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Teacher learning in a combined professional development intervention☆

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HIGHLIGHTS

- Combining lesson study, video club, and animations yielded teacher learning.
- Majority of video club discussions were about student conceptions.
- Prior knowledge discussed during conversations on student conceptions or pedagogy.
- Teacher-initiated discussions of students' prior knowledge were more sophisticated.

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ABSTRACT

The study examines geometry teachers' video club discussions in a two-year professional development intervention that combined lesson study, video clubs, and animation discussions to promote teacher noticing of students' prior knowledge. Most discussions pertained to student conceptions (78%), followed by pedagogy (19%). Discussion of students' prior knowledge surfaced only when talking about student conceptions or pedagogy. There was statistically significant evidence that teacher-initiated discussions of students' prior knowledge were more substantial than facilitator-initiated discussions. The findings suggest that the professional development model and the facilitators' moves promoted and sustained teacher noticing of student thinking throughout the intervention.

Promoting teacher learning is the goal of all teacher professional development initiatives. Various professional development strategies, such as lesson study and video clubs, support teacher learning by increasing teachers' attention to student thinking and advancing instructional improvement (Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2009). In lesson study, teachers engage in a cycle of activities that includes investigating curricular materials, identifying student learning goals, crafting a research lesson, observing the implementation of the lesson, and reflecting upon the student thinking that occurred in the lesson (Fernandez, 2002). In lesson study, the term "research lesson" refers to the lesson that the teachers plan and teach to observe student learning. Lewis, Perry, and Murata (2006) explain, "The observed lessons, called 'research lessons,' are regarded not as an end in themselves but as a window on the larger vision of education shared by the group of teachers, one of whom agrees to teach the lesson while all the others make detailed records of the learning and teaching as it unfolds" (p. 3). Lesson study aims at promoting teacher learning which in turn increases students' learning opportunities in the classroom (Lewis, Perry, & Hurd, 2009; Lewis et al., 2006). Video clubs consist of teachers' discussion of videos from their own classrooms (Sherin & Han, 2004). Teachers who participate in video clubs engage students in reasoning about their ideas and,

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consequently, promote students' mathematical understanding (Sherin & van Es, 2009). In addition to lesson study and video clubs, a more recent professional development strategy is that of using animations of classroom instruction (Amador, Weston, Estapa, Kosko, & de Araujo, 2016; Chazan & Herbst, 2012). While videos center on real classroom events, professional developers use the fictional scenarios in the animations to promote teacher noticing of student thinking.

In this study, we examine the effects on teacher learning as a result of participating in a professional development intervention that combined lesson study, video clubs, and animation discussions. We identify five potential benefits of combining lesson study, animation discussions, and video clubs. First, researchers have documented challenges when implementing the first step of lesson study, the examination of instructional materials (Fernandez, 2002). Traditional Japanese lesson study often begins by the examination of teachers' guides from a common curriculum to investigate how concepts are interrelated, what prior knowledge is relevant, and teaching methods (Takahashi & Yoshida, 2004). However, examples of implementations of lesson study in the U.S. show that this step is often omitted or curtailed, limiting opportunities for teachers to ground their examination of student thinking in relation to curricular demands (Akiba & Wilkinson, 2016). Fernandez (2002) noted that the lack of a common curriculum in the U.S. limit teachers' opportunities to engage in common lesson planning. While the Common Core State Standards for Mathematics ((National Governors Association Center for Best Practices, Council of Chief State School Officers NGAC, 2010) provide a common curricular framework for states that have adopted the standards, there is still much flexibility in curriculum implementation in the U.S. Animations can motivate the examination of instructional materials by showing examples of lessons that the teachers can investigate as a source for creating their own lesson in lesson study. Second, teachers participating in video clubs initially tend to focus on various aspects of instruction instead of student thinking, which becomes teachers' main topic of discussion over time (Sherin & Han, 2004; ; Sherin & van Es, 2005). By combining lesson study and video clubs, teachers can design a lesson that provides opportunities to examine student thinking, one of the main goals of lesson study (Lewis & Hurd, 2011; Lewis et al., 2009). Third, opportunities for conducting live observations, an integral component of traditional lesson study (Gorman, Mark, & Nikula, 2010), can be challenging in some contexts because teachers would need to obtain release time to visit each other's classrooms. Implementations of lesson study in the U.S. require at times paying for teacher substitutes, which add to the costs of making lesson study viable (Akiba & Wilkinson, 2016). Video clubs can enable more teachers to participate in the lesson reflection step by allowing teachers to watch the enactment of a research lesson without having to physically be in the classroom for a live observation. Fourth, while in lesson study only one teacher teaches the lesson, combining lesson study and video clubs can enable many teachers to teach the lesson, increasing teacher accountability. Finally, having many teachers teach the lesson has the effect of enlarging the pool of classroom video clips that showcases student thinking. These examples illustrate the potential benefits of integrating lesson study, video clubs, and animation discussions in professional development for promoting teacher learning, especially considering specific challenges of each strategy when implemented in isolation. Even though combining several professional development strategies is a common recommendation in professional development literature (Loucks-Horsley et al., 2009) and projects such as The Problem Solving Cycle (Borko, Jacobs, Koellner, & Swackhamer, 2015) combine teachers' engagement in solving mathematics problems and video clubs, investigating teacher learning as a result of participating in professional development that combines animation discussions, lesson study, and video clubs is an open question in the field. Identifying teacher learning outcomes from this professional development intervention would broaden opportunities for teacher education.

We focus on the video club discussions and consider whether the effectiveness of video clubs was compromised because of integrating this strategy with others. [1] The analytical methods replicate other studies that investigate teacher noticing of student thinking during video club discussions. Since video clubs have the same focus on increasing teacher attention to student thinking than our study, we wanted to examine possible ways in which the integration of strategies affected that goal. Additionally, we apply novel methods for investigating whether the intervention achieved the objective of promoting teacher noticing of students' prior knowledge. By centering this study on video clubs, we examine whether and how the participating teachers noticed student thinking and their prior knowledge.

1. Promoting teacher noticing in professional development

In this section, we review research on teacher noticing and specify what we mean by teacher noticing of students' prior knowledge. At the end, we discuss research that establishes how video clubs support teacher noticing.

1.1. Teacher noticing

Work on situated cognition has made apparent that members of a community of practice have particular ways of engaging in activities and generating knowledge from their participation in those activities (Lave, 2011; Lave & Wenger, 1991; Wenger, 1998). Goodwin's (1994) notion of *professional vision* refers to how members of a profession attend to phenomena and construct the discourse of their profession. This notion has connections with Mason's (2002) work on *noticing*, which he defined as "a collection of practices both for living in, and hence learning from, experience, and for informing future practice" (p. 29). In recent years, mathematics education researchers have used the construct of noticing to identify knowledge and skills that teachers possess and goals for promoting teacher learning. Sherin, Jacobs, and Philipp (2011) describe teacher noticing as, "the process through which teachers manage the 'blooming, buzzing, confusion of sensory data' with which they are faced, that is, the ongoing information with which they are presented during instruction" (p. 5). How and what teachers notice, or fail to notice, is critical for teacher decision-making in their classrooms (Erickson, 2006, 2011; Erickson et al., 1986; Jacobs, Lamb, & Philipp, 2010; Lampert & Ball, 1998; Lampert, 2001; Sherin & van Es, 2002; van Es & Sherin, 2008). Renewed focus on teacher noticing in the classroom has brought more discussion about what composes teacher noticing, and what practices of teacher noticing can be learned or honed. We take the view that teacher noticing of students' thinking involves three components: *attending* to students' actions, *interpreting* students' thinking, and *responding* in the classroom (Jacobs et al., 2010). This definition implies that teacher noticing is active and requires teachers to wrestle with classroom events, as well as interpreting those events and making sense of them. Noticing is not a passive action, but a practice of teaching that research has shown can be

[1] In other studies, we investigate the effects of the intervention in promoting learning during animation discussions (Skultety & González, 2017), in the lesson study cycle (Deal & González, 2017; Skultety, González, & Vargas, 2017), and in teachers' implementation of the lessons (González & Vargas, 2017).