Review of Educational Research
Fall 2002, Vol. 72, No. 3, pp. 387–431

Policy Implementation and Cognition: Reframing and Refocusing Implementation Research

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Education policy faces a familiar public policy challenge: Local implementation is difficult. In this article we develop a cognitive framework to characterize sense-making in the implementation process that is especially relevant for recent education policy initiatives, such as standards-based reforms that press for tremendous changes in classroom instruction. From a cognitive perspective, a key dimension of the implementation process is whether, and in what ways, implementing agents come to understand their practice, potentially changing their beliefs and attitudes in the process. We draw on theoretical and empirical literature to develop a cognitive perspective on implementation. We review the contribution of cognitive science frames to implementation research and identify areas where cognitive science can make additional contributions.

KEYWORDS: *classroom practice, education policy, intergovernmental relations, policy implementation, school reform.*

> Policy ideas in the abstract . . . are subject to an infinite variety of contingencies, and they contain worlds of possible practical applications. What is in them depends on what is in us, and vice-versa. (Majone & Wildavsky, 1978, p. 113)

Over the past decade we have witnessed unprecedented efforts to reform the quality and content of instruction in America's schools. Gaining momentum in the late 1980s, reform initiatives, frequently clumped under the rubric of "standards," have garnered considerable attention from local and state policymakers as well as federal lawmakers. Many state governments, which a decade earlier took little interest in curricular and instructional matters, have developed policies that define challenging learning standards for all Americans (Fuhrman, 1994). Forecasts of the demise of the standards in the late 1990s appear to have been premature, as learning standards occupy a central position in President George Bush's education agenda. The reform initiatives call for more intellectually demanding content and pedagogy for *everyone,* challenging deeply rooted beliefs about who can do intellectually demanding work and questioning popular conceptions of teaching, learning, and subject matter. Attempting to change what counts as teaching and learning in K–12 schools, reformers are using public policy to press for fundamental and complex changes in extant school and classroom behaviors.

Although standards represent some new directions in education policymaking, they face a familiar public policy tension: When the legitimacy of policymakers flows from the consent of the governed, the state risks losing legitimacy when citizens equate force, often necessary for successful implementation, with state action. Hence local officials often have a great deal of discretion vis-à-vis federal and state policies. During the past 50 years of educational policymaking, this dialectic of requiring change and allowing for local autonomy has played itself out. If compliance is the goal of policy implementation, then how local practice can change through public policy initiatives is especially problematic. In this article we outline an approach to understanding the conditions under which such change is possible by focusing on how local actors interpret the demands that are made on them. Unpacking the notion of discretion as currently understood in policy analysis, we add a cognitive dimension that demonstrates how discretion acquires content based on the interplay between the policies that attempt to direct local action and the ways in which that direction is constructed by locals.

Our aim is not to undertake a comprehensive review of the literature on the implementation of education policy, but rather to explore in depth one key, though seldom explored, dimension of the implementation process: agents' sense-making with regard to reform initiatives. Comprehensive reviews serve an important function by identifying variables affecting policy implementation, but they are also limited in that they frequently fail to develop integrative models (O'Toole, 1986). The integrative framework that we outline here is designed to make transparent the cognitive component of the implementation process by identifying a set of constructs and the relations among these constructs. We develop a theoretically and empirically grounded cognitive framework to characterize sense-making in the implementation process, drawing on scholarship in basic cognitive processes, social cognition, and situated cognition, as well as a small but growing implementation literature that investigates implementing agents' cognition in reform situations.

After briefly reviewing prominent perspectives on policy implementation, we develop our argument: What a policy means for implementing agents is constituted in the interaction of their existing cognitive structures (including knowledge, beliefs, and attitudes), their situation, and the policy signals. How the implementing agents understand the policy's message(s) about local behavior is defined in the interaction of these three dimensions. We intentionally begin with an oversimplified notion of human cognition, and then add layers of complexity to the human sense-making process. We use the term "cognitive framework" in a broad sense that takes into account basic information processing as well as the complexities and influences involved in the processing of information about abstract ideas (including reform ideas such as "student-centered classroom," "inquiry science," and "mathematics discourse"), the influence of motivation and affect, and the ways that social context and social interaction affect sense-making. We develop this framework in three stages:

- Individual cognition: First, we explore the local implementing agent as individual sense-maker, paying attention to how individuals notice and interpret stimuli and how prior knowledge, beliefs, and experiences influence construction of new understandings. Next, we move from a purely cognitive account to consider how the implementer's beliefs, values, and emotions influence the sense-making process.

- Situated cognition: We complicate the human sense-making process by arguing that situation or context is critical in understanding the implementing agent's sense-making. Drawing on work in sociology and social psychology, as well as on recent implementation studies, we illuminate how multiple dimensions of a situation influence the implementing agent's sense-making from and about policy. We then complicate the social sense-making process by adopting a situated cognition perspective, arguing that situation or context is not simply a backdrop for the implementing agent's sense-making but a constituting element in that process. We then consider the implications of this perspective for implementation scholarship.
- Role of representations: We consider the role of policy stimuli in implementing agents' sense-making, focusing chiefly (in keeping with our cognitive frame) on the role of external representations in the sense-making process. Of critical concern is the development of representations of ideas about changing practice in policy so that they can enable the implementing agent's sense-making. We consider the design challenges of crafting policy to influence teaching.

We conclude by examining the affordances of a cognitive framework in the implementation process.

A few caveats at the outset. First, the perspective developed here is meant to supplement rather than supplant extant models of the implementation process. The framework is *not* proposed as an alternative to conventional models. Instead, it is meant to characterize the way that natural sense-making processes can lead to the types of challenges observed in reform efforts. Second, in constructing a cognitive framework, we go beyond arguing that it matters how implementing agents interpret policy; we identify types or categories of variables that are likely to influence such interpretations. However, our goal in this article is to identify and define the broad parameters of a cognitive framework, not to specify in detail each element of the framework. Third, this article should not be interpreted as suggesting a normative perspective—as assuming that local agents ought to implement directives according to the intentions of state or national policymakers and reformers. We do not assume that policymakers get it right all or even most or the time.[1] Indeed, the framework sketched in this article allows for implementing agents' rejection or fundamental revision of state and national policy proposals that are unworkable or harmful. But to reject a policy directive because it is not workable in local practice, implementing agents must first understand what it is that the directive is asking them to do. To understand directives requires cognitive processes of interpretation.

Implementation Research: A Retrospective

Conventional Accounts

Implementation scholars have offered numerous explanations for how policy is implemented that focus on the nature of social problems, the design of policy, the governance system and organizational arrangements in which policy must operate, and the will or capacity of the people charged with implementing policy. Many of these explanations are premised on principal–agent and rational choice theories, in which the principal requires the assistance of an agent to achieve a particular outcome. The agent's decisions are guided by rational choice ideas in which utility

maximization is the guiding principle for human behavior. Both the principal and the agent are motivated by self-interest; hence appropriate incentives and monitoring systems are essential if principals are to have their way. Rational choice theory assumes that choice is at the center of an individual's life, that there is no interaction among individuals' choices or preferences, and that all choices can be reduced to personal interest or utility maximization. Individual preferences are not considered to be vague or contradictory (Moessinger, 2000).

Some explanations for implementation failure focus on the inability of principals to formulate clear policy outcomes or to adequately supervise the implementation of their goals. The inability of state or federal policymakers to craft clear and consistent directives with respect to the behaviors desired from implementing agents and agencies can undermine local implementation (Mazmanian & Sabatier, 1981; Pressman & Wildavsky, 1974; Van Meter & Van Horn, 1975; Weatherly & Lipsky, 1977). Policy ambiguity is often a function of coalition and consensus building in the policy development process, but it is also a function of the social problems addressed by policymakers. The behaviors that a policy targets for change and the magnitude of the changes sought affect the likelihood of successful implementation; policies that press for incremental changes are more likely to engender a positive response and be implemented (Cuban, 1988; Lindblom, 1965; Wildavsky, 1974). In addition, when policy directives pair a clear implementation goal with tractable procedures (i.e., policies that have a valid theory connecting behavioral change to outcome and an effective and efficient way to measure change in local behavior), they are more likely to be implemented, in part because in such cases the principals can monitor their agents' behavior more effectively and efficiently (Mazmanian & Sabatier, 1983).

Other explanations focus on the governance system and organizational arrangements that structure principal–agent relations. Responsibility for policymaking is not clearly demarcated or defined in the various branches and levels of government that exercise policy jurisdiction, often over the same issues. The segmented policy system sends a mélange of mixed and often competing signals that can undermine the authority and power of policy (Cohen & Spillane, 1992; Porter, Floden, Freeman, Schmidt, & Schwille, 1988; Pressman & Wildavsky, 1974; Weatherly & Lipsky, 1977). These arrangements complicate principal–agent relations because it is often unclear to which policy signals implementing agents should attend and to whom they are accountable for implementation.

Still other explanations focus on the autonomy of implementing agents and their unwillingness and limited capacity to change their behavior (Berman, 1978; Hjern, 1982; Lipsky, 1978; McLaughlin, 1987). Implementing agents fail to notice, intentionally ignore, or selectively attend to policies that are inconsistent with their own (and/or their agency's) interests and agendas (Firestone, 1989). Policies that fit their agendas are more likely to be implemented, and those that do not are more likely to be either opposed or modified so that they do fit. The implementing agents' ability to ignore policy is in great part a function of the nature of their work, which involves unpredictable human relations not reducible to programmatic routines or easily regulated and monitored from above by principals (Cohen, 1988; Lipsky; Weatherly & Lipsky, 1977). Implementing agents and agencies also often lack the capacity—the knowledge, skills, personnel, and other resources—necessary to work in ways that are consistent with policy (Firestone; Fullan, 1991; McLaughlin, 1990).

A Limitation of Conventional Accounts

Many conventional accounts, regardless of the variables they foreground, assume that implementers understand a policy's intended messages or that failure to understand results from the policy's ambiguity. Treating policy as a stimulus, these accounts find that implementation failure results when the stimulus is unclear or weak, or when the stimulus does not fit with the agendas and interests of utility-maximizing implementing agents. But recent work challenges some of these assumptions. Research in political science suggests that bureaucrats tend to be hardworking and that they do *not* typically work to undermine policy or directives from above (Brehm & Gates, 1997). Recent studies of the implementation of education standards show that teachers and school administrators frequently not only heed higher-level policies but also work hard to implement them (Guthrie, 1990; Firestone, Fitz, & Broadfoot, 1999; Hill, 2001; Wolf, Borko, Elliott, & McIver, 2000). Yet the same studies offer ample evidence of limited implementation of state and national policies. Portrayals of implementing agents as resisters and saboteurs working to circumvent policy proposals that do not advance their self-interest are insufficient to account for these outcomes.

We suggest that, by assuming that implementing agents understand what policymakers are asking them to do, most conventional theories fail to take account of the complexity of human sense-making. In these accounts, implementing agents are portrayed, either implicitly or explicitly, as intentionally interpreting policy to fit their own agendas, interests, and resources. Consistent with their rational-choice foundation, these accounts assume that teachers and other implementing agents are responding to the ideas intended by policymakers, which they either ignore or modify.

Research in cognitive and social psychology, however, suggests that caution is necessary here. Viewing failure in implementation as demonstrating lack of capacity or a deliberate attempt to ignore policy overlooks the complexity of the sense-making process. Sense-making is not a simple decoding of the policy message; in general, the process of comprehension is an active process of interpretation that draws on the individual's rich knowledge base of understandings, beliefs, and attitudes (Carey, 1985; Markus & Zajonc, 1985; Rumelhart, 1980; Schank & Abelson, 1977). Differences in interpretation or in acting on understandings are a necessary aspect of the human understanding process. Sense-making is fraught with ambiguity and difficulties: "[T]he human condition is small brain, big problems" (Lindblom, 1977, p. 66). The same mechanisms, such as making inferences or relying on heuristics that make cognition powerful, can also lead to biases and errors in understanding and decision making (Nisbett & Ross, 1980). Thus implementing agents' sense-making provides numerous opportunities, aside from any willful or intentional efforts to revise policy to fit with local agendas, for the transformation of policymakers' ideas about changing local practice. To explain the influences on implementation, we must explore the mechanisms by which implementing agents understand policy and attempt to connect understanding with practice.

Some conventional accounts allow for implementation problems resulting from implementing agents' understanding or "misunderstanding" (Berman & McLaughlin, 1977; Pressman & Wildavsky, 1974). As Werner puts it, "implementation as a minimum includes shared understanding among participants concerning the implied presuppositions, values, and assumptions which underlie a program, for if participants

understand these, then they have a basis for rejecting, accepting or modifying a program in terms of their own school, community and class situation" (Werner, 1980, p. 62). But the process by which implementing agents come to understand policy, the understandings that result, and the consequences of those understandings for policy implementation are rarely analyzed explicitly in conventional implementation models.

Sketching a Cognitive Framework of Implementation

By illuminating the interpretive or sense-making dimension of the implementation process, our cognitive framework is designed to underscore the need to take account of, and to unpack, implementing agents' sense-making from and about policy. Moving beyond a purely behavioral focus on what implementing agents do, we articulate a model for how they construct understandings of the policy message, construct an interpretation of their own practice in light of the message, and draw conclusions about potential changes in their practice as a result. A cognitive perspective underscores that behavioral changes have a fundamental cognitive component. From this perspective, a policy message about changing implementing agents' behavior is not a given that resides in the policy signal (e.g., legislation, brochures, regulations). Policy messages are not inert, static ideas that are transmitted unaltered into local actors' minds to be accepted, rejected, or modified to fit local needs and conditions. Rather, the agents must first notice, then frame, interpret, and construct meaning for policy messages. Conceptualizing the problem of implementation in this way focuses attention on how implementing agents construct the meaning of a policy message and their own behavior, and how this process leads or does not lead to a change in how they view their own practice, potentially leading to changes in both understanding and behavior.

Scholars have increasingly applied a cognitive framework in studying the policy process (Jobert & Muller, 1987; Sabatier, 1998; Surel, 2000). Cognitive frames have also been used in studies of policy implementation in education (Ball, 1994; Cohen & Weiss, 1993; Spillane, 2000), public policy (Weiss, 1989, 1990; Yanow, 1996), political science (Hill, 1999; Lin, 1998, 2000), sociology (Marris, 1975), and social psychology (Kunda, 1999; Nisbett & Ross, 1980; Weick, 1995). Under rubrics that include "interpretation," "cognition," "learning," "sense-making," and "reading," these scholars argue that the ideas that implementing agents come to understand or interpret from policy are an integral, and largely unexplored, component of the implementation process. Scholars have investigated how various dimensions of this sense-making process influence implementation. Some work concentrates on implementing agents' prior knowledge (Cohen & Weiss, 1993; Guthrie, 1990) and the analogies that implementing agents draw between new ideas and their existing understandings (Spillane, 2000). Other work concentrates on how aspects of the social situation—including organizational and community history (Lin, 2000; Yanow, 1996), organizational segmentation and professional expertise (Spillane, 1998b), professional discourse (Hill, 1999), and formal and informal networks (Coburn, 2001)—influence implementing agents' sense-making.

Building on this work and situating it in the broader literature on basic cognitive processes and social cognition, the integrative framework that we outline involves three core elements: the individual implementing agent, the situation in which sense-making occurs, and the policy signals. Cognitive science scholarship suggests that

what individuals make of new information has much to do with their prior knowledge, expertise, values, beliefs, and experiences. The first component of our framework involves applying these mechanisms of comprehension and sense-making to an analysis of implementers making sense of policy and the complex practices of learning and teaching. Whereas cognitive scientists have set as their goal finding common or universal patterns in human cognition—"cognitive universalism"—some sociologists and psychologists argue for more attention to the social and situated dimensions of cognition (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Resnick, 1991; Zerubavel, 2000). Individuals do not make sense of their world in a vacuum; their sense-making is situated in particular "thought communities," including, but not limited to, professions, nations, political parties, religions, and organizations (Mannheim, 1936; Resnick, 1991; Zerubavel, 2000). Hence, in the second component of our framework, we consider how aspects of the situation influence what implementing agents notice and how they interpret what they notice. A third component of our framework is the policy. Although policy might be treated as one element of the situation, we single it out because of its special significance in considering issues of implementation. The design challenge for policymakers involves representing ideas about instruction in ways that enable the implementing agent's sense-making; inherent in this task is a critical tension between the abstract and the concrete in communicating the ideas. We address each element separately below.

The Implementing Agent as Sense-Maker

Individuals assimilate new experiences and information through their existing knowledge structures (Rumelhart, 1980; Schank & Abelson, 1977). From this perspective, what a policy comes to mean for implementing agents depends to a great extent on their repertoire of existing knowledge and experience. In this section, we discuss the cognitive processes involved in making sense of complex activities such as teaching and learning, and we consider how these processes explain observed findings about the influence of policy on practice.

Prior Knowledge and Sense-Making

In conventional accounts, if implementing agents' interpretations of policy signals are analyzed, "misinterpretations" are often portrayed as willful efforts on the part of implementing agencies and agents to sabotage implementation or to justify their modifications of the policy. Yet it is clear in many cases that agents faithfully attempt to implement reforms but fail. Teachers' prior beliefs and practices can pose challenges not only because teachers are unwilling to change in the direction of the policy but also because their extant understandings may interfere with their ability to interpret and implement the reform in ways consistent with the designers' intent.

What role do prior knowledge, beliefs, and experiences play in shaping agents' understanding of policy and their relation to it? Considering the role of human sense-making in implementing policy underscores the importance of unintentional failures of implementation, while still allowing for willful misinterpretation. What is paramount is not simply *that* implementing agents choose to respond to policy but also *what* they understand themselves to be responding to. The "what" of policy only begins with the policy texts, such as directions, goals, and regulations. As is conveyed by the quotation of Majone and Wildavsky (1978) that opens this article, the content of a policy—its ideas about changing extant behavior—depends crucially on

the implementing agents—their ideas, their expertise, and their experiences. Individuals must use their prior knowledge and experience to notice, make sense of, interpret, and react to incoming stimuli—all the while actively constructing meaning from their interactions with the environment, of which policy is part.

Recent empirical work illuminates the importance of agents' prior knowledge in their implementation of policy. As Cohen and Weiss wrote, "when research is used in policymaking, it is mediated through users' earlier knowledge," with the policy message "supplementing" rather than "supplanting" teachers' and other implementing agents' prior knowledge and practice (Cohen & Weiss, 1993, p. 227). What are the implications of building new understandings of policy on present understanding—of supplementing rather than replacing knowledge?

We emphasize "sense-making," rather than referring simply to "information encoding" or "interpretation," to focus on the active attempt to bring one's past organization of knowledge and beliefs to bear in the construction of meaning from present stimuli. All acts of understanding require accessing prior knowledge and applying it to guide the noticing, framing, and connecting of new ideas and events to what is already encoded in memory (Mandler, 1984; Rumelhart, 1980). This is an active process, not a passive encoding of information (von Glasersfeld, 1989). What is novel is always seen in terms of past understandings. In large part, "people generate what they interpret"—they create the environment and select the cues and signals that they interpret (Weick, 1995, p. 34).

The importance of accessing the known and familiar to make sense of new stimuli has been a recurring theme in cognitive work on comprehension, drawing on early notions of building and using schemas from Gestalt and developmental psychology (Bartlett, 1932; Piaget, 1972). The fundamental nature of cognition is that new information is always interpreted in light of what is already understood (Brewer & Nakamura, 1984; Greeno, Collins, & Resnick, 1996). An individual's prior knowledge and experience, including tacitly held expectations and beliefs about how the world works, serve as a lens influencing what the individual notices in the environment and how the stimuli that are noticed are processed, encoded, organized, and subsequently interpreted. Schemas are knowledge structures that link together related concepts used to make sense of the world and to make predictions. They represent understandings of complexes of ideas for everyday objects and events, such as "kitchen," "classroom," "going shopping," or "reviewing homework" (Mandler, 1984; Rumelhart, 1980; Schank & Abelson, 1977). Schemas are not just collections of associated features; rather, they seem to encode causal explanations or theories about how the world operates (Keil, 1989; Markus & Zajonc, 1985; Murphy & Medin, 1985; Schank, 1986). Schemas also encode knowledge about the social world, representing associations of expectations about people and social situations (Cantor & Mischel, 1979; Cantor, Mischel, & Schwartz, 1982; Trope, 1986), such as how one interacts with others at a party or business meeting and how one expects librarians, musicians, and auto mechanics to appear and behave.

Schemas can guide the processing of cognitive and social information, helping to focus information processing and enabling the individual to use past understandings to see patterns in rich or ambiguous information. Accessing a schema from memory affects comprehension by activating collections of expectations that are used to fill the gaps in what is explicitly said or observed, driving the "top-down" nature of comprehension, so that much of what is understood is in fact inferred from input that is

only partially explicit (Brewer & Nakamura, 1984; Schank & Abelson, 1977). For example, understanding and memory for narratives involve accessing and using schemas to construct a network of coherent goals, events, and states, filling gaps between those goals, events, and states explicitly mentioned and the many plausible inferences "invited" by the schema (Bower, Black, & Turner, 1979; Bower & Morrow, 1990; Brewer & Nakamura, 1984). People naturally categorize what they see in terms of existing knowledge structures encoding conceptions of types of people or behaviors (Kunda & Thagard, 1996; Trope, 1986). Once accessed, a schema can focus an interpretation, helping to resolve ambiguous information, affecting the interpretation of information presented in that context (Higgins, 1996). For example, people may interpret an ambiguous statement or facial expression on the basis of how they would expect a person to react in that situation. What people expect may also lead them to pay more attention to information that confirms the expectation (Klayman & Ha, 1987; Olson, Roese, & Zanna, 1996). Schemas allow memory to be reconstructed, using general knowledge to search for and infer likely contextual information from the partial information explicitly recalled (Kolodner, 1983; Reiser, Black, & Abelson, 1985).

Research on schemas has also stressed the mental representation of dynamic processes, called mental models (Gentner & Stevens, 1983). An important finding in this research is that people construct intuitive models from their experience, apart from formal instruction (Greeno, 1989; Vosniadou & Brewer, 1992), and use those models to envision a situation, essentially "running" the model to make predictions about its causes and outcomes. People build intuitive models of the physical world (Carey, 1985; Smith, diSessa, & Roschelle, 1993) and the world of social interactions (Cantor & Mischel, 1979; Cantor et al., 1982; Markus, 1977; Nisbett & Ross, 1980). For example, intuitive models allow people to predict what will happen when someone pushes a chair or bounces a ball, or how a potential employer will react to various kinds of behavior in a job interview. Similarly, people construct their own intuitive models that encode their biases, expectations, and explanations about how people think and how they learn (Dweck, 1999; Hammer & Elby, 2002). Intuitive models of learning and classroom interactions should strongly influence how agents interpret reforms. For example, when asked to interpret a proposed instructional practice, such as encouraging elementary students to explain their mathematical reasoning, one applies tacit knowledge about children and the discipline to mentally envision the situation and draw inferences about how effective that practice would be.

What may be new ideas, such as teaching science with inquiry, are interpreted on the basis of agents' current frame of reference—their views of the discipline, views of students, and ideas about what it means to teach science. What is understood from a new message depends critically on the knowledge base that one already has. This means more than simply recognizing that lack of knowledge interferes with the ability to understand. It means that different agents will construct different understandings, seeing what is new in terms of what is already known and believed. What we see is influenced by what we expect to see.

A second implication of the sense-making framework concerns the difficulty of major restructuring as part of learning. In the early accounts of learning and development, Piaget (1972) stressed the importance of what he termed "accommodation," or restructuring of existing knowledge. But the complementary process of "assimilation," or encoding stimuli into existing knowledge frames, is often the central part

of perception and action. Assimilation is a conserving process, as it strives to "make the unfamiliar familiar, to reduce the new to the old" (Flavell, 1963, p. 50). Later cognitive accounts of conceptual change stressed the difficulty of major restructuring and the need for continued engagement with problematic ideas as a catalyst for this restructuring (Carey, 1985). Thus the sense-making framework implies that learning new ideas such as instructional approaches is not simply an act of encoding these new ideas; it may require restructuring a complex of existing schemas, and the new ideas are subject to the danger of being seen as minor variations of what is already understood rather than as different in critically important ways.

A third implication of the sense-making framework concerns the mechanisms of accessing and applying knowledge structures. The concrete features of a situation are highly salient. Superficial aspects of a situation, although not the most significant for deep conceptual analysis, nevertheless are effective memory triggers for superficially similar situations. People often rely on superficial similarities when accessing related information from memory, even when knowledge structures connected through deeper principles might be relevant (Gentner, Rattermann, & Forbus, 1993; Ross, 1987). Interestingly, a major factor in the mechanism used to access knowledge is the degree of sophistication in that knowledge. With developing expertise in a domain, one builds knowledge structures that encompass more diverse cases and are organized around deeper principles. Experts can see deeper meaningful patterns in problem situations that may not be apparent to novices (Chase & Simon, 1974; Chi, Feltovich, & Glaser, 1981; Larkin, McDermott, Simon, & Simon, 1980; VanLehn, 1989). Experts focus their attention on features of stimuli that are more significant conceptually; that is, they can see situations in terms of the "big ideas" and core principles of a specific domain. Consequently, experts are less likely to be distracted by similarities that are only superficial—to "lose the forest for the trees" in solving problems—and can access situations connected by deeper principles (Novick, 1988). The difficulty this poses for reform is that agents with less expertise in the substance of the reforms may rely more than they should on superficial similarity, assuming that two situations are similar in important principled ways because they are similar in salient superficial ways. For example, teachers may not distinguish between two teaching scenarios in elementary mathematics that both use concrete manipulations, one where the manipulatives form the basis for exploration and discourse in a reform mathematics way and one where the same manipulatives are used in a more procedural way (Cohen, 1990).

In the next three sections, we examine the evidence for each of these implications of the cognitive sense-making framework. First, we consider how top-down comprehension can lead to differences in interpretation of the same messages and experiences. Second, we consider the obstacles to true restructuring and the dangers of seeing what should be partially new ideas as mere examples of what is already known. Finally, we consider how implementing agents may be distracted by superficial similarities, becoming overconfident about their success in achieving the true principles of the reform.

Different Interpretations of the Same Message

A teacher with a well-articulated schema for project-based science might observe a classroom where students are engaged in multiple animated conversations around computers or desks covered with laboratory notebooks, printouts, and resource

materials, and perceive it as an engaging inquiry science experience. Another teacher might perceive it as a chaotic classroom in need of better management. Similarly, different teachers may receive the same "policy message" and interpret an idea such as "inquiry" in very different ways.

Recent studies have emphasized the importance of differences in interpretations of reforms. Adopting a learning or pedagogical perspective on implementation, the Educational Policy and Practice Study's (EPPS) research on mathematics and language arts standards in California, Michigan, and South Carolina underscores how teachers' and administrators' prior knowledge and practice influenced their ideas about changing instructional practice (Cohen & Barnes, 1993; Guthrie, 1990; Jennings, 1992; Spillane, 1996, 1998a). Even teachers who used the same language (e.g., reading strategies) did not have the same ideas about revising reading instruction. Some differences were due to the teachers' varying opportunities to learn about the policy, including the policy texts available, professional development workshops, and guidance and support from the district or school. Yet teachers who encountered the policy from the same policy texts or professional development experiences constructed different understandings of the policy's message about revising reading instruction. Teachers' beliefs about subject matter, teaching, students, and learning were influential in what they interpreted from state and national standards about their practice. Furthermore, differences in interpretation were more predictive of the level of implementation than of teachers' outright rejection of the reform. This research illuminates the importance of differences in interpretation based on prior knowledge in influencing implementation of policy.

Recent studies demonstrate similar trends, in which misunderstandings about implementation cannot be attributed to lack of effort, incomplete buy-in, or explicit rejection of the reform ideas. Hill (2001) found that teachers working on a district committee to adopt materials to support the state's mathematics policy understood the reform ideas in ways very different from what the state intended. These teachers, perceiving little distance between their own position and the state's, assumed that a traditional curriculum was sufficient to implement great chunks of a state policy that was designed to press for fundamental change in mathematics education. What is striking is that the teachers devoted substantial time to discussing and attempting to understand the state's mathematics policy. Their misunderstandings of the reform proposals cannot be explained in terms of limited or perfunctory attention to the policy. Another study of the implementation of standards-based mathematics reforms in four Colorado school districts, identified as leaders in standards-based reform, also reveals the influence of individual interpretations on implementation (Haug, 1999). Although the four districts had had standards in place for several years, there was "great variability" in local educators' understandings, ranging from interpreting the state reform as a curricular checklist to understanding it as involving fundamental change in classroom practice (Haug, 1999, p. 256). The differences in interpretation were predictive of levels of implementation in these districts. These studies reveal the importance of the meanings that implementing agents create when they interpret policy messages.

Agents Can Misunderstand New Ideas as Familiar, Hindering Change

Another implication of the top-down nature of comprehension is that ideas may be seen as more familiar than they actually are. As we have discussed, expectations

strongly influence perception and guide the interpretation of ambiguous events (Olson et al., 1996). For example, suppose one meets a young man dressed like a college student with multiple earrings and brightly colored hair. Automatically we access schematic knowledge about people and use it to guide our understanding. If we then hear that he likes to go to concerts, we might understand that to mean that he listens to loud rock music or hip hop; later, we might forget whether it was stated explicitly that he went to rock as opposed to classical or folk music concerts. Furthermore, unless one is focused on deviations from expectations, inconsistent ideas may be glossed over and an understanding more consistent with expectations than it should be is formed and remembered (Klayman & Ha, 1987; Nisbett & Ross, 1980; Olson et al.). Thus, when implementing agents perceive an instructional idea in policy, the idea may be overinterpreted as essentially the same as the belief or practice that the teachers already hold. The influence of expectations from existing knowledge structures helps to focus understanding and may lead to rejection of information incongruous with those expectations (Chinn & Brewer, 1993; Keisler & Sproull, 1982).

Fundamental conceptual change requiring restructuring of existing knowledge is extremely difficult (Strike & Posner, 1985). Understanding involves accessing relevant structures in memory and applying them to make sense of what is presented, and the top-down nature of this process often causes inconsistencies or unexpected features to be overlooked. In some situations, however, features that violate expectations can become the focus of attention; they may be noticed and remembered as inconsistent information when one is motivated to be attentive to all details (Stangor & McMillan, 1992), perhaps because the incongruities trigger explanatory reasoning to account for the violation of expectations (Schank, 1986). This kind of effort to explain discrepant cases is precisely what is needed for deep conceptual reorganization to occur (Carey, 1985; Strike & Posner, 1985). It takes more than a single discrepant event, however. A sustained engagement with a sequence of problematic ideas and an explicit goal of making sense of them and reconsidering what is already "known" are required (Smith, Snir, & Grosslight, 1992; Strike & Posner, 1985, 1992). The research on teaching for conceptual change underscores the difficulty, even in focused instruction, of leading learners to fundamentally restructure their prior beliefs. Such dramatic changes are rare. More typically, people encode new information by adapting it to fit what is known; or they encode it without exploring the implications of the new ideas for what they already know, resulting in pockets of inconsistent knowledge (Smith et al., 1993).

In sum, our usual approach to processing new knowledge is a conserving process, preserving existing frames rather than radically transforming them. New ideas either are understood as familiar ones, without sufficient attention to aspects that diverge from the familiar, or are integrated without restructuring of existing knowledge and beliefs, resulting in piecemeal changes in existing practice.

Recent implementation research suggests that seeing new ideas as familiar is indeed an obstacle to implementation. A recent study of school districts' responses to state and national mathematics and science policies suggests that district leaders were more likely to attend to familiar policy ideas than to the more novel ideas (Spillane, 2000; Spillane & Callahan, 2000). Reform ideas such as "hands-on mathematics" and "problem solving," popularized in previous reform waves and already part of the practitioner conversation about instruction, featured much more prominently in district

officials' understandings of the policy message than did novel reform ideas such as "mathematics as communication" and "mathematics as reasoning." A similar pattern appears in studies of classroom implementation. For example, case studies of teachers' responses to the California Mathematics Frameworks show that teachers missed the unfamiliar and more fundamental transformation in mathematics content and pedagogy sought by the frameworks (Cohen, 1990; Guthrie, 1990). They noticed and attended to familiar ideas, such as group work and the use of manipulatives; however, lacking a mental framework to connect and explain the unfamiliar ideas, they devoted less attention to them and often overlooked them altogether.

A number of implementation studies suggest that teachers and other implementing agents tend to assimilate the new knowledge about instruction into their existing frameworks for understanding. Both the EPPS study and the Hill (2001) study, described earlier, underscore the conserving nature of teachers' sense-making with respect to state standards. For example, the EPPS researchers found that California teachers' understandings of that state's mathematics frameworks contained a blend of old and new ideas about instruction (Cohen, 1990). A study of the implementation of state and national assessment policy that was intended to challenge conventional ideas about mathematics and mathematics pedagogy, involving schools in Maryland, Maine, England, and Wales, also found that teachers tended to assimilate reformers' proposals into their existing frameworks (Firestone et al., 1999). For example, teachers interpreted complex assessment items requiring students to construct responses as chiefly requiring the memorization of simple formulas and algorithms. Thus the teachers constructed understandings of the reform ideas that fit within their existing models for mathematics and mathematics instruction rather than substantially rethinking them, leading to important differences between the intended policy and these teachers' understanding.

Other studies have revealed similar patterns, demonstrating that teachers attempting to engage in reform efforts exhibit understandings and practices that diverge from the intent of the designers. Spillane and Zeuli (1999) studied 25 teachers who reported that they were familiar with and supported national or state mathematics standards and believed that they were implementing these standards. While reporting support for reform themes such as "mathematics as problem solving," the sense they made of those themes was influenced by their tacit models of mathematics knowledge. Only a few of the teachers understood the core ideas of the reform as transforming notions of mathematical content and doing mathematics, emphasizing principled over purely procedural mathematical knowledge (Greeno, Riley, & Gelman, 1984; Lampert, 1986; Leinhardt, 1985). Many of the teachers, in contrast, understood the mathematics standards in ways that involved no fundamental changes in what counted as mathematical knowledge. These teachers saw the standards through the lens of their current practice, and the understanding they constructed failed to reflect the sort of fundamental changes in extant practice pressed by reformers.

Studies of science teachers have revealed similar findings; teachers incorporate reform ideas into their existing beliefs and understandings of epistemology and learning, posing challenges for reform when teachers' tacit models conflict with the intent of a policy (Beck, Czerniak, & Lumpe, 2000; Czerniak & Lumpe, 1996). Teachers see new policies in terms of their current understandings, interpreting science reforms such as standards-based teaching and inquiry in terms of access to more textbooks or emphasis on hands-on activities (Vesilind & Jones, 1998). Technology that is

intended to bring inquiry pedagogy into science classrooms is often seen as simply an extension of library research and incorporated into existing practice rather than enabling students to play new roles of question posing, investigation, and argumentation (Songer, Lee, & Karn, 2002).

Haug's 1999 study (described earlier) uncovered similar patterns among district administrators, teachers, and principals in understanding Colorado's standards-based mathematics reforms, although her account also offers some evidence of accommodation on the part of local implementing agents. Of the 69 study participants, working in schools and districts identified as leaders in standards-based reforms, approximately one-fourth had surface-level interpretations of the mathematics reforms. These implementing agents, mostly elementary teachers, understood the reforms as chiefly involving rearranging the content covered in the traditional mathematics curriculum to ensure that it fit the topics covered by the state. One-third expressed what Haug terms "partial understandings," typically involving a few isolated changes in extant practice, such as more problem-solving activities, new assessments, and the use of manipulatives. A third group of teachers, somewhat fewer than one-third, understood the reforms as involving fundamental changes for traditional mathematics instruction, involving instruction that built on students' prior mathematical knowledge and that made connections among mathematical topics as well as connections among content areas. Thus, even in local agencies that were known for attention to standards-based reform and that had been engaged in the process for some time, fundamental changes in understanding tended to be present in only a minority of the participants. True change is difficult; indeed, in these studies it is not even clear whether the participants who exhibited understandings consistent with the reforms had actually changed their beliefs or had held those understandings prior to the implementation of reforms.

Understanding May Focus on Superficial Features, Missing Deeper Relationships

We have discussed the importance of expertise as affecting the use of superficial features and deeper principles to access and use knowledge structures in making sense of situations and ideas. People can be misled by superficial similarities in situations. Only with substantial expertise do they look beneath the surface to recognize deeper principles. Understanding may focus on the superficial features in comparison and analogical reasoning. Consequently, agents may contrast a classroom implementation with a goal state and see important similarities, which may be only superficial. One may perceive an implementation to be as intended by policymakers because the core surface features such as "problem solving" or "using manipulatives" or "hands-on activities" are represented, even if deeper and more abstract principles such as changes in mathematical discourse or changes in students' epistemological stance toward science are not reflected. Unfortunately, when it comes to the implementation process, especially the implementation of policies that press for complex and novel changes in extant behavior, most implementing agents are novices. Few are experts when policy charts new terrain.

A recent study examining prevalent patterns in implementing agents' understandings of mathematics and science standards shows that, when implementing agents encounter new ideas about their work through policy, they are more likely to draw surface-level connections to their prior experiences. Studying the local school districts' responses to state and national mathematics policy, this work highlighted

how agents' understandings of the reform message tended to focus on surface features rather than the underlying structural ideas (Spillane, 2000; Spillane & Callahan, 2000). In this study, four-fifths of district leaders expressed a "form-focused" understanding, in which the agents' interpretations of key reform ideas, such as problem solving in mathematics, focused on the surface-level forms rather than the underlying functions of the policy ideas. For example, their understandings of problem solving focused on the form of the mathematical problems; implementing the mathematics reforms involved making the story problems given to students more realistic and connected to real life situations, but did not involve any changes in the epistemological function of mathematics education. While problem solving did represent change for these district leaders, it did not involve fundamental change in what counted as mathematics. Drawing surface analogies and failing to access the deeper structural relations between the reform proposals and their experiences, district leaders interpreted the reform in ways that missed its core intent, contributing to superficial implementation of state and national mathematics policies.

The tendency of teachers in reform efforts to be overly reliant on superficial features is also consistent with studies of implementation failures described by Cohen (1988, 1990). Teachers reported teaching consistent with the reforms while incorporating the reform ideas into very traditional practice, because they were applying the more salient features of the reform, such as using manipulatives, using a reform mathematics textbook, or incorporating hands-on activities into science. The "partial understandings" reported by Haug (1999) are also consistent with the reliance on superficial similarities, in which teachers interpreted the reform to mean concrete changes, such as more problem solving activities or mathematics manipulatives, while not recognizing the need to change fundamental aspects of students' interactions in relation to the subject matter.

Values, Emotions, and Motivated Reasoning in Sense-Making

So far, we have considered the challenges facing practitioners from a purely dispassionate cognitive perspective. However, the debates about reform concern more than purely scientific and empirical questions about the nature of learning and the most effective ways to teach. Many reform ideas about teaching, learning, and schooling are very value-laden, for example, arguments about the purpose of schooling or what our society should value as mathematical or scientific literacy. Furthermore, the substance of the reforms—implementation of changes in teaching practice—affects the core behaviors that are central to one's self image. Hence one's motivations, goals, and affect come into play in making sense of and reasoning about reforms. The rich connections of abstract intellectual ideas, such as the concept of inquiry in science, to deeply held values colors the cognitive processes involved in understanding, interpreting, and acting on reform initiatives. The influence of motivation and affect on cognitive processing is called "hot cognition" or "motivated reasoning" by social psychologists (Dunning, 1999; Kruglanski, 1980; Kunda, 1990, 1999). In this section we consider briefly the implications of that dimension of sense-making for implementation.

People Are Biased Toward Interpretations Consistent With Their Prior Beliefs and Values

There are a number of ways that goals, affect, and biases can influence reasoning about complex judgments. Existing structures can be very resistant to change,

and an individual's own experiences are more heavily counted in reasoning about debates than those of external experts. Concrete and familiar examples from one's own experiences carry more weight in judgment and decision making than does abstract information (Nisbett & Ross, 1980). Furthermore, strong motivation can affect the way reasoning is carried out, leading people to pay more attention to information consistent with the desired outcome or to discount inconsistent information (Klayman & Ha, 1987). For example, if we are presented with a problematic idea, such as the need for substantial changes in the way we teach science, the bias toward asserting that "things are working fine as they are" may lead us to focus on information from experience consistent with that point of view. On the other hand, motivation toward an outcome can also affect the investment we make in reasoning, so that we commit more effort to understanding and evaluating undesirable evidence than to desirable evidence, which is more easily accepted (Edwards & Smith, 1996). Motivation can also affect the use of personal memories in reasoning (Sanitioso, Kunda, & Fong, 1990), biasing memory search to recall examples consistent with the target assertion. For example, if one is pressured to assert that one is behaving in ways consistent with a reform initiative, one may more easily recall examples consistent with the reforms. This is particularly critical given the tendency discussed earlier to make superficial connections rather than deeper connections. Hence one may jump to conclusions and focus unduly on familiar aspects in understanding new policies or reform initiatives, and be ready to claim, "We already do that in our school!"

The Affective Costs to Self-Image Can Work Against Adopting Reforms

Affect is an important part of memory. Emotional associations are an integral part of knowledge structures used to reason about the world and may affect reasoning about value-laden issues (Bower & Forgas, 2000; Ortony, Clore, & Collins, 1988). Accessing emotional associations can affect the judgments people make; for example, negative affects may lead to more pessimistic judgments (Schwarz, 1990; Thagard & Shelley, 2001). Reasoning about changes in one's core practices is likely to engage affective responses, and these responses may color perception and judgment. As a result, one may persevere in behaviors that have been rewarding in the past or shy away from ideas perceived to be similar to negative experiences, such as unsuccessful attempts at reform teaching.

A related factor is the strong motivation to maintain a positive self-image. Typically, people want to believe that they have performed well in the past and are hesitant to believe that their efforts have failed (Baumeister, 1998; Rosenberg, 1965), particularly regarding practices central to their self-concept or self-schema (Markus, 1977). For example, how an elementary school teacher interacts personally with young children may be an important dimension that defines her self-concept. Reasoning and judgments about changes in one's core practices are likely to engage affective responses and trigger a motivation to affirm one's own value. This self-affirmation bias can affect judgments, exerting pressure in favor of the view that what one has done in the past has value or that whatever threat is challenging self-esteem can be discounted (Steele, 1988). Consider how self-affirmation bias might play out in reform situations. Often, reform movements have the appearance of saying that what we were doing before in schools was "wrong," or at least less effective

than what we could be doing. To accept reform and become its advocates could cost teachers some loss in positive self-image. Teachers might become advocates by deciding that they were "ahead of the curve" and already teaching in ways consistent with the reform. Or they might be motivated to discount the reform idea, seeing it as inconsistent with "the reality" that they "know best." Alternatively, teachers might accept the need for change but attribute the reasons for their not adopting the reform to factors in their context (the children, the parents, lack of support from administrators). In any of these situations, the challenge to self-esteem and the tendency of human judgment-making to preserve self-esteem can work against convincing implementing agents of the need to change and of the differences between their current practices and the goals of the policy.

A few studies of teaching and of change in general have noted the importance of some of these factors. For the implementing agents, understanding and adopting an innovation often involves a reinterpretation of existing ways of thinking about the world, about themselves, and about their purposes—it involves parting with some familiar ways of thinking about and acting in the world (Marris, 1975). As Hargreaves (1998) points out, teaching and learning are not about knowledge and cognition alone; they are also "emotional practices." Some teachers, for example, are deeply upset when they encounter reforms that basically tell them that the way they have taught for 10 or 20 years was "wrong" (Jennings, 1992). These sorts of transformations can be highly emotional, involving considerable human cost. Some recent case studies of efforts to fundamentally transform instruction point to the emotional and personal nature of the implementation process for those undertaking the changes (Ball, 1993; Lampert, 1990). Earlier implementation studies showed the detrimental emotional consequences for teachers of their failed efforts to decipher abstract and unclear policy mandates; anxious, confused, and frustrated teachers simply abandoned their attempts at implementation (Gross, Giacquinta, & Bernstein, 1971; Huberman & Miles, 1984).

Some case studies also suggest, indirectly, that values and emotion are a critical component as teachers construct new understandings about their practice from and about reform initiatives. For example, in an investigation of a fifth-grade teacher's efforts to transform her teaching in response to state and district reform initiatives, Spillane (2000) shows that this teacher constructed very different learning opportunities in mathematics as compared with literacy, and that who she was as a learner differed substantially in the two subject areas. These differences contributed to tremendous variation in her enactment of reform in mathematics as compared with literacy. The teacher valued reading and writing as activities that she herself enjoyed. She was vividly excited when she taught language arts and when she spoke in interviews about her teaching in that subject area. Mathematics instruction failed to ignite a similar passion for her. Moreover, she saw language arts as a subject that was closely connected to the moral purpose that was at the core of her career as an educator—preparing students to appreciate and respect diversity. She saw no such connection in the case of mathematics. Values and emotions were important factors in accounting for what this teacher came to understand about reform in her mathematics and language arts instruction. Similarly, Zembylas's (2002) ethnography of a science teacher reveals the tight connections between her values and her emotional experiences in teaching. Her engagement with reform ideas was mediated through those positive and negative experiences.

Relations between implementing agents' values and emotions and their sense-making are not well understood. Indeed, research on the emotional dimensions of teachers' work is scarce (Hargreaves, 1998, 2001; Hargreaves, Beatty, Lasky, Schmidt, & James-Wilson, in press). This line of work suggests that investigating the emotional dimension of the implementation and change process is likely to be especially fruitful. The relations between local implementing agents' values and emotions, on the one hand, and what they come to understand about reforming their practice from policy, on the other hand, is one of the areas where studies of cognitive science and social cognition can help frame new lines of inquiry into the implementation process.

The Implementing Agent as Social Sense-Maker

Although individual cognition and the search for universal patterns are important, sense-making is not a solo affair. Social psychologists, scholars working on situated and distributed cognition, and researchers working in the Cultural-Historical Activity Theory tradition, argue that the situation of the individual is essential in understanding human cognition. While scholars working in these traditions underscore the importance of situation, their treatment of it differs in some important respects. Social psychologists tend to explore how representations of knowledge about social situation influence individuals' cognition and their frames and schemas for understanding new knowledge. Scholars working in the situated and distributed cognition traditions treat situation as a constituting element of sense-making activity, shifting the level of analysis from the individual's knowledge structure to the activity system. Sense-making and action are *distributed* in the interactive web of actors, artifacts, and situation, and this system becomes the appropriate level of analysis (Greeno, 1998). We discuss the situated perspective in more detail at the end of this section, arguing that applying that framework in implementation research would shed new light on the implementation process.

Sense-Making Occurs in a Social Context

We have considered how an individuals' prior knowledge and belief systems affect how they make sense of policy and how they translate that understanding into action. Adding the dimension of social context suggests another way that differences in knowledge affect sense-making and action. Here, we consider how knowledge, embedded in social contexts as the practices and common beliefs of a community, affects sense-making and action in implementation.

Situation or context is a multifaceted construct that includes everything from national and professional identities to the structures of the offices and organizations in which people work. Implementing agents encounter policy in a complex web of organizational structures, professional affiliations, social networks, and traditions. Both macro and micro aspects of the situation are important for implementing agents' sense-making.

At a macro level, individuals' mental frameworks or schema for apprehending new knowledge depend on their "thought communities" or "worldviews" (Mannheim, 1936; Resnick, 1991; Vaughan, 1996; Zerubavel, 2000). People typically belong to multiple thought communities by virtue of national and ethnic identity, religious affiliation, social class membership, professional identity, and political leanings. Our ways of categorizing the world we live in, acquired through our socialization as chil-

dren and adolescents and our socialization into particular professions, influence how we define things and the meanings we give to them (Loseke, 1999). Vaughan argues that by virtue of our position in the world—doctor, parent, child, and so forth—we develop a unique set of experiences, assumptions, and expectations. From this integrated set of experiences and expectations we construct "a worldview, or frame of reference, that shapes" our perceptions of things (p. 63).

An aspect of situation that has featured prominently in scholarship is the institutional sector—such as schools, hospitals, social service agencies—in which implementing agents work. From an institutional perspective, social agents' thinking and action are situated in institutional sectors that provide norms, rules, and definitions of the environment, both constraining and enabling action (DiMaggio & Powell, 1991; Scott & Meyer, 1991). These tacit schemata define appropriate structures and give meaning and order to action in institutional sectors (Scott & Cohen, 1995). Institutional theory then challenges "models of social and organizational action in which relatively autonomous actors are seen as operating with unbounded rationality" (Rowan & Miskel, 1999, p. 359). Showing that individual cognition and agency are constrained by the institutional sectors in which they are situated, this work illuminates how different sectors structure work practices, innovations, and the implementation process. For example, almost three decades' worth of scholarship on schools from an institutional perspective suggests, among other things, that schools "decouple" formal structure (i.e., administration and management) from core activities (i.e., teaching and learning) (Meyer & Rowan, 1977, 1978; Weick, 1976). Minimizing inspection of the uncertain core activities of schooling enables schools to maintain the confidence of their external constituents (Meyer & Rowan, 1977, 1978). Policy is designed chiefly not to transform the core technology but rather to protect it from scrutiny and thereby maintain the legitimacy of the institution in the eyes of key constituents. Within these institutional arrangements, the well-documented limited influence of education policy on administrators and teachers is not surprising.

Institutional theory helps to account for macro patterns of implementation within an institutional sector, but it has limitations in accounting for differences in implementation within any one sector. These limitations are a product of institutional theorists' excessive reliance on aggregation and determinism (DiMaggio, 1988). Specifically, in focusing on populations of organizations—institutional sectors—institutional theory has stressed the emergence of dominant organizational forms rather than particular responses or activities that may be specific to individual organizations (Whittington, 1991). Furthermore, the overemphasis on the role of institutional schemata tends to smother attention to human agency and other contexts that are potentially important in the work of implementing agents. As a result, institutional theory runs the risk of being overly deterministic, focusing chiefly or exclusively on how institutional context shapes human agency. In addition, contrary to the original intent, the institutional perspective runs the risk of ignoring how social actors make sense of, and shape, their situations (Giddens, 1984; Weick, 1995). Some of the core original works in the new institutionalism did not treat institutional sectors as all-determining and gave a substantial role to human agency (Dimaggio, 1988). Some recent work pays more attention to the role of agency and the two-way interaction in institutional environments (Burch & Coburn, 1999; Edelman, 1991).

Recent implementation research suggests that a variety of other contexts nested within these institutional sectors are especially influential when it comes to sense-

making by implementing agents (Ball, 1994; Coburn, 2001; Spillane & Jennings, 1997). At a micro level, the immediate environment—considered in terms of the organizational arrangements of the workplace—contributes to defining the ways in which people make sense of new experiences and situations. Social norms and organizational structures are important contexts for implementing agents' work and for their efforts to make sense of policy. Individuals draw on existing reservoirs of individual and collective knowledge to determine what particular policies mean, in order to decide on a response to policymakers' recommendations (Porac, Thomas, & Baden-Fuller, 1989). Stephen Ball's work on the local response to education policy in the United Kingdom illuminates how "policy texts" evolve as they are apprehended and read in different local contexts; the meaning of the policy message shifts (Ball, 1994).

Social interactions can aid sense-making not only because individuals learn from one another but also because group interactions bring insights and perspectives to the surface that otherwise might not be made visible to the group (Brown & Campione, 1990; Brown et al., 1989). For example, discussing ambiguous situations with coworkers may allow an individual to be exposed to alternative interpretations of shared stimuli. Interacting with each other, local actors can explicate tacit beliefs as individuals are prompted to summarize and articulate their interpretations in struggling to communicate their point of view. Once articulated, these frequently tacit opinions become visible to the individual and the group—open to discussion, debate, and negotiation, supporting group sense-making to find inconsistencies and flaws and to resolve them. Calling on the distributed expertise of their communities, local actors can mediate confusing situations by interacting with their colleagues, leveraging the knowledge that is situated within webs of social relationships (Sachs, 1995).

Social Interactions Can Shape Sense-Making in Implementation

Some recent implementation studies have underscored the influential role of social interactions in the implementation process. Studies of the mediating role of teachers' professional communities in teachers' construction of messages about their practice from policy and other sources underscore the importance of socially mediated sense-making in the implementation process (Coburn, 2001; Stein & Brown, 1997). As members of a community interact over time on problems of shared concern, they negotiate meanings about the nature of their work and in some instances shared understandings about what they need from outsiders (e.g., the district or state) to do their work well (Stein & Brown). These shared understandings become a filter for ideas about revising extant practice.

Coburn (2001) described how teachers' sense-making even within the same school could be situated in different formal and informal groups; Coburn observed that these situations mattered because teachers in different groups often made different sense of the same policy messages. Teachers typically were grouped by grade level in formal settings, but they also interacted informally with colleagues, building informal networks with similar worldviews. For example, first-grade teachers separated into two groups: A group of older, more experienced teachers favored direct instruction, and a group of new teachers favored more progressive ideas about teaching. These two groups included teachers with contrasting worldviews, and they interpreted and implemented policy messages in substantively different ways. Continuing to use the old reading series, two teachers rejected the new reading series entirely

because it was inconsistent with the way that they had structured reading instruction. Two other teachers in a different informal group, who used larger thematic units to structure their reading instruction, understood the textbook as a source of stories for those units rather than as a reading curriculum to be followed. Another three teachers in an informal group followed the new reading series. Patterns of formal and informal teacher interaction influenced what teachers noticed, how they noticed it, and how they interpreted reform initiatives. Teachers in different formal and informal groups understood the reading reforms differently (Coburn).

Another implementation study of teachers' responses to state and national mathematics and science standards illuminates how social context influences the ways in which teachers make sense of policy and the need to revise their practice (Spillane & Zeuli, 1999). The potency of policy levers in getting teachers to change their practice depends in part on teachers' "enactment zones," the spaces where the world of policy meets the world of practice. In this study, teachers' local contexts of enactment served a powerful mediating function between policy levers and classroom practice. The study found three key areas in which the enactment zones of teachers differed: the extent to which the zones were social rather than individualistic, the extent to which they involved rich deliberations with other teachers and reform experts about instruction, and the extent to which they included material resources or artifacts that supported those deliberations. Teachers whose enactment zones extended beyond their individual classrooms to include frequent and ongoing deliberations with fellow teachers and other experts about the policy proposals and their implications for practice understood the standards in ways that resonated with policymakers' proposals. Those teachers undertook fundamental changes in their instructional practice, changing its core in response to the standards. Most teachers in the study, however, had enactment zones that were mostly private and individualistic and afforded them few opportunities to grapple with the meaning of policymakers' proposals for revising practice. They undertook less fundamental, frequently surface-level, changes in their practice. Thus, although the teachers in this study all received the same policy message, the presence of a social context that supported productive group sense-making led to more substantial engagement with the policy ideas.

Of course, opportunities for implementing agents to interact with each other about policy proposals do not ensure that they understand the proposals in ways that resonate with the intent of the policy. For example, Hill's study of a district committee's efforts to respond to a state mathematics policy illuminates how teachers can appropriate the language of reform in ways that miss its intent (Hill, 2001). Whereas the state's standards document used "construct" and "concept" to imply particular pedagogical approaches for mathematics, teachers assigned more conventional definitions to those words, contributing to the state policy's loss of influence on local practice. As Hill's study illuminates, language is central in the sense-making process because it frames the way people understand their world (Conger, 1991; Pfeffer, 1992). Language is the chief medium that policymakers have for representing their ideas about revising local practice and a key tool that teachers use in thinking about and constituting the realities of their practice. But language is an imprecise tool. Implementing agents can use the same policy language to represent rather diverse ideas about changing their behavior, and those ideas do not always resonate with the intent of the policy (Hill, 1999; Spillane, 1998b). The absence of a technical language

for talking about practice among teachers (Lortie, 1975) poses a major challenge to the implementation of policies that seek substantial changes in extant practice. Without such a language, communication among teachers about their practice is constrained. Indeed, there is some evidence to suggest that a shared technical language about practice facilitates teachers' analyses of their practice and their navigation of the change process (Little, 1982). Thus when we speak of "situation," we refer not only to structural and social arrangements but also to tools of various sorts, such as language, that enable or constrain human sense-making.

Sense-Making Is Affected by the Organizational Context

Human interaction patterns in schools and other delivery agencies are in part a function of organizational structure. Organizational arrangements can hamper or enable interactions among implementing agents about policy and practice. In schools, the prevailing "egg-carton" structure, in which teachers work chiefly as isolates with little interaction with colleagues, undermines opportunities for teachers to test or be exposed to alternative understandings of policy proposals (Lortie, 1975). Dominant patterns aside, schools nevertheless vary in their ways of structuring the work of teaching, and especially in the extent to which their structural arrangements support interactions among staff about their work. Those arrangements are especially influential when it comes to the taking up of innovation in schools (Bryk, Lee, & Holland, 1993; Driscoll, 1990; Little, 1982, 1990; Louis & Kruse, 1995). Teacher collaboration provides access to new ideas and knowledge, can provide incentives for instructional improvement, and, when focused on student learning, can contribute to improvements in student performance (Fullan & Hargreaves, 1996; Newman & Wehlage, 1995; Rosenholtz, 1989).

Recent implementation research suggests that organizational arrangements are also important when it comes to the implementation of state education policy. Wolf and colleagues (2000) illuminate how organizational arrangements and norms can enable the implementation of reform by providing opportunities for implementing agents to deliberate. In their study of the Kentucky Instructional Reform Act, involving four schools, they argue that the development of the human capital necessary for successful implementation was closely tied to the school's social capital as reflected in relations of trust and collaboration among school staff. The EPPS study of Michigan's state reading policy illuminates how teachers' limited opportunities to talk with each other about their reading practice, and about policymakers' proposals for revising it, contributed to substantial differences among teachers (even within the same building) in the meanings that they constructed about revising their practice on the basis of the reforms (Cohen et al., 1998).

Organizational arrangements are also influential in the sense-making process at other levels of the school system. A study of a district office's role in the implementation of state policy illuminates how organizational arrangements can contribute to the construction of multiple and sometimes contradictory understandings in the same office about the same policy on revising instruction (Spillane, 1998b). Specifically, responsibility for reading instruction in the district office is often divided among subunits such as an assessment office, a staff development office, a Title I office, and a curriculum office. District administrators' *situations* influenced their understandings of the reading policy; that is, organizational arrangements and the accompanying vertical and horizontal segmentation of responsibility enabled different parts of these

school districts to construct the policy message differently and to respond separately and often in different ways. Different subunits took their cues from different parts of the school system, cues that influenced their particular missions. Efforts to enact the reading reforms varied among subunits because they construed and prioritized state policy through their distinct missions and responded to the policy in ways that reflected those different understandings (Spillane, 1998b). Different subunits sent teachers different, and at times conflicting, messages about reforming reading instruction.

In general, implementing agents' work is nested in multiple organizational contexts simultaneously (McLaughlin & Talbert, 1993). This is especially true in education: Teachers and school administrators work in schools that are nested in school districts, which in turn are nested in states, and so on. Overlapping contexts interact with each other and situate implementing agents' attempts to make sense of standards and other education policies. The Michigan reading policy study illuminates how overlapping contexts situate teachers' efforts to make sense of state reading standards (Cohen et al., 1998). Specifically, differences among school districts, within district offices, and among schools within districts interacted with each other and were reflected in differences in what teachers understood and did in their classrooms in response to the reading standards. Some teachers found themselves in situations where both school and district office leaders provided strong support for reform, mobilizing multiple opportunities for teachers to learn about the reading reforms and incentives for teachers to take the reforms seriously. Other teachers in the study found themselves in situations where school leaders supported the reading reforms but central office leaders did not. Still other teachers were in situations where both central office and school leaders ignored the state standards and continued to endorse extant instructional practice. These situational differences mattered—they accounted in part for the diversity in teachers' reported understandings of the reading reforms.

Informal Communities Provide a Social Context That Affects Sense-Making in Implementation

In thinking about the situated nature of implementing agents' sense-making, however, it is important to take into account not only the formal education system but also the vast nonsystem of textbook publishers, professional development providers, educational consultants, and the like. Hill's study (1999) of efforts to reform policing and teaching moves beyond the structures of formal organizations to examine "implementation networks" in the fields of law enforcement and education, illuminating how those structures influence implementing agents' sense-making during the implementation process. Hill demonstrates that the ways in which teachers and police personnel come to understand public policy and their ways of interpreting it are influenced by nonstate or nonsystem agencies that "teach" policy and its entailments to implementing agents. Burch (2000) also illuminates how actors within the nonformal policy system are especially influential in shaping school-level interpretations of district accountability policies.

Professional specializations are one potentially influential nonsystem context for implementing agents' sense-making. The professional or occupational identities of workers influence their work with individuals in professional communities sharing norms, knowledge, perspectives, commitments, and often a language or vocabulary, all of which influence their work in the organization (Clark, 1983; Van Maanen & Barley, 1984). Professional specializations frequently form the basis for connections

with groups outside the organization as well, as individuals network with other members of their professional communities (Clark, 1983; Scott & Cohen, 1995). These professional affiliations *situate* implementing agents' efforts to interpret policy and may contribute to the construction of the different understandings of policy messages. For example, the study referred to earlier (Spillane, 1998b) illuminates how district office staff in a segmented organization had very diverse professional associations and identities; they included reading specialists, assessment specialists, and staff development specialists. Staff in the assessment unit were psychometricians and program evaluation specialists, and their specializations were the lenses through which they understood the state reading policy. Their different lenses contributed to multiple understandings of the same state policy within one district office. Thus, even within the same district office, policymakers' efforts at sense-making from and about state policy were situated differently, leading them to pursue divergent changes as they attempted to implement the policy.

Professional specializations also operate at the school level, and research suggests that subject matter specializations are an important context for high school teachers' work (Ball & Lacy, 1984; Little, 1993; McLaughlin & Talbert, 1993; Siskin, 1991, 1994). High school teachers differ in their conceptions of the subjects they teach; subjects vary on dimensions that include their definition, scope, and sequencing of material and whether the subject is static or dynamic (i.e., the rate of new knowledge production). These differences have consequences for curricular practices, such as teachers' control of content and curriculum coordination and standardization, differences that may mediate relations between policy and classroom practice (Stodolsky & Grossman, 1995).

The Historical Context Affects Sense-Making in Implementation

Situation involves more than the here and now. A historical perspective, at both the individual and organizational levels, is also important. As is the case with individually held beliefs, most of what people know about the cultures that they inhabit is tacit—learned primarily through experience and the unconscious integration of contextual cues from being immersed as a member of the community. It is this tacit knowledge—actively acquired through participation in a culture—that forms the basis of an individual's beliefs and expectations about how to act in a certain situation. Arguing for a person-centered approach to policy analysis, Lewis and Maruna (1998) suggest that individual life histories and biographies may be useful analytical tools for investigating the implementation of public policy. Recent work in this tradition shows how the life stories of implementing agents help to account for how they make sense of and respond to reform proposals (Drake, Spillane, & Hufferd-Ackles, 2001). For example, a study of elementary school teachers' responses to a new mathematics curriculum that was consistent with the National Council of Teachers of Mathematics' Standards identified different types of mathematics life histories among teachers and showed how teachers' understanding of the curriculum depended on their story type. Teachers' understandings of the curriculum were situated in their mathematics life stories (Drake et al., 2001).

Organizations also have histories that can be especially influential in the efforts of implementing agents to understand what a policy is asking of them. A recent study of the implementation of rehabilitation programs in prisons, for example, shows how each prison's unique history influenced the ways in which the programs were understood by staff and inmates (Lin, 1998, 2000). Arguing that implementation failure

was a function of "a fundamental misunderstanding between policymakers and the implementing agents" (p. 35), Lin illuminates how the unique histories of the prisons in her study shaped their understandings of the rehabilitation program, contributing to the program's being implemented in distinctly different ways in each prison. For example, at one facility that had been established decades earlier as a model prison for experimentation with pilot rehabilitation programs, the spirit of experimentation continued among staff even though most of the original programs had ceased to exist. At that facility, the educational programs were understood as important even by staff who were not particularly interested in or convinced of their likely effectiveness, because the programs fit the facility's experimental orientation. Hence the history of an implementing agency, as embodied in organizational norms and stories, serves as an influential context for implementing agents' sense-making from and about policy.

Values and Emotion Are Key Parts of the Social Context

Again, emotions and values are an important, if often overlooked and understudied, aspect of the social sense-making process with respect to reform. The available evidence suggests that values and emotions are a crucial factor. Hargreaves (2001), on the basis of a study of 53 Canadian elementary and secondary teachers in 15 schools that varied in terms of size and communities served, found that when working together teachers value appreciation and acknowledgement along with personal support and acceptance. However, teachers tend to avoid disagreement and conflict regardless of their friendship with colleagues, and that avoidance significantly impedes the opportunities for instructional improvement. Indeed, strong personal ties and the shared beliefs and values that undergird those ties, which are often uncritically advanced as positives by education scholars, may undermine instructional change because they can promote the status quo in teacher thinking, cutting off the consideration of alternative ideas and the intellectual disagreements that might accompany discussion of such ideas (de Lima, 2001). Such discussions are essential to coming to see one's practice as problematic, a critical aspect of engaging teaches in reforming their practice. We found a similar attitude in a study of collaborative curriculum design work involving teachers and university researchers. The prevalent mode of interaction for teachers was to try to avoid making the hard calls necessary to decide between competing proposals; instead they frequently opted to avoid conflict and compromise by simply including all proposed ideas and leaving it to the teacher audience to make choices later (Reiser, Spillane, Steinmuller, Sorsa, Carney, & Kyza, 2000).

Oakes and colleagues found that collaboration among teachers about instruction that did not involve a shared moral commitment to "growth, empathy, and shared responsibility" was as likely to contribute to preserving the status quo as it was to transforming it (Oakes, Quartz, Ryan, & Lipton, 2000). This work suggests that investigations of the ways in which values and emotions influence the social sense-making process are likely to generate important knowledge about the implementation process.

A Situated Perspective on Implementation and Cognition

The implementation work that we have reviewed here under the broad rubric of social cognition falls at various points on the continuum between traditional social psychology, on the one hand, and work in situated and distributed cognition, on the

other hand. Although some recent implementation studies lean toward situated or distributed cognitive constructs, these perspectives are still rather novel in policy research, and the conceptual tools that they offer are not exploited to the degree they could be.

We believe that adopting and adapting conceptual tools from work in situated and distributed cognition to frame implementation research is likely to contribute to investigations that yield important new insights into the implementation process. Some early work in this direction is already promising. Cohen and Ball have reconceptualized instructional capacity as a function of the instructional unit rather than the individual teacher or curricular materials (Ball & Cohen, 1996; Cohen & Ball, 1999). Rogoff and others have looked at school transformation or professional development as a process of "learning together" (Rogoff, 2001) or building a community of learners (Grossman, Wineburg, & Woolworth, 2001).

We are using conceptual tools from the perspective of situated and distributed cognition (which we refer to as situativity theory for readability purposes in the remainder of the article) to frame our own continuing investigations of the implementation of technology-infused inquiry-based science curriculums in middle grades classrooms in the Chicago metropolitan area (Kemp, Tzou, Reiser, & Spillane, 2002; Reiser et al., 2000; Reiser, Tabak, Sandoval, Smith, Steinmuller, & Leone, 2001; Tzou, Reiser, Spillane, & Kemp, 2002). Below, we outline some of the core elements of our conceptual frame and identify some of the unique perspectives that we believe this frame offers, for our work and for implementation studies in general.

The situativity perspective focuses our research on implementation in at least three ways.

First, implementation practice or activity as reflected in curriculum meetings, grade-level meetings, classroom instruction, informal meetings, and so forth, is the central focus of our work.

Second, implementation practice is not simply a function of an individual agent's ability, skill, and cognition; rather, it is *constituted in the interaction* of administrators, teachers, students, and their situation in the execution of particular tasks. Hence the activity system, as distinct from the individual teacher's or administrator's knowledge structures, becomes the appropriate level of analysis (Greeno, 1998). Sensemaking activity is *distributed* in the interactive web of administrators, teachers, students, and their situation. As Greeno argues, the defining characteristic of the situated perspective is "its theoretical focus on interactive systems that are larger than the behavior and cognitive processes of an individual agent" (Greeno, pp. 5–6). In our own work on middle school science, the implementation practice as constituted in the interaction of the teachers, students, materials, and situation (including the temporal, material, cultural, intellectual, and social situation) is our primary focus, and we examine how inquiry practice emerges through that interaction.

Third, situation, a constitutive element of implementation practice, is multidimensional: It includes social, material, intellectual, temporal, historical, and cultural aspects. Situation does not simply "affect" what teachers and administrators do; it defines implementation practice. The contribution of situation to implementation practice is not necessarily mediated through the implementing agent's cognitive processing.

Guided by these ideas, we investigated implementation practice by observing the activity *as it unfolded* in the daily work of classrooms and schools, using a com-

bination of field notes and videotapes to collect data. Rather than focus chiefly on implementing agents' knowledge structures and beliefs, we explored the activity structures. This approach had a number of advantages in our efforts to unpack the implementation process in schools and classrooms. Two are illustrative.

First, focusing on implementation practice as it unfolded in the day-to-day work of classrooms where teachers and students were attempting to put inquiry-based science curriculums into practice allowed us to observe the emergence of teachers' and students' sense-making about reform science as situations evolved. Inquiry science *takes form* over time as teachers and students try out reform curriculums in their daily work and learn in the process. Understandings and beliefs about instruction, subject matter, and the like are worked out in the context of instructional practice. As a result, Milbrey McLaughlin's (1990) adage that "belief can follow action" takes on even richer significance: *Understanding can follow action.* As different elements of inquiry science curriculums are played out in practice, we find that teachers negotiate an evolving understanding of inquiry science. For example, one of our middle school teachers was firmly convinced that her inner-city students did not have the requisite knowledge and skills to successfully engage in some of the more ambitious activities that required metacognitive skills. In the process of her implementation, as students worked on the assignments, she developed a new appreciation for their ability to generate and support scientific hypotheses. The work that students produced as they used software allowing them to conduct investigations about a crisis in a Galapagos ecosystem surprised the teacher in terms of their ability to engage in the task, generating sophisticated hypotheses and data-based arguments (Reiser et al., 2000).

Another contribution of the frame to our work on implementation is that it pressed us to move beyond categorizing classrooms according to high- and low-fidelity implementations of inquiry science, forcing us to grapple with the shifts in the enactments of reform curriculums over time in a particular classroom rather than averaging the differences as we sought some mean or modal level of implementation to characterize a particular classroom (Kemp et al., 2002; Tzou et al., 2002). We could have used such categories fairly easily, but that strategy became unsatisfying as we watched the implementation practice unfold over the 4 or 5 weeks of the unit. During that period, we saw shifts from more inquiry-based to more traditional teaching, depending on the curricular activity. For example, in one classroom the enactment of an activity in the curriculum suggested high implementation of some dimensions of teaching science as inquiry (e.g., eliciting and using students' voices, building a sense of community in the classroom), whereas the enactment of another activity suggested low implementation of other dimensions of teaching science as inquiry (e.g., helping students explore ways to connect scientific data to scientific explanations). Instruction and reformed instruction, as represented in policies and reform curriculums and also as they unfold in the day-to-day life of classrooms, are multidimensional and dynamic, shifting over time. Various aspects of the reform practice emerge as more relevant to a particular teacher's conceptions of inquiry and students' attitudes toward the work, resulting in important variations in what could be viewed as "fidelity" when observation moves from activity to activity. Discounting changes over time and reducing that complexity to some common denominator does not serve us well as implementation researchers. Finally, using the situativity frame has illuminated for us how focusing on an individual teacher's knowledge

and beliefs exclusively *and* as static variables serves to obfuscate rather than reveal the implementation process.

In summary, we have examined ways that both formally structured social contexts and informally created social contexts affect how agents make sense of reforms, providing a shared base of beliefs and knowledge that agents use to interpret policy and to reason about implementation. The context includes an affective dimension underlying these social interactions, as well as a historical dimension. Recent research on situated cognition has further complicated the notions of "knowledge" and "context" by arguing that knowledge is distributed and emergent from the interactions of the participants. These views help to explain important variations in implementation that arise both between agents and within agents across time and materials.

Implications: Policy Design, Representation, and Implementing Agents' Sense-Making

What are the implications of a cognitive framework for policy design and its implementation? In our sense-making framework for the implementation process, the policy—as represented through verbal and written media, including regulations, directives, legislation, workshops, and pamphlets of various sorts—is relevant to an understanding of the implementation process. Although the sense-making framework underscores the fact that implementing agents construct a policy's messages about changing local behavior, our explanatory model nevertheless affords policy and the particulars of its design a central role. Although policies cannot construct understanding for implementing agents, the message and design of policies influence implementing agents' sense-making efforts.

In this section, we consider the implications of our sense-making framework for the design of policy. We characterize a collection of design challenges for policy that represent the tensions inherent in crafting policy to communicate messages to implementing agents about how to change extant practice. The design of policy is especially relevant from a cognitive perspective. Through the organization of new ideas or knowledge about existing behavior, some policies do better than others in enabling implementing agents to understand what is problematic about their current behavior and to construct practices that might ameliorate the problems. Of course, education standards and policy in general take multiple forms. Conventional implementation research offers insights on such matters, showing that policy inconsistency and ambiguity undermine implementation because they increase the discretion of implementing agents and agencies over whether and how to put policy proposals into practice (Porter et al., 1988; Pressman & Wildavsky, 1974; Weatherly & Lipsky, 1977). Ambiguity and inconsistency are also important in that they influence implementing agents' sense-making.

Substantive Rather Than Superficial Change Is Very Difficult

The first issue is the difficulty of restructuring belief systems because of the cognitive complexity and affective challenges that this process involves. Policies are not monolithic. Some policies press for tremendous changes in existing behavior; others seek less fundamental changes. These differences are consequential when it comes to policy implementation. The tractability of the problem that a policy seeks to address, coupled with the nature of the change, influences the implementation process (Mazmanian & Sabatier, 1983). In our cognitive framework, the nature of

the changes sought by policymakers is also important because some changes involve more complex cognitive transformations for implementing agents than others. Focusing on the balance between continuity, growth, and loss, Marris (1975) identifies three levels of social change. The first level is incremental change, which requires little or no alteration of the extant purposes or expectations of the people undertaking the change. For example, changing the time at which a particular mathematical skill or topic is taught during the school year requires no alteration of the teacher's existing instructional purposes and expectations. The second level of change requires growth on the part of those undertaking change, but extant purposes and expectations can remain intact. Such change can be incorporated into existing schemas and frameworks rather than undermining them. The third level of change represents loss for the implementing agent, in that it necessitates the discrediting of existing schemas and frameworks. This level of social change is the most difficult to achieve (Marris, 1975). The more fundamental the changes sought by an innovation, the greater the extent to which existing schemas must be restructured to form coherent understandings of the new ideas.

The implementation of recent state and national standards-based reform initiatives involves all three levels of change because the reforms press for instructional changes that require teachers and other school personnel to give up existing schemas or frameworks for thinking about instructional practice. They will have to unlearn a considerable amount of what they already know and believe about instruction (Cohen & Barnes, 1993). Although the cognitive framework is relevant for all types of changes promoted by public policy, it is especially relevant for considering policies that require implementing agents to give up their existing frameworks and schemas. Policies that seek more complex and fundamental changes in local behavior are more prone to implementation problems because they require such fundamental changes in implementing agents' knowledge structures. Take, for example, recent education standards that press teachers to help their students to understand mathematics as involving conjecture, problem solving, and justification rather than as being entirely about computation. These standards demand tremendous change that would require teachers and school administrators to understand key aspects of their work, such as the nature of mathematics as a subject and what it means to teach mathematics to children, in ways that differ fundamentally from their existing cognitive scripts. Teachers would have to fundamentally transform their models for mathematics and mathematics instruction to understand the entailments of these policy proposals for their classroom practice.

Indeed, a recurring theme in the implementation studies discussed earlier is that instructional ideas that involve minimal or modest changes to implementing agents' existing schemas for subject matter and instruction tend to figure much more prominently in their implementation efforts than do ideas that require fundamental restructuring of agents' schemas (Guthrie, 1990; Firestone et al., 1999; Spillane & Jennings, 1997; Spillane & Zeuli, 1999). As we argued earlier, implementing agents may rely excessively on superficial similarities between their current practice and the reform ideas, may lose important aspects of the reform in the push to assimilate it into existing knowledge structures, and face affective challenges in finding problems with their current practice. Hence reforms often reflect the superficial aspects of a new policy rather than the deeper ideas intended by reformers (Haug, 1999; Hill, 2001; Spillane, 2000).

The Tension Between General Principles and Specific Examples in the Representation of Policy

If one takes seriously the role of human cognition in the implementation process, an especially influential dimension of policy design, rarely discussed in conventional accounts, is the external representations used by policymakers to convey their proposals for changing behavior. External representations are interpretations, only partial depictions of social reality, reflecting choices made by individuals creating the representations about what to include, what to exclude, and what problems have been targeted (Bannon, 1995; Becker, 1986; Latour, 1990). However the meaning of external representations exists fully only when individual decisions and actions are based on what has been actively interpreted and constructed as a result of interacting with the artifact (Becker, 1986; Latour, 1990). Analyzing how the policymakers' external representations enable or constrain implementing agents' sense-making is pivotal from a cognitive perspective. A cursory examination of state and national policies suggests that policies differ with respect to their external representations; the dominant mode for representing reform ideas is as a series of brief, often one-sentence statements cast as goals or objectives. Other external representations of reform ideas are found less frequently, including extended essays that attempt to unpack the key change ideas and justify the changes, as well as vignettes that illuminate the reform ideas as they might be applied in practice.

Policymakers face serious challenges in crafting a system to communicate and enforce reforms. The goal is to communicate deep underlying principles rather than the superficial aspects of specific examples. For example, in reforms for teaching approaches in science education, the core change advocated by national standards is specified in terms of using inquiry as a fundamental element of teaching (NRC, 1996). The standards assert that "inquiry into authentic questions generated from student experiences is the central strategy for teaching science." Inquiry is contrasted with simply learning terminology and scientific facts. Similarly, in the mathematics reforms, a core idea is "teaching for understanding" rather than for learning of algorithms (NCTM, 1989). Policy documents necessarily need to focus on underlying principles rather than advocating a particular program or prescribing a particular set of practices, such as using mathematics manipulatives or "science projects." Yet the language of the abstract principle is very susceptible to being understood in superficial and idiosyncratic ways from the perspective of agents' existing belief and knowledge systems. There is thus a very real tension between communicating abstract principles and being concrete enough to provide adequate constraint on the understanding process.

Communicating the rationale that motivates a reform is critical. Indeed, the surface form of practices can be implemented in such a way as to miss the underlying intent of the reform (Brown & Campione, 1996; Cohen, 1990). Adopting a practice without understanding or fully constructing the underlying idea can lead to these types of "lethal mutations." On the other hand, it is well known that many teachers characterize their teaching as consistent with reform when the judgment of observers is discrepant with their characterization; Fullan describes that belief by teachers as "false clarity" (2001). It is common for science teachers to report, for example, that they use inquiry in their classroom. Yet people can mean very different things by such a report. Indeed, practitioners often develop a superficial understanding of the reform, viewing the reform idea as a set of specific practices.

Policy Must Affect a System of Practices

The challenge to the communication of abstract policy ideas is, in fact, that those ideas represent a system of practices. Incoherence arises when the reform is interpreted as consisting of specific practices essentially out of context. The science teacher who interprets the reforms as prescribing an occasional activity in which students design an experiment has not addressed the system of practices necessary for the underlying idea. Scientific inquiry cannot occur with an isolated activity. It requires a different model of work for students, in which classrooms focus on posing questions, generating hypotheses based on initial observations, developing a data collection scheme to investigate hypotheses, building theories based on interpretation of data, socializing interpretations with others, receiving feedback, and continuing the cycle of questioning, investigation, and interpretation. It represents a major shift in how students think about science and how they think about their role as learners (Smith, Maclin, Houghton, & Hennessey, 2000). It is a change not only in activity but more fundamentally in discourse (Lemke, 1990). It is a change not only in the cognitive practices of scientific reasoning but also in the social interactions of learners and teachers (Beeth & Hewson, 1999). Such reform cannot be accomplished by having teachers learn only the surface form of reform practices. It requires grappling with the underlying ideas and may require deep conceptual change, in which teachers rethink an entire system of interacting attitudes, beliefs, and practices.

Some policy representations are likely to be more effective than others in enabling sense-making on the part of users, helping them to develop better understandings of the intentions of the designers. By better representations we mean more than providing thicker descriptions of the changes in extant behavior advanced through policy; the detail with which new ideas are explicated is not all that matters. As argued earlier, a key challenge in the sense-making process is that, when presented with new information, individuals tend to draw analogies to surface rather than structural features of their existing knowledge, thus misunderstanding the new information. As Gentner and colleagues (1993) point out, when individuals are reminded of structural similarities they are more likely to draw analogies. Hence we suggest that it is critical that policy representations support agents in "looking beneath the surface", perhaps by juxtaposing potential form- and function-based understandings of central reform ideas. Similarly, research on external representations suggests that the when new ideas are represented in a manner that matches the internal representation (prior understanding) of the user, it is more likely that the ideas will be used and adopted and the targeted behavior changed (Norman, 1988; White & Frederiksen, 1998). Hence implementing agents' internal representations or prior knowledge are a key leverage point for the representation of reform ideas in policy. Representations that build on and engage implementing agents' existing schemata are likely to enable implementing agents to construct understandings that more closely approximate policymakers' goals. If implementing agents' sense-making is central in the implementation process, then the nature of the external representations used by policymakers is as important a design feature as the rewards and sanctions attached to the policy to ensure that implementing agents and agencies comply.

A policy's messages about reforming practice can be represented in multiple ways. As was noted earlier, education standards take the form of legislation, standards documents, student assessment instruments, government and professional

association pamphlets of various sorts, and professional development workshops. Moreover, state standards usually contain multiple representations of any given idea about reforming instruction. For example, the EPPS study found that representations of Michigan's reading reforms varied among, and in some cases within, the state's own instruments, such as the state definition of reading, the state goals and objectives, the state assessment instruments, and the state professional development workshops (Cohen et al., 1998). The state reading assessment instrument represented the reform ideas in a way that was both similar and contradictory to the state's definitions of reading and reading objectives and its professional development efforts. The new assessment instrument included much richer text passages for students to interpret, reflecting the emphasis on students' construction of meaning and literature evident in other state policy instruments. But it also required students to respond to forced-choice, closed-ended items for which there were only right and wrong answers for the richer text passages. This struck some observers as being at odds with the state reading definition and professional development workshops.

Similarly, Hill (2001) found that many of the professional developers who "taught" teachers about the state's Mastery Test in mathematics, part of a policy that pressed for more attention to principled mathematical knowledge, de-mathematized and proceduralized the policy's messages about revising existing practice. Staff developers represented the reforms in ways that made complex mathematical problems into routine ones. And the representations of reform in the standards were not identical; each carried somewhat different messages about the reform of instruction.

The System for Providing Support for Sense-Making Is as Critical as the Content of the Message

A key theme of this article is that agents will need to make sense of a policy. Thus it is not enough simply to communicate the policy. There is a critical need to structure learning opportunities so that stakeholders can construct an interpretation of the policy and its implications for their own behavior. Some studies, though not many, offer additional insights into the influence of policy representations on implementing agents' sense-making from policy. For example, some recent work suggests that under the right conditions, to involve classroom teachers in scoring students' tests can enhance their understanding of instructional reform proposals (Murnane & Levy, 1996). Similarly, research on teachers' professional development, another context in which policymakers frequently represent their proposals for reforming practice, also offers insight. Cohen and Hill (2000) argue that policy is more likely to influence teaching when teachers' opportunities to learn are grounded in the curriculum that students study, are extended in time, and are connected to several dimensions of teaching (Cohen & Hill, p. 320). Wiley and Yoon's (1995) study also points to the importance of providing teachers with extended learning opportunities that are grounded in mathematics curriculum and instruction.

The Tension Between Creating Dissonance and Triggering Rejection

The literature on restructuring emphasizes the need, first, to lead implementing agents to recognize an existing model as problematic and, then, to focus resources and support on attempts to make sense of the novel idea, restructuring existing beliefs and knowledge. So it is key to create a sense of dissonance in which agents see the issues in their current practice rather than seeing the new ideas as achieved within their current practice. This dissonance, or dissatisfaction with one's own behavior,

is essential to the reinterpretation of one's beliefs. But this process cannot be too negative, or it may trigger the natural tendency toward self-affirmation, leading agents to find fault in or explain away the reform idea. Reformers need to create a context in which agents focus considerable resources on analyzing practice. To avoid the risk that abstractions will be interpreted through the teachers' own schemas for practice, the efforts must begin with examples and then build up to generalizations.

Conclusion

Policy analysts have long recognized that policy evolves as it is implemented: "[I]mplementation is evolution" (Majone & Wildavsky, 1978). We have argued that one plausible explanation for the evolution of reform proposals during implementation is the process of human sense-making. State and national standards ask local implementing agents—teachers, school administrators, local government officials, policemen, human service providers—to change their behavior and do things differently, but a cognitive perspective on implementation underscores that behavioral changes on the part of individuals are fundamentally cognitive. A cognitive perspective contributes to our understanding of implementation of policy by unpacking *how* implementing agents construct ideas from and about state and national standards. If implementing agents respond to standards, they act on the ideas about instruction that they construct from and about these standards. If implementing agents construct ideas that misconstrue policymakers' intent, then implementation failure is likely. Implementation failure in this case results not because implementing agents reject the reform ideas advanced via standards-based reform but because they understand them differently.

We believe that if implementation scholarship is to move beyond simply documenting that policies such as education standards evolve during implementation, it must—through the development and testing of integrative models—unpack how and why policy evolves as it does. This strategy is likely to generate important insights into the implementation process, insights that can inform the design of state and national standards as well as other education policies. The cognitive model outlined above attempts to demystify the ways in which human sense-making or cognition contributes to the evolution of policy proposals in the implementation process. The model makes this possible by identifying categories of variables that help to account for the understandings that implementing agents construct from policy. These categories of variables can be used to generate hypotheses about the ways in which education standards might evolve, as a result of implementing agents' sense-making, as they percolate through the system. Our cognitive model of implementation does not conclude with documenting an infinity of meanings that implementing agents come to understand from standards. Rather, the model suggests that there are patterns in what implementing agents come to understand from standards and in how they arrive at that understanding; the model also suggests that we can identify variables to help account for the patterns.

Although all policies involve sense-making on the part of those who attempt to implement them, some involve only minor changes in implementing agents' schemas—such as teaching two-digit multiplication in third rather than fourth grade—whereas others involve tremendous changes in those schemas. Education standards press for many reform ideas that, to be successfully implemented, would require tremendous reorganizing of most implementing agents' existing schemas.

The cognitive model proposed here is especially relevant in analyzing the implementation of policies of this type because successful implementation necessitates substantial changes in implementing agents' schemas.

Although some implementation research might be interpreted as suggesting that implementing agents make what they want to of policy signals, we take a different perspective. In our model, the policymakers' intentions, or the spirit of the policy, is important even if it is not always clear. Our notion of intent or spirit is meant to suggest that policy texts represent ideas about reforming practice and that we can analyze policy to see if it was understood as it intended. This strategy does not exclude the possibility of multiple interpretations of a single policy by implementing agents. Moreover, it does not exclude the fact that a policy proposal can have multiple versions (e.g., state standards and a state student assessment instrument) or that each version, or even the same version, can represent the policy message differently and that the differences may embody multiple intentions. Nevertheless, the realities of public policy, or the methodological challenges involved in representing those realities, should not be reasons for brushing them aside. Policy analysts should be able to identify some local understandings of a policy that are either compatible or incompatible with some of its intentions—that involve misinterpretation on the part of implementing agents and agencies.

The cognitive model developed here is not meant to supplant more conventional models of the implementation process but rather to supplement the existing models by making transparent an aspect of the process that has not been systematically unpacked in the literature. Our cognitive model complements existing models by exploring the manner in which implementing agents and agencies construct ideas from policy about changing their behavior. It offers new insights into the policy implementation process, illuminating additional explanations for implementation failure. If implementing agents construct understandings of the policy proposal that resonate with the policy's intent, they may ignore or adapt that understanding to advance their own agendas and, as a result, undermine the implementation of the policy. Nevertheless, it is a necessary if not sufficient condition for successful implementation that the implementing agents construct understandings of the policy message that resonate with its core intent. Of course, even if implementing agents construct understandings that reflect policymakers' intent, they may lack the necessary skills and resources to put those understandings into practice; that is, they may not have the necessary human and material resources to do what they understand the policy to be asking of them.

Our cognitive model incorporates both bottom-up and top-down perspectives on the implementation of standards. The top-down perspective is important in this model because the policy messages and the manner in which policy documents represent the messages are influential in implementing agents' understanding of them. Furthermore, the intent of policymakers' proposals serves as a gauge for analyzing implementing agents' understandings of the policy message. The bottom-up perspective is also central, in that implementing agents' scripts or schemata, coupled with their situations, are fundamental constituting elements in the sense-making process. In our scheme, the ideas about changing behavior that implementing agents construct from policy are a function of the interaction of (a) the policy signal; (b) the implementing agents' knowledge, beliefs, and experience; and (c) the circumstances in which the local actor attempts to make sense of policy.

The cognitive frame complicates the notion of attention to policy, suggesting that it is not solely a matter of whether implementing agents are rewarded or punished. Although policy analysts have long understood that attracting the attention of implementing agents is no small feat, most work has focused on the mobilization of inducements and sanctions (Bardach, 1980; Elmore & McLaughlin, 1988; McDonnell & Elmore, 1987). But attention to policy ideas is more complex than attention to a policy initiative. Policy ideas work as levers for change only if policymakers convince implementing agents to think differently about their behavior, prompting them to raise questions about their existing behavior and encouraging them to construct alternative ways of doing business (Stone, 1988; Weiss, 1990). Our goal in generating a cognitive model is to provide policymakers and analysts with an additional analytical tool to investigate the implementation process—allowing for the development of more comprehensive explanations for why policy succeeds or fails at the "street level."

A related point here is that our cognitive model is not linear; that is, we do not mean to suggest that the sense-making process is prior to decisions by implementing agents with respect to adopting or adapting the policy into local practice. Attempts to put into local practice some idea or set of ideas that approximate, to some extent, policymakers' proposals may help implementing agents to develop new understandings or insights into the changes promoted by policymakers. Implementing agents' attempts to put some version of the changes they understand from policy into practice can help them better understand the nature of the changes sought by policymakers. Understanding can follow action.

Notes

This article was made possible by support from Northwestern University's Institute for Policy Research and School of Education and Social Policy, the National Science Foundation (Grants No. OSR-9250061 and REC-9873583), the Spencer Foundation, the Consortium for Policy Research in Education (Grant No. OERI-R308A60003, U.S. Department of Education), and the James S. McDonnell Foundation. We are grateful to Hilda Borko, Patricia Burch, Cynthia Coburn, Corey Drake, Susan Fuhrman, Heather Hill, Dan Lewis, and Lisa Walker for their thoughtful suggestions on earlier drafts of this article. Additional information about some of the work discussed in the article can be found at *http://www.letus.org/dls/index.htm.* All opinions, findings, and conclusions expressed in this article are those of the authors and do not necessarily reflect the views of any of the funding agencies.

[1] Some scholars, arguing from a "bottom-up perspective," argue that local implementing agents' failure to follow policy directives are best understood as making otherwise unworkable policy directives workable. Often, local inattention to policy directives results because the directives are not sensible and would worsen rather than ameliorate the social problems that they are designed to address (Lipsky, 1978). Numerous examples in implementation research support this perspective. Others counter that this perspective is fundamentally flawed, arguing that in a democracy the perspectives of elected officials must take precedence over those of bureaucrats; implementation scholarship offers some compelling cases in support of their claim, including cases of school desegregation and implementation of Title 1 policy in southern states in the 1960s and 1970s.

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