ICMI Study 25
TEACHERS OF MATHEMATICS WORKING AND LEARNING IN COLLABORATIVE GROUPS
Theme C
Lisbon, Portugal, 3-7 February 2020

FACILITATORS' AND SCHOOL LEADERS' ROLE IN ESTABLISHING AN INQUIRY-ORIENTED COMMUNITY OF MATHEMATICS TEACHERS

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This paper addresses the role school leaders and professional learning facilitators play in establishing communities of mathematics teachers characterized by authentic, collective inquiry into instructional practice and oriented toward ambitious and equitable learning aims for students. We report on an ongoing qualitative analysis instructional leaders' work designing and facilitating a professional learning system to develop an inquiry-oriented teacher community. We highlight the commitments and principles that guided the leaders' decisions and the challenges that arose.

Decades of research indicates that establishing teacher communities in subject-specific departments can benefit teachers and students (e.g., Horn, 2005; McLaughlin & Talbert, 2001). In inquiry-oriented communities,[1] teachers wrestle with dilemmas of teaching, they press on one another's views about teaching, subject matter, and students' capabilities, and they identify and work towards collective aims for their practice (Grossman, Wineburg, & Woolworth, 2001). In such communities, learning together about and from teaching is inherent to the work of teaching. For example, within the U.S., studies of the mathematics department at "Railside High School" provide powerful images of teachers engaging in authentic, collective inquiry into instructional practice oriented toward ambitious and equitable learning aims for students, accompanied by compelling evidence that students' learning and senses of themselves as mathematics learners improved (e.g., Boaler, 2002; Nasir, 2014).

As a field, while we know the value of teacher communities, there is minimal scholarship that explores how inquiry-oriented communities of mathematics teachers such as the one at Railside are established. In this paper, we report on an ongoing qualitative analysis of instructional leaders' support of the development of an inquiry-oriented community of mathematics teachers in a U.S. middle-school. In particular, we focus on the work of professional learning facilitators and the school leader, especially the principles that guided these instructional leaders' decisions in designing and facilitating a system of professional learning toward establishing such a community. Our focus on understanding the role of facilitators and school leaders is guided by existing literature that suggests that both matter for the development of teacher communities (Bryk et al., 2010; van Es et al., 2014).

Supporting Community Through Professional Learning

Developing inquiry-oriented teacher communities is incredibly difficult for a number of reasons. One reason, as Grossman et al. (2001) observed, is that, in general, the teaching profession lacks a collective vision. In addition, such communities challenge deeply established norms of privatization in U.S. schools (Little, 1990; Lortie, 1975). Historically, schools in the U.S. have not been organized to support teachers' learning. Until relatively recently, it was somewhat unusual for teachers to have time built into their workday to collaborate on teaching, and it remains unusual for teachers to have

[1] We use the term "inquiry-oriented community" to specify the kind of work happening in a subject-specific department, that being inquiry into instructional practice in relation to, e.g., students' mathematical thinking and participation.

routine opportunities to see one another teach, let alone teach together. However, creating a structure in which teachers are expected to collaborate, on its own, does not necessarily lead to strong community nor does it necessarily benefit teachers or students (Horn et al., 2016). As Grossman et al. (2001) argue, becoming a community often requires "transformation" of individuals' current practices and of the workplace setting (p. 948). Hence, as we will elaborate in what follows, the role of the school leader and facilitators of professional learning are critical.

Establishing a community is, in part, dependent on creating a coherent instructional system (Newmann et al., 2001). A coherent instructional system is one in which instructional decisions and policies are organized around an explicit set of goals for students' learning and a complimentary, shared vision of high-quality instruction (Cobb et al., 2018). Key elements of an instructional system include instructional materials and assessments, and professional learning opportunities.

Professional learning in the U.S., more broadly, tends to be piecemeal and fragmented (Borko, 2004). Within a school, it is increasingly common for U.S. mathematics teachers to be provided with time to collaborate with colleagues, often in grade level teams, as well as opportunities to work individually with a "coach" (Banilower et al., 2018). However, these various opportunities to collaborate are often not well connected or coordinated, such that what teachers work on in one structure is elaborated on in another (Cobb et al., 2018). Research indicates the value in designing professional learning opportunities (e.g., time for teachers to collaborate in a grade-level team, department-wide meetings, individual coaching) that are anchored to an explicit and specific set of student learning goals and instructional vision, and through which teachers can deepen their collective inquiry and instructional practice.

From a learning perspective, especially when teachers' aspirations for their practice requires substantial shifts in their current practice, it is especially important that teachers have opportunities to engage in cycles in which they *investigate* and *enact* key aspects of instructional practice (Grossman et al., 2009). A well-designed professional learning system ideally allows for teachers to analyze their current practice, through, for example, viewing video-records of their teaching and/or making sense of student work, perhaps in the context of time to collaborate during the school day. Teachers might then identify next steps for their practice, and then work with one another or an instructional coach to try out the key aspect of practice, followed by further analysis, and so forth.

Further, a well-designed professional learning system is *principled* in its design and facilitation (Kennedy, 2016). As an example, in the case of Railside, principles organizing the mathematics department's collaborative work included: all teachers and students are learners; working from strengths while making space for vulnerability; redefining "smart;" redefining what it means to do math in school; and the importance of relationships (Nasir, 2014). Nasir and colleagues argue that these principles were crucial for the work of the community of mathematics teachers at Railside: "The aspects of teaching practice and professional community at Railside were only powerful when connected to important and meaningful overarching principles" (p. 235). Because school leaders and facilitators of professional learning (e.g., instructional coaches) play a crucial role in the design and facilitation of professional learning events in schools, it is critical to understand the principles that organize their work toward establishing inquiry-oriented communities (Cobb et al., 2018).

Methods

This ongoing analysis was guided by the following research question: What emerged as central to instructional leaders' work in establishing an inquiry-oriented community of mathematics teachers?

Research Context

This analysis is part of a research-practice partnership which aims to understand how district math leaders, coaches, and teachers can use data about instructional practice to support system-wide instructional improvement. We focus on the development of an inquiry-oriented community in the Forest Middle School mathematics department during the year 2018 - 2019. Forest is an ethnically, racially, and linguistically diverse school in the Northwest U.S. The school had undergone significant changes in the two years prior to this analysis. The school had "detracked" all of its mathematics classes, meaning that students were no longer assigned to mathematics classes based on presumed ability. All seven of the mathematics teachers, along with more than three quarters of the teaching staff as a whole, were in their first two years of teaching at Forest (though some had been teaching for longer). The school leader and facilitators of professional learning were in their first year of a coordinated effort to design and facilitate a connected set of professional learning experiences, toward the aim of developing an inquiry-oriented community of teachers.

These experiences included a professional development model called Math Labs, providing opportunities for teachers to investigate and enact instructional practice together (Kazemi et al., 2018). Similar to Lesson Study, Math Labs involve opportunities for teachers and instructional leaders to enact instruction with each other present and attend carefully to the mathematical thinking and participation of students in response to instructional decisions. Different from Lesson Study, the lesson enactment is collective, and as such, teachers engage in enacting instruction with each other's students. During enactment, they pause to confer about instructional decisions they might make in response to students' thinking and participation. After enactment, they inquire into their instructional decisions in relation to students' thinking and participation, grounded in artifacts from the classroom visit, including student work, video of interactions, and/or teachers' and leaders' observations of students' thinking and participation. As we describe further below, professional learning experiences at Forest also included opportunities for grade-level teams to investigate practice together and opportunities for individual teachers to investigate and enact practice with an instructional coach.

The school leader (principal; hereafter, Jack) had been a principal for six years total and three years at Forest and, prior to becoming a principal, had worked as a secondary mathematics teacher. Jack expressed a strong commitment to equitable outcomes for students at Forest and to teacher and leader collaboration. He had participated in district-supported Math Labs in his previous principalship, facilitated by the third author and her colleagues. The facilitators of professional learning (school-based instructional coaches; hereafter, Patty and Ada) were responsible for planning and facilitating professional learning experiences at Forest, alongside Jack. Patty was in her first year as the mathematics instructional coach at the school after having taught middle grades mathematics at Forest for 13 years, during which she participated in Math Labs. Ada was in her eighth year as an instructional coach at Forest and her second year focused especially on English Language Arts. Several years prior to this study, Ada had collaborated with the third author and other instructional coaches to support teachers' implementation of rich tasks through their design and facilitation of

Math Labs. Prior to coaching, she taught in elementary and middle schools for a total of 19 years. Patty, Ada, and Jack saw themselves as "co-learners and co-facilitators and co-planners" in the work of supporting the community of mathematics teachers at Forest (Ada).

Data Sources

Our team participated in 12 collaborative planning sessions with Patty, Ada, and Jack throughout the year; the planning sessions were organized prior to and after key professional learning experiences. We shared ideas and resources and offered suggestions grounded in research on mathematics education, teacher learning, and systems for instructional improvement, and we audio-recorded and collected field notes and artifacts at each meeting. Additionally, at least one member of our team attended, audio-recorded, and collect field notes and artifacts at key professional learning events (13 total events, spanning a range of forms). A district mathematics leader participated in half of the planning and professional learning events.

The first author conducted semi-structured interviews with Patty, Ada, and Jack. Initial interviews in the fall included questions aimed at understanding their goals for students' and teachers' learning, and particular goals for each form of professional learning. She conducted a second semi-structured interview with each of them after the final set of professional learning events. These interviews included questions aimed at understanding how they saw the community developing in relation to their goals, and their rationale for specific planning decisions. She conducted one additional interview with Patty (the primary facilitator of professional learning events specific to grade levels) in order to understand her in-the-moment facilitation decisions.

Data Analysis

To date, our team has engaged in analysis of the instructional leaders' visions and goals in relation to developing an inquiry-oriented community. We especially focused on the leaders' design and facilitation of what we came to view as a system of professional learning, with a focus on detailing the theory of action underpinning the design of each structure for professional learning, as well as the intended connections, or threads, across the system. We asked a set of analytic questions of the observation data from the instructional leaders' planning for and enactment of professional learning and the interviews with facilitators including, *Why were particular planning and facilitation decisions made?* to identify principles guiding the instructional leaders' work.

Results

In what follows, we detail three categories that emerged in our analysis of how the instructional leaders worked to support the developing community of mathematics teachers.

Commitments Regarding the Community's Work

Establishing a shared vision of instruction. Based on interviews and planning conversations, it was evident that Patty, Ada, and Jack shared a vision of high-quality mathematics instruction in which students engage in rich conversations about their and others' mathematical ideas in order to develop meaningful mathematical understandings and come see themselves and others as mathematicians. They articulated an overarching aim that students "feel competent and safe as mathematicians, as people that can mess up and solve things … to collaborate, to feel safe enough to speak and share what they're thinking and value the diverse voices in the room" (Jack). The three leaders saw this

vision as married to the school's broad aims to work toward justice and equity in relation to race, ethnicity, ability, and language status.

Jack described explicitly hiring teachers who shared broad commitments to justice and equity in relation to their students' learning. However, the leaders recognized that the teachers had differing ways of talking about mathematics instruction in relation to these commitments. As Ada articulated, "it's one thing to be committed and to say you're committed to [justice and equity] and it's another thing to see what that looks like and to experience what that looks like."

To work toward a shared vision of instruction, for example, the leaders organized professional learning around a set of shared goals for students' learning and teachers' instruction that were co-developed with the mathematics department. The leadership team first met in the fall to draft ideas grounded in research and documents such as the National Council of Teachers of Mathematics' (2014) *Principles to Actions*. They specified and refined these goals in an initial meeting with teachers. The resulting goals for students included listening to and making sense of the ideas and reasoning of others and seeing themselves has having a mathematical voice and agency in their classrooms. The resulting goals for teachers' instruction included facilitating dialogue among students that supports sense-making of a variety of strategies and approaches. These goals were referenced in each of the planning meetings.

Leaders further offered opportunities for teachers to deepen their instructional vision in relation to their shared commitments to justice and equity by engaging in strategic professional development together outside of the school day. For example, the department attended a conference together centered on "equity in the day to day work of math teaching, learning and leading." They found that a teacher who had been teaching in more didactic ways came back from the conference ready to "really think about [students'] agency and voice" in relation to their teaching practice (Ada).

Establishing a shared vision for how the community works together. Patty, Ada, and Jack also shared a vision for how the community would work together, characterized by authentic, collective inquiry into instructional practice. They aimed for teachers to see immense value and even necessity in collaboration with colleagues ("see that they need to collaborate, that it's better that way," Jack; "it's so powerful to be collaborating with other folks, and that's what really shifts practice," Ada). Relatedly, they aimed for teachers to see themselves and each other as having valuable resources for the community to build from in their work together, disrupting typical hierarchies of status among teachers and leaders in schools. They also noted the importance of teachers and leaders making their instructional practice public, positioning it as an object of inquiry for their own and others' analysis.

While willingness to collaborate was also a hiring criterion, the mathematics teachers oriented in different ways to collaboration, as they did with their vision of instruction. To work toward a shared vision for the community's work together, for example, the leadership team made careful facilitation decisions during enactments of instruction. They described intentionally framing collective instruction (e.g., before going into a classroom together in a Math Lab), emphasizing that their work would not be characterized by perfect, polished instructional practice ("...it's not going to be perfect the first time and we have to stick with it…," Patty). In our observations of professional learning involving enactments of instruction, the three leaders used language like "try it out," and "let's see what happens" to underscore the experimental nature of their collective instruction.

Structuring Collaboration: Designing and Facilitating A System of Professional Learning

Patty, Ada, and Jack designed a system of professional learning structures all organized around the vision of instruction and vision for the community's work together described above. Jack crucially built these structures into the school calendar. The structures involved a) collaboration within the mathematics department; b) collaboration among grade-level teams of mathematics teachers; and c) individual collaboration with Patty.

The mathematics department met three times in the 2018 - 2019 school year for Math Labs, which were co-facilitated by Patty, Ada, and Jack. Because Math Labs were typically full-day department-wide professional learning experiences, Jack arranged for full-day substitute teachers for each of the seven mathematics teachers for each of the three Math Lab days. Patty, Ada, and Jack "purposefully chose" classrooms to host the Math Labs to counter particular narratives such as "'Well, I can't do that because …' or, 'That's just a good group of kids'" (Patty). Math Labs were organized around particular instructional routines (e.g., Contemplate then Calculate; Kelemanik, Lucenta, & Creighton, 2016), which served as a predictable structure through which teachers could work on broader principles and practices of teaching (e.g., supporting students' mathematical identity and agency). These routines were selected by Patty, Ada, and Jack as conducive for working on the goals for students and teachers they co-developed with the mathematics department.

Between Math Labs, Patty visited teachers' classrooms, in which she and/or the teacher worked on particular aspects of instruction, implementing the same instructional routine used in the Math Lab. These visits were co-planned by Patty and the teacher to involve co-teaching or strategic observation of the teacher's instruction, aligned to goals set in the prior Math Lab and in response to the particular teacher's practice and narratives about their students' capabilities to support teachers to see that their developing vision of instruction "can happen … in the context of [their own] classroom" (Jack).

In addition, Jack organized the schedule such that teachers in the same grade level had a common planning period. Teachers met weekly in grade-level teams with the mathematics coach to explore mathematics content and to investigate instruction. Some of this grade-level planning time was used to interview students about their mathematical thinking and collectively debrief the interviews (adapted from the Math Reasoning Inventory; Burns et al., 2012). Other grade-level planning time involved joint analysis of students' work on common formative assessments and conversations about instructional decisions they would make on the basis of their analysis.

Principles Guiding Instructional Leaders' Design and Facilitation of the System of Professional Learning

We identified three principles that appeared to underpin the instructional leaders' planning and facilitation decisions for the system of professional learning as they worked to establish an inquiry-oriented community of mathematics teachers at Forest.

(1) Intersecting lines of inquiry. Each structure in Forest's system of professional learning was organized to engage teachers and leaders in joint inquiry in relation to students' mathematical thinking, participation, and identities; mathematics content; instructional practice; and narratives about students' capabilities. During each professional learning event, instructional leaders pressed teachers to reason across multiple of these categories (e.g., a student's participation in relation to how that student's mathematical ideas were positioned). This is commensurate with what Rosebery,

Warren, and Tucker-Raymond (2016) found to be generative in supporting science teachers' learning: "investigating dilemmas in their everyday practice at the intersection of student sense-making, academic subject matter, and structural inequalities" (p. 2).

(2) Teachers' experience of coherence. There were common "threads" across the professional learning system at Forest, which appeared in each of the professional learning events we analyzed:

- A specific set of goals for students that the department collectively defined and specified (e.g., "What does mathematical agency look like?")
- A specific high-leverage aspect of instruction that the department was committed to improving (e.g., facilitating meaningful mathematical discussions)

These common foci connect directly to the shared vision and set of goals the instructional team worked to foster and support a coherent instructional system (Cobb et al., 2018), as discussed above. In an initial analysis of teachers' experiences of the system of professional learning, these common foci appear crucial to teachers' experience of coherence across various professional learning events.

(3) Collective investigation and enactment of instruction. Each of the professional learning structures designed made space for collective investigation or collective enactment of instruction, or both. Literature points to the importance of opportunities to both investigate and enact key aspects of instructional practice (e.g., Grossman et al., 2009). It appeared crucial in the work at Forest that these opportunities were *collective.* That is, teachers had opportunities to enact instruction *together* (with colleagues during Math Labs and with Patty during classroom visits) and engage in inquiry in relation to that collective enactment.

(4) Responsiveness to teachers. Key decisions were made in response to teachers, informed for example by teachers' current thinking, participation in the system of professional learning, instructional practice, and narratives about their students' capabilities. In an initial analysis of teachers' experiences of the system of professional learning, these responsive decisions appear crucial to teachers' developing vision of mathematics teaching and goals for their teaching practice.

Discussion and Conclusions

We have provided an image of how an inquiry-oriented community of mathematics teachers is established. In doing so we contribute to the literature on teacher communities by highlighting (1) the importance of facilitators' and school leaders' work and (2) the potential of building community through a principled system of professional learning organized around shared commitments.

Important questions are raised by our examination of this case. The development of the Forest community appeared fragile at least in part because it was at tension with normative U.S. expectations for teachers and leaders. We hypothesize that the sustainability of such a community requires decisions responsive to the department context (e.g., current district initiatives; needs of the students). How do leaders' design and facilitation decisions change in response to contextual changes?

A second issue concerns our finding that community at Forest appeared to be contingent at least in part on the work of a school leader who valued teachers' collaboration and created the necessary conditions to enact the principles named above. How do communities of mathematics teachers form in contexts in which the school leaders and facilitators do not start with shared vision for the work?

In this paper, we have focused on instructional leaders' planning and facilitation decisions in support of the community. In our future analyses, we plan to make sense of teachers' experiences of the system of professional learning and their goals in relation to the instructional leaders' goals for the community. Understanding the role and experiences of various community members is crucial in making sense of the development of an inquiry-oriented teacher community.

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