite of teachers' prompting to the contrary, students repeatedly built their artifacts first (circuits, catapults, etc.) and tested them to see if they worked, only later to draw the completed artifact to ensure that the design "was right."

If teachers are willing to "re-culture" these kinds of classrooms, their first obstacle is the influence of their own personal histories as learners. Most teachers are themselves products of traditional schooling. As students, they were exposed to teacher-centered instruction, fact-based subject matter, and drill and practice (Russell, 1993). This past furnishes them with mental models of instruction—models that shape behavior in powerful ways. Teachers use such models to imagine lessons in their classrooms, develop innovations, and plan for learning (Kennison, 1990); teachers are more likely to be guided not by instructional theories but by the familiar images of what is proper and possible in classroom settings (Elbaz, 1981; Russell; Zeichner & Tabachnick, 1981).

Despite images and norms for schooling that have not changed substantively in decades, researchers have demonstrated that, under the right conditions, it is possible to introduce new participation structures that redefine the roles and responsibilities of teacher and students in relation to knowing and learning (Au & Jordan, 1981). In an example of this idea, Cobb and Yackel (1996) studied a group of first-graders who took it for granted that, when conversing with the teacher during mathematics class, they were to infer the answer that the teacher had in mind rather than articulate their own understandings. The teacher eventually succeeded in renegotiating the social norms of the classroom to liberate the students from previous expectations, to allow them to relate to her as young inquirers, and to encourage them to interact in a more exploratory way with the subject matter. In a related study, Cobb,

Wood, and Yackel (1991) describe the efforts of a teacher who created a classroom in which children came to perceive themselves as validators of one another's ideas. The teacher and the students worked together to establish norms (such as persisting in the resolution of challenging problems) and practices (such as explaining personal solutions to one's partner, listening to and making sense of the partner's explanation, and attempting to achieve consensus about answers and solution processes). The transformation was arduous at times, but within five months the new norms were in place and the students had adopted the new practices.

Classroom cultures such as those described above are rare, but they do exist at various levels. In a study of 24 elementary, middle, and high schools that were going through restructuring, Marks, Doane, and Secada (1996) found that students felt most positive about classroom environments in which they assisted each other and where they felt encouraged to take intellectual risks. In these "high support" classrooms, teachers established a culture for learning that supported success in complex tasks. Teachers disallowed students' unfounded assertions, flippant generalizations, and the familiar discourse that one teacher labeled "studentese" (p. 214). Teachers met answers with calls for evidence or explanation, frequently using phrases such as "What do you mean?" or "How do you know that?" One eighth-grade teacher stressed the importance of reasoning to her students: "I want you to get in touch with your own thinking, don't make it task of getting a paper in that has right answers on it. Try to let go of that. Try to see how you think about the problem" (p. 215). It is worth noting that, in these classrooms, teachers' challenging of student thinking was coupled with students' sense of feeling academically supported.

Disjunctures Between School Culture and the Lives of Students

Constructivist teachers intend for their students to generate meaningful ideas or make sense of subject matter. Meaningfulness and sense, however, are always relative to some frame of reference—a frame that, for learners in an increasingly multicultural society, is not likely to be shared among all members of the classroom. Goodman and Goodman (1990), in their work with elementary whole-language classrooms where learners were engaged in purposeful uses of written and oral language, found that teachers "needed to know a great deal about their students and the communities in which their students lived in order to provide for and support authentic opportunities for learning" (p. 246). The authors go on to say that classrooms traditionally have been organized to pass on "conventional wisdom," usually the wisdom of an educated elite that ignores the knowledge, culture, and wisdom of large groups of people representing the less powerful gender, races, languages, and ethnicities. In such situations, students' attempts at invention or interpretation of convention are rejected because they do not fit the teacher's values and expectations (Goodman & Goodman). Moll (1992) has described the difficulties of those children who must manage the often contradictory beliefs and values of the in-school and out-of-school cultures to participate successfully in both. He asserts that, for Native American, African American, Latino, and other minority children, the individualistic, competitive, and decontextualized character of "traditional pedagogy often constrains, and just as often distorts, what they do and what they are capable of doing" (p. 239).

In classrooms where teachers are unaware of students' interests and life experiences, they not only fail to build on local knowledge but essentially offer "dis-

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invitations" to participate in classroom discourse. Gutierrez, Rymes, and Larson (1995) observed how a teachers' use of an instructional script, based on his own cultural frame, became problematic when it was the only one used to construct an activity. A ninth-grade social studies teacher conducted an oral "current events" quiz with his working-class students, based on the assumption that their daily routine included reading the *Los Angeles Times.* Oblivious to differences between his middle-class habitus and the experiences of his Latino and African American students, he suggested that his lesson would test students' knowledge about "the world." While the teacher presented the quiz as if it pertained to news about some universally shared "world," the reality he referred to was quite specific—it was "the world of news available to most middle-class adults who read the paper with their morning coffee" (p. 455).

It is not just lack of knowledge of each other's experiences that separates teachers and students from diverse backgrounds; patterns of communication as well are different from one cultural group to another (Au, 1980; Phillips, 1983), and middle-class White teachers may find it difficult to work with discourse patterns favored by various ethnic and racial minorities (Lee & Anderson, 1993). There are cases, however, of successful interventions in bridging such disconnections. In Heath's (1983) work in a Black working-class community in the southeast United States, teachers (who commuted from a different, middle-class neighborhood) complained that their students were not participating in lessons. Heath helped the teachers to understand that the children were not used to their ways of posing known-answer questions about the labels and attributes of objects and events. She encouraged teachers to ask more open-ended questions in the classroom and to use photographs of local buildings and the nearby countryside to stimulate discussion among the students. By recording and replaying the resulting classroom discussions, she helped the students and the teachers understand each others' discourse patterns and respond to different types of classroom questions.

Lee (2001) has also demonstrated through her Cultural Modeling Project that African American Vernacular offers a fertile bridge for scaffolding responses to literary texts rather than being a deficit to overcome. She and a group of secondary English teachers in an urban high school incorporated literature in African American Vernacular, together with principles of composition and constructivist learning theory, to develop a curriculum that eventually helped the underachieving students build new norms for reading, value complex problems, and scaffold one another's sense-making strategies for interpreting texts. Lee concludes that

> talk, routines, activities, and artifacts are the stuff out of which classroom culture is constructed over time. . . . Students, in particular adolescents, contribute as much to classroom culture as teachers, because students either engage or resist the classroom norms. . . . I argue that what students bring from their home and community lives are just as important as the hybrid space that is constructed in the classroom. (p. 137)

Drawing on students' lived experiences and cultural backgrounds has had similar successful applications in mathematics (The Algebra Project, Moses, 1994) and science (Che Che Konnen, Rosebery, Warren, & Conant, 1992).

More recently Ladson-Billings (1994), in her work with successful teachers of African American children, has identified characteristics of a culturally relevant pedagogy that builds on students' varied cultural knowledge bases, discourse patterns,

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and conceptions of what schooling is for. Several of Ladson-Billings's recommendations conjoin cultural awareness with constructivist principles for teaching. Ladson-Billings urges mathematics teachers, for example, to provide various types of instructional scaffolding so that students can move from what they know to what they need to know. She also encourages teachers to seek comprehensive knowledge of both the students and the subject matter. Literature teachers are urged to apprentice students in a learning community rather than teach them in an isolated way, and to legitimize students' real life experiences as part of the official curriculum.

IV. Political Dilemmas: Confronting Controversy

Reform-oriented teaching often generates controversy and substantial conflict that can make success difficult, if not impossible, to achieve (Fullan, 1993; Mirel, 1994; Muncey & McQuillan, 1996). The inability to anticipate or handle objections from the larger school community can doom efforts that seem promising in many other respects (Fine, 1994; Sarason, 1996). In this regard, reconceptualizing the classroom as a constructivist culture is a risk-taking venture with political implications. The term *political* refers to those aspects of education that are linked with the exercise, preservation, or redistribution of power among students, teachers, administrators, parents, school board members, and other participants in the educational enterprise (Delpit, 1995; McLaren, 1989).

If constructivist instruction begins with what students know and is driven by meaningful interactions between the students and the teacher, it follows that there is a great deal of authority invested in the teacher to select and enact curriculum. Historically, policymakers have sought to control curriculum and standardize teaching rather than to educate teachers to make more sophisticated choices about their own curriculum (Apple, 1982), and this trend continues today (Rogers, 1999). Granting teachers the authority to create curriculum is often greeted with resistance from political conservatives who fear not only the teacher's autonomy in choosing content but also children's learning of critical thinking skills (Elliot, 1994). Such conservatives view teachers as technicians—called upon to implement classroom objectives that are tightly controlled and defined by others higher up on the administrative chain of command. Purpel and Shapiro (1995) argue as follows:

> Such a role increasingly precludes the involvement of teachers from any real authority for decision-making in the school. It robs them of the opportunity to think creatively about how they teach or what it is that should be taught. . . . The deskilled teacher is required to teach with little consciousness or conscience about the fundamental values that he or she is trying to initiate in the classroom. (p. 109)

Current reforms associated with teaching for understanding require teachers to transcend the goals of the basic skills movement that began in the 1960s; these reforms continue to figure prominently in the urban "school improvement" landscape (Carlsen, 1992; Cuban, 1990; Little, 1993). Whereas the original purpose of the skills movement was to produce graduates who possessed basic literacy, more recently the public has acknowledged the need to emphasize higher levels of literacy, greater understanding of subject matter, use of technology, and the capability to adapt to changing workplace demands. However, since most available texts and assessments stress basic skills outcomes, teachers, in turn, are pressured to use

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methods of direct instruction to teach to the objectives of minimum competency and basic skills achievement tests (Darling-Hammond & Wise, 1985; Talbert & McLaughlin, 1993). Some teachers alter the subject matter to teach to the test itself (Rowan, 1990). Paradoxically, while many states are urging educators to teach in ways that promote deeper student understandings, the pedagogy required for this is often actively discouraged by local and state policies. Such policies discourage teachers from spending time inquiring about their own practices and from adapting instruction to individual learners (Darling-Hammond, 1996).

Constructivist teachers must also deal with the standards movement, which now dominates the educational agenda and (because of the consequences that flow from high-stakes testing) influences instruction, curriculum, assessment, promotion policies, and other aspects of school life (Smerdon, Burkam, & Lee, 1999). The work of teachers is becoming more routinized as state education agencies and local school systems increasingly implement standardized curricula and use standardized achievement tests to assess performance of students, teachers, and schools. Teachers who aim beyond basic skills eventually must deal with the public perception that the diversity of student understandings emerging from constructivist instruction is not compatible with convergence on state and local standards. For example, student groups doing science projects on photosynthesis may have radically different approaches to developing their understanding of the phenomenon. One group may focus on chemical reactions at the molecular level; another group may examine how oxygen and carbon dioxide are exchanged between animals and plants on a global scale. These two groups will take disconcertingly divergent paths to understanding photosynthesis. This kind of project-based learning must be skillfully orchestrated so that, however students choose to identify and investigate problems, they will acquire an understanding of key principles and concepts as well as the thinking skills that are assessed on high-stakes tests. Indeed, proponents of project-based learning have demonstrated that these kinds of learning outcomes are entirely possible (Blumenfeld et al., 1991; Muncey, Payne, & White, 1999).

Teachers not only feel pressure from the standards movement but often feel they must "tune" their instruction to expectations from students and parents. In one such case (Tobin, 1993), a high school teacher employed a constructivist approach with his marine biology students, allowing them to decide what they would investigate, what materials to use, what products they would produce, and how they would demonstrate what they had learned. Yet the same teacher, in his chemistry class, used direct instruction and maintained an emphasis on factual knowledge. The reason for the difference? The chemistry class was populated by college-bound students who the teacher felt needed to master a corpus of specific facts to prepare for their undergraduate studies. The marine biology class, on the other hand, had lower-ability students. The teacher felt that it was important for them to enjoy what they were doing and to "learn by doing."

Parents, as educational stakeholders, often see constructivist approaches as dangerously experimental and are skeptical about the use of such pedagogy with their children. In one Midwestern middle school, two teachers developed an interdisciplinary social studies and language arts unit based on constructivist principles (Marlowe & Page, 1998). They introduced a process by which their fifth-grade students could develop their own curriculum. The students made lists of questions about themselves and their world and decided on themes for investigation

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(e.g., "Families"). Although the teachers reported impressive results regarding how much the students learned about themselves and others, several parents strongly disapproved of the project and threatened to take the teachers before the superintendent if they continued. In a similar set of circumstances, Oakes et al. (2000) reported that parents in one upper-middle-class school, where constructivist teaching was being implemented, formed an organization called the Group for Educational Accountability (p. 15). They presented a petition to their board of education demanding that the school return to a basics curriculum and to traditional teaching. The constructivist mathematics curriculum, in particular, had become a lightning rod for a group of fathers with degrees in science and engineering, who "blasted the program" as failing to prepare their children for the rigors of the university. The school conceded to parents' demands by creating a traditional curriculum strand that avoided progressive practices such as active learning, integrated curriculum, and a classroom community environment. Teachers in this strand closed their classrooms, placed desks in rows, and relied more heavily on textbooks. Oakes et al. commented on trends across a number of middle schools that they had studied:

> In every school, interdisciplinary curriculum, constructivist teaching, heterogeneous grouping and cooperative learning met intense ideological opposition from teachers and parents. Deeply-held, conflicting, pre-existing norms about the purposes of schooling and the nature of students fostered the formation of pro- and anti-reform camps, even before teachers could begin to explore the substantial changes on the horizon. (p. 91)

Teachers adopting progressive reforms have often found that they are responsible for persuading pupils, colleagues, parents, and school boards to accept new norms for learning as productive and desirable. For example, one new teacher, a graduate of a teacher education program that explicitly promoted constructivist pedagogy, attempted to incorporate a writing workshop and a literature-based reading program into her second-grade instruction (Fosnot, 1996). A number of vocal parents began to complain that skills pages were not coming home. The principal subsequently demanded that the teacher use the basal reader and spelling text and demonstrate the use of praise and reinforcement. In response, the teacher and her mentor from the teacher education program planned an open house for parents to explain the writing program and held a series of "Authors Teas" where parents could read pieces published by the students. Meanwhile, faculty from the teacher education program held inservices for the administrators. By February, the tide had turned and the new teacher had garnered substantial support from both administrators and parents.

Teachers who want to change the "grammar of schooling" today are more likely to succeed if they enlist the support of administrators who believe (or can be convinced) that constructivism serves the mission of the school (Tyack & Cuban, 1995). Spillane and Thompson (1997) argue that a district's capacity to support reform rests in the capacity of key administrators and teacher leaders to grasp the central reform ideas for themselves and to help others in the district to learn them. Administrators must be open to structural changes such as block scheduling or integrating the curriculum, perhaps even arranging for interested teachers to be placed together in team-teaching situations that are premised on the constructivist approach. Just as important, administrators must take the lead in defending a "less is more" curriculum approach. The compulsion to cover material is antithetical to one of the

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primary aims of constructivist instruction—the deep and elaborate understanding of selected core ideas. Unfortunately, the de facto curriculum for many teachers is the increasingly encyclopedic textbook. These textbooks fuel teachers' anxious sense that they must cover an ambitiously broad but desperately thin curriculum. Such an agenda encourages the culture of rote learning and precludes teachers' spending class time on authentic forms of inquiry.

In the public eye, the *idea* of constructivism suffers the same handicap as previous progressive philosophies because it is often framed as a questionable alternative to what already exists. The status quo is privileged by descriptors such as "basic," "historic," "fundamental," even "real"; by contrast, constructivist orientations are marginalized by terms such as "alternative" or "experimental." In communicating with the larger school community, educators must be armed with a grounded rationale for their curriculum and their teaching methods. Because constructivism is so contrary to historical norms, the rationale must be based on sound research that appears coherent and applicable to the local school context. Community members usually are suspicious of teaching methods so different from the ones they remember as students and sounding much like a laissez faire approach to education. As Ball (1993) has observed, when student understanding becomes problematic and knowledge less absolute (as it is in constructivist classrooms), teachers' own understandings soon become less certain as well—and being confronted with their own uncertainties can make teachers feel inadequate and other educational stakeholders less trusting.

Examining the Intersections of the Dilemma Categories

Distilling the "raw experiences" of constructivist teachers into four categories of dilemmas emphasizes the multiple layers of concerns that they must address in their working lives. These categories help us not only to appreciate the complexity of constructivism in practice but also to identify key aspects of teachers' experiences that influence whether progressive pedagogies are likely to survive in their classrooms. Each category embodies a set of issues for teachers and suggests areas of concentration for professional development or school reculturing.

Teachers, however, do not often organize their thinking around theoretical constructs; rather, they must process a continuous stream of emergent situations that are problematic, ill defined, and multidimensional (Stevens, 2000). Despite this article's tidy theoretical compartmentalization of teachers' experiences, each category of dilemma is intimately connected to the others in the context of teachers' professional lives. For example, teachers' design and execution of pedagogical strategies (category II) are contingent on how they conceptualize constructivism (category I). As another example, the authority that teachers are given within the political power structure of a school community (category IV) has major implications for the kind of culture that can be supported or discouraged in classrooms (category III). The overlaps between the four categories are loci for identifying how understanding and experience in one area can be combined with understanding and experience in another area to foster conditions for the vitality of constructivist learning environments.

Table 2 portrays intersections of teachers' conceptual, pedagogical, cultural, and political concerns. However, rather than representing each of the four areas as problematic, the table recasts them in positive terms—essentially as the attributes of a classroom teacher empowered by knowledge, experience, and support. In this

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TABLE 2
Conditions for the success of constructivist reforms in various combinations

	Pedagogical expertise	Cultural consciousness	Political acumen
Conceptual understanding	• Teachers have made sense of constructivism well enough to apply its principles flexibly in various instructional contexts. • Teachers recognize the limitations of instructional prescriptions for constructivist teaching; they use valuable practical knowledge of their students and their own teaching to fashion lessons that are adapted to their classroom contexts.	• Teachers understand the foundations of and distinctions between cognitive and social constructivism and the implications that each has for norms, beliefs, and practices that will characterize the culture of their classrooms. • To change the culture of their classrooms, teachers may undergo profound changes in their beliefs about what counts as learning, what classroom activities should be valued, and what the role of the teacher is.	• Teachers reflect on how assumptions about learning, implicit in constructivism, can be made public and intellectually accessible to others and can be reconciled with the values of the local community. • Teachers reference their well-integrated understanding of the principles of constructivism to fashion convincing arguments to explain to administrators, school boards, and parents the bases for this approach to teaching and why it is effective.
Political acumen	• Teachers use state and local standards as one source of guidance in developing a constructivist curriculum.	• Teachers redistribute power, privilege, and responsibility for learning in the classroom.	

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| Cultural consciousness | • Teachers manage the tensions of individualizing instruction while being accountable for all students' learning of certain key ideas.
• Teachers develop varied, more sophisticated, and defensible ways for students to provide evidence that they have learned.
• Teachers recognize and build on the discourse patterns and local knowledge of diverse learners.
• Teachers remove themselves as hubs of authoritative discourse; students are prompted to cultivate patterns of interaction in which they use tools, information resources, and dialogue to construct knowledge.
• Teachers alter classroom norms by developing questioning strategies that privilege the processes and sharing of thinking rather than rewarding only "right answers." | • Teachers develop public classroom guidelines for negotiating curricular decisions with learners.
• Teachers reconfigure classroom dialogue patterns to emphasize the use of argument, evidence, and interpretation rather than dependence on external authorities to supply "knowledge." |

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revised interpretation, conditions that originally were described as dilemmas now become *conceptual understanding, pedagogical expertise, cultural consciousness,* and *political acumen.* Each of the intersection cells presents conditions that must be realized for constructivist teaching to flourish in a classroom—conditions that are best realized when teachers draw on multiple dimensions of experience. For instance, because school boards or parents may be wary of nontraditional forms of instruction, teachers must draw on a firm conceptual understanding of constructivism, *and* they must anticipate the kinds of strategies needed in presenting their ideas about instruction to key educational stakeholders (combining *conceptual* understanding with *political* acumen). Teachers must be able to help others become familiar with the foundations of constructivism, describe how certain classroom practices have evolved from knowledge about how people learn, problematize current norms for teaching and assessment, and argue effectively for reevaluation of traditional definitions of learning and teaching. Without conceptual grounding, reform-minded teachers can generate neither coherent instructional strategies nor arguments to advance their aspirations past conservative gatekeepers in the school community.

Each of the cells in Table 2 contains only a few of the conditions related to constructivist teaching that require various combinations of conceptual understanding, pedagogical expertise, cultural consciousness, and political acumen. And despite the apparent clarity of the categories and their intersections, theoretical analyses (such as this) that fit the dilemmas into such containers must nevertheless recognize the organic nature of constructivism in practice, where the confluence of events in a teacher's life subsumes and even defies these artificial assignments.

Discussion

Putting constructivism into practice requires a host of teacher skills not directly implied by idealized design principles coming out of the learning sciences research or from the broader rhetoric of reform movements. Teachers, for example, must learn to capitalize on, rather than suppress, differences in students' existing understandings due to background; they must become critically conscious of the dynamics of their own classroom culture; and they must attend to patterns of classroom discourse as well as to the thinking that goes with them. By contrast, advocates of more traditional models of pedagogy can ignore all of that without undermining their assumptions about learning. Moreover, constructivist teachers are subject to an intensification of accountability because their teaching is so conspicuous, so unlike typical classroom practice, which, although perennially ineffective, is rarely subjected to fundamental critique. Even at the level of specific instructional strategies, constructivist teachers are obliged to have a deep and flexible understanding of what it means to put the strategies into practice—more so than their instructionally conservative peers. Knowledge of constructivism or even of its applied principles is simply not enough. It is not enough, for example, for teachers to *know that* students should make their thinking explicit by means of instructional conversations, writing, or other representations. Teachers must also understand

- Why this is an important practice
- In what context it should be used
- How it can be adapted to their students and their classroom context

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- How it should be combined with other, perhaps more traditional strategies (direct instruction, for example)
- How it relates to the assessment of learning

This means that teachers should be able to both relate the practice *back* to its origins in learning theory (to some degree) and *project* the likely consequences (pitfalls and benefits) of using the technique with their students.

Returning once again to the assertion that began this review: Is it possible for this country to produce the "infinitely skilled teachers" that Cremin (1961) claimed were necessary to carry on educational reforms? Given the profound challenges (in every dimension of the teaching experience) associated with creating constructivist classrooms, it appears that, without fundamental changes in teacher development and preparation, as well as in the culture of schooling in general, the prospect is all but nonexistent. At the same time, the fact that some educators are consistently and successfully able to employ student-centered pedagogy in teaching for understanding and to do so in culturally diverse settings stirs hope. The question is, How can the education community foster, *by design,* this kind of exceptional teaching?

Implications for Professional Development

The dominant training model for teachers' professional development—a model focused primarily on expanding the individual teacher's repertoire of well-defined and skillful classroom practices—is not adequate to the ambitious visions of teaching and schooling embedded in present reform initiatives (Little, 1993) and certainly cannot address the cultural and political complexities of constructivism in practice. Recent approaches to professional development have been more sensitive to local conditions and to teacher knowledge, although they nevertheless fail to recognize adequately that school reform is a complex endeavor and a sociocultural process, influenced by the histories of the institutions and the people involved (Clandinin & Connelly, 1998).

In efforts to help teachers understand and implement constructivism, researchers have applied elements of social constructivism to the design of professional development itself. For example, Englert and Tarrant (1995) have established learning communities for literacy teachers to facilitate examination of their own classroom practices. These communities of teachers have attempted to translate the ideas underlying the social constructivist perspective into curriculum and pedagogy for students with learning difficulties, at the same time applying these principles to their own professional development. The teachers discuss their beliefs about teaching and learning with one another, critique their own practice, systematically test new ideas, and share their findings with one another. Similar professional development research has been conducted with secondary school teachers (Grossman & Wineburg, 1997), elementary school teachers in science (Palincsar, Magnusson, Marano, Ford, & Brown, 1998), and elementary school teachers in mathematics (Schifter, 1996). Through these and other efforts, the emphasis of professional education has shifted to posing questions, not just answering them, and to interrogating one's own practice and the practices of others, making assumptions explicit, and making classrooms sites for inquiry (Cochran-Smith & Lytle, 1999).

As observed by Thompson & Zeuli (1999), this kind of learning can be more than merely additive (grafting new skills onto an existing repertoire); it can be

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transformative (fostering fundamental changes in deeply held beliefs, knowledge, and habits of practice). Within this frame of thinking it is particularly educative to give close attention to students' work, especially their responses to open-ended questions or to problems where students explain their thinking. Recognizing that what students have learned is not necessarily what one has taught can produce a kind of dissonance—a puzzling, even shocking experience that prompts some teachers to begin an extensive reconsideration of their ideas about teaching and learning (Darling-Hammond et al., 1995).

In accordance with these trends in professional development, teachers seeking to more deeply understand constructivism in practice could benefit greatly from the case histories of other teachers who have attempted pedagogical reforms. Currently, the knowledge base about constructivist teaching is largely codified in lists of prescriptive instructional principles, which are clearly stated but do not instill in teachers the necessary mental images of constructivism as practiced in authentic classroom situations. And only marginally more useful are brief, decontextualized examples of how these principles can be applied to classroom practice. In their study of elementary school teachers implementing constructivist-oriented reforms, Elmore et al. (1996) report that "in all instances, their practices were unlikely to change without some exposure to what teaching actually looks like when it's being done differently and exposure to someone who could help them understand the difference between what they were doing and what they aspire to do" (p. 241). Similarly, in Mintrop's (2001) previously described account of preservice teachers' failed attempts to learn the Fostering a Community of Learners model of instruction, participants reported being continually frustrated by not having models (videos, actual units of instruction) to give them an idea of how this kind of teaching looked in practice.

Extended vignettes of real teachers attempting constructivist instruction are promising tools for helping teachers develop mental models of constructivism in practice. Still better are richly elaborated case studies that focus on the long-term struggles of classroom teachers who manage the intellectual challenges, pedagogical renewals, cultural transformations, and political upheavals of transforming one's practice. Studies of such cases can form the basis of inquiry groups in which participants learn to identify problems, recognize key players in the school community and their agendas, and become aware of factors that contribute to success or problems at various levels.

Creating and Continuing Important Conversations

The analysis presented in this article is intended to stimulate conversations about conditions that define both opportunities and dilemmas for progressive educators. These conversations must engage teachers with researchers. Developing effective principles for progressive teaching is a knowledge-intensive, broad-ranging endeavor involving reciprocity between those who practice and those who investigate and inform practice. If research is to be meaningful to those who teach, it must address teachers' concerns and points of view (Shavelson, 1988), acknowledging the mundane realities of constructivism in practice and creating knowledge from the "inside out" as well as the "outside in" (Lieberman, 1992). As compelling as the rhetoric is, the image of the constructivist classroom remains too idealized to be useful to teachers. For conversations about constructivism to become relevant

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to educators, they must be situated in the culture of the classroom and take into account the range of challenges that confront teachers who are willing to improve instruction and take risks in doing so. From this perspective, studying entire classrooms, schools, and communities as units of analysis becomes important. Classroom and school ethnographies that pay attention to the lived experiences of participants will likely provide us with much-needed insights into the range of contexts in which constructivist instruction can succeed.

Teachers must also create opportunities for conversations among themselves (*in addition* to those that occur in professional development situations), if for no other reason than to share their beliefs about teaching and learning. This is not an easy task because schools maintain a dispiriting array of regularities that promote isolation (Heckman, 1987). Teachers rarely discuss among themselves productive approaches to classroom problems or even share how they teach; consequently, the individual and collective beliefs that drive school culture remain unstated and unexamined. In their study of the stability of the "grammar" of schooling, Tyack and Cuban (1995) suggest that what has held the status quo in place is not so much conscious conservatism as it is unexamined institutional habits and widespread cultural beliefs about what constitutes a "real school" and "real teaching." The ways that new kinds of conversations among colleagues can be initiated and mediated toward productive ends is yet another challenge.

The ideas of whole-school or departmentwide efforts to reform instruction seem sensible, but several researchers have also noted the success of smaller groups of teachers who come together informally to advance their teaching. On the basis of his findings about schools that support constructivist-oriented instruction, Newmann and Associates (1996) recommend that teachers locate "like-minded collaborators" as a critical step in advancing their practice. Oakes et al. (2000) describe schools in which pairs of teachers interested in constructivist teaching came together to develop shared goals, values, support, and respect. The authors observe that the teachers' "daily conversations were peppered with theories of learning and teaching, expectations, classroom relationships and talk of teaching" (p. 81). Similarly, in an ethnography of middle school teachers learning to use technology, Windschitl and Sahl (2002) describe how one participant's regular social access to a like-minded colleague helped her picture how other teachers were experimenting, both with technology and with constructivist practices:

> Carol's joint lesson planning with Joan was a particularly powerful "learning-how" setting because, with Joan, she could have ongoing conversations about how technology could be used within the context of constructivist teaching. The results of their equal-status relationship (both novices to technology and constructivist practice), appeared to be as fruitful as those which might be expected from a relationship in which one is mentored by a "more knowledgeable" other. (p. 199)

Dialogue should also broaden between practitioners and other school reformers. Current progressive reform has a democratically oriented vision for schools at its core. Reformers who see constructivism as a means to bring about democracy must consider how practitioners can infuse constructivism with a democratic social vision. It seems likely that constructivist principles can be combined with democratic ideals and pluralistic themes to assist progressive reforms. However, it would

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be irresponsible to suggest that constructivism can act as *the* fulcrum of educational reform. Constructivism is not a philosophical platform from which policy about social justice, equitable schools, de-tracking, and inclusion can be fashioned. It is merely a promising theory that describes learning and suggests principles for instruction; it has only indirect implications for curriculum. From the roots of constructivism comes a system of values that has been difficult to locate in the sphere of human concerns. It offers no social vision and no incentives for learners to participate in the community or the larger culture outside school (O'Loughlin, 1992). Learners develop the intellectual tools to think autonomously as well as to work collaboratively with others, but there are no sustaining moral or social visions that participants carry with them from the constructivist classroom culture. Its pedagogy would clearly be more transformative of individuals and society if it were inclusive of the complexities of race, class, and gender (Rivera & Poplin, 1995). Thus the intellectual autonomy championed by constructivism does not necessarily translate into a shared vision of a better society. These arguments reinforce the need for teachers and other reformers to identify the limits of the influence of constructivism on learning as clearly as they portray its potential.

Conclusion

The most effective forms of constructivist teaching depend on nothing less than the re-culturing of the classroom, meaning that familiar relationships, norms, and values have to be made public and be critically reevaluated (Fullan, 1993; Joseph et al., 2000). As a result, business as usual gives way to dynamic and often de-stabilizing changes in classroom practice. The very features that make constructivist classrooms so effective also create tensions that complicate the lives of teachers, students, administrators, and parents.

Some stakeholders in the educational community see constructivism as the latest theory du jour—attaching fuzzy new rhetoric to old ideas and distracting us from teaching the "fundamentals." In many cases of uncritical or unsophisticated use of "constructivist" principles, this reputation is deserved. If, however, teaching reforms premised on constructivism cause us to collectively problematize classroom practice, prioritize the learner in the grand scheme of schooling, and work in new ways with local cultures and politics, the theory can be an important catalyst for change.

The major dialogues in education over the last century have focused on the advancement of learning (Brown, 1994). I quote Darling-Hammond (1996), who argues that the major challenge of the next century will be the advancement of teaching. The resolution of that challenge, she says,

> will depend on our ability to develop knowledge for a very different kind of teaching than what has been the norm for most of this century. If we want all students to actually learn in the way that new standards suggest and today's complex society demands, we will need to develop teaching that goes far beyond dispensing information, giving a test, and giving a grade. We need to understand how to teach in ways that respond to students' diverse approaches to learning, that are structured to take advantage of students' unique starting points, and that carefully scaffold work aimed at more proficient performances. We will also need to understand what schools must do to organize themselves to support such teaching and learning. (p. 7)

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To transform practice that can sustain progressive educational change, researchers, reformers, and practitioners must jointly fashion a vision of constructivism that involves more than theories of learning or instruction. The vision should include a picture of schooling with all the players, the conflicts, and the tensions. The emerging theories of instruction can evolve into more sophisticated and useful incarnations only when informed by the knowledge of constructivism in practice. Teachers, as the central figures in classrooms and the principle agents of reform, are prime candidates for the examination of how this pedagogy will flourish or flounder in our nation's schools.

Notes

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[1] See the *National Science Education Standards* (National Research Council, 1996), *National Standards for Social Studies Teachers* (National Council for the Social Studies, 1997), and *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1992). Both the Coalition of Essential Schools (Sizer, 1992) and the National Association of Secondary School Principals (NASSP), in partnership with the Carnegie Foundation for the Advancement of Teaching (NASSP, 1996), have also called for an emphasis on student-centered, understanding-based teaching.

[2] The term *dilemma* is used here in the broadest sense, referring to a wide variety of problematic situations that defy easy answers.

[3] Unfortunately, there is little historical documentation of teachers' encounters with children over academic material, although nearly every other aspect of teaching has been documented—the schooling of teachers, working conditions and contracts, curriculums, how teachers were exploited, even the buildings they worked in (Cohen, 1989; Tyack, 1989).

[4] *Constructivist instruction* and *student-* or *child-centered teaching* are interrelated but not synonymous terms, and each has contested meanings (see Nola, 1997; Chung & Walsh, 2000). In this article, teaching that allows students to use their own interests as one of the bases of classroom activities, that encourages productive student-student dialogue in the quest of meaning-making, and that supports the collaborative development of unique products that are evidence of understanding is considered both student-centered and constructivist.

[5] *Social constructivism,* or the *emergent perspective,* is related to, but distinct from, the sociocultural and sociohistorical perspectives on learning. These three theoretical views have different origins and view learner development through different lenses, but their implications for the design of learning environments are similar. In light of the similarities, I use the label *social constructivism* to circumscribe the compatible and classroom-relevant principles of the emergent, sociocultural, and sociohistorical perspectives (see Cobb & Yackel, 1996, and Cole, 1990, for a more comprehensive discussion of these theoretical approaches).

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