Running head: ANALYZING EDUCATIONAL POLICIES

Analyzing Educational Policies as Designs for Supporting Learning

Paul Cobb
Vanderbilt University
Department of Teaching and Learning
1930 South Drive, 240 Wyatt Center
Peabody Box 330
Nashville, TN 37203
615.343.1492 (office)
paul.cobb@vanderbilt.edu

Kara Jackson
McGill University
Faculty of Education
Department of Integrated Studies in Education
3700 McTavish Street
Montreal, QC
Canada H3A 1Y2
kara.jackson@mcgill.ca

Submitted to *The Journal of the Learning Sciences*

The analysis reported in this chapter was supported by the National Science Foundation under grant No. ESI 0554535. The opinions expressed do not necessarily reflect the views of the Foundation. We are grateful to Thomas Smith, Chuck Munter, Lynsey Gibbons, Annie Garrison, and two anonymous reviewers for their constructive comments on a previous version of this paper.

Abstract

In this article, we describe and illustrate an analytical perspective in which educational policies are viewed as designs for supporting learning. This *learning design perspective* is useful when designing policies, when adapting policies to particular school and district settings during implementation, and when revising policies after implementation to make them more effective. Analyzed from this perspective, a policy comprises the goals for the learning of members of the target group, the supports for their learning, and an often implicit rationale for why these supports might be effective. We clarify that this perspective on policies has broad generality. In addition, we illustrate that personnel at all levels of the US education system both formulate policies designed to influence others' practices, and are practitioners targeted by others' policies. Policy implementation is viewed from the learning design perspective as a process in which people at multiple levels of a system reorganize their practices in settings shaped by others' policymaking efforts.

Our purpose in this article is to describe and illustrate an analytical perspective in which educational policies are viewed as designs for supporting learning. The contribution of the resulting *learning design perspective* is that it enables us to identify limitations of educational policies before they are implemented, understand why specific policies were implemented in certain ways and not others in particular schools and districts, and inform the formulation of empirically testable recommendations about how policies might be adjusted to make them more effective. As a consequence, the learning design perspective is useful when designing policies, when adapting policies to particular school and district settings during implementation, and when revising policies after implementation. Analyses conducted from this perspective are therefore directly relevant to Bryk's (2009) observation that "knowing that a program [or policy] *can* work is not good enough; we need to know *how to make it work* reliably over many diverse contexts and situations" (p. 598).

In the first part of the article, we clarify the tenets of the learning design perspective. An analysis of educational policies conducted from this perspective focuses on three potential components in addition to the intended consequences or outcomes of a policy: the learning of members of the group that the policy targets, the supports for their learning, and an often implicit rationale for why the supports might enable the members of a target group to attain the learning goals. We refer to these three components of a policy as the *what of policy*, the *how of policy*, and the *why of policy* respectively. In discussing the second component, the how of policy, we present a detailed taxonomy of different types of supports for learning and draw on work in the learning sciences to discuss the potential relevance of each type of support to the design of effective policies.

We also clarify that the learning design perspective on policy is an analytical approach and does not make any claims about policymakers' intentions as they formulate policies. This perspective on policies therefore has broad generality and is not restricted to cases in which policy makers view themselves to be developing designs for supporting others' learning.

In the second part of the article, we present a sample case to illustrate how analyses of a policy and its implementation conducted from the learning design perspective can inform the revision of policies. The case concerns a large urban school district that was attempting to improve the quality of mathematics instruction and thus student mathematics achievement in the middle grades. We illustrate how the analysis of the district's instructional improvement policies resulted in actionable recommendations about how district leaders might adjust district policies to make them more effective.

In the final part of the article, we develop the conceptual implications of the learning design perspective on policy. In doing so, we clarify that personnel at all levels of the US education system both formulate policies designed to influence others' practices, and are practitioners targeted by others' policies. Policy implementation is viewed from the learning design perspective as a process in which people at multiple levels of a system reorganize their practices in settings shaped by others' policymaking efforts.

Policies, Sense Making, and Learning

As Coburn and Stein (2006) observed, a policy is an intentional attempt by members of one group to influence the practices of members of another group. A myriad of school and district policies have implications for classroom teaching and learning (e.g.,

fiscal policies that increase the size of mathematics classes). In this article, we restrict our focus to educational policies that are intentionally formulated to bring about changes in mathematics teaching and/or learning by influencing the practices of members of one or more target groups (e.g., teachers, coaches, principals, district mathematics specialists, district leadership directors).

Some educational policies set outcomes that require members of one or more groups to change their practices, but leave the nature of the changes unspecified. Examples of policies of this type include school adequate yearly progress goals for student mathematics achievement. From the learning design perspective, a key characteristic of such policies is that they include neither a vision for the practices of members of target groups (the what of policy), nor supports for members of those groups to change their practices and produce the required outcomes (the how of policy). Other policies specify changes that members of the target group should make in their practices. Policies of this type have become increasingly commonplace in the era of standards-based reform as classroom instruction and teachers' work have come under increasing scrutiny (Gallucci, 2008; Honig, 2006). For example, it has become common for district leaders to introduce policies that require principals to act as instructional leaders by observing mathematics instruction and giving teachers feedback to support them in improving their classroom practices. The illustrative case that we will present involves policies of the second type that specify changes in practices. In the concluding section of the article, we will clarify that the learning design perspective is also relevant when examining policies of the first type that specify only outcomes.

The learning design perspective builds on work in educational policy that emphasizes that policy implementation involves active sense making by teachers and other practitioners and that implicates their understanding of subject matter, teaching, students, and learning (Spillane, Reiser, & Gomez, 2006; Stein & Nelson, 2003). Studies of policy implementation conducted from this sense making perspective focus squarely on the what of policy and document the changes that teachers and other targets of policy actually make in their practices (Honig, 2006; Stein, 2004). The findings of these studies call into question the common assumption that implementation failure involves either willful distortion or resistance, and that incentives and penalties will be sufficient to remedy the situation (Elmore, 2004). Studies that attend to practitioners' sense making also indicate that successful implementation involves a process of mutual adaptation between the intended policy and the local context in which implementers modify policy goals and strategies to suit local conditions (McLaughlin, 1987). In addition, Coburn's (2001) investigation of teacher groups reveals that sense making is a collective as well as an individual activity in which the common worldview and shared understandings of the group both privileges certain policies for revising practice and influences how those policies are understood.

Researchers who take a sense making perspective also emphasize that policy implementation involves the reorganization of practice. Cohen and Barnes (1993) articulated the basic tenets of this view when they observed that any serious policy that does not simply endorse current practice and call for more of it requires that those who implement it develop new capabilities and unlearn present capabilities. In the last few years, several studies conducted from the sense making perspective have focused on the

how of policy as well as the what of policy (Coburn & Russell, 2008; Penuel, Frank, & Krause, 2006; Stein & Coburn, 2008). These studies have attempted to understand how schools and districts can support teachers' development of increasingly effective instructional practices by analyzing cases of successful policy implementation. We draw on the findings of these studies in the next section of the article when we discuss the how and why of policy. For the present, it suffices to note that studies of this type substantiate Cohen and Barnes' (1993) contention that implementation is a species of learning and policy is a sort of instruction that should include the provision of supports for learning.

The learning design perspective extends this line of work by bringing to the fore an analysis of the learning demands of specific policies, the intended supports for learning specified in policies, and the learning supports that are actually implemented or enacted. In the following section, we present a taxonomy of different types of supports for learning that we then employ in the illustrative case.

The How and Why of Policy

Our purpose in developing a taxonomy of learning supports was to clarify the potential of each type of support as a scaffold for practitioners' development of more effective practices. Knowledge of various types of supports for learning is useful when formulating policies that require practitioners to reorganize their practices significantly, when analyzing such policies in order to identify their strengths and weaknesses prior to implementation, and when studying their implementation in order to determine how they might be adjusted to make them more effective.

The taxonomy emerged in the course of the first three years of a collaboration with district leaders, school leaders, and mathematics teachers in four urban districts

including the focal district, and from a consideration of the literature on school and district instructional improvement. We drew heavily on research in the learning sciences when assessing the potential of the various types of supports for learning that we identified, and viewed co-participation with others who have already developed relatively accomplished practices as crucial (Lave & Wenger, 1991; Rogoff, 1997; Sfard, 2008). In addition, we attended to what Wenger (1998) called reifications as well as co-participation by considering the role of tools as supports for the reorganization of practice. The potential of tools as scaffolds for learning has been well documented (Lehrer & Lesh, 2003; Meira, 1998). In the context of large-scale instructional improvement efforts, designed tools can also play a second important role by enabling members of a particular role group to develop compatible practices, and by supporting alignment in the practices developed by members of different role groups (e.g., teachers, principals, coaches). The taxonomy includes four types of supports: new positions (or changes in the responsibilities of existing positions), learning events, new organizational routines, and new tools. In presenting the taxonomy, we take as an example the learning goal that principals should become effective instructional leaders in mathematics (i.e., the what of policy) and discuss the rationale for each type of support (i.e., the how and why of policy).

New Positions

School and district policies for instructional improvement typically include changes in the responsibilities of existing positions, such as principals becoming effective instructional leaders in mathematics. In addition, improvement efforts often include the creation of new positions whose responsibilities include supporting others' learning. We

distinguish between cases in which the intended support for learning is direct (expert guidance) from those in which it is indirect (sharing responsibilities).

Expert guidance. In some cases, the holder of the new position is expected to support learning directly by providing expert guidance. For example, the district on which we will focus created the position of a school-based mathematics coach in each middle school. The responsibilities of the mathematics coaches included supporting their principals in becoming instructional leaders in mathematics. This aspect of the policy assumes that the coaches have developed greater expertise as instructional leaders in mathematics and can therefore guide principals as they attempt to support mathematics teachers' improvement of their classroom practices (Bryk, 2009; Spillane & Thompson, 1997).

The importance that we attributed to the expertise or knowledge-in-practice of the holder of the new position follows directly from Vygotskian accounts of human development (Kozulin, 1990; van der Veer & Valsiner, 1991; Vygotsky, 1978) and is supported by studies of apprenticeship and coaching (J. Brown, Collins, & Duguid, 1989). We therefore view the provision of expert guidance by creating new positions (or changing the responsibilities of existing positions) as a primary support for learning. The extent to which the investment in the new position will pay off is influenced by a variety of factors in addition to the expertise of the appointee. These additional factors include the overall coherence of school or district instructional improvement policies and the extent to which the expert and target of policy co-participate in activities that are close to the intended forms of practice.

Sharing responsibilities. Schools and districts also create new positions in the expectation that the appointees will take over some of the responsibilities previously fulfilled by the targets of policy. In such cases, the rationale for the new position is often to provide indirect support for learning by enabling the targets to focus on improving practices that address other responsibilities. For example, leaders in a second district with which we are working have created the position of school administrative manager to take over some of the principal's administrative responsibilities, thereby enabling the principal to focus more directly on instructional leadership. In this and similar cases, the rationale for the new position is to increase the opportunities for targets' learning rather than to provide direct support or guidance for their learning. We therefore view the sharing of responsibilities as a supplementary means of support because it is unlikely to be effective unless it is complemented with the provision of some form of direct support.

Learning Events

Most school and district instructional improvement efforts include professional development for teachers and, on occasion, for members of other role groups including principals. We treat professional development sessions as instances of learning events, which we define as scheduled meetings that can give rise to opportunities for targets of policy to improve their practices in ways that further policy goals. We take account of learning events that can give rise to incidental learning opportunities as well as those that are intentionally designed to support learning in order to make a comprehensive analysis of a school's or district's instructional improvement policies.

Intentional learning events. A distinction that proves useful when analyzing the strengths and weaknesses of educational policies is that between intentional learning

events that are ongoing and those that are discrete. The two key characteristics of *ongoing intentional learning events* are that they comprise a series of regularly scheduled meetings that build on one another, and that they involve a relatively small number of participants. As an example, a district mathematics specialist might work regularly with middle-school principals as a group in order to support them in recognizing high-quality mathematics instruction when they make classroom observations. Because a small number of participants are involved, the group might evolve into a genuine community of practice[1] that works together for the explicit purpose of improving their practices.

It is important to note that communities of practice are emergent phenomena that are jointly constituted by the participants in the course of their interactions (Wenger, 1998). As a consequence, communities of practice cannot be mandated into existence by policymakers. However, policies can be crafted that aim to establish conditions that are conducive to the emergence of communities of practice (Smylie & Evans, 2006; Spillane, et al., 2006). Although communities of practice can be productive contexts for professional learning (Horn, 2005; Kazemi & Hubbard, 2008), the emergence of a community of practice does not guarantee the occurrence of learning opportunities that further policy goals (Bryk, 2009). Recent research in both teacher education and educational leadership indicates the importance of interactions among community members that focus consistently on issues central to practice (Marks & Louis, 1997) and that penetrate beneath surface aspects of practice to address core suppositions, assumptions, and principles (Coburn & Russell, 2008). This in turn suggests the value of one or more members of the community having already developed relatively accomplished practices so that they can both push interactions to greater depth (Coburn

& Russell, 2008) and provide concrete illustrations that ground exchanges (Penuel, et al., 2006). The critical role of expertise in a community of practice whose mission is to support participants' learning is consistent with the importance attributed to "more knowledgeable others" in sociocultural accounts of learning (Bruner, 1987; Cole, 1996; Forman, 2003).

It is worth noting that the key aspects of ongoing intentional learning events that we have identified are consistent with the qualities of effective teacher professional development identified in both qualitative and quantitative studies. These qualities include extended duration, collective participation, active learning opportunities, a focus on problems and issues that are close to practice, and attention to the use of tools that are integral to practice (Borko, 2004; Cohen & Hill, 2000; Desimone, Porter, Garet, Suk Yoon, & Birman, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001). We view ongoing intentional learning events that have these qualities as a primary means of supporting consequential learning that involves the reorganization of practice.

Discrete intentional learning events include one-off professional development sessions as well as a series of regularly scheduled meetings in which activities do not build on each other. For example, leaders in the district on which we will focus organized monthly meetings for principals. We classify these meetings as discrete rather than ongoing intentional learning events because principals engaged in activities that focused on instructional leadership in mathematics only occasionally, and these activities did not build on each other. Discrete intentional learning events can be valuable in supporting the development of specific capabilities that elaborate or extend current practices (e.g., introducing a classroom observation tool that fits with principals' current

practices and is designed to make their observations more systematic). However, they are by themselves unlikely to be sufficient in supporting the significant reorganization of practice called for in districts that are pursuing ambitious instructional agendas.

Incidental learning events. In addition to intentionally planned or designed learning events, opportunities for targets of policy to improve their practices can also arise incidentally as they collaborate with others to carry out functions of the school or district. For example, middle-school principals and mathematics coaches in the focal district were expected to meet each week to discuss the quality of mathematics teaching in their school and to consider how to address teachers' needs. Although these meetings were not designed to support the principals' learning, it is possible that learning opportunities could arise as a principal interacts with a mathematics coach about instructional issues. In general, the extent to which regularly scheduled meetings with a more knowledgeable other involve significant learning opportunities depends on both the focus of interactions (e.g., the nature of teachers' classroom practices and student learning opportunities) and on whether the expert has in fact developed relatively accomplished practices and the novice recognizes and defers to that expertise (Elmore, 2006; Mangin, 2007). The extent to which significant learning opportunities actually arise in incidental learning events can therefore be assessed by documenting the focus and the depth of interactions. However, in the absence of compelling evidence to the contrary, relying on incidental learning events as the primary means of supporting professional learning appears to be an extremely risky strategy.

New Organizational Routines

In addition to creating new positions and planning learning events, instructional improvement policies sometimes include the specification of new organizational routines. Feldman and Pentland (2003) define organizational routines as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (p. 94). Investigations of organizational routines in school settings demonstrate that they can play a critical role in ensuring continuity and thus school stability in the face of high staff turnover (Spillane, Mesler, Croegaert, & Sherer, 2007). In addition, these studies clarify that organizational routines often evolve incrementally in the course of repeated enactments and can therefore also be a source of organizational flexibility (Feldman, 2000, 2004). Furthermore, as Sherer and Spillane (in press) illustrate, the introduction of carefully designed organizational routines can be an important means of supporting learning.

As an illustration of an organizational routine, leaders in the focal district expected that middle-school principals would conduct learning walks with the mathematics coach at their schools on a regular basis. A learning walk is a repetitive, recognizable pattern of actions that involves determining the focus of classroom observations (e.g., the extent to which teachers maintain the cognitive challenge of tasks throughout the lesson), selecting classrooms to visit, observing a classroom, and then conferring to discuss observations about the quality of mathematics instruction and students' learning before moving on to the next classroom. In addition, a learning walk is carried out by multiple actors, namely the principal, mathematics coach, and the observed teachers. The intent of leaders in the focal district in designing this organizational routine was that the mathematics coach would scaffold the principal in assessing the quality of teachers' instructional practices and determining the additional supports that they might

need. In particular, the coach might support the principal in coming to recognize key aspects of high-quality mathematics instruction.

In this example, the organizational routine is conducted independently of any formally scheduled meetings. Other organizational routines might be enacted during either intentional or incidental learning events.[2] For example, a district mathematics specialist working with a group of principals might introduce an organizational routine that involves first having principals collect student work on the same task from one or more classrooms in their schools, then having the principals analyze the quality of the student work in small groups, and finally leading a whole group discussion that aims to delineate the characteristics of high-quality work. In general, organizational routines in which a more knowledgeable other scaffolds relative novices' learning as they co-participate in a sequence of activities that are close to practice are a primary means of supporting professional learning (Grossman & McDonald, 2008; Lampert & Graziani, 2010).

New Tools

Work in the learning sciences and in teacher professional development indicates that introducing carefully designed tools is a primary means of supporting learning (Borko, 2004; Cobb, Zhao, & Dean, 2009; Lehrer & Lesh, 2003).[3] In speaking of tools, we refer to material entities that are used instrumentally to achieve a goal or purpose. Examples include textbooks, curriculum guides, state mathematics objectives, classroom observation protocols, reports of test scores, student written work, and written statements of school and district policies.[4] In discussing the role of tools as supports for learning, we distinguish between tools designed to support learning in intentional learning events such

as pull out professional development sessions, and tools designed to be incorporated into practice.

Tools in intentional learning events. Although tools play a central role in most school and district instructional improvement efforts, they have rarely been an explicit focus of analysis in the policy and leadership literature (Coburn & Stein, 2010). In contrast, recent studies of teacher professional development have highlighted the value of using tools to ground professional development in classroom instructional practice (Ball & Cohen, 1999; Nelson, 1997; Putnam & Borko, 2000; Schifter, 1998). Examples of such tools include instructional tasks, classroom video-recordings, and students' written work. The use of tools of this type addresses Ball and Cohen's (1999) call for professional development activities to be organized around artifacts[5] that are directly relevant to practice.

A number of studies indicate the potential of this general approach in supporting teachers' development of ambitious instructional practices that involve building on students' current reasoning to achieve a significant disciplinary agenda (Lampert & Ball, 1998; Lewis, Perry, & Murata, 2006; Sherin & Han, 2004). However, recent investigations also clarify that the design of intentional learning events should take account of how the participants currently use particular artifacts in their practice (Kazemi & Hubbard, 2008). For example principals might currently look at student work in practice to monitor pacing and content coverage whereas the intent of professional development is that they will review student work to monitor whether teachers are maintaining the cognitive challenge of instructional tasks. It is probable that the principals will use student work to assess pacing when it is introduced in intentional

learning events unless the limitations of this way of using student work are made explicit (e.g., by having principals interview students who appear to have mastered content that has been covered in a procedural manner in order to assess the depth of their understanding).

The above example illustrates the more general point that the movement of artifacts between practice and intentional learning events is not, by itself, sufficient to support substantial learning (Cobb, et al., 2009). It appears crucial to take account of how artifacts are currently used in practice when planning how they will be used in intentional learning events (Beach, 1999). We view tools that are used in this manner as a primary means of supporting consequential professional learning.

Tools in practice. Large-scale instructional improvement efforts almost invariably involve the introduction of a range of new tools designed to be used in practice, including newly adopted instructional materials and revised curriculum frameworks for teachers, and new classroom observation protocols and data management systems for principals. The findings of a number of studies conducted in the learning sciences substantiate Pea's (1993) claim that the incorporation of a new tool into current practices can result in the reorganization of those practices (Lehrer & Schauble, 2004; Meira, 1998; Stephan, Bowers, & Cobb, 2003). However, it is also apparent that people frequently use new tools in ways that fit with current practices rather than reorganizing those practices as the designers of the tool intended (Wenger, 1998). For example, the findings of a number of studies of policy implementation and of teaching indicate that teachers often assimilate new instructional materials to their current instructional practices rather than reorganize how they teach as envisioned by the developers of the

materials (Cohen & Hill, 2000; Remillard, 2005; Spillane, 1999). As Wenger (1998) observed, although a tool is a relatively transparent carrier of meaning for its developers, there is every possibility that it will be used differently and come to have different meanings as others incorporate it into their current practices. This observation in turn implies that the distinctive qualities attributed to a tool depend not only on its concrete form but also on how it is actually used in practice. It is therefore important to consider the design of a tool and the supports for its increasingly accomplished use in a coordinated manner. In doing so, we extrapolate from work on tool design in the learning sciences and related fields.

As a first design heuristic, it is important, particularly in the context of professional learning, that intended users see a need for the tool when it is introduced (Cobb, 2002; Lehrer, Schauble, & Penner, 2000). This implies that either the tool should be designed to address a problem of current practice or it should be feasible to cultivate the need for the tool during intentional learning events. As an illustration, consider a classroom observation protocol that has been designed to support principals in focusing not merely on whether students are engaged, but also on the types of activities in which they are engaged and the extent to which significant learning opportunities arise for them. It is unlikely that the principals who are expected to use the new observation form will see a need for it unless it is introduced during a series of intentional learning events that might, for example, focus on the relation between classroom learning opportunities and student achievement.

Second, it is also important that the tool be designed so that intended users can begin to use it shortly after it has been introduced in relatively elementary ways that are

nonetheless compatible with the designers' intentions and do not involve what A. Brown (1992) termed lethal mutations. In the case of our example, it would seem advisable to minimize the complexity of the observation protocol given the significant reorganization of practice that most principals would have to make to use it in a way compatible with the designers' intentions (Nelson & Sassi, 2005). The protocol might therefore focus on teachers' enactment of only one or two high-leverage instructional practices during each major phase of mathematics lessons (e.g., pressing students to justify their reasoning during the concluding whole class discussion phase).

Third, in using the tool in rudimentary but intended ways, users have not merely assimilated the tool into their current practices. Instead, they have begun to reorganize those practices as they have incorporated the tool. The challenge is then to support further reorganizations of practice by providing a graduated series of apprenticeship experiences designed to scaffold increasingly accomplished use of the tool (J. Brown & Duguid, 1991; Lave, 1993; Rogoff, 1990). This scaffolding could occur either during intentional learning events or while co-participating in organizational routines explicitly designed to support users' learning. In the case of the observation protocol, for example, mathematics coaches might support principals' use of the tool as they conduct learning walks together. Just as the failure to provide sustained teacher professional development around a new curriculum can lead to difficulties (Crockett, 2007), failure to scaffold principals', coaches', and others' use of new tools is also likely be problematic. In this regard, Coburn and Stein's (2006) analysis of two districts' introduction of elementary mathematics curricula revealed that implementation was more effective when it involved co-participation with more accomplished others rather than the mere hand-over of tools.

Summary

In this section of the article, we have elaborated the how of policy by describing four types of support for learning: new positions (or changes in the responsibilities of existing positions), learning events, new organizational routines, and new tools. Based on our discussion of the rationale for each type of support (i.e., the why of policy), we anticipate that policies that are effective in supporting consequential professional learning will involve some combination of new positions that provide expert guidance, ongoing intentional learning events in which tools are used to bridge to practice, carefully designed organizational routines carried out with a more knowledgeable other, and the introduction of new tools designed to be incorporated into practice. We do not discount the support that discrete intentional learning events and incidental learning events might provide and would want to take account of them in analyses of policies. However, research on professional learning and on students' learning in particular content domains indicates that they will rarely be sufficient to support the reorganization of practice.

In addition to fleshing out the how and why of policy, the taxonomy also elaborates the relatively common approach of analyzing school and district capacity for instructional improvement in terms of the development of human, social, and material (financial) capital. We consider Spillane and Thompson's (1997) analysis of district capacity to support ambitious instruction in mathematics and science to be seminal in this regard. In Spillane and Thompson's terms, the function of each type of support for learning that we have discussed is to increase a district's human capital by scaffolding people's development of increasingly effective practices. Each of the supports also draws on the district's current human capital, namely people who have already developed

relatively accomplished practices and can scaffold others' learning. In addition, the supports draw on the district's existing social capital because relationships involving apprenticeship and professional learning entail both collaboration and trust (Bryk & Schneider, 2002; Schön, 1986). The enactment of the learning supports might also draw on a second aspect of social capital identified by Spillane and Thompson, namely links to people and organizations outside the district who have the expertise to assist in the instructional improvement effort. Conversely, the enactment of the learning supports can enhance the district's social capital by fostering the development of trust (Halverson, 2003), shared understanding, and professional networks (Penuel, Riel, Krause, & Frank, 2009).

In analyzing the role of financial resources, Spillane and Thompson (1997) focused on the allocation of staffing, time, and materials to the instructional improvement effort. As they observed, teachers' development of ambitious instructional practices, and instructional leaders' development of concomitant leadership practices, requires the direct support of more accomplished others for an extended period of time.[6] They therefore concluded that a threshold of financial resources is necessary, but "it will be the superior human and social capital that they [district leaders] hire or develop, not the material resources themselves, that position them to get richer in capacity for improvement" (p. 199). The taxonomy we have outlined is compatible with and extends Spillane and Thompson's discussion of human, social, and financial capital by foregrounding the design of specific types of learning supports that give substance to the how of policy.

The Case of District B

The case that we present comes from an ongoing study designed to address the question of what it takes to improve the quality of middle-grades mathematics teaching, and thus student achievement, at the scale of a large urban district. We are conducting this study in collaboration with four urban districts that are attempting to increase student achievement by supporting teachers in improving the quality of their mathematics instruction. In the vision of high-quality instruction that orients the four collaborating districts' instructional improvement efforts, teachers are expected to continually adjust their plans for instruction to students' developing mathematical capabilities as informed by ongoing assessments of their mathematical reasoning. Instructional practices of this type are complex and demanding (Franke, Kazemi, & Battey, 2007). They require a deep understanding of the mathematical content on which lessons focus (Ball, 2000; Lampert, 2001; Ma, 1999) and of how students' reasoning develops in particular mathematical domains (Carpenter, Fennema, Franke, Levi, & Empson, 1999; Franke, et al., 2007), and involve the development of new instructional routines for building on students' solutions to achieve a mathematical agenda (Ball, Sleep, Boerst, & Bass, 2009; Grossman & McDonald, 2008). The districts' visions for mathematics instruction therefore constitute ambitious policy goals whose achievement requires significant learning on the part of teachers and members of other role groups.

We focus on one of the four districts, District B, to illustrate the usefulness of the learning design perspective on policy. District B serves approximately 80,000 students, over 50% of whom are Hispanic, over 25% are African American, and about 15% are White. Over 25% of all students are classified as Limited English Proficient (LEP). The majority of the students receive free or reduced-price lunches. District B's student

achievement patterns in middle-school mathematics are typical for large, urban districts. For example, on a recent state assessment in eighth grade mathematics, less than 40% of the African American students met the eighth grade mathematics standards, as compared to 55% of the Hispanic students and about 75% of the White students. Only about 25% of the LEP students met the eighth grade standards in mathematics.

In the current climate of high-stakes accountability associated with the federal legislation of the No Child Left Behind (NCLB) Act (U.S. Congress, 2001), leaders of urban districts are under pressure to demonstrate evidence of improvement in students' mathematics achievement. Prior research has documented that leaders in most large urban districts respond to the accountability demands associated with NCLB by implementing policies that emphasize "teaching to the test," providing remedial instruction for students not meeting achievement standards, and, on occasion, "gaming the system" (Heilig & Darling-Hammond, 2008). In contrast, as we detail below, District B central office leaders (e.g., Superintendent, Chief Academic Officer) framed the overall low-performance in middle-school mathematics achievement and the disparities in achievement between sub-groups as a problem of supporting teachers' learning.

In the following paragraphs, we describe our methodology for documenting District B's policies and their implementation, and then describe the what of District B's policies for instructional improvement in middle-school mathematics. Against this background, we illustrate the predictive and explanatory power of the learning design perspective on policy by analyzing one of District B's policies, the development of principals as instructional leaders in mathematics.

Methodology

As part of the larger study, we are conducting four annual cycles of data collection, analysis, and feedback in each of the four districts aimed at identifying district and school organizational arrangements, social relations, and material resources that support improvements in the quality of middle-school mathematics instruction. The case that we present draws on the data collection-analysis-feedback cycle conducted in District B in 2008-2009 during the second year of the study. At that time, District B was in the second year of implementing an initiative to improve the quality of mathematics teaching and learning in the middle grades.

An annual cycle of data collection, analysis, and feedback comprises five phases:

1) Document the set of policies that comprise the district's theory of action (Argyris & Schön, 1978) for instructional improvement in mathematics.
2) Document how the district's theory of action, or set of improvement policies, is being implemented in schools and classrooms.
3) Identify how and explain why the enacted policies differ from the designed or intended policies.
4) Provide feedback to district leaders about how policies are being implemented in schools, and make actionable recommendations about how the policies might be adjusted to make them more effective.
5) Document the extent to which our recommendations influence the revision of policies for the following academic year.

Below, we explain each of these phases as they were carried out in District B during the second year of the larger study.[7]

Phase one: Document the district's theory of action for instructional improvement. To determine the district's theory of action for improving middle-school mathematics instruction, we conducted audio-recorded interviews with key district leaders whose central office units were involved in the improvement effort in the fall. These units included: Curriculum and Instruction (C&I), Leadership, Bilingual Education, Special Education, and Research and Accountability. In District B, the Chief Academic Officer (CAO) presided over all matters of curriculum and instruction. The CAO, whom we interviewed, was centrally involved in the design of policies associated with the middle-school mathematics improvement effort. Within C&I, we also interviewed the leaders of the Mathematics Department (Executive Director of the department and the Director of Secondary Mathematics). Additionally, we interviewed the three district Mathematics Specialists who were responsible for supporting the middle-school mathematics teachers and coaches.

C&I was responsible for assessing and supporting teachers and coaches, whereas the Office of Leadership was responsible for assessing and supporting principals and assistant principals. Each of the approximately 25 middle schools was assigned to one of three Leadership Directors in the Secondary Leadership Department, who held principals accountable for meeting expectations for instructional leadership and provided support (e.g., professional development). We interviewed the head of Secondary Leadership and one of the Leadership Directors who was most directly involved in the design of policies for school instructional leadership.

The audio-recorded interviews typically lasted one hour and focused on the district's goals for middle-school mathematics instruction and the policies that were

being implemented to achieve those goals (e.g., supporting principals' development as instructional leaders, providing high-quality professional development for teachers). We triangulated different leaders' responses when we analyzed transcriptions of the interviews to develop a comprehensive, empirically grounded representation of the district's instructional improvement policies. The goals and policies reported by the district leaders in District B were generally consistent. We then created a document in which we detailed our understanding of the district's theory of action, organized by the two major policies we identified. For each policy, we described the goals of the practices of particular role groups (i.e., the what of the policy), the intended means of supporting the learning of members of those groups (i.e., the how of the policy), and the rationale for why the supports might enable members of the target groups to develop the envisioned forms of practice (i.e., the why of the policy). We shared the resulting document with the CAO to check whether we accurately understood the district's theory of action for instructional improvement prior to moving to phase two of our analysis. The CAO confirmed that our account of District B's theory of action was accurate.

Phase two: Document how the district's theory of action is being implemented in schools and classrooms. At the beginning of the larger study, we purposefully selected a sample of seven middle schools in District B that reflected variation in student performance and in capacity for improvement across schools. As we have noted, District B had created the position of mathematics coach in each middle school. The principal, mathematics coach, and up to five randomly selected mathematics teachers in each school participated in the study. The data we collected in the winter to document how the district's improvement policies were being enacted included the following: video-

recordings of teachers' classroom instruction; assessments of teachers' and coaches' mathematical knowledge for teaching (Hill, Ball, & Schilling, 2008); video-recordings of pull-out teacher professional development; audio-recordings of school-based teacher learning community meetings; audio-recorded interviews and surveys of teachers, coaches, and principals; and audio-recorded interviews of district leaders. In addition, we had access to student achievement data.

For the analysis reported in this article, we relied primarily on interview data. Each of the approximately 50 semi-structured interviews conducted in District B were guided by one of nine different interview protocols depending on the position of the interviewee. The questions we asked teachers, coaches, and principals in the seven focal schools were informed by the district's theory of action and focused on a range of issues including participants' visions of high-quality mathematics instruction, the formal and informal supports they could draw on to improve their practices, and to whom and for what they were accountable. We also interviewed the central office leaders listed above in the description of phase one, as well as the remaining two Leadership Directors, to gauge their perspectives on the implementation of the various policies, find out their visions of high-quality mathematics instruction, and document their perceptions of the support they provided to others and received themselves as part of the improvement effort. The interviews typically lasted between 45 and 60 minutes, and all interviews were transcribed.

The analysis of the interview transcripts reported in this article sought to identify patterns in the principals', coaches', and teachers' perspectives on the support they had received for improving their practices. First, a member of the research team completed

an Interview Summary Form (ISF) for each interview transcript. The ISF summarizes the sources of formal and informal assistance on which the participant drew, to whom the participant perceived herself to be accountable and what she was accountable for, and so forth. Next, we created detailed accounts of how each of the policies in District B's theory of action was playing out *within* each of the seven schools by completing School Summary Forms (SSF) in which we synthesized the teachers', mathematics coach's, and principal's accounts. In addition, we created detailed accounts of how each of the policies was playing out *across* the seven schools by completing mid-level summary forms that synthesized the accounts of members of each role group (i.e., teachers, principals, mathematics coaches). In developing these syntheses, we took care to triangulate participants' accounts for each policy. For example, the focal account of the policy for principals as instructional leaders (that we describe below) is based on the triangulation of principals', coaches', and teachers' accounts of principals' practices.

Phase three: Identify how and explain why the enacted policies differ from the designed or intended policies. We conducted a gap analysis by comparing the policies as designed by district leaders with how the policies were being implemented in the seven schools. In addition to comparing intended and enacted policy goals by focusing on issues of accountability (i.e., the what of the policies), we also related our analysis of enacted supports for teachers', mathematics coaches', and principals' learning to the intended supports for their learning (i.e., the how of the policies). Our purpose in conducting this gap analysis was to understand why specific policies were being implemented in certain ways and not in others in particular schools and across the district. We therefore analyzed the SSFs and mid-level summary forms (described

above) in order to identify aspects of the school and district settings in which members of particular role groups worked that appeared to be significant in explaining why they were developing practices that differed from those that the policies were designed to support.

Our accounts of teachers', coaches', and principals' practices therefore aimed to situate their practices with respect to the organizational arrangements, social relationships, and material resources that comprised the school and district settings in which they worked. As we will illustrate, this approach enabled us to explain why teachers, coaches, and principals were developing particular practices and not others by delineating how these settings afforded and constrained their learning. Crucially, these settings included the supports for their learning as they were actually being implemented (i.e., the implemented how of the policies).

Phase four: Provide feedback to district leaders. In addition to reporting our findings about how the district's policies were being implemented, we also made recommendations regarding how district leaders might revise the how of the policies for the following academic year. In developing these recommendations, we drew on our gap analysis and a prior iteration of the taxonomy of supports for consequential professional learning. Shortly before the end of the academic year, we presented our findings and recommendations to key district leaders in a written report and in a subsequent two-hour meeting with those leaders in which we discussed the report and its implications. The timing of the feedback was intentional as the leaders in most districts develop and revise instructional policies for the following school year during the summer.

Phase five: Document the impact of our recommendations. Near the beginning of the following academic year, we again documented the district's theory of action for

instructional improvement (see phase one above). We documented the impact of our feedback and recommendations on District B's policies by noting changes in the district's theory of action from the previous year and comparing these changes with the feedback report that we had discussed with district leaders.

District B's Theory of Action for Improving Middle-School Mathematics Instruction

In this section, we provide an overview of the policies that comprised District B's theory of action for instructional improvement in mathematics. The what of the two primary policies that the district was attempting to implement were: 1) teachers would develop high-quality instructional practices that would enable all students to both understand significant mathematical ideas and develop procedural fluency, and 2) principals would develop instructional leadership practices that involved supporting and holding teachers accountable for developing high-quality instructional practices.

We discuss the second of these policies in some detail in the next section of this article. With regard to the how of the first policy, designed supports for teachers' learning included the adoption of an inquiry-oriented middle-grades mathematics textbook series whose initial development had been funded by the National Science Foundation. In addition, members of the Mathematics Department provided pull-out professional development for middle-school mathematics teachers and created an elaborate Curriculum Framework that was designed to support teachers in using the adopted texts effectively.

The district was in the second year of implementing a school-based mathematics coaching program in all middle schools. The CAO and Executive Director of the Mathematics Department designed the position of mathematics coach to support the

implementation of the recently adopted textbook series. Coaches' primary responsibilities were to support teachers' development of high-quality instructional practices (e.g., by observing instruction and providing feedback, co-teaching, modeling instruction) and principals' development of content-specific instructional leadership practices. Principals had been asked to choose a mathematics teacher who had already developed relatively accomplished instructional practices from their staff to serve as a coach. The selected teachers received relatively intensive professional development and were expected to teach middle-school mathematics half of each day and act as a coach for their peers the other half of the day.

In our assessment, the theory of action for instructional improvement in mathematics that District B was implementing during the second year of our study is coherent because the two policies that comprised it address the overall objective of supporting teachers in using the inquiry-oriented textbook series effectively, and because both policies built systematically on prior policy initiatives in the district (e.g., the mathematics coaching program). Interviews conducted with the CAO and members of the Mathematics Department during the second year of the study indicated that the decision to address accountability demands associated with NCLB by supporting teachers' development of ambitious instructional practices had been purposeful, and that they consistently conceptualized their work in terms of designing and implementing supports for others' learning.

District B's Policy for Principals as Instructional Leaders in Mathematics

Our goal in this section is to illustrate the predictive and explanatory power of the learning design perspective on policy. First, we present our analysis of the district's

policy for principals as instructional leaders and illustrate how the learning design perspective allowed us to anticipate limitations of the designed policy. We then report how the policy was actually implemented and illustrate how the learning design perspective enabled us to explain differences between the designed and enacted policy. Finally, we summarize the actionable recommendations we made to the district based on our analysis and report the adjustments that district leaders made to the policy for the following year.

As stated above, the what of the policy for principals as instructional leaders was that principals would support and hold teachers accountable for developing high-quality instructional practices. More specifically, the what entailed three related practices:

1) observe classroom instruction regularly, look for the implementation of the adopted text and the Curriculum Framework, and provide feedback on instruction;
2) conduct learning walks, sometimes with the coach, to assess building needs and to determine the nature of assistance that teachers need to improve their instructional practices; and
3) work with the coach to ensure that the coach is providing appropriate professional development at the school.

These practices required that principals develop a relatively sophisticated vision of high-quality mathematics instruction so that they could distinguish between strong and weak inquiry-oriented mathematics instruction. This in turn implies that principals would have to learn to focus not merely on the surface features of instructional forms (e.g., use of real world problems, group work, whole class discussions), but on the learning opportunities

that arise for students as those forms are enacted in particular classrooms (Cobb & Smith, 2008; Saxe, Gearhart, Franke, Howard, & Crockett, 1999; Spillane, 2000).

The first step in assessing a policy is to scrutinize the what of the policy by asking whether the policy is likely to result in the intended outcomes if practitioners develop the envisioned forms of practice. In the case at hand, the question is whether principals' enactment of the three practices listed above is likely to support teachers in improving their classroom instruction. Because most of the middle-school principals in District B were not mathematics specialists, we consider it unlikely that they could become more knowledgeable others who would be able to support mathematics teachers' learning directly even if they received sustained support.[8] Thus, in our assessment, the change in the principals' responsibilities was unlikely to result in the provision of expert guidance for teachers. However, if the principals could, with support, learn to distinguish between strong and weak mathematics instruction, they might be able to communicate expectations for instructional improvement that are consistent with the district's theory of action when making classroom observations. This press for improvement could be important provided there is a distribution of instructional leadership such that the mathematics coach supports teachers' learning directly and the principal holds teachers accountable for improving their teaching. In addition, if principals could distinguish between strong and weak mathematics instruction, they might be better able to identify teachers' needs and, in collaboration with the coach, plan or procure additional supports for their learning (e.g., from district mathematics specialists or external consultants). They might also be able to capitalize on the instructional expertise available in the school more effectively, and might make more informed hiring decisions (Stein & Spillane,

2005). Furthermore, they might appreciate the value of the coach's work, and both legitimize that work and ensure that the coach is not assigned additional responsibilities that takes her away from direct work with teachers (Gibbons & Cobb, 2010; Mangin, 2007; Matsumura, Sartoris, Bickel, & Garnier, 2009). We therefore concluded that the what of District B's policy for principals as instructional leaders might potentially contribute to the intended outcome, improvement in the quality of classroom instruction.

The second step in assessing a policy is to scrutinize the how and why of the policy by asking whether the designed supports for learning are likely to result in practitioners developing the envisioned forms of practice. In the case at hand, the question is whether the planned supports for principals' learning are likely to result in principals' development of the three instructional leadership practices listed above. We address this question by first describing the how and why of the policy.

New positions. The creation of the position of mathematics coach in all middle schools was a key component of District B's long-term instructional improvement in middle-school mathematics. It was evident from our interviews with district leaders that they anticipated that principals would need ongoing support from more expert others if they were to develop the intended leadership practices. Part of the rationale for the position of mathematics coaches was to provide expert guidance for principals in instructional leadership.

Learning events. In our analysis of the how of District B's policy for principals as instructional leaders, we did not identify any ongoing intentional learning events. However, the supports for principals' learning did include both discrete intentional learning events and incidental learning events. The discrete intentional learning events

occurred during monthly meetings that the head of Secondary Leadership conducted with all middle-school principals in the district. The purpose of these meetings was to provide professional development that aimed to support principals in developing a vision of high-quality mathematics, and in learning how to observe classroom instruction and how to conduct learning walks. However, the professional development that focused on learning walks and classroom observations was conducted by an external professional developer and was not specific to mathematics (i.e., the professional development was intended to apply to any content area). Members of the Mathematics Department worked with the principals occasionally during the monthly meetings to orient them to the recently adopted mathematics textbooks and the Curriculum Framework. As we describe when we discuss tools as a support for the principals' learning, the meetings also included the regular review of student work, some of which was mathematics student work.

We classified the monthly principal meetings as discrete rather than ongoing intentional learning events because the meetings were not designed to build on one another, and because issues specific to mathematics instruction were discussed only occasionally. It was therefore unlikely that the participating principals would become a genuine community of practice whose purpose was to improve their instructional leadership practices in mathematics.

The incidental learning events we identified involved weekly meetings that principals were expected to conduct with the coaches in their buildings (i.e., mathematics, English language arts, social studies, science). During these meetings, the coaches were expected to share observations about the quality of instruction they observed during the prior week and to work with the principal to determine how to support struggling

teachers. The principal and coaches were also expected to discuss campus improvement plans, examine student achievement data, and discuss how to use these data to improve instruction. We classified these weekly meetings as incidental learning events because it was possible that principals might learn about aspects of mathematics instruction and instructional leadership while talking with a more knowledgeable other, the mathematics coach, even though the meetings were not intentionally designed to support principals' learning.

New organizational routines. We identified one organizational routine whose enactment might give rise to learning opportunities for principals. As we have noted, district leaders expected that middle-school principals would conduct learning walks with the mathematics coach at their schools on a regular basis. The intent of these learning walks was for coaches to assist principals in gauging the extent to which teachers' instructional practices were aligned with district goals for instruction and to assess teachers' needs (e.g., for professional development). It is possible that exchanges about the quality of instruction and students' learning in the observed classrooms with a more knowledgeable other might involve learning opportunities for principals.

New tools. We identified two types of tools whose use might support principals' development as instructional leaders. The first tool was the student mathematics work that was reviewed periodically in an intentional learning event, the monthly principal meetings. The Mathematics Department selected tasks in the recently adopted textbooks that all teachers were required to use with students so that principals could bring student work on the same task to monthly meetings. The intent of examining student work in the monthly meetings was to support principals in identifying evidence that students had

learned particular mathematics standards in the curriculum. This activity had the potential to support principals' development as instructional leaders provided their current observational practices were taken into account (Cobb, et al., 2009; Kazemi & Hubbard, 2008).

The second tool designed to support principals' learning were curriculum maps that principals were expected to incorporate into their practice. Members of the Mathematics Department created the maps specifically for principals by streamlining the Curriculum Framework. The curriculum map for each six-week instructional module included a pacing schedule together with descriptions of the concepts being taught, resources teachers should use, expected student products, and expected student assessments. The intent in creating the curriculum maps was to provide principals with a tool that would guide what they should focus on when they observed classroom instruction. However, the curriculum maps were emailed to principals and there was no designed professional development to support them in using these tools.

Summary. Table 1 provides a summary of our analysis of the how and why of District B's policy for supporting principals' development as instructional leaders, organized in terms of the taxonomy of supports we proposed earlier in the article.

==========INSERT TABLE 1 ABOUT HERE==========

Assessment of the Designed Supports for Principals' Learning

We have argued that one of the advantages of the learning design perspective is that it enables us to anticipate the limitations of specific policies before they are

implemented. In the case of District B's policy for principals as instructional leaders in mathematics, it was questionable whether the supports for their learning that we identified would be sufficient. We therefore doubted that the principals would be able to develop the types of leadership practices envisioned by district leaders.

First, we were not able to identify any ongoing intentional learning events. It is unlikely that discrete intentional learning events would, by themselves, support the principals' development of a vision of high-quality mathematics instruction or their capacity to support teachers' development of ambitious instructional practices. The potentially most productive aspect of these meetings was the examination of student work as this activity could support principals in deepening their understanding of instructional goals. However, it was not clear who would lead the principals in this activity and whether they would take account of principals' current observation practices. Second, although the how of the district's policy included a new tool designed specifically for principals, the curriculum maps, no support was planned to enable principals to incorporate the maps effectively into their practice. We therefore anticipated that principals would assimilate this tool into their current observational practices rather than reorganize those practices as intended. Finally, the position of mathematics coach was designed to provide the principal with support from a person who was more knowledgeable about the teaching and learning of mathematics. However, the incidental learning opportunities that might arise for principals during the weekly meetings with coaches on their campuses were, by themselves, unlikely to support the principals' reorganization of their practices. In contrast, learning walks that principals were expected to conduct with the mathematics coach had greater potential because the

enactment of this organizational routine involved co-participating with a more knowledgeable other while making observations. However, the extent to which learning opportunities actually arose for the principal depended on the extent to which the coach was indeed a more knowledgeable other. We therefore questioned whether the supports for principals' learning and thus the how of the policy would be adequate.[9] More generally, the observations we have made about District B's policy also illustrate how analyses conducted from the learning design perspective can suggest modifications that might improve policies before they are implemented.

We are concerned that the reader might conclude erroneously from our analysis of the policy for principals as instructional leaders that the District B leaders were less than competent. In our view, the limitations we have identified attest to the complexity of and the challenges inherent in attempting to support instructional improvement at scale. District B leaders stood out from the leaders of most urban districts by framing the problem of improving student achievement as one of supporting principals', coaches', teachers', and students' learning. As a consequence of this framing, they were venturing into uncharted territory where research could provide only limited guidance and where documented examples of successful instructional improvement efforts were in extremely short supply. The overall coherence of policies that comprise their theory of action indicates the thoughtful nature of their policy-making efforts. In the course of our collaboration with the District B leaders, we have come to admire their steadfastness of purpose, skillful marshalling of resources, and openness to feedback about how their policies are actually playing out.

The Principals' Practices

We now describe the instructional leadership practices that the principals had developed by midway through the academic year in which the policy was implemented. In doing so, we summarize our findings from the second phase of the data collection-analysis-feedback cycle.

First, the leadership practices that principals were expected to develop required a relatively sophisticated vision of high-quality mathematics instruction. In interviews, we asked principals what they would expect to see if they observed a mathematics teacher whose instruction was of high quality, including what the teacher would be doing, the indicators of a productive whole class discussion, and what might constitute a high-quality mathematics task. The principals' responses to these questions indicated that the majority of them had developed visions of high-quality instruction that were compatible with the overall goal of the district's instructional improvement effort. However, the instructional visions of all seven principals were underdeveloped. They tended to focus on what Spillane (2000) called the forms of high-quality instruction rather than on the function of these instructional practices in supporting students' mathematical learning. For example, the principals said that teachers should be facilitators in the classroom, that they should use problem-solving tasks with multiple solution paths, and that instruction should include student discussion. However, none of the principals' responses indicated that they had developed an understanding of how elements of instruction, such as student discussion, can be organized to support students' learning of mathematics.

Second, principals were expected to observe classroom instruction regularly, and in doing so were to look for the implementation of the inquiry-oriented textbooks and the Curriculum Framework, and to provide teachers with feedback on their instruction. The

teachers' reports of principals' observations indicated that most principals spent a significant proportion of their time observing instruction. However, teachers also reported that principals' feedback tended to focus on easily observable elements of instruction (e.g., student work displayed, expectations posted, presence of word walls) and on the extent to which students were engaged in the lesson. In addition, the majority of teachers reported that their principal used a generic observation form that was not specific to mathematics, and that they were not expected to teach mathematics in a certain way. As a consequence, the feedback that teachers received from principals failed to communicate expectations for instructional improvement that were consistent with the district's theory of action.

Third, principals were expected to conduct learning walks, sometimes with coaches, to assess teachers' instructional practices and to determine the assistance they might need to improve their teaching. Principals reported that they only occasionally took learning walks, and only one principal reported conducting learning walks with a mathematics coach. Principals said that coaches' schedules made it difficult to schedule learning walks.

Fourth, principals were expected to work with the coach to ensure that the coach provided appropriate professional development at the school. Both principals and coaches reported that they met regularly. In interviews, we asked principals and coaches to describe the focus of the meetings. We found that in half of the schools, meetings focused on issues such as the pacing of instruction, while in the other schools, they focused on teachers' classroom practices (e.g., what should happen in a whole class discussion after students have worked on a task). There was little evidence that

principals and coaches were working together to plan for appropriate professional development. Most coaches reported that their principal had organized the school schedule so that they had time to meet with all the mathematics teachers in the school (e.g., department meetings before school, collaborative planning time), and that the principal attended at least some of these meetings. However, teachers, coaches and principals reported that these meetings tended to focus on the analysis of student test data, preparing for state mathematics assessments, or administrative matters rather than on issues central to improving instructional practice. Table 2 summarizes our comparisons of the practices that district leaders expected principals to develop (i.e., the what of the policy) with the practices that they were actually developing.

==========INSERT TABLE 2 ABOUT HERE==========

Situating Principals' Practices in School and District Settings

The third phase of the data collection-analysis-feedback cycle aims to understand why the enacted policy differed from the designed policy. In the case at hand, this involved accounting for differences between the intended instructional leadership practices (documented in the first phase of the cycle) and the practices that principals were actually developing when the policy was implemented (documented in the second phase). In accounting for these differences, we purposefully situated principals' development of the leadership practices in the school and districts settings in which they worked. This in turn required that we consider how the supports for principals' learning were actually implemented as the enacted supports were key aspects of these settings.

We identified three aspects of the school and district settings that proved relevant in understanding why the principals' leadership practices differed from those intended by District B leaders: accountability relationships with the Leadership Directors, the implemented supports for principals' learning, and the expertise of the school-based mathematics coaches.

Accountability relationships with the Leadership Directors. District B's policy for principal instructional leadership specified that the three Leadership Directors who worked directly with principals were to hold them accountable for supporting the improvement of teachers' instructional practices (e.g., observing classroom instruction, structuring time for mathematics teachers to collaborate, conducting learning walks, providing support for struggling teachers). However, the principals all reported that the Leadership Directors primarily held them accountable for improving student achievement on state assessments, and only secondarily for observing and supporting the improvement of instruction. As a consequence, the principals experienced a tension between improving learning outcomes in the short-term and supporting teachers' learning in the long-term.

The interviews we conducted with district leaders indicated that this tension reflected limited collaboration between and differences in the agendas of the Leadership Department and the C&I Department (including the CAO). The two departments were attempting to implement conflicting policies for principal instructional leadership.[10] The tension that principals experienced was consequential for many of the teachers in our study. For example, the teachers in some schools reported that the principal expected them to spend half of each class period preparing for the state assessment and half using

the inquiry-oriented text. Additionally, teachers in a few of the schools reported that the majority of collaborative planning time was spent on test-prep activities (e.g., creating test-formatted warm-ups, planning how to teach particular test items). This tension also had implications for what principals expected of their mathematics coaches. Half of the coaches reported that their principal (not district leaders) expected them to analyze student achievement data to identify students for tutoring, create lesson plans for tutoring, and in some cases actually hire the tutors. These additional responsibilities limited the time that coaches could work with mathematics teachers and were in conflict with the district's policy for coaches.

Implemented supports for principals' learning. We questioned the adequacy of the designed supports for principals' learning when we analyzed District B's policy for principals before it was implemented. Our analysis of the learning opportunities that actually arose for principals indicates that the implemented supports were insufficient to support their development of the types of practices envisioned by district leaders. Principals reported receiving little professional development that was specific to middle-school mathematics instruction aside from informal conversations that occurred during the monthly principal meetings. Although district leaders had planned to examine student work during monthly principal meetings, principals reported that this did not occur. Aside from these limited professional development opportunities, there were few opportunities for principals to work with a more knowledgeable other on their instructional leadership practices. As we have noted, principals took very few learning walks with the mathematics coach at their school. In addition, although principals did meet regularly with the coaches at their campus, these meetings gave rise to few

incidental learning opportunities for them. In interviews, principals also reported that they were not using the curriculum maps to guide their observation of classroom practice. This was attributable at least in part to the lack of support for principals to learn how to use the tool in practice. The need for additional supports became evident in our interviews when several principals expressed a desire for professional development on how to recognize high-quality instruction that was specific to the inquiry-oriented text so that they would have a clearer idea of what to look for when observing mathematics instruction, and where to focus their feedback.

Expertise of the mathematics coaches. In the district's policy, mathematics coaches were expected to serve as more knowledgeable others who would support principals in their role as instructional leaders. However, the coaches were only in their second year of using the recently adopted text (as were most of the teachers), and although the majority of the coaches had taught for many years, they were yet to develop sophisticated visions of high-quality instruction aimed for in the district's theory of action. Based on our interviews with the coaches, we found that their visions of high-quality instruction varied in detail and depth. The majority of the coaches articulated a vision of high-quality mathematics instruction that was compatible with the district's goals (e.g., emphasis on the teacher as a facilitator, student discussion, problem-solving tasks with multiple solution paths). However, similar to the principals, most coaches were yet to develop an understanding of how elements of instruction (e.g., student discussion) could be organized to support students' learning of mathematics. Generally, coaches' visions were only slightly more developed than those of the principals (and teachers), and therefore it was not evident that the most of the coaches could support

principals in becoming effective instructional leaders in mathematics (e.g., scaffolding principals' classroom observations and feedback).

Proposed Revisions to the How of the Policy

We drew on our analysis of District B's policy and its implementation to give feedback to district leaders about how they might revise the policy to make it more effective. As we have explained, our initial assessment indicated that the what of the policy was reasonable: it was likely that principals would contribute to improvements in the quality of instruction if they developed the envisioned instructional leadership practices. The recommendations that we made to district leaders therefore focused on limitations that we identified in the how of the policy.

We provide two examples of the revisions we proposed. These recommendations concerned accountability relations and supports for principals' learning respectively. We then report on the extent to which district leaders acted on our recommendations when they revised the policy for the following academic year. Our intent in discussing these examples is to illustrate how analyses conducted from the learning design perspective can inform the improvement of policies.

Accountability relations. We reported to district leaders our finding that the differing agendas of the Offices of Leadership and C&I were consequential for how collaborative planning periods were used, for how classroom lessons were organized, and for the time available for coaches to work with teachers. We acknowledged that we understood it would be difficult to address the tension between improving the quality of instruction and raising test scores given the very real consequences that district and school leaders would face if student achievement did not increase in the short term.

Against this background, we recommended that the Offices of Leadership and C&I reach agreement on what principals should hold mathematics teachers accountable for, including what principals should expect instructionally of their teachers, what principals should expect of mathematics coaches, and how principals should communicate those expectations to teachers and coaches. In addition, we suggested that personnel from both Offices clarify with principals and coaches that the work of coaches should focus on improving the quality of instruction in the long-term rather than on tutoring to increase student achievement in the short term. (In a separate set or recommendations, we proposed supports for mathematics coaches' learning).

We detected the influence of our feedback on accountability relations when we interviewed district leaders the following fall about their current theory of action. The Office of Leadership now attempted to ensure that Leadership Directors' expectations for principals were consistent with the district's theory of action, and also placed an increased emphasis on how the Leadership Directors might communicate those expectations to principals. For example, Leadership Directors were to conduct learning walks with principals on a regular basis so that they could convey their assessments of and expectations for instruction. Principals were also expected to hold weekly instructional leadership meetings in which a Leadership Director would participate along with coaches.

Support for principals' learning. We recommended that the district provide sustained professional development (i.e., ongoing intentional learning events) for principals that focused on recognizing high-quality mathematics instruction and giving feedback to teachers that was specific to the inquiry-oriented text. We suggested that the

mathematics coaches participate in at least some of this professional development with principals so that they might also deepen their understanding of the district's vision of high-quality mathematics instruction and so that principals might come to understand the coach's role in instructional improvement. We also suggested that the principals and mathematics coaches conduct learning walks together so that the coach might support the principal's understanding of high-quality mathematics instruction specific to the adopted text.

The interviews we conducted the following fall revealed that district leaders had revised the policy for supporting principals' learning by including sustained professional development designed by the Mathematics Department that was to be organized around the inquiry-oriented text and would focus on recognizing high-quality instruction. However, the planned professional development did not include a focus on providing feedback to teachers on instruction. Table 3 offers a brief summary of our recommendations and district leaders' revisions to the how of the policy, as discussed above.

==========INSERT TABLE 3 ABOUT HERE==========

It is worth noting that even though district leaders adjusted this and other policies in response to our feedback, we identified potential problems in the revised policy when we commenced a new data collection-analysis-feedback cycle and analyzed it from the learning design perspective. As one example, although we recognized that the weekly instructional leadership meetings might enable principals to clarify their expectations

with coaches, we anticipated that the meetings were not likely to support principals' learning given the lack of mathematics specific instructional expertise (unless the coaches' visions of high-quality mathematics instruction improved dramatically).

Summary

Our goal in sharing our analysis of District B's policy for developing principals as instructional leaders was to illustrate the predictive and explanatory power of taking a learning design perspective on policy. We first considered whether the what of the policy was likely to result in the intended outcomes and then scrutinized the how of the policy using the taxonomy of supports. In doing so, we were able to anticipate limitations of the policy before it was implemented and concluded that the adequacy of the designed supports for principals' learning was questionable. In addition, we illustrated how, in taking a learning design perspective, we were able to explain differences between the designed and enacted policy, and thus why the policy was playing out in specific ways that differed from those envisioned by district leaders. Furthermore, we illustrated how taking this perspective positioned us to contribute to the improvement of the policy by reporting the actionable recommendations we made to district leaders about how they might revise the learning supports for principals as instructional leaders.

Discussion

In this article, we have described and illustrated an analytical perspective in which policies are treated as designs for supporting learning. An analysis conducted from this perspective focuses on three components of a policy: goals for the learning of members of a target group, supports for that learning, and an often implicit rationale for why the supports might prove effective. We have referred to these components as the what of

policy, the how of policy, and the why of policy, respectively. As we indicated at the beginning of the article, the value of the learning design perspective on policies stems from its usefulness both in anticipating the limitations of specific policies before they are implemented, and in understanding why specific policies are playing out in certain ways and not others in particular settings. Two characteristics of the perspective contribute to its usefulness.

First, in presenting a taxonomy of learning supports, we drew on recent work in the learning sciences, teacher education, and related fields to clarify the rationale for each type of support. This attention to the why as well as the how of policy enabled us to anticipate potential limitations in the illustrative case of District B's policy for principals as instructional leaders. Second, analyses of how policies are playing out that are conducted from the learning design perspective situate the practices that practitioners are developing with respect to the school and district settings in which they are developing those practices. The implemented supports for learning are key aspects of these (evolving) settings. The resulting analyses therefore relate practitioners' learning to the implemented supports. As we illustrated, the analysis can therefore inform the formulation of empirically testable recommendations about how the policy might be adjusted to make it more effective.

In the opening paragraphs of this article, we claimed that the analysis of policies as designs for supporting learning has considerable generality. However, the illustrative case does little to substantiate this claim because the leaders of District B's response to the demands of high-stakes accountability was atypical; they conceptualized instructional improvement in terms of supporting teachers' and others' learning, had articulated an

explicit vision of high-quality mathematics instruction, and had developed a coherent set of policies for instructional improvement in middle-school mathematics. We therefore consider a hypothetical case in which a district's policies for mathematics instruction specify a desired outcome, expected increases in student achievement, but leave the what, how, and why of policy undefined. In such a case, we would follow the approach we used when studying District B by first collecting baseline data to document the school and district settings in which teachers' work (i.e., to whom teachers are accountable and what they are accountable for, and formal and informal sources of support), teachers' instructional practices, and student mathematical learning (ideally supplementing state assessment scores with other measures). After the policy had been implemented, we would collect a second set of data to document the consequences of the implementation, focusing on changes in the school and district settings in which they work, teachers' instructional practices, and student mathematical learning.

In analyzing these data we would relate changes in student mathematical learning to the documented changes in teachers' classroom practices, and would relate the changes in the teachers' practices to changes in the school and district settings in which they worked. The goal of the analysis would be to explain why teachers changed their practices, and thus why the policy had the documented effects on students' mathematical learning. The crucial point to note is that an analysis of this type treats the implemented policy as a design for supporting learning and details the quite possibly multiple whats and hows of the policy constructed and enacted by members of different role groups during the implementation process. The learning design perspective is useful in cases of this type in which policies only specify student outcomes because the resulting analyses

can inform the elaboration and revision of the policy by clarifying why the intended outcomes were or were not achieved. More generally, analyses conducted from the learning design perspective can inform the improvement of policies that seek to influence instruction by documenting the whats and hows that are enacted as the policies are implemented.

Early in the article, we followed Coburn and Stein (2006) in defining a policy as an intentional attempt by members of one group to influence the practices of members of another group. This definition is relatively broad and does not restrict policymaking to administrators who are formally charged with developing policies. In the case of District B, middle-school principals were the targets of district policies and also made and enacted policies that targeted mathematics teachers. As we saw, the principals' goal for teachers' classroom practices (i.e., the what of principals' policies) was broadly compatible with the vision of high-quality mathematics instruction promoted by district leaders (i.e., the what of the district's theory of action) but involved a form rather than a function view of this type of instruction (Spillane, 2000). For their part, teachers were the targets of district and school policies, and made and enacted policies that targeted students' mathematical practices. The what of teachers' policies concerned their goals for students' learning, and the how was specified as they developed lesson plans.

Cohen, Moffitt, and Goldin (2007) observed that, in general, people at all levels of the US education system both make policies and are practitioners targeted by others' policies. Consistent with this observation, the implementation of a district or school policy is viewed from the learning design perspective as process in which practitioners at multiple levels of an educational system reorganize and elaborate their practices (or not)

in settings shaped by others' policymaking efforts. In the illustrative case of District B, we described how principals reorganized their instructional leadership practices in settings shaped, in part, by district leaders' policy-making efforts. More generally, the goal when analyzing the implementation of a policy from the learning design perspective is to document and account for the situated reorganization of practice at multiple levels of an educational system. This approach elaborates McLaughlin's (1987) notion of mutual adaptation between the intended policy and the context of implementation by enabling us to understand why a policy was adapted in particular ways and not others in the course of implementation. Furthermore, this approach goes some way towards substantiating Spillane et al.'s (2006) contention that situation and social context fundamentally shape how human cognition affects policy implementation.

Conclusion

We have indicated that the learning design perspective is particularly useful when the goal is not merely to assess whether a policy is effective but to understand why in a manner that can inform the improvement of the policy. With regard to future research, we speculate that analyses of a number of judiciously chosen schools or districts conducted from the learning design perspective might constitute an adequate basis from which to develop a generalizable theory of action for school or district instructional improvement in particular subject matter areas. If this speculation proves feasible, the resulting theory of action would be empirically grounded in specific cases of instructional improvement as they actually play out in schools and classrooms. A theory of this type would have considerable practical value in informing large-scale instructional improvement efforts.

Although we have covered a considerable amount of ground in this article, we should acknowledge that our discussion of policy implementation is nonetheless incomplete. We have focused on supports for learning but have not considered how policies might be designed to foster practitioners' motivation to improve current practices. This is an important issue that deserves to be the focus of a detailed analysis in its own right. For the present, we restrict ourselves to noting that motivation is often framed in policy research in terms of the provision of incentives and sanctions. These inducements are no doubt important in many policy contexts. However, we also see considerable merits in Akerlof and Kranton's (2005) observation that "the ability of organizations to place workers into jobs with which they identify and the creation of such identities are central to what makes organizations work" (p. 11). In this regard, Spillane and Thompson (1997) found that district personnel who not only understood ambitious mathematics or science instruction but were also personally committed to instruction of this type made crucial contributions to their districts' instructional improvement efforts. Studies of mathematics teachers' learning also indicate the importance of teachers becoming personally committed to or, in other words, identifying with ambitious instructional practices if they are to view the effort involved in reorganizing their current classroom practices as worthwhile (Gresalfi & Cobb, in press; Kazemi & Hubbard, 2008; Stein, Silver, & Smith, 1998). In light of these findings, it is reasonable to propose that discussions of motivation should attend to the fostering of particular types of professional identities as well as to the role of incentives.

We emphasized at the beginning of this article that the view of policies as designs for supporting learning is an analytical perspective. However, we have also illustrated

that this perspective is useful in anticipating possible limitations of specific policies. Clearly, the identification of limitations a priori can inform the revision of the policies before they are implemented. This observation indicates the potential value of adopting the learning design perspective when formulating as well as when analyzing policies, particularly in cases in which the what of the policy involves significant learning. In our view, future research should investigate this possibility as the findings will have implications for educational leadership programs and for professional development for school and district leaders.

References

Akerlof, G. A., & Kranton, R. E. (2005). Identity and economics of organizations. *Journal of Economic Perspectives, 19*, 9-32.

Argyris, C., & Schön, D. (1978). *Organizational learning: A theory of action perspective*. Reading, MA: Addison Wesley.

Ball, D. L. (2000). Bridging practices: Intertwining content and pedagogy in teaching and learning to teach. *Journal of Teacher Education, 51*, 241-247.

Ball, D. L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Towards a practice-based theory of professional education. In G. Sykes & L. Darling-Hammond (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3-32). San Francisco: Jossey-Bass.

Ball, D. L., Sleep, L., Boerst, T., & Bass, H. (2009). Combining the development of practice and the practice of development in teacher education. *Elementary School Journal, 109*, 458-476.

Beach, K. (1999). Consequential transitions: A sociocultural expedition beyond transfer in education. *Review of Research in Education, 24*, 103-141.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher, 33*(8), 3-15.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences, 2*, 141-178.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*, 32-42.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Towards a unified view of working, learning, and innovation. *Organizational Science, 2*, 40-57.

Bruner, J. (1987). *Actual minds, possible worlds*. Cambridge, MA: Harvard University Press.

Bryk, A. S. (2009). Support a science of performance improvement. *Phi Delta Kappan, 90*(8), 597-600.

Bryk, A. S., & Schneider, B. (2002). *Trust in schools: A core resource for improvement*. New York: Russell Sage Foundation.

Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (1999). *Children's mathematics: Cognitively guided instruction*. Portsmouth, NH: Heinemann.

Cobb, P. (2002). Reasoning with tools and inscriptions. *Journal of the Learning Sciences, 11*, 187-216.

Cobb, P., McClain, K., Lamberg, T., & Dean, C. (2003). Situating teachers' instructional practices in the institutional setting of the school and school district. *Educational Researcher, 32*(6), 13-24.

Cobb, P., & Smith, T. (2008). The challenge of scale: Designing schools and districts as learning organizations for instructional improvement in mathematics. In T. Wood, B. Jaworski, K. Krainer, P. Sullivan & D. Tirosh (Eds.), *International handbook of mathematics teacher education* (Vol. 3, pp. 231-254). Rotterdam, Netherlands: Sense.

Cobb, P., Zhao, Q., & Dean, C. (2009). Conducting design experiments to support teachers' learning: A reflection from the field. *Journal of the Learning Sciences, 18*, 165-199.

Coburn, C. E. (2001). Collective sensemaking about reading: How teachers mediate reading policy in their professional communities. *Educational Evaluation and Policy Analysis, 23*(2), 145-170.

Coburn, C. E., & Russell, J. L. (2008). District policy and teachers' social networks. *Educational Evaluation and Policy Analysis, 30*, 203-235.

Coburn, C. E., & Stein, M. K. (2006). Communities of practice theory and the role of teacher professional community in policy implementation. In M. I. Honig (Ed.), *New directions in educational policy implementation* (pp. 25-46). Albany, NY: State University of New York Press.

Coburn, C. E., & Stein, M. K. (Eds.). (2010). *Research and practice in education: Building alliances, bridging the divide*. New York: Rowman & Littlefield Publishing Group.

Cochran-Smith, M., & Lytle, S. L. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education, 24*, 249-305.

Cohen, D. K., & Barnes, C. A. (1993). Pedagogy and policy. In D. K. Cohen, M. W. McLaughlin & J. E. Talbert (Eds.), *Teaching for understanding: Challenges for policy and practice* (pp. 207-239). San Francisco: Jossey Bass.

Cohen, D. K., & Hill, H. C. (2000). Instructional policy and classroom performance: The mathematics reform in California. *Teachers College Record, 102*, 294-343.

Cohen, D. K., Moffitt, S. L., & Goldin, S. (2007). Policy and practice: The dilemma. *American Journal of Education, 113*, 515-548.

Cole, M. (1996). *Cultural psychology*. Cambridge, MA: Belknap Press of Harvard University Press.

Crockett, M. D. (2007). Teacher professional development as a critical resource in school reform. *Journal of Curriculum Studies, 39*, 253-263.

Desimone, L., Porter, A. C., Garet, M., Suk Yoon, K., & Birman, B. (2002). Effects of professional development on teachers' instruction: Results from a three-year study. *Educational Evaluation and Policy Analysis, 24*, 81-112.

Elmore, R. F. (2004). *School reform from the inside out*. Cambridge, MA: Harvard Education Press.

Elmore, R. F. (2006, June). *Leadership as the practice of improvement.* Paper presented at the OECD International Conference on Perspectives on Leadership for Systemic Improvement, London.

Feldman, M. S. (2000). Organizational routines as a source of continuous change. *Organization Science, 11*, 611-629.

Feldman, M. S. (2004). Resources in emerging structures and processes of change. *Organization Science, 15*, 295-309.

Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly, 48*, 94-118.

Forman, E. A. (2003). A sociocultural approach to mathematics reform: Speaking, inscribing, and doing mathematics within communities of practice. In J. Kilpatrick, W. G. Martin & D. Schifter (Eds.), *A research companion to*

principles and standards for school mathematics (pp. 333-352). Reston, VA: National Council of Teachers of Mathematics.

Franke, M. L., Kazemi, E., & Battey, D. (2007). Mathematics teaching and classroom practice. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 225-256). Greenwich, CT: Information Age Publishers.

Gallucci, C. (2008). Districtwide instructional reform: Using sociocultural theory to link professional learning to organizational support. *American Journal of Education, 114*, 541-581.

Garet, M., S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*, 915-945.

Gibbons, L. K., & Cobb, P. (2010, October). *How principals and coaches support each other in assisting teachers to improve mathematics instruction.* Paper presented at the Annual Conference of the United Council for Educational Administration, New Orleans.

Gresalfi, M., & Cobb, P. (in press). Negotiating identities for mathematics teaching in the context of professional development. *Journal for Research in Mathematics Education*.

Grossman, P., & McDonald, M. (2008). Back to the future: Directions for research in teaching and teacher education. *American Educational Research Journal, 45*, 184-205.

Grossman, P., Wineburg, S., & Woolworth, S. (2001). Toward a theory of teacher community. *The Teachers College Record, 103*, 942-1012.

Halverson, R. (2003). Systems of practice: How leaders use artifacts to create professional community in schools. *Education Policy Analysis Archives*, v11, n11. Accessible on line at http://epaa.asu.edu/epaa/v11n37/.

Heilig, J. V., & Darling-Hammond, L. (2008). Accountability Texas-style: The progress and learning of urban minority students in a high-stakes testing context. *Educational Evaluation and Policy Analysis, 30*(2), 75-110.

Henrick, E., Cobb, P., & Munter, C. (2010, March). *Educational design research at the district level: A methodology for supporting instructional improvement in middle school mathematics at scale*. Paper presented at the Educational Design Research Conference, Athens, GA.

Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic-specific knowledge of students. *Journal for Research in Mathematics Education, 39*(4), 372-400.

Honig, M. I. (2006). Complexity and policy implementation: Challenges and opportunities for the field. In M. I. Honig (Ed.), *New directions in education policy implementation: Confronting complexity* (pp. 1-23). Albany: State University of New York Press.

Horn, I. S. (2005). Learning on the job: A situated account of teacher learning in high school mathematics departments. *Cognition and Instruction, 23*, 207-236.

Kazemi, E., & Hubbard, A. (2008). New directions for the design and study of professional development: Attending to the coevolution of teachers' participation across contexts *Journal of Teacher Education, 59*, 428-441.

Kozulin, A. (1990). *Vygotsky's psychology: A biography of ideas*. Cambridge: Harvard University Press.

Lampert, M. (2001). *Teaching problems and the problems of teaching*. New Haven, CT: Yale University Press.

Lampert, M., & Ball, D. L. (1998). *Teaching, multimedia, and mathematics: Investigations of real practice*. New York: Teachers College Press.

Lampert, M., & Graziani, F. (2010). Instructional activities as a tool for teachers' and teacher educators' learning. *Elementary School Journal, 109*, 491-509.

Lave, J. (1993). The practice of learning. In S. Chaiklin & J. Lave (Eds.), *Understanding practice* (pp. 3-32). Cambridge: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. London: Cambridge University Press.

Lehrer, R., & Lesh, R. (2003). Mathematical learning. In W. Reynolds & G. Miller (Eds.), *Comprehensive handbook of psychology* (Vol. 7, pp. 357-391). New York: John Wiley.

Lehrer, R., & Schauble, L. (2004). Modeling natural variation through distribution. *American Educational Research Journal, 41*, 635-679.

Lehrer, R., Schauble, L., & Penner, D. (2000). The inter-related development of inscriptions and conceptual understanding. In P. Cobb, E. Yackel & K. McClain

(Eds.), *Symbolizing, mathematizing, and communicating: Perspectives on discourse, tools, and instructional design* (pp. 325-360). Mahwah, NJ: Erlbaum.

Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? The case of lesson study. *Educational Researcher, 35*, 3-14.

Ma, L. (1999). *Knowing and teaching elementary mathematics*. Mahwah, NJ: Erlbaum.

Mangin, M. M. (2007). Facilitating elementary principals' support for instructional teacher leadership. *Educational Administration Quarterly, 43*, 319-357.

Marks, H. M., & Louis, K. S. (1997). Does teacher empowerment affect the classroom? The implications of teacher empowerment for instructional practice and student academic performance. *Educational Evaluation and Policy Analysis, 19*, 245-275.

Matsumura, L. C., Sartoris, M., Bickel, D. D., & Garnier, H. (2009). Leadership for literacy coaching: The principal's role in launching a new coaching program. *Educational Administration Quarterly, 45*, 655-693.

McLaughlin, M. W. (1987). Learning from experience: Lessons from policy implementation. *Educational Evaluation and Policy Analysis, 9*, 171-178.

Meira, L. (1998). Making sense of instructional devices: The emergence of transparency in mathematical activity. *Journal for Research in Mathematics Education, 29*, 121-142.

Nelson, B. S. (1997). Learning about teacher change in the context of mathematics education reform: Where have we come from? In E. Fennema & B. S. Nelson (Eds.), *Mathematics teachers in transition* (pp. 3-19). Mahwah, NJ: Lawrence Erlbaum Associates.

Nelson, B. S., & Sassi, A. (2005). *The effective principal: Instructional leadership for high-quality learning*. New York: Teachers College Press.

Pea, R. D. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (Ed.), *Distributed cognitions* (pp. 47-87). New York: Cambridge University Press.

Penuel, W. R., Frank, K. A., & Krause, A. (2006, June). *The distribution of resources and expertise and the implementation of schoolwide reform initiatives.* Paper presented at the Seventh International Conference of the Learning Sciences, Bloomington, IN.

Penuel, W. R., Riel, M., Krause, A. E., & Frank, K. A. (2009). Analyzing teachers' professional interactions in a school as social capital: A social network approach. *Teachers College Record, 111*(1)*,* 124-163.

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher 29*(1), 4-15.

Remillard, J. (2005). Examining key concepts in research on teachers' use of mathematics curricula. *Review of Educational Research, 75*, 211-246.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. Oxford: Oxford University Press.

Rogoff, B. (1997). Evaluating development in the process of participation: Theory, methods, and practice building on each other. In E. Amsel & A. Renninger (Eds.), *Change and development: Issues of theory, application, and method* (pp. 265-285). Hillsdale, NJ: Erlbaum.

Saxe, G., Gearhart, M., Franke, M., Howard, S., & Crockett, M. (1999). Teachers' shifting assessment practice in the context of educational reform in mathematics. *Teaching and Teacher Education, 15*, 85-105.

Schifter, D. (1998). Learning mathematics for teaching: From a teachers' seminar to the classroom. *Journal of Mathematics Teacher Education, 1*, 55-87.

Schön, D. A. (1986). *The design studio*. London: Royal Institute of British Architects.

Sfard, A. (2008). *Thinking as communicating: Human development, the growth of discourses, and mathematizing*. New York: Cambridge University Press.

Sherer, J. Z., & Spillane, J. P. (in press). Constancy and change in work practice in schools: The role of organizational routines. *Teachers College Record*.

Sherin, M. G., & Han, S. Y. (2004). Teacher learning in the context of video club. *Teaching and Teacher Education, 20*, 163-183.

Smylie, M. A., & Evans, P. J. (2006). Social capital and the problem of implementation. In M. I. Honig (Ed.), *New directions in educational policy implementation* (pp. 187-208). Albany, NY: State University of New York Press.

Spillane, J. P. (1999). External reform initiatives and teachers' efforts to reconstruct their practice: The mediating role of teachers' zones of enactment. *Curriculum Studies, 31*, 143-175.

Spillane, J. P. (2000). Cognition and policy implementation: District policymakers and the reform of mathematics education. *Cognition and Instruction, 18*(2), 141-179.

Spillane, J. P., Mesler, L., Croegaert, C., & Sherer, J. Z. (2007, August). *Coupling administrative practice with the technical core and external regulation: The role of organizational routines.* Paper presented at the Annual Meeting of the

European Association for Research on Learning and Instruction, Budapest, Hungary.

Spillane, J. P., Reiser, B., & Gomez, L. M. (2006). Policy implementation and cognition: The role of human, social, and distributed cognition in framing policy implementation. In M. I. Honig (Ed.), *New directions in educational policy implementation* (pp. 47-64). Albany, NY: State University of New York Press.

Spillane, J. P., & Thompson, C. L. (1997). Reconstructing conceptions of local capacity: The local education agency's capacity for ambitious instructional reform. *Educational Evaluation and Policy Analysis, 19*, 185-203.

Stein, M. K. (2004). Studying the influence and impact of standards: The role of districts in teacher capacity. In J. Ferrini-Mundy & F. K. Lester (Eds.), *Proceedings of the National Council of Teachers of Mathematics Research Catalyst Conference*. Reston, VA: National Council of Teachers of Mathematics.

Stein, M. K., & Coburn, C. E. (2008). Architectures for learning: A comparative analysis of two urban school districts. *American Journal of Education, 114*, 583-626.

Stein, M. K., & Nelson, B. S. (2003). Leadership content knowledge. *Educational Evaluation and Policy Analysis, 25*, 423-448.

Stein, M. K., Silver, E. A., & Smith, M. S. (1998). Mathematics reform and teacher development: A community of practice perspective. In J. G. Greeno & S. V. Goldman (Eds.), *Thinking practices in mathematics and science learning* (pp. 17-52). Mahwah, NJ: Erlbaum.

Stein, M. K., & Spillane, J. P. (2005). Research on teaching and research on educational administration: Building a bridge. In B. Firestone & C. Riehl (Eds.), *Developing*

an agenda for research on educational leadership (pp. 28-45). Thousand Oaks, CA: Sage Publications.

Stephan, M., Bowers, J., & Cobb, P. (Eds.). (2003). *Supporting students' development of measuring conceptions: Analyzing students' learning in social context. Journal for Research in Mathematics Education Monograph No. 12*. Reston, VA: National Council of Teachers of Mathematics.

U.S. Congress. (2001). *No Child Left Behind Act of 2001*. Washington, DC: Author.

van der Veer, R., & Valsiner, J. (1991). *Understanding Vygotsky: A quest for synthesis*. Cambridge, MA: Blackwell.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University Press.

Authors' Note

The analysis reported in this article was supported by the National Science Foundation under grant No. ESI 0554535. The opinions expressed do not necessarily reflect the views of the Foundation. The empirical case that we present in this article is based on work conducted in collaboration with Thomas Smith, Erin Henrick, Glenn Colby, Anne Garrison, Lynsey Gibbons, Sarah Green, Karin Katterfeld, and Chuck Munter.

Footnotes

[1]Indicators that a group has become a community of practice include a joint enterprise or mission, an established set of norms, and a shared technical repertoire (Cobb, McClain, Lamberg, & Dean, 2003; Wenger, 1998). In the educational policy and leadership literature, it is common for any group of people who meet on a regular basis to be called a community of practice. In these instances, communities of practice appear to be brought into existence by what Grossman, Weinberg and Woolworth (2001) termed the fiat of the researcher's pen. The question of whether a particular group has evolved into a genuine community of practice is one that needs to be addressed empirically.

[2]Analyses of organizational routines in the educational policy and leadership literature often treat a series of weekly or monthly meeting as an organizational routine without identifying a pattern of interdependent actions. As Feldman and Pentland (2003) make clear, frequency of enactment is not a defining characteristic of an organizational routine. In our view, it is important to substantiate the claim that an organizational routine has been identified by specifying both the recurrent pattern of actions and the multiple actors involved.

[3]Wenger (1998) discriminates between people's participation in activities and their use of reifications or tools as two distinct types of supports for learning. The supports that we have discussed thus far emphasize targets' participation in various types of activities, often with someone who has already developed relatively sophisticated practices. Attention to tools rounds out the taxonomy of supports for policy implementation.

[4]In the policy literature, the term tool is sometimes used more broadly to include conceptual tools such as a set of core principles for high-quality instruction. However, conceptual tools of this type are whats rather than hows of policy. In our view, it is more productive to treat them as learning goals rather than supports for learning. For example, the goal of a district policy might be that principals will come to use a particular set of instructional principles as a conceptual tool when they observe classroom lessons and give teachers feedback. Our decision to restrict our focus to material tools is pragmatic and reflects our concern to develop a taxonomy of supports for policy implementation.

[5]These artifacts of practice are tools that professional development providers use to support the participants' learning.

[6]Recent work in teacher education indicates that a time frame of two to three years might be appropriate for teachers to develop ambitious instructional practices with adequate support (Cochran-Smith & Lytle, 1999; Grossman & McDonald, 2008).

[7]A more detailed account of these phases can be found in Henrick, Cobb, and Munter (2010).

[8]The work of Nelson and Sassi (2005) demonstrates that, with sustained high-quality professional development, elementary-school principals can learn to coach elementary teachers effectively in mathematics. There is reason to doubt that this success can be replicated at the middle-school level because the mathematical ideas on which instruction focuses are more challenging and because middle-grades teachers are typically content specialists.

[9] We did not share our recommendations with district leaders about how they might improve their policies until May of each academic year. When we interview

district leaders in the fall, they have already begun to implement their instructional improvement policies and are not in a position to make major adjustments. We therefore wait until the end of the academic year before sharing findings, when district leaders are about to develop their plans for the subsequent year. This approach also allows us to present empirical evidence to support our recommendations for revising policies.

[10]The working relationship between the two departments improved significantly during the third year of the larger study after the head of the Leadership Department changed and a member of the Curriculum and Instruction Department moved to a senior position in the Leadership Department.

Table 1

Analysis of District B's designed means of support for principals' learning (i.e., the how of the policy)

Taxonomy of Supports for Learning		**District B Supports for Principals' Learning**
New Positions or Changes in Responsibilities of Existing Positions	Expert guidance	Mathematics coach
	Sharing responsibilities	
Learning Events	Intentional—ongoing	
	Intentional—discrete	Monthly principal meetings
	Incidental	Weekly meeting of the principal and coach
New Organizational Routines		Learning walks
New Tools	Tools in intentional learning events	Examining student work in monthly principal meetings
	Tools in practice	Curriculum maps

Table 2

Comparison of principals' intended and actual practices as instructional leaders

The 'What' of the Policy for Principals as Instructional Leaders: *Principals will support and hold teachers accountable for developing high-quality instructional practices.*	
Intended Principal Practices	**Actual Principal Practices**
1a) Observe instruction and provide feedback.	Principals regularly observed and provided feedback. However, feedback focused on easily observable elements of instruction and did not communicate expectations for instructional improvement consistent with district's goals.
1b) Providing relevant feedback requires that principals develop a relatively sophisticated vision of high-quality mathematics instruction in order to distinguish between strong and weak instruction.	Although the majority of principals developed visions that were compatible with the goal of the improvement effort, their visions were not sophisticated enough to support them to distinguish between strong and weak instruction.
2) Conduct learning walks with coach to determine the nature of assistance teachers need.	Principals occasionally took learning walks; only one principal reported conducting learning walks with a coach.
3) Work with the coach to ensure that the coach is providing appropriate professional development at the school.	Principals and coaches met regularly. However, there was little evidence that they worked together to plan professional development.

Table 3

Recommendations for improving the how of the policy and the district leaders' subsequent revisions

Recommendations for Improving the How of the Policy	**District Leaders' Revisions to the How of the Policy**
Accountability Relations with Leadership Directors	
Address the tension that principals experience between improving the quality of instruction in the long-term and raising students' test scores in the short-term.	Increased emphasis on Leadership Directors' expectations for principals, on how they should communicate those expectations to principals, on and how they should support principals' development of instructional leadership practices. Leadership Directors and principals will conduct Learning Walks together. Leadership Directors will meet with principals (and coaches) during weekly Instructional Leadership meetings at schools.
Clarify what principals should hold teachers accountable for teachers, and how principals should communicate those expectations. This requires the coordinated efforts of the Offices of Curriculum and Instruction and Leadership.	
Supports for Principals' Learning	
Provide sustained professional development (i.e., ongoing intentional learning events) focused on recognizing high-quality mathematics instruction and offering feedback specific to the inquiry-oriented text.	Principal meetings will include ongoing intentional learning events specific to the mathematics curriculum and to recognizing high-quality mathematics instruction. However, no support was planned on providing useful feedback on instruction.