

Together Building a Theory of Teacher Learning

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Abstract: This session addresses two major problems that hold back research on teacher learning. First, research often tests efficacy of professional learning interventions without illuminating *how* teachers learn within the intervention. Second, as a field, we have not reached consensus on how to document teacher learning, making it hard to share results in robust ways. For instance, researchers rarely view and discuss video from each other's professional learning interventions, making it difficult to build shared ideas about concepts like "noticing student thinking" or about specific experiences that build teacher learning. To address these issues, this session will present professional learning video from four research projects focused on teachers' learning to improve mathematics instruction. Video will be linked to a tentative conceptual framework of teacher learning that will be critiqued by the audience, discussant, and presenters, in order to expand it, identify gaps, and provide a shared framework for future research.

Symposium summary

Using data from four long-term collaborations between researchers and educators, the session will:

- Highlight key elements of teachers' learning to improve practice, using video and artifacts;
- Present claims and evidence about why and how these experiences support teachers' learning;
- Relate each presentation to a developing conceptual framework of teachers' learning;
- Have audience members critique and expand this framework.

Session overview

As a construct, *teacher learning* has been shaped largely by research that intervenes to change instruction toward predetermined forms of practice, making a "fidelity of implementation" conception dominant in the field (Goldsmith et al, 2014; Sztajn, 2011). That is, researchers study how well particular forms of professional development shape instruction towards the interventions' desired goals, deeming teachers to have learned when the goals are met. In larger scale research, findings of "teacher learning" are also often diluted by teacher self-reports of having taken up the targeted forms of practice, an unreliable form of verification (Dunlap, 2016).

To make progress on the field's understanding of teacher learning, we move beyond the narrowness of fidelity of implementation models and the potential reliability concerns of self-report data. Instead, the four featured research projects all seek to empirically document teacher learning by operationalizing it within video data of teachers during professional development. Specifically, during the session, the research teams will present video and artifacts that highlight each project's ideas about the experiences that support teachers' learning to improve mathematics instruction. Each video and artifact will be related to a tentative conceptual framework of interactions (experiences with colleagues, curriculum, etc.) that:

1. Build teachers' mathematical knowledge and sense-making;
2. Support pedagogical mastery;
3. Make student thinking visible;
4. Connect abstract ideas to concrete practices;
5. Nurture beliefs and commitments that allow all of the above.

In addition, the researcher-organizational collaborative context for the interaction will be described.

Scholarly significance

By sharing concrete artifacts and specific examples of “teacher learning” from four research projects, and relating these to an overall framework, we aim to build shared ideas about the elements of the teacher learning framework, provide concrete examples of the elements, and identify gaps in the framework.

In Paper 1, Lewis and colleagues examine 13 lesson study sessions with the same elementary mathematics teacher team. They operationalize learning in their data by showing shifts in team members’ understandings of core topics and activities over time. In Paper 2, Horn and colleagues examine experienced secondary mathematics teachers participating in a video-feedback coaching process. Through the comparison of three focal teachers’ learning through multiple coaching sessions, the authors highlight the epistemic shifts that took place as participants made sense of the video feedback. In Paper 3, Borko and colleagues describe the learning of 18 teacher leaders participating in an ongoing research-practice partnership. Using video records of the teacher leaders’ learning and supported by interviews, the research team shows how *modeling* and *rehearsals* were effective learning experiences for the focal participants. In Paper 4, Shaughnessy and Garcia report on a professional development design that takes a “laboratory approach” to the analysis of teaching, where participants “prebrief” a lesson, co-observe a live elementary mathematics lesson, and then debrief their observations. Looking across the prebriefing and debriefing conversations, they noted teachers’ learning as evidenced by their reframing of teaching moments. Together, the papers share a commitment to finding empirical warrants for teacher learning, while representing a cross-section of interventions, grade level teachers, and analytic techniques. We believe that there is enough commonality to be generative, and enough difference to raise important questions across the papers. Our discussant, Lynn Goldsmith, recently led a review of mathematics teacher learning and has a up-to-date, field level view of the issues. Indeed, it is our hope that the session will elicit audience feedback to spark expansion and revision of the conceptual framework of teacher learning, as well as provoke conversations across projects. This format aims to use “crowdsourcing” to gain input from researchers beyond the four represented programs.

Structure of the session

The session discussant, an experienced researcher of teacher learning unaffiliated with the four projects, will briefly introduce the session (5 min) and provide printed and online versions of the theoretical model, so audience members can provide input in either modality. The theoretical model will outline five major categories of teachers’ learning. Representatives from each of the projects will share their analyses (15 min each). After each presentation, audience members will have approximately two minutes to update their responses to prompts about the theoretical model. Next, presenters will field questions and feedback from the audience regarding the model for teacher learning (8 min). Finally, the discussant will summarize and question ideas from the session. The discussant will have real-time access to participants’ responses, as well as to the four presentations.

How do teachers learn during Lesson Study?

Catherine Lewis, Shelley Friedkin, Kevin Lai, and Valerie Chavez, Mills College

Objectives

This presentation:

- Adds to the limited knowledge on teacher-led, practice-based professional learning;
- Uses the case to examine a conceptual framework of teacher learning;
- Solicits audience observations and critique, so that the conceptual framework can benefit from broader input.

Theoretical framework

Improvement of mathematics teaching is a complex, recursive process in which different elements must be built and coordinated for improvement to occur (Goldsmith et al., 2014), such as: teacher knowledge (of content, student thinking, etc.); teacher beliefs (about good instruction, student capacity, etc.); classroom norms and routines (questioning, sustained investigation, etc.); and high-quality curriculum. Lesson Study is a collaborative professional learning approach in which teachers study, plan, and reflect around a live “research lesson,” designed to enact and test the team’s ideas about high-quality teaching. An accumulating body of research suggests Lesson Study can build teachers’ content knowledge, beliefs in students’ learning capacity, knowledge of student thinking, effectiveness as collaborators, and instructional change, as well as to positively impact student learning (Huang et al., 2019; Lewis & Perry, 2017). Yet we have relatively few case studies that illuminate *how* these impacts on teachers, instruction, and students occur.

Methods

A mathematics lesson study team was video-recorded across a lesson study cycle, a total of about 13 sessions (including study, planning, research lessons, and post-lesson discussions). The team included three elementary teachers who had agreed to take part in a study designed to use lesson study to improve fractions instruction. They recorded their lesson study meetings and submitted them along with the video of their classroom instruction. Their lesson study cycle took place as part of a randomized trial; their random assignment condition was mailed a fractions lesson study resource kit, and they self-managed their lesson study cycle. The resource kit included mathematical tasks, lesson videos, research findings related to fractions, and a suggested process for the team to discuss these materials and use them to inform their lesson planning.

Data sources

Transcribed video of meetings and lessons, along with research meetings notes and lesson artifacts, are the primary data. Challenges and learnings identified by participants were culled from transcripts by one researcher and reviewed by three additional researchers; the presentation focuses on challenges and learnings identified by multiple reviewers.

Results

A sequence of videos from teachers' planning, execution and post-lesson reflection over a cycle of Lesson Study allow audience members to examine how teachers shift from seeing a novel fractions task (using a linear fractions model) as a barrier to seeing it as an enabler of learning. We will see team members initially explore a hands-on fractions "mystery strip" activity and critique the possibility of replicating this type of activity in their own classrooms. The teachers comment on the students' understanding of fractions, saying that they are "just not taking that knowledge." The teachers also comment that the inquiry process of the lesson study intervention is taking too long and "we can't do that in our country." Later on, after implementing the activity, the teachers express the belief that it impacted student retention, and express the intention to continue to implement it in the following year.

Significance

Too often, mathematics professional learning studies focus on the success or failure of a particular intervention, rather than building a more general body of knowledge about the experiences that support teachers' learning. Using video and transcripts, we provide detailed examples of the ways that teachers built knowledge needed to improve instruction, as well as the ways this knowledge informed instructional change and the barriers that constrained it (Davis et al., 2016).

Learning to listen closely: Experienced mathematics teachers' *instructional tuning* via video feedback

Ilana Horn, Vanderbilt University; Brette Garner, University of Denver; and Nadav Ehrenfeld, Vanderbilt University

Objectives

We examine experienced secondary mathematics teachers' learning about ambitious instruction through a video-based intervention. We co-designed a video formative feedback (VFF) process with our partners in a professional development organization. VFFs started with teachers' instructional questions, then used clips from dense video lesson records to inquire into these questions. Afterwards, members of the research team, the focal teacher, and their colleagues debriefed around their question.

Theoretical framework

We conceptualize teachers' sensemaking as a core phenomenon of teacher learning (Coburn, 2001). VFFs uncover sensemaking to support learning. Accordingly, we take a situative perspective on learning (Greeno, 1998) to examine how teachers interpret instruction, rooted in contextual resources, and how interpretations change over time. In prior work, Horn and Kane (2015) found that teachers' *epistemic stances* on instruction shape their interpretations— that is, perspectives on what can be known, how to know it, and why it is of value.

Data sources

Over two years, we tracked 12 teachers' learning through multiple VFFs. We report three cases here — Julie, Brad, and Veronica — selected because their learning was evident not only in their self-reports, but also through

shifts in their instruction. We use this “best case” analysis (Yin, 2017) to build theory about what is possible for teachers’ learning through the VFF. To examine teachers’ learning, we triangulate data from (a) correspondence with teachers before VFFs; (b) classroom video recordings, including audio from four groups of students; (c) video of VFF debriefs, in which we share classroom video with teachers; and (d) member-checking interviews.

Methods

Broadly, we take an ethnomethodological approach to looking at our data (Heritage, 2013), focusing on participants’ interpretations of their situations, operationalizing learning by tracking changes in their interpretations over time. More specifically, aligning with our situative perspective, we use interaction analysis (Jordan & Henderson, 1995) to examine teachers’ interpretations about instruction during debriefs (primary data), as well as how interactions with students changed during recorded lessons (secondary data).

Results

The focal teachers’ instructional sensemaking shifted through access to interactional details — like students’ small-group conversations — that are beyond their perception during instruction. In a VFF with her Algebra II class, for example, Julie was initially interested in learning about how students interpreted logarithms in contexts. After the lesson, however, she was also concerned that many students had made procedural errors.

Because our video viewing was rooted in teachers’ questions, they were generally eager to offer interpretations about what they saw. As facilitators pressed them to elaborate and reconcile their interpretations with these details, their epistemic stances shifted, thereby changing their interpretive lenses for instruction. In Julie’s case, she introduced a representational tool for solving logarithmic equations, which some groups adapted in an unexpected way. At first, Julie interpreted their adaptation as a procedural error — a misuse of the order of operations. Yet during the VFF debrief, Julie heard students’ discussions of the tool and realized that students were not making an arithmetic error, but instead were using the tool in a coherent — albeit unexpected — way. Gaining access to the details of students’ interactions led to a key shift in Julie’s interpretations of students’ strategies. As a result of her VFFs, Julie summarized that: “When I come up to a group, I just try to ask them what they were thinking there. Whereas before, I might have assumed I knew what they were thinking.”

Looking across Julie’s, Brad’s, and Veronica’s cases, they recognized (a) their understandings of instruction were always partial; (b) the need to develop listening practices for understanding students’ in-the-moment experiences; (c) the need to structure student-to-student interactions to support productive mathematical talk. These epistemic shifts supported greater *instructional tuning* with students, as teachers developed more receptivity for students’ input. As Veronica stated, “When you have a chance to rethink the in-the-moment decisions, it helps you make better in-the-moment decisions in the future.”

Significance

Prior work on teacher learning has primarily focused on the learning of novice teachers or of those who are new to ambitious instruction. By looking at experienced mathematics teachers’ instructional challenges, we identify harder aspects of learning ambitious instruction, which require greater attention to the nuances of classroom interactions. The VFFs highlight the learning potential of making interactional details of the classroom available as teachers engage questions about practice. Our examples highlight the role of video-based examination of practice in shifting teachers’ interpretations of instruction.

Using video to foster teacher leadership to strengthen mathematics teaching and learning

Janet Carlson, Hilda Borko and Alissa Fong, Stanford University

Objectives

Through a research-practice partnership between a university and an urban school district, we are working to achieve the district’s mission of providing every student with high-quality instruction and equitable learning opportunities by building the district’s capacity to conduct school-based professional development (PD) for mathematics teachers. Video of classrooms plays a central role in both the preparation of site-based teacher leaders (TLs) and the professional development they facilitate. The purpose of this presentation is to illustrate the frameworks for TL learning and teacher learning we have developed, emphasizing the multiple roles that video plays. We will share videos of TL rehearsals and teacher video-based discussions to illustrate our Theory of Change (see Figure 1).

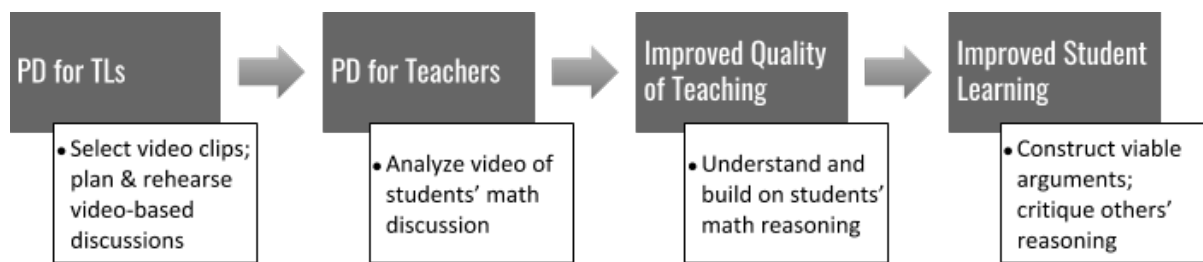


Figure 1. Theory of Change.

Theoretical framework

Our theory for TL and teacher learning is based on multiple frameworks. At the center of the learning is the Problem Solving Cycle (PSC). The PSC consists of three interconnected workshops, organized around a rich mathematical task (see Figure 2). Teachers solve the task and prepare to teach it during Workshop 1. They video record the classroom as they teach the lesson between Workshops 1 and 2. Video clips from these lessons are used to collaboratively analyze student reasoning and instructional practices in Workshops 2 and 3.

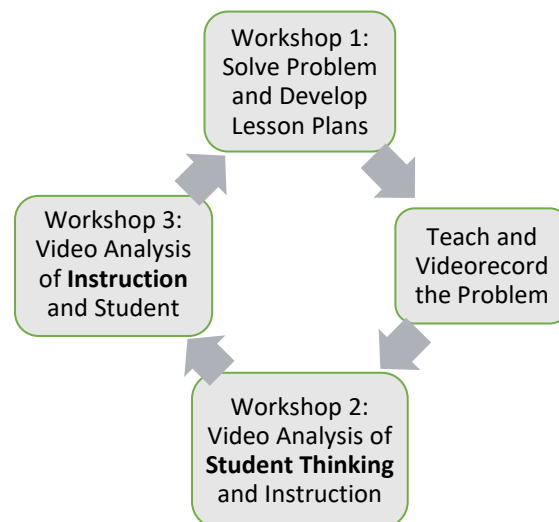


Figure 2. The Problem Solving Cycle (PSC).

To learn to lead PSC workshops at their sites, TLs have the opportunity to experience the PSC in a four phase cycle (see Figure 3). In Phase 1 they participate as a teacher learner. They collaboratively solve a mathematical task or participate in a video-based discussion. They return to the role of TL in Phase 2 and experience “pulling back the curtain” as the facilitators discuss their goals for the activity and reasons for their pedagogical choices. In Phase 3 TLs plan and rehearse a PSC workshop based on the learning experience from Phase 1, but tailored for their sites. During the rehearsal, the TLs practice the portion of the workshop they have the most concern about. The other TLs participate as colleagues and then debrief the rehearsal. In Phase 4, the TLs conduct the workshop with the mathematics teachers at their school.

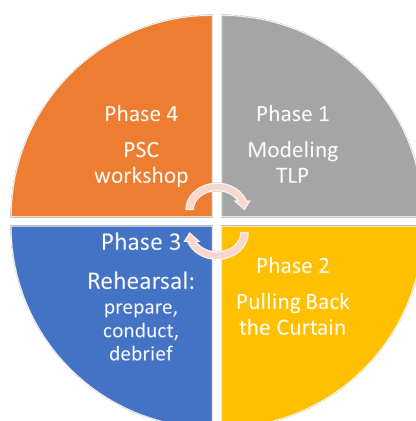


Figure 3. The TLP/PSC Cycle of Collectively Learning (adapted from McDonald et al., 2013).

Methods

This research-practice partnership uses Design-Based Implementation Research (Penuel et al., 2011) methods to adapt the PSC and learning-to-lead models to district priorities and study how the district builds capacity and sustains the work.

Data sources

Our data set comes from 18 TLs and their colleagues, representing half the middle schools in the district. To study the TLs' development over time, we video recorded all TLP sessions and PSC workshops and conducted multiple interviews with each TL. The findings we share in this presentation focus on the TLs' development as TLs, changes in their leadership of video-based discussions over time, and changes in the teachers' classroom practice. They are based on an analysis of the video recordings of TLP sessions, PSC workshops, and classroom lessons.

Results

TLs at every site led at least three video-based discussions annually and their enactment of facilitation moves that foster high-quality discussions (e.g., connecting ideas, distributing participation) increased over time. They reported that modeling and rehearsals were particularly effective learning experiences. During video-based discussions in Workshops 2 and 3 teachers discussed topics such as ways to encourage more student authority in their classrooms and to foster students' use of multiple representations during mathematics problem-solving. Teacher learning was also evident in changes in classroom practice.

Significance

Our work illustrates the role of video for two key intertwined learning opportunities:

1. Teacher leaders learn a process for working with colleagues to have meaningful video-based discussions.
2. Teachers learn ways to consider the relationship between their teaching and student learning by examining their own video clips with colleagues.

Reshaping conversation about teaching practice and student learning: Investigating moments of learning within a lab

Meghan Shaughnessy and Nicole Garcia, University of Michigan

Objectives

Our project aims to make the collective study of instruction possible. We have been developing an approach that we call an instructional "laboratory," following Dewey's (1904) notion of a "laboratory approach" to teacher education, focused on the ongoing study of students, subject matter, and teaching. In this approach, professional learning is situated in a "live" case of elementary mathematics instruction, which is used as a "common text" for working on practice. Participants' engagement approximates a form of "legitimate peripheral participation" (Lave & Wenger, 1991) through structured conversations about the lesson plans, close observation, analysis of student tasks, the examination of records of teaching and learning, and facilitated reflection on and refinement of instruction. The setting provides a forum through which theoretical attributes of instruction can be made more salient. Thus, the setting provides a bridge between theory and practice.

Our analyses revealed that participants increased their skills in identifying and naming moves that the teacher made to lead mathematics discussions. Specifically, following participation in the professional learning experiences, when participants watched a mathematics discussion, they were able to identify and name more moves made to elicit student thinking and orient students to the thinking of others during the discussion compared to what they were able to do prior to the professional development. Second, participants significantly shifted in their language for talking about students and learning, specifically, they shifted from evaluating to describing what students were doing. In this paper, we analyze the structured conversations about the lesson plan (the prebriefing) and facilitated reflection on and refinement of instruction (the debriefing) as opportunities to impact teacher learning.

Methods and data sources

We analyzed videos of the prebriefing conversations in which participants engaged in structured conversations about the lesson plans and debriefing conversations in which participants engaged in facilitated reflection on and refinement of instruction. These conversations occurred on each day of the five day professional development. Specifically, we identified instances in which teaching practice was unpacked or reframed as well as instances in which attention was reframed to be about students' strengths rather than deficits. After identifying these instances, we examined video of the classroom observation with a specific focus on the relationship between what was evident in the video and participants' conversations and the facilitator's role in re-shaping conversation.

Results

Our findings suggest a framework of facilitator moves to reframe teachers' attention to the nuances of teaching practices and noticing and naming students' strengths. For example, to redirect participants attention towards students and their learning rather than "deficits," one common move entailed asking participants to consider what a sample of student work suggests that a student can do or the ways in which the task posed to a student created or constrained opportunities to display competence. In our full paper, we lay out a framework and provide illustrative examples from the data to illustrate moments in which participants' language for talking about teaching as well as students' and their learning appeared to shift.

Significance

This paper contributes to efforts to better understand teachers' learning in the context of professional development and contributes a set of facilitator moves that were successfully used to reframe participants' talk about teaching practice and student learning.

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