

Analyzing video records of mathematics teaching practice to support teachers' learning

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The Project

This study is part of a larger design-based research project intended to support and theorize the learning of elementary teachers of mathematics with respect to particular "high leverage" (Ball et al, 2009) teaching practices. The research project is designing professional development (PD) in on-going school-based teacher professional learning communities (PLCs), which are structured to collaboratively analyze records of teaching practice (ROPs) as a means of enhancing teachers' mathematics teaching and coaching of teaching interns.

Purpose

In order to support our iterative design work and develop a well-warranted theory of teachers' learning in context, our methods must include a means of tracking the collective learning of the PLC. Given the quantity and complexity of the sessions, we need an approach that will be efficient and allow us to trace learning over time, explore differences associated with design choices, and illuminate segments of talk for deeper analysis. This paper reports pilot work to develop a method to meet those goals by analyzing the subset of the PD sessions in which teachers investigate ROPs to focus on one high leverage practice, leading a discussion (LaD).

Literature Review and Theory of Learning

Research on discourse in PLCs shows that different kinds of conversations support different kinds of learning (Horn & Little, 2010). The content of teachers' talk matters; a study of video clubs found that teachers moved from talking more about teachers to talking more about students. Specifically, these teachers provided more detailed talk about students and included more discussions of students in their talk about teachers (Sherin & Han, 2004). Also important are norms for discourse; for example, it is necessary and difficult to overcome norms of privacy and move toward critical conversations (e.g. Grossman, et al, 2001; Males, et al, 2010; Windschitl, et al, 2011). It is also important that teachers develop solidarity (Brodie & Shalem, 2011), share successes (Kazemi & Franke, 2004), and develop common goals (Richmond & Manokore, 2010).

Research Questions

To what extent do the methods employed in this study allow us to address the following questions:

1. What are the qualities of teachers' discourse around ROPs?
2. To what extent are key design choices related to the qualities of teachers' discourse, including:
 - (a) whether the teacher in the RoP analyzed is a teaching intern or an experienced teacher (PLC participant); and
 - (b) whether the video RoP is accompanied by written copies of lesson plans or of students' work?
3. How does teachers' discourse around records of practice change over time?

Context and Data Collection

The data were generated during 3 semesters of 1.5-hour PD sessions from Fall 2009 through Fall 2010 at two elementary schools, Kennedy Elementary and Hamilton Elementary. These were pilot sessions, preceding and contributing to a formally designed PD curriculum, where the goal was to try out language and strategies for supporting teachers in analyzing ROPs for professional learning. The facilitator led the teachers through a variety of RoP-related activities, such as analysis of videos and related artifacts (e.g., lesson plans, student work, curriculum material, depending on the RoP). We analyzed video records of the subset of PD sessions in which analyzing a RoP was a central activity. Nine sessions met this criterion, four at Kennedy and five at Hamilton. Data also included facilitator's lesson plans and handouts for each session and the RoP used.

Methods

Developing Field Notes and Parsing. The research team wrote field notes narrating each PD session video, focusing on teachers’ dialogue and engagement with ROPs (Emerson, Fretz, and Shaw, 2011; Erickson, 2006). The lead author checked the field notes for quality. Two members of the team then parsed the field notes into smaller, emic coding units that we called “chunks” and “mini-chunks.” Each set of field notes was parsed by one researcher and checked by another; when questions arose, consensus was reached through discussion. On average, the field notes had 34 chunks (range 20-47). The average number of mini-chunks per set of field notes was 161 (range 85-261).

Coding. Groups of codes emerged from the research questions, the literature review, and open coding a set of field notes from each school. Because the pilot study involved a small subset of PD activities (investigations of ROPs of teachers’ leading discussions), the code list could be quite detailed, yet still manageable. The lead investigator developed definitions of the codes, including topic codes, facilitator codes, and participant codes with more focused codes within each category. After all research team members felt comfortable with the codes and their application, the nine sets of field notes were divided among three members of the research team. The two sets used for test codes were included among these. All sets of field notes were coded by two members of the research team. Any disagreements in coding were settled by the first author.

The lead author created analytic tables organized by PD session and school. The analytic tables included conditions (e.g., such as whether the teacher in a RoP was an intern or a PLC participant), and indicators based on the codes. We coded at the mini-chunk level and then aggregated codes to the chunk level for final analyses. The indicators reflected the percent of chunks or in each discussion that contained the codes or selected intersections of the codes (e.g., see the variables in the figures below).

Kennedy Elementary School Professional Development Sessions

Date	Semester	# Participants	RoPs Used	Focal Teacher	Description of Lesson(s) in RoPs
December 3, 2009	Fall 2009	6	Video	Student teacher	Third grade lesson about estimation using money
April 15, 2010	Spring 2010	6	Video, student work	Participant	Third grade multiplication word problem
November 4, 2010	Fall 2010	5	Two videos, student work	Participant and student teacher	Third grade division word problem and money problems
November 18, 2010	Fall 2010	6	Narration, lesson plan	Participant and student teacher	Third grade division word problem and Kindergarten addition number sentence

Hamilton Elementary School Professional Development Sessions

Date	Semester	# Participants	RoPs Used	Focal Teacher	Description of Lesson(s) in RoPs
October 8, 2009	Fall 2009	5	Audio record, lesson plan + LaD rubric	Student teacher	N/A
November 12, 2009	Fall 2009	4	Narration, video	Participant and student teacher	Third grade place value and unknown grade with fact families
April 22, 2010	Spring 2010	5	Student work, video	Participant	5 th /6 th grade fraction concepts (equivalence and comparison)
October 14, 2010	Fall 2010	2	Video	Participant	4 th graders fraction concepts
November 11, 2010	Fall 2010	2	Lesson plan, video	Student teacher	Third grade division word problem and Kindergarten addition number sentence

Selected Findings

We focused on the extent to which our methods illuminated answers to a number of research questions related to shifts in the qualities of teachers’ discourse across design choices and over time.

Question 1: Qualities of Teachers’ Discourse.

When data were aggregated across all sessions and schools, teachers most frequently talked about Teacher Moves (32%), Student Thinking (28%), and Classroom Management (27%). Of the code intersections that interested the research team based on the literature review and conceptualization of strong PLC discussions, the intersection of Student Thinking and Teacher Moves appeared most often (9%). Participants’ conversational moves most often were evaluative (22%) or affirmed the focal teacher or something that another participant had said (19%).

Question 2a: Focal Participants in RoP.

When an intern was the focal teacher in a RoP used in a PD session, participants were more likely to focus on the teacher, talking about classroom management and teacher moves. They were also more likely to use conversational moves that were affirmative, offered advice, and were positively and negatively evaluative.

Question 2b: Whether Written Copies of Lesson Plans or Students Accompanied RoP.

The topics that teachers raised varied depending upon the types of records available at a given session. In particular, at Kennedy Elementary, when student work was available as a supporting record of practice, participants were more likely to talk about student thinking. We believe this is the case because records of practice like student work allow participants to see more details about student thinking.

TABLE KEY

**Each column represents a PD session. They are represented chronologically from left to right.*

FALL 2009

SPRING 2010

FALL 2010

STUDENT TEACHER

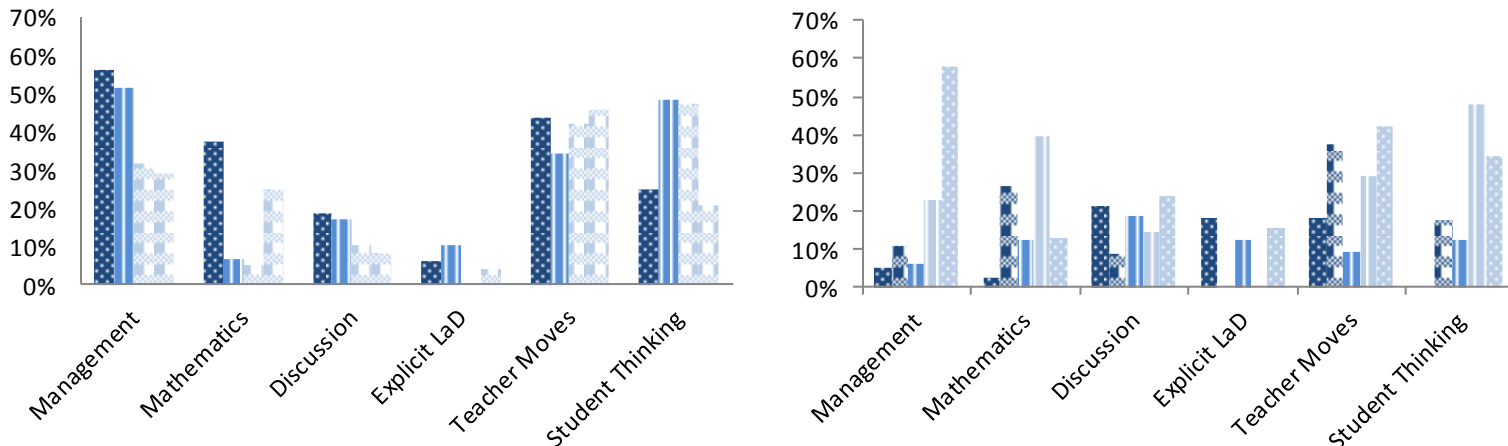
STUDENT TEACHER/PARTICIPANT

PARTICIPANT

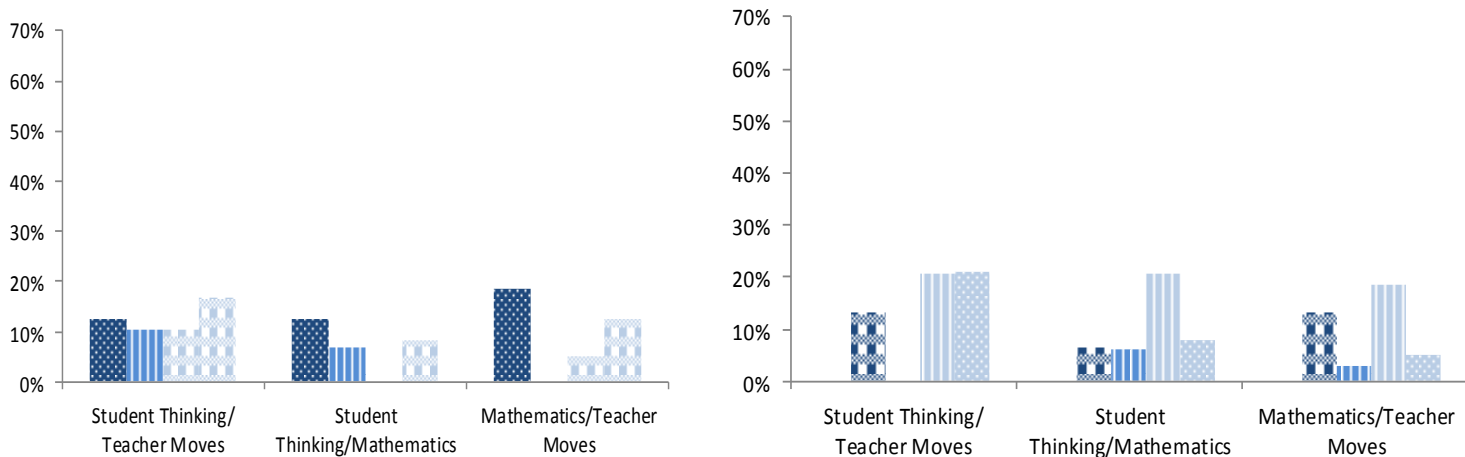
Kennedy Elementary

Hamilton Elementary

Topics Discussed in PD Sessions Over Time
(% of Chunks)



Intersections of Topics Discussed in PD Sessions Over Time
(% of Chunks)

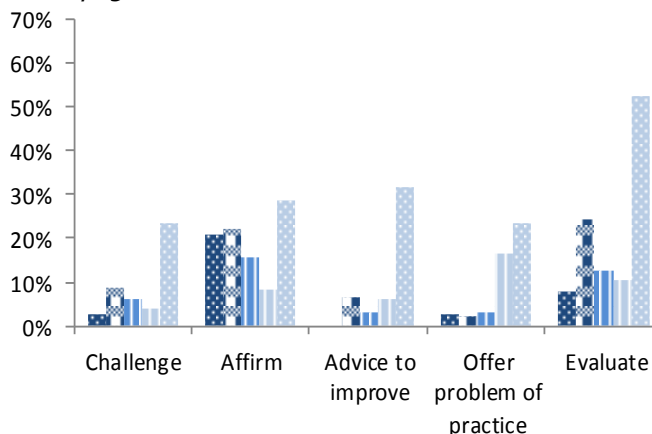
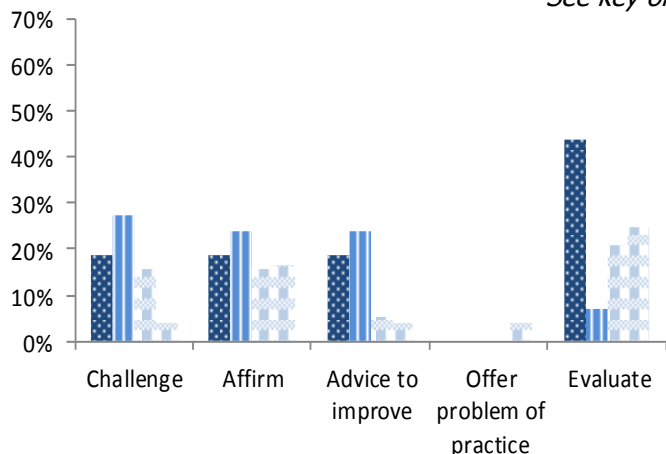


Kennedy Elementary

Hamilton Elementary

Conversational Moves in PD Sessions Over Time

See key on previous page.



Question #3: Change over Time.

There were no apparent trends over semesters. Variation occurred from session to session rather than over semesters, suggesting that design choices for individual sessions were important in shaping participants' dialogue.

Discussion

As has been documented in other research, constructing a coding method that is efficient yet attentive to the complexity of discourse is no small task (Schoenfeld, 2003). Our findings show that the topics and conversational moves varied from session to session, suggesting that variation was more likely due to the activities or attributes of the activities, such as the identity of the focal teacher of a RoP. Some topics and conversational moves occurred more often when the focal teacher was an intern. Similarly, some supporting RoPs, such as student work or lesson plans, seemed to allow participants to notice more about student thinking and mathematics or to offer ways that the focal teacher could improve their practice. Thus, the methods we developed illuminated the impact of some design choices but did not illuminate change over semesters. There are multiple additional explanations, including the possibility that the field notes removed important nuances, the codes were insufficiently sensitive, the unit of analysis (chunks) was not at the right grain size, or that our preliminary goals of collaborating with our participants to develop language and strategies analyzing classroom discussion led to too many shifts in the design of individual sessions to allow us to detect change over time.

This pilot experience has led to a number shifts in our methodology for addressing the subset of our research questions that focus on the qualities of discourse during the PD sessions, including revision and elaboration of the coding system and the use of software that permits unitizing and coding directly from the video of the PD. The larger research agenda—which includes attention to shifts in teachers' classroom practice, mathematical knowledge for teaching, and self-reports of their learning, along with close analyses of transcripts of selected PD sessions—will allow us to address a number of validity questions about our methods for tracking change in the qualities of discourse across design choices and over time.

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