Coordinating Professional Development Across Contexts and Role Groups

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Teacher Education and Pedagogy: Theory, Policy and Practice
Edited by Michael Evans
Cambridge University Press

Accepted for publication February 8, 2012

The research project reported on in this chapter was supported by the National Science Foundation under grant Nos. ESI-0554535 and DRL-1119122. Kara Jackson's contributions to the article were also supported by the National Academy of Education/Spencer Postdoctoral Fellowship Program. The opinions expressed do not necessarily reflect the views of either Foundation. The work reported on in this chapter has been conducted in collaboration with Thomas Smith, Erin Henrick, Ilana Horn, Christine Larson, Annie Garrison, Lynsey Gibbons, Charlotte Munoz, and Jonee Wilson.

Abstract

In this chapter, we report on an ongoing research project in which we have partnered with leaders of two U.S. school systems to both support and investigate large-scale instructional improvement. One potentially important improvement strategy involves coordinating professional development across contexts (e.g., pull-out teacher professional development, school-based teacher collaborative time) and role groups (e.g., teachers, coaches, school leaders). We draw on recent literature on teacher professional development and teacher education, which suggests the importance of both focusing professional development on specific instructional practices and of creating opportunities for participants to both investigate and enact those practices. We ground our discussion of coordinated professional development in our work with leaders of one of the two school systems in which we are collaborating to design professional development for teachers, coaches, and school leaders around high-leverage instructional practices in middle-grades mathematics.

Coordinating Professional Development Across Contexts and Role Groups

In the United States, mathematics education researchers have reached a broad consensus about a set of learning goals for students that include developing both conceptual understandings of key mathematical ideas and procedural fluency in a range of domains (e.g., number and operations, algebra, geometry, measurement, data analysis and probability). Additionally, most U.S. mathematics education researchers agree that instruction should support students to engage in the disciplinary practices of mathematics (e.g., generalizing from a solution, justifying solutions, evaluating the reasonableness of solutions, making connections among multiple representations of a mathematical idea) (Franke, Kazemi, & Battey, 2007; Kilpatrick, Swafford, & Findell, 2001). These learning goals for students are represented in several documents including the National Council of Teachers of Mathematics' (NCTM; 2000) *Principles and Standards for School Mathematics*, and the more recent *Common Core State Standards* in mathematics (Common Core State Standards Initiative, 2010).

The NCTM *Standards* also present a research-based vision of mathematics instruction intended to support students' attainment of these learning goals (Hiebert & Grouws, 2007). Students' development of conceptual understanding and procedural fluency requires frequent opportunities to solve cognitively demanding tasks (e.g., non-routine tasks that have the potential to support students in connecting mathematical representations and ideas) (Stein, Smith, Henningsen, & Silver, 2000). Instruction of this type requires the teacher to orchestrate discussions of students' solutions in which they are pressed to justify their reasoning and to make connections among the solutions (Franke, et al., 2007; Stein, Engle, Smith, & Hughes, 2008). The instructional goals and

forms of classroom practice detailed in the *Standards* have been elaborated and further specified by a number of elementary-, middle-, and high-school mathematics curricula developed with support from the U.S. National Science Foundation (Senk & Thompson, 2003).

The instructional vision proposed in the *Standards* has been called "ambitious teaching" because it aims to support all students to develop enduring understandings of central mathematical ideas by teaching in response to students' thinking (Kazemi, Franke, & Lampert, 2009; Lampert, Beasley, Ghousseini, Kazemi, & Franke, 2010; Lampert & Graziani, 2009). Ambitious teaching contrasts sharply with typical U.S. mathematics instruction that emphasizes the reproduction of demonstrated procedures for solving routine problems (Stigler & Hiebert, 1999).

The task of supporting the development of ambitious mathematics teaching across classrooms, schools, and school systems is challenging and involves supporting teachers to significantly reorganize their current instructional practices. Previous and ongoing research (Bryk, Sebring, Allensworth, Luppesco, & Easton, 2010; Cobb & Jackson, in press-b; Coburn, 2003; Newmann, Smith, Allensworth, & Bryk, 2001) indicates that improving the quality of instruction on a large scale entails supporting both teachers' learning and the reorganization of the school settings in which they work.

In this chapter, we report on an ongoing research project that seeks to both support and investigate large-scale instructional improvement in middle-grades mathematics. As described elsewhere (Cobb & Jackson, in press-b), we have developed a provisional, empirically-grounded theory of action for instructional improvement in mathematics at scale based on analyses conducted during the first phase of this project

(2007-2011). In its current iteration, the theory of action includes five interrelated components: a) coherent system of supports for ambitious teaching that include curriculum materials and instructional guidance instruments such as curriculum frameworks; b) pull-out teacher professional development and teacher collaborative meetings; c) mathematics coaches' provision of job-embedded support for teachers' learning; d) school instructional leadership in mathematics; and e) support for the development of schools' capacity for instructional improvement provided by school system leaders.

We restrict our focus in this chapter to one central aspect of this theory of action: the coordination of professional development across contexts (district-based and school-based) *and* across role groups (teachers, mathematics coaches, and school leaders). We use the term "professional development" to refer to activities that are intentionally designed to support the learning of members of a particular role group. Professional development for teachers therefore includes pull-out sessions led by a mathematics specialist for teachers from a number of schools, school-based collaborative meetings of mathematics teachers, and one-on-one support provided by mathematics coaches in teachers' classrooms.

The recent literature on teacher professional development and teacher education indicates the importance of organizing professional development around specific high-leverage instructional practices (Ball, Sleep, Boerst, & Bass, 2009) and of creating opportunities for participants to both investigate and enact those practices (Grossman et al., 2009). We are currently investigating conjectures about coordinated professional development for teachers, coaches, and school leaders that focuses on high-leverage

instructional practices in the second phase of the research project (2011-2014) in which we have partnered with leaders of two U.S. school systems that serve a total of 180,000 students.

Research Context

The overall goal of the research project (Middle School Mathematics and the Institutional Setting of Teaching, MIST)[1] is to understand what it takes to support middle-grades mathematics teachers' development of ambitious teaching at the scale of large, urban, U.S school districts. We provide a brief description of the U.S. educational system before discussing relevant aspects of the research project.

The U.S. Educational System

The U.S. educational system is decentralized, and there is a long history of the local control of schooling. Each U.S. state is divided into a number of independent school districts. In rural areas, districts might serve less than 1,000 students whereas a number of urban districts serve more than 100,000 students. In the context of the U.S. educational system, urban districts are the largest jurisdictions in which it is feasible to design for improvement in the quality of instruction (Supovitz, 2006).

Large school districts such as those with which we are collaborating have a central office whose staff are responsible for selecting curricula and for providing teacher professional development in various subject matter areas including mathematics. In this chapter, we use *district leaders* to refer to members of the central office staff whose responsibilities focus on either classroom instruction or school leadership. We use *district mathematics specialists* to refer to central office staff whose responsibilities focus

[1] For information on MIST, see http://www.peabody.vanderbilt.edu/mist.xml.

specifically on the teaching and learning of mathematics. We use *district leadership directors* to refer to central office staff whose responsibilities involve evaluating and supporting school leaders (i.e., principals, assistant principals).

The role of the U.S. federal government in education has been quite limited historically when compared with most other industrialized countries. However, in 2001, the U.S. Congress passed a national policy called the No Child Left Behind (NCLB) act. The intent of NCLB is to enable all students to meet high performance standards in language arts and mathematics. States are given financial incentives to design and enact the three central components of NCLB policy: content standards for student achievement, tests aligned with the standards, and mechanisms for holding schools accountable for increasing scores on those tests and for reducing disparities in achievement between particular student sub-populations. Historically, students of color, students from economically disadvantaged backgrounds, and students for whom English is not their first language have performed at significantly lower levels than white students and students from economically advantaged backgrounds on mathematics assessments (Darling-Hammond, 2007).

Most impartial commentators consider that NCLB policy is flawed in two important respects. First, most states lacked the capacity to respond effectively to the assessment and accountability mandates of the policy (Elmore, 2004). As a consequence, the tests used in these states to assess student achievement emphasize procedural skills at the expense of understanding central mathematical ideas (Shepard, 2002). Second, it is becoming increasingly clear that most district and school leaders are ill-equipped to respond effectively to state accountability policies (Elmore, 2006). The majority of

districts are implementing strategies that involve "teaching to the test," and some are attempting to "game the system" (Heilig & Darling-Hammond, 2008). As a consequence, reform that was intended to focus on rigorous content standards is instead driven by procedurally-oriented assessments in most districts (cf. Resnick & Zurawsky, 2005). However, a minority of schools and districts have developed moderately worked-out strategies that go beyond teaching to the test by supporting teachers in improving the quality of their instructional practices (Elmore, 2006).

Description of Research Project

During the first phase of the project (2007-2011), we collaborated with four, large urban districts. Each of the districts is typical of urban districts in most respects in that it has to cope with a number of challenges including substantial numbers of low-performing students, limited funding, high teacher turnover, and a significant proportion of novice teachers. However, they are atypical in one respect: they are amongst the minority identified by Elmore and are responding to high-stakes accountability pressures by attempting to support teachers' development of ambitious instructional practices.

As part of the project, we conducted annual cycles of data collection, analysis, and feedback in which we collected and analyzed data to document how the districts' improvement strategies were playing out in schools and classrooms, shared our findings with district leaders, and made actionable recommendations about how their improvement strategies might be revised to make them more effective. [For a complete description of the annual cycles, see Cobb and Jackson (in press-a) and Henrick, Cobb, and Jackson (in press).] The leaders in all four districts acted on our recommendations and, as a consequence, we became co-designers of their improvement strategies. The

primary product of the first phase of the project was an empirically grounded, provisional theory of action for instructional improvement in middle-grades mathematics, as outlined above (Cobb & Jackson, in press-b), which we developed as we conducted the four annual data collection, analysis, and feedback cycles.

In the second phase of the project (2011-2014), we are collaborating with two of the original four districts for a further four years to test, revise and elaborate the conjectures inherent in the provisional theory of action. We are continuing to conduct the annual data collection, analysis and feedback cycles. In addition, we are intentionally working to support the development of district-leader capacity to support instructional improvement. We lead a two-day meeting with district leaders (e.g., heads of Curriculum and Instruction, Mathematics, Leadership, Bilingual Education, Special Education) each June to co-design professional development for teachers, mathematics coaches, and school leaders. We also co-plan and co-lead professional development for school leaders with members of the Curriculum and Instruction and Mathematics Departments each school year. Co-designing for instructional improvement with district leaders enables us to test and refine our emerging theory of action for instructional improvement at scale.

Supporting Teachers' Development of Ambitious Teaching

Achievement of the learning goals and vision of teaching specified in the NCTM *Standards* requires that teachers develop sophisticated knowledges and practice. For example, supporting all students' understanding of particular mathematical ideas requires that teachers understand those ideas deeply and how children typically develop those ideas (Hill, Ball, & Schilling, 2008). It also requires skill in responding to and building

on student contributions in ways that further each student's current understanding (Lampert, 2001).

As Ball and Forzani (2009) observe, enacting ambitious instructional practice is both complex and unnatural in that it differs markedly from typical everyday interactions. Teachers therefore need sustained support given the learning demands inherent in developing this type of practice (Borko, 2004). There is some evidence that in-service pull-out teacher professional development that impacts classroom instruction shares the following qualities: it is sustained over time, involves the same group of teachers working together, is focused on issues central to instruction, and is organized around the instructional materials that teachers use in their classrooms (Darling-Hammond, Wei, & Orphanos, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Kazemi & Franke, 2004; Little, 2003). However, the influence of pull-out professional development for in-service teachers on instructional practice and student learning outcomes has usually been minimal (Borko, 2004). This is in large part because the impact of high-quality professional development on what teachers do in their classrooms is mediated by the school settings in which they teach (Cobb, McClain, Lamberg, & Dean, 2003).

Key aspects of school settings that influence teachers' classroom practice include the instructional materials and resources that teachers use (Stein, Remillard, & Smith, 2007), what school leaders hold teachers accountable for (Elmore, 2006), and the formal and informal sources of support on which teachers can draw. Supporting teachers' development of ambitious instructional practices on a large scale therefore involves reorganizing the school settings in which teachers work. It is a problem of organizational as well teacher learning (Cobb, et al., 2003; Coburn, 2003). High-quality pull-out

professional development is necessary, but, by itself, insufficient to support teachers in improving the quality of their classroom instruction.

A central tenet of our work is that coordinating professional development across contexts and role groups will support teachers' learning and contribute to the reorganization of the school settings in which teachers work. This coordination involves focusing on the same set of instructional practices in teacher, coach, and school leader professional development. Recent research on teacher education suggests the importance of organizing professional development around "high-leverage practices" that happen frequently in the classroom and "in which the proficient enactment by a teacher is likely to lead to comparatively large advances in student learning" (Ball, et al., 2009, p. 460). The findings of several studies indicate that focusing on particular practices supports novice teachers' skilled enactment of routines that are central to ambitious teaching (Ball, et al., 2009; Kazemi, et al., 2009; Lampert, et al., 2010). Examples of high-leverage practices include eliciting and responding to student thinking, managing small group work on challenging tasks, and orchestrating whole-class discussions of students' solutions to challenging tasks (Stein, et al., 2008).

Grossman and colleagues (Grossman, this volume; Grossman, et al., 2009; Grossman & McDonald, 2008) have noted that pre-service teacher education tends to emphasize *pedagogies of investigation* at the expense of *pedagogies of enactment*. Pedagogies of investigation involve analyzing and critiquing representations of practice such as student work and video-cases of teaching (Borko, Jacobs, Eiteljorg, & Pittman, 2009; Sherin & Han, 2004). Pedagogies of enactment involve planning for, rehearsing, and enacting aspects of practice in a graduated sequence of increasingly complex settings

(e.g., teaching other pre-service teachers who play the role of students, working with a small groups of students, teaching an entire class). Grossman et al. argue convincingly that pedagogies of investigation and enactment are both necessary if teachers are to develop ambitious forms of practice. This claim is supported by studies of professional learning, which suggests that it is critical for novices to co-participate in activities that approximate the targeted practices with more accomplished others (Bruner, 1996; Forman, 2003; Lave & Wenger, 1991).

As in the case of pre-service teacher education, pedagogies of investigation are far more common in in-service mathematics teacher professional development than pedagogies of enactment. This is especially problematic as in-service professional development aims to support teachers' reorganization of already established practices that are presumably functional to some extent in their current school settings. It is unlikely that an exclusive focus on pedagogies of investigation will be sufficient to support in-service teachers' development of ambitious instructional practices. In our work, we are therefore adapting the design principles of practice-focused pre-service mathematics teacher education to in-service teacher professional development as well as to professional development of coaches and school leaders.

Coordinating Professional Development Across Contexts and Role Groups

In the following paragraphs, we describe our current work in which we collaborate with district leaders to design coordinated professional development that entails pedagogies of investigation and enactment across contexts (particularly for teachers) and across role groups (teachers, mathematics coaches, school leaders), all organized around specific high-leverage practices. We ground our discussion by

focusing on the professional development for the 2011-2012 school year designed in collaboration with leaders in one of the two districts with which we are working, District B. We in the process of collecting data and are yet to analyze data to document how the design is actually being implemented. As a consequence, we are not in a position to report on the influence of the professional development on teachers', coaches', and school leaders' practices.

District B

District B serves approximately 80,000 students, 55% 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). 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.

District B district leaders have framed the overall low-performance in middle-school mathematics achievement and the disparities in achievement as a problem of supporting teachers' learning rather than merely of ensuring that they teach for the test. They adopted an inquiry-oriented mathematics text that was aligned with ambitious goals for student learning, created an elaborate Curriculum Framework that is designed to support the teachers in using the text effectively, and provided pull-out professional development for teachers. In addition, the district implemented a school-based mathematics coaching program in all middle schools. The coaches teach half of each day

and serve as a coach for the other half of the day. The coaches' primary responsibilities are to support teachers' development of ambitious instructional practices (e.g., by observing instruction and providing feedback, co-teaching, modeling instruction) and principals' development of content-specific instructional leadership practices. The mathematics coaches received relatively intensive professional development. As part of the district's improvement plan, school leaders were supported and held accountable for acting as instructional leaders in mathematics, and have received extensive professional development. District leaders expect them to observe classroom instruction regularly and provide feedback on instruction, look for the implementation of the adopted text and the Curriculum Framework, and work with the coach to determine the assistance that teachers need to improve their instructional practices.

Identification of a High-Leverage Instructional Practice

In the mathematics text adopted by District B, lessons are organized around cognitively demanding tasks (which tend to embed mathematics in problem-solving scenarios) and are designed to unfold in three phases. First, the task is introduced to students (i.e., the "launch" phase of instruction). Second, students work on solving the task either individually or in groups. Third, the teacher leads a concluding whole-class discussion in which students are pressed to make mathematical connections between solutions and to develop conceptual understanding of significant mathematical ideas (Stein, et al., 2008). During the first phase of the project (2007-2011), we identified the launch as crucial in terms of whether all students are able to engage productively in solving the task. Characteristics of launches that support all students' productive engagement include that the cognitive demand of the task is maintained and that the

teacher supports the students' development of a common language for describing contextual features and mathematical relationships specific to the task (Jackson, Garrison, Wilson, Gibbons, & Shahan, 2011; Jackson, Shahan, Gibbons, & Cobb, accepted for publication). An empirical analysis of 132 video-recorded mathematics lessons revealed a positive relationship between how teachers launched tasks and students' learning opportunities in the concluding whole-class discussion (Jackson, et al., 2011). We also found that in most of the 240 lessons we video-recorded in the 2009-2010 and in 2010-2011 school years, the launch was not effective and did not support all students to engage productively in the task. Additionally, it was very common for the teacher to lower the cognitive demand of the task in this first phase of the lesson by suggesting particular procedures to use to solve the task.

In Ball et al.'s (2009) terms, we identified launching cognitively demanding tasks as a high-leverage practice that, if conducted effectively, was likely to result in significant improvement in opportunities for student learning. In the second phase of the project, we therefore proposed to leaders of the two collaborating districts that the launch serve as a focal instructional practice around which professional development for teachers, coaches, and school leaders should be organized for the 2011-2012 school year.

Coordinating Professional Development for Teachers Across Contexts

Teachers in many U.S. school districts often participate in both district-based and school-based professional development. District leaders often provide district-wide pull-out professional development for all mathematics teachers at particular grade levels for a few days each year and teachers are released from teaching to attend. For example, in District B, middle-grades mathematics teachers were provided with four days of pull-out

professional development during the 2011-2012 school year, two days prior to the school year and two during the fall. This professional development was led by mathematics coaches and district mathematics specialists and was organized by grade levels.

It is increasingly common for U.S. districts to mandate that school leaders schedule time during the school day for teacher collaboration, in which the mathematics teachers at a school meet on a regular basis to work on problems of practice. In District B, school leaders were required to schedule at least one meeting each week for mathematics teachers to work together on improving instruction. These are costly initiatives, given that teacher collaborative time varies in the extent to which it supports instructional improvement (Little, 1993). A growing number of studies indicate that when teacher collaborative time functions well, it provides opportunities for teachers to address problems that arise in the course of instruction, integrate ideas and tools introduced in district professional development into practice, and rehearse specific practices (Cobb, Zhao, & Dean, 2009; Horn & Little, 2010).

One of the conjectures we are currently investigating is that teachers' work during collaborative time will be more productive if it follows up on district professional development by focusing on the same high-leverage instructional practices. The design developed with leaders in District B also acknowledges that district professional development is better suited for pedagogies of investigation because large numbers of teachers are involved, whereas school-based teacher collaborative time is suited for both types of pedagogies. Research in teacher professional development suggests that potentially productive teacher collaborative activities might include doing mathematics problems and comparing solution strategies, analyzing student work and classroom

video-recordings, and rehearsing high-leverage instructional practices (Ball, et al., 2009; Borko, et al., 2009; Kazemi & Hubbard, 2008; Sherin & Han, 2004). In addition, this research indicates the importance of ensuring that someone with instructional expertise leads collaborative time by setting an agenda, initiating and guiding activities, and pressing teachers to work on, reflect on and improve particular aspects of practice. Given that few of the teachers in District B who are participating in our study have developed sophisticated instructional practices, we view the coaches in each school as the most likely candidates for providing this leadership.

Although U.S. districts are increasingly funding coaching positions as a primary means of supporting teachers' learning, the designs of their coaching programs vary considerably. As we have noted, District B implemented a school-based coaching design in which a mathematics teacher in each middle-grades school serves as a mathematics coach for half of the day and teaches the other half of the day. In contrast, the second district with which we are collaborating created a cadre of full-time coaches who each serves three or four schools.

Research on how coaches might work with individual teachers in their classrooms and on what constitutes high-quality coach professional development is limited. However, research on teacher learning suggests that potentially productive coaching activities include those in which the teacher co-participates in activities central to ambitious teaching with the coach. These activities might include co-teaching and/or enacting the coaching cycle of jointly planning a lesson, observing the enactment of the lesson, and then jointly analyzing the lesson (Bradley, 2007; Neufeld & Roper, 2003; Olson & Barrett, 2004).

In our collaboration with District B district leaders, we co-designed teacher professional development (district pull-out professional development, teacher collaborative time, coach's work with teachers) such that all components focus on a single high-leverage practice, the launch. The intended district professional development primarily involves pedagogies of investigation in which teachers analyze video-recordings of teachers introducing cognitively demanding tasks to identify key aspects of successful launches that support all students' productive engagement. Against this background, teachers then plan launches with other teachers from their school.

Teacher collaborative time is intended to serve as a context for teachers to engage in cycles of investigation and enactment specific to the launch. For example, leaders in District B expect that teachers will plan how to launch tasks in forthcoming lessons, rehearse these launches with their colleagues acting as students, conduct the launches in their classrooms, and then debrief the launch with their colleagues during the next teacher collaborative time.

In addition to leading teacher collaborative time, leaders in District B expect coaches to support individual teachers in launching tasks in their classrooms. This work might involve co-teaching, modeling effective launches, or observing and providing feedback depending on the coach's assessment of the teacher's practice. Coaches are also expected to use assessments of individual teachers' launches to inform their agendas for collaborative time.

The coordination of professional development for teachers across contexts depends crucially on the expertise and skill of the professional development facilitators (Borko, et al., 2009; Elliott et al., 2009). A recent study conducted by Coburn and

Russell (2008) indicates the importance of professional development leaders routinely posing questions that press participating teachers on key issues (e.g., identifying the central mathematical ideas in a sequence of tasks, identifying aspects of the task scenario that might be unfamiliar to some students, anticipating student solutions to particular tasks). Coburn and Russell present evidence that coaches who had been pressed on issues of this type in coach professional development subsequently pressed teachers on the same issues, and that teachers then began pressing each other on these issues. Based on this finding, we conjecture that it is important that teachers are pressed on the same set of issues in district-based and school-based professional development.

Summary. The goal of the professional development design for teachers was to coordinate the various forms of professional development for District B teachers (district-based pull-out professional development, school-based teacher collaborative meetings, coach's work with individual teacher) around a single, high-leverage instructional practice, launching complex tasks. The design of this professional development reflected the central principle that teachers would need to be provided with carefully sequenced cycles of investigating and enacting launching with a more expert colleague, if they were to develop proficiency in launching complex tasks in their classrooms.

Coordination of Professional Development Across Role Groups

The impact of coordinated professional development for teachers on their classroom instruction is likely to be influenced by other aspects of the school setting such as school leaders' expectations for teachers. In the first phase of our research project, we identified cases in which teachers participated in professional development designed to support their development of ambitious teaching, but school leaders communicated

instructional expectations that were at odds with the goals of ambitious teaching (Cobb & Jackson, in press-a). For example, leaders in some schools expected teachers to skip sections of the mathematics text adopted by their district and instead focus on preparing students for the state assessment, which emphasized procedural fluency. These and other observations indicate the importance of coordinating professional development for teachers, school leaders, and mathematics coaches so that school-level support and accountability are tightly aligned.

Professional development for school leaders. In our work, we conjecture that the distribution of instructional leadership in mathematics between school leaders and mathematics coaches can both support and press teachers to improve the quality of mathematics instruction. In our view, it is unreasonable to expect school leaders, most of whom do not have a mathematics background, to directly support mathematics teachers' development of ambitious instructional practices. However, we are investigating whether school leaders can be supported to communicate appropriate instructional expectations to teachers, while mathematics coaches support teachers in meeting those expectations.

Our work suggests that the provision of feedback is a key way in which school leaders can communicate instructional expectations and press teachers to develop the intended forms of practice (Katterfeld, 2011). In the case of District B, district leaders had expected school leaders to observe mathematics teachers' instruction on a regular basis and give them feedback for several years. In the 2011-2012 school year, school leaders are expected to observe how teachers launch tasks and provide feedback that communicates instructional expectations specific to the launch. In order to support school leaders' development of this capability, we co-planned and co-led four half-day

professional development sessions with District B district leaders from the Curriculum and Instruction Department. In addition to testing and revising the professional development design, we viewed this collaboration as an opportunity to support district leaders' capacity to support instructional improvement.

The half-day professional development sessions involved cycles of investigation and enactment, similar to the design of teacher professional development. School leaders first watched video-recordings of launches and were pressed to identify characteristics of a successful launch. These characteristics were framed in terms of "look-fors" and "ask-abouts," which formed the basis for a tool that could then guide their classroom observations of launches. School leaders then observed launches of specified mathematics tasks in their schools using this tool, ideally with their mathematics coaches so that they could discuss their observations with a more expert colleague. Our goal in a subsequent session was to support school leaders' formulation of feedback that would communicate instructional expectations for effective launches. In preparation for this session, we worked with district leaders to create a Feedback Guide that school leaders could use when crafting feedback. During the session, school leaders viewed video-recordings of launches and gave feedback to participants who acted as teachers in the sessions. They were then asked to observe specific launches in their schools, provide feedback to the teacher, and make notes of their observations and feedback for discussion in a subsequent session. The overall intent of these sessions is to provide school leaders with scaffolded opportunities to practice observing and providing feedback that is specific to launches.

The district leadership directors who are responsible for both evaluating and supporting school leaders attended the professional development for school leaders. Our rationale was that if the district leadership directors attended professional development with school leaders, they would be more likely to hold school leaders accountable for observing launches and providing teachers with feedback that communicated appropriate instructional expectations. The head of the Leadership Department also indicated to the district leadership directors that he expected them to observe and discuss launches with the school leaders when they visited schools.

In addition to observing the launch and providing feedback, District B district leaders expect school leaders to engage in two other instructional leadership practices. First, school leaders are expected to meet with their mathematics coach every week to discuss their observations of classroom instruction (especially of the launch) and how to support teachers' development of the intended practices. These meetings are also intended to serve as a context for the school leader and coach to jointly plan the agenda for teacher collaborative time, based on their assessments of classroom instruction. Second, school leaders are expected to participate in mathematics teacher collaborative time on a regular basis. School leaders' attendance at those meetings is intended to serve several purposes: to communicate the importance of the meetings to teachers, to ensure that the focus of the meetings is on instructional improvement, and to provide opportunities for school leaders to learn about the aspects of instruction that teachers are attempting to improve. Together, the three focal instructional leadership practices (observe instruction and provide feedback, meet regularly with the coach, attend mathematics teacher collaborative meetings) and the professional development were

designed to enable school leaders' reorganization of their leadership practices such that what they did on a daily basis in schools would support teachers' development of ambitious teaching practices.

Professional development for mathematics coaches. As we have indicated, the envisioned role of school leaders is to press teachers to develop the intended instructional practices, whereas the role of mathematics coaches is to support teachers' development of those practices. In the two districts with which we are currently working, coaches are frequently the sole source of expertise in a school. In these situations, the goal of professional development is to enable coaches to both lead groups of teachers effectively during teacher collaborative time and follow-up by supporting individual teachers in their classrooms.

In District B, mathematics coaches received a week of intensive professional development prior to the start of the 2011-2012 school year and participated in monthly full-day sessions during the school year. We contributed to the planning of this professional development, which was led by the Director of Secondary Mathematics and the district mathematics specialists. As was the case with teacher and school leader professional development, the sessions involved cycles of investigation and enactment specific to the launch. Activities include watching video-recordings of launches to identify characteristics of successful launches, and then practicing using the same Look-Fors and Ask-Abouts tool and Feedback Guide as the school leaders. In addition, coach professional development includes a focus on supporting teachers to develop successful launches, both during teacher collaborative time and while working with individual teachers in their classrooms. For teacher collaborative time, the emphasis is on

facilitating teachers' co-planning and rehearsals of launches, whereas the emphasis for work with individual teachers is on co-teaching, modeling, and enacting the coaching cycle with teachers. District mathematics specialists are expected to provide coaches with additional support by modeling how to conduct coaching cycles and how to co-teach launches in the coaches' classrooms (recall that the District B mathematics coaches are half-time teachers). The intent of these activities is to provide the coaches with opportunities to co-participate in the work of coaching with a more a more accomplished colleague, a district mathematics specialist.

Summary. The goal of the professional development design that we have described is to support school leaders and mathematics coaches in becoming effective instructional leaders who assume joint responsibility for improving mathematics instruction. District B's design includes providing school leaders and coaches with professional development on the launch that is tailored to their specific role, and with common tools for conducting observations and providing feedback (e.g., the Look-Fors and Ask-Abouts tool, the Feedback Guide). In addition, school leaders and coaches are expected to meet weekly to discuss their classroom observations and to plan future collaborative time meetings. The intent of these supports is that school leaders' and coaches' classroom observations will have a common focus that will ground their discussions about how to support teachers.

Conclusion

The approach we have described of designing professional development in collaboration with district leaders is an ongoing attempt to support the development of district leaders' capacity to support school instructional improvement in mathematics.

This work is guided by three key design principles. First, it appears important that professional development involves both pedagogies of investigation and enactment, and that it be organized around specific, high-leverage practices. Second, it appears important that opportunities for professional learning are coordinated across contexts, such that what participants work on in one context is explicitly linked to and elaborated on in another context. Third, it appears important that professional development is coordinated across role groups so that it supports both teachers' learning and the reorganization of the school settings such that they become supportive environments in which teachers can work on enacting ambitious teaching.

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