

SOCIAL CAPITOL, SOCIAL NETWORKS, AND LESSON STUDY: SUSTAINING MATHEMATICS LESSON STUDY PRACTICES

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I investigate the sustainability of lesson study as mathematics teachers who participated in a 3-year professional development partnership engage in a district scale-up lesson study professional experience. This study answers three questions: (1) what are K-12 teachers' conceptions of sustaining mathematics lesson study, (2) what practices of lesson study continued after the grant as reported by participants, and (3) what are supportive and constraining factors in continuing lesson study after external funding ends when there is both reported desire from teachers as well as some district support? Survey and interview data are analyzed using grounded theory and social network analysis for patterns in and structure to activities. Findings suggest rich conceptions of lesson study, the continuation of particular lesson study practices, and the importance of integration and linkage as factors that supported or hindered lesson study.

Keywords: Policy Matters; Teacher Education-Inservice (Professional Development); Instructional Activities and Practices

Introduction

Though lesson study shows promise as a vehicle for professional development (Stigler & Hiebert, 1999; Yoshida, 2012) and has been described as a sustainable form of professional development, little research exists on what would help to support teachers in continuing lesson study past the life of a grant. Why do some mathematics teachers of lesson study continue while others do not, particularly when teachers express interest and have some district support? Therefore, to develop a better understanding of sustainability with respect to lesson study, the field is in need of a deeper understanding of how to support the continuation of lesson study.

The purpose of this report is to examine teachers' conceptions and practices of lesson study, and factors that supported and constrained teachers' ability to continue to engage in lesson study. The setting for this study is unique in that participants surveyed and interviewed come from one network of U.S. mathematics teachers of grades 3 through Algebra 1 (students 8–14 years old) who participated in a three-year professional development partnership that used lesson study and who expressed interest in and had some district support for continuing lesson study after grant funding ended. In this report, I answer the following research questions: (1) what are K-12 teachers' conceptions of sustaining mathematics lesson study, (2) what practices of lesson study continued after the grant as reported by participants, and (3) what are supportive and constraining factors in continuing lesson study after external funding ends when there is both reported desire from teachers as well as some district support?

Background

Lesson study has been described as a vehicle for developing and sustaining professional learning communities whose goal is to improve instruction (Yoshida, 2012). Research on mathematics lesson demonstrates the potential to enhance teachers' knowledge about mathematics content (Alston, Pedrick, Morris, & Basu, 2011; Fernandez, 2005; Lewis, Perry, & Hurd, 2009; Meyer & Wilkerson, 2011; Robinson & Leikin, 2012; Yoshida 2012), change teaching practice (Hart & Carriere, 2011; Murata, Bofferding, Pothén, Taylor & Wischnia, 2012; Olson, White & Sparrow, 2011), nurture professional communities of teachers (Lieberman, 2009; Lewis, Perry & Hurd, 2009; Saito, Khong,

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& Tsukui, 2012), and help teachers understand how to teach mathematics aligned to reform efforts (Lee & Ling, 2013; Lewis & Takahashi, 2013; Takahashi, Lewis & Perry, 2013). These foci – enhancing mathematical content knowledge, changing teachers’ practice, nurturing professional communities, and helping teachers teach in ways aligned to reform efforts – are ways in which lesson study has contributed to the improvement of learning and teaching mathematics, benefiting both teachers and students. Yet researchers call for more research in lesson study (Fernandez, 2005; Lewis, Perry & Murata, 2006). Future research pathways would be impossible without teachers continuing to implement and engage in lesson study.

Although many educators involved in lesson study research and work describe it as a sustainable form of professional development, little research exists that seeks to understand aspects of engaging in lesson study that ensure its continued success (cf. Gero, 2015; Lewis & Perry, 2014; Saito, Khong & Tsukui, 2012). Factors that hinder lesson study include engaging in collaboration, observing a lesson, the potential critique of a teacher’s lesson and teaching, and the collision with the existing culture in districts with the tenants of lesson study (Gero, 2015). Saito, Khong & Tsukui (2012) found that faith in meetings, support and enthusiasm from principals and other senior teachers, and the desire to retain respect from external parties supported teachers in continuing to organize PLCs with lesson study. This study furthers research on these factors to add to a deeper research base on continuing lesson study.

Theoretical Perspective

The theoretical model of lesson study used in this study is based on Japanese Lesson Study (Fernandez, 2005), which consists of teachers collaboratively (a) *investigating* content and setting goals for the research lesson, both content-focused and broader site based goals; (b) *planning* a research lesson that seeks to inquire into how students learn a particular topic or sets of topics; (c) *teaching* and *observing* a live research lesson while gathering student data; and (d) finally, *debriefing* on specifics of what was learned from the lesson as well as more generally about teaching and learning mathematics (Lewis, Perry, & Hurd, 2009). Optionally, teachers may modify their research lesson and opt to teach it a second time, collecting data on student thinking and debriefing again.

Yet to understand how mathematics teachers engage in professional activities like lesson study requires understanding how they are situated within their site and district. Consequently, this study is shaped by the perspective that teaching is embedded within institutional settings like classrooms, school sites, and districts with teachers members of communities (Cobb, McClain, Lamberg, & Dean, 2003). Additionally, understanding how mathematics teachers engage in professional activities requires understanding the nature of collaborative activities that the teachers engage in both in informally arranged groups and formally arranged groups by the school or district.

Supporting the work of teachers in complex institutional settings also requires attention to different types of resources supporting teacher work (Gamoran et. al, 2003). These include *material resources* (physical objects or information like curriculum or activities), *human resources* (qualities of people that can be changed like training someone to be a math coach), and *social resources* (attributes of relationships, roles or modes of communication like connections to math coaches and other people). I examine social resources for this study, which is one way to understand conditions for sustainability (Gamoran et al., 2003).

Sustainability is defined as maintaining generative practice, or to keep growing and learning (Franke et al., 2001; Gamoran et al., 2003). I use Gamoran and colleagues’ (2003) framework for conditions for sustainability to inform data collection and analyses, which was derived from an economic growth model (Woolcock, 1998). To understand how social capital is embedded in groups among complex institutional settings, Gamoran and colleagues describe the four conditions for sustainability as integration, linkage, organizational integrity, and synergy. *Integration* refers to

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shared values, mutual expectations, levels of trust, and norms. *Linkage* refers to the social relations that attract resources. *Organizational integrity* refers to the effectiveness of the organization in distributing human and material resources. Finally, *synergy* refers to whether the efforts of the teacher community is aligned with the efforts of the school and district. For this study, I restrict my analyses to integration and linkage.

To conceptualize and document social resources like integration and linkage, I use the perspective of social network wherein the goal is to understand how individual actors are embedded in social structures by examining relationships among actors in addition to attributes of individuals (Carolan, 2014; Daly, 2010).

Methods

Participants

A subgroup of six primary teachers, one principal, and one district administrator is selected from a larger data set to examine in detail due to the high concentration of former grant teachers at one site and reported support by their principal.

Context

The study began with a survey administered on the last day of the former partnership where approximately 75% of 80 teachers described an interest in continuing lesson study. Thus, all participants in the current study recently participated in this three-year university partnership that sought to improve teachers' instruction on algebraic thinking. The three-year partnership was structured to include a 40-hour week long summer institute for teachers focused on mathematics content, student thinking, and pedagogy; four rounds of lesson study during each school year that utilized Japanese Lesson Study; and mathematics coaching. For the lesson study component, eighteen groups of 3-6 teachers each engaged in two lesson study cycles per year and observed two lesson study cycles per year. Groups were arranged to consist of cross-site and cross-district participants but are now reconstituted groups as relations among teachers shifted with the conclusion of the grant.

Data Collection and Analysis

Data were collected after external support from the university ended, or the first school year, 2013-2014, following the conclusion of the grant. A survey and interview instrument were constructed and administered. The survey results were collected in October 2013 and asked for lesson study cycles and components completed, resources needed for lesson study, support given by principal and fellow teachers, and any additional comments. From these surveys, I gathered participants to engage in individual, semi-structured interviews and asked about who teachers worked with, the nature of their activities, their work with lesson study, resources that support their work, resources that support lesson study, and changes they would make if they were to do another cycle of lesson study. I used a snowball technique for collecting interviews, which involved interviewing those participants named by interviewees (Carolan, 2014; Cobb, McClain, Lamberg & Dean, 2003; Cobb, Zhao & Dean, 2009). I then interviewed principals of participants to learn more about the work of teachers at their school site.

Data were analyzed using grounded theory methods (Corbin & Strauss, 1990), with the methods of open coding and constant comparison methods used to derive themes in the data. Analyses were also informed by Woolcock's (1998) conditions of sustainability on integration and linkage and analyzed using social network analysis (Carolan, 2014). Specifically, egocentric networks were inferred from interview data and analyzed for qualities such as like density and structure.

Results

I first characterize participants' conceptions of what it means to engage in lesson study using data from interviews. I then report on which aspects of lesson study have continued as reported by participants on surveys and during interviews. Finally, I describe factors that support and hinder teachers' potential to continue engaging in lesson study using analyses on survey and interview data.

Teacher' Conceptions of Lesson Study

To address the first research question on teachers' conceptions of lesson study, I analyzed teacher responses to characterizations of lesson study. Their responses targeted three general areas to varying degrees – (a) the structure or protocol associated to engaging in lesson study, (2) the nature of the activities that comprise lesson study, and (3) the focus or purpose of the described structure or nature of activities.

Structure. Most all participants described the structure of lesson study to include planning, teaching, observing the research lesson, collecting data during the research lesson, and then debriefing on the research lesson. Five participants included the goal setting stage in addition to the planning. There was a strong emphasis on student thinking for all participants, and often for all components. Ways in which the conceptions of structure varied included whether or not the participant described a second enactment of teaching, observing, and debriefing on the research lesson.

Nature of Activities. As mentioned before, most all teachers described activities as including goal setting, planning the research lesson with attention to questioning techniques and student misconceptions and responses, observing the lesson while one teacher taught the lesson and others collected student data, and finally debriefing the lesson where the teacher of the lesson would comment first on what went well and changes they would make to improve the lesson based on their goals.

Focus. Two teachers described the focus or purpose of lesson study as a way to unpack the teaching practices (e.g. understanding assessment, standards, or student thinking). Primary teacher Gillian¹ reported that, "It's more of a philosophy of how to approach what you're doing professionally in the classroom. It's the philosophy of teaching, if you will." Four participants described it as an activity to better understand student thinking. Jimmy described lesson study as useful for observing student thinking and "to be the one standing back and listening. And, you know, asking the kids to explain themselves." One participant described the focus of lesson study as improving mathematics content knowledge as well as pedagogy. One participant described lesson study as a way to create polished lessons, in addition to a way of understanding student thinking.

In summary, teachers conceptions of lesson study aligned with how experts in the lesson study literature describe lesson study. This finding is significant with the strong presence and focus of student thinking in conversations.

Practices of Lesson Study That Have Continued

Most teachers (N=4) reported engaging in one cycle of lesson study in the beginning of their school year (See Table 1). During this cycle of lesson study, teachers reported to engage in goal setting, planning the research lesson, observing the research lesson and collecting student data while one teacher taught, debriefing on the research lesson with final reflections. This effort was initiated and supported by the district. It differed from former grant efforts in that there was less time for planning (three hours on average versus six hours), shorter time between the planning and enactment of the lesson, and only one cycle of lesson study planned for the year. Those study participants that participated in this effort served as facilitators of lesson study for teachers who had never participated in lesson study.

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Though not all participants completed a round of lesson study, participants reported continuing practices of lesson study. Most significantly, all participants reported engaging in the practice of analyzing student thinking. For example, one primary school teacher participant named Bertha

Table 1: Practices of Lesson Study Reported to Continue

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	Teachers						Administrators	
<u>Practice</u>	<u>Bertha</u>	<u>Carmen</u>	<u>Jimmy</u>	<u>Ben</u>	<u>Mia</u>	<u>Gillian</u>	<u>Ron</u>	<u>Kono</u>
Complete Cycle of Lesson Study		X	X	X	X			X
Unofficial Cycle			X		X	X		
Goal Setting	X	X	X	X	X	X		X
Planning	X	X	X		X	X		
Observing							X	X
Analyze Student Thinking	X	X	X	X	X	X	X	X
Debriefing	X	X	X		X	X	X	

highlighted one of her conversations with her colleague by recalling her notes from a lesson study:

The kids were just kind of brain storming what is multiplication. And one of the notes that the kids came up with that Carmen and I had on our notes was, multiplication is, you know, a bunch of things. But one of the things that stood out was when you multiply, the value always increases. I think that's what it was. And then somebody was having a conversation, where they said, 'Yeah.' And I always thought that, too. But then they're talking about, 'Yeah, but what about when it's multiplied by 1 or 0, it does not increase.'

Mia, a primary school teacher participant, described an example of the role that student thinking played in her work with colleagues. She gave the example on how to modify a multiplication task with fractions to a multiplication task with whole numbers to help scaffold a problem for a student. "If they're not understanding that it is $\frac{3}{4}$ of one half, and it is getting smaller. Why? Because they're not understanding that it's groups of. Oh, so that's multiplication. So we have to come back with, if you have 3 times 5, bring it to an array." These two examples highlight the role that student thinking played in the reported activities of participants.

None of the teacher participants reported observing their colleagues' lessons, though administrators like the principal and Teacher on Special Assignment (TOSA) reported observing teachers. Most teacher participants reported planning and debriefing together, oftentimes during formally arranged time like Professional Learning Community (PLC) time and during informally arranged times like lunch or sporadically throughout the day. Gillian reported meeting at a coffee shop after school to debrief with fellow teachers on what students did during the lesson.

And it was not, umm, full scale lesson study, I would say. It was more, why don't we try this lesson. And then after the lesson we collaborated. We met at Starbucks to talk about, you know, how everything went. And, and share information on what the kids were doing. So I would, I would call it kind of like a mini lesson study. Cause we didn't, umm, we didn't do the observing of each person doing the lesson. So it was more that we, we had common planning and debriefing. Which I think is a good option when you can't get release time.

Factors that Supported and Hindered Lesson Study

Two factors that have the potential to support the continuing of lesson study as a form of professional development include integration and linkage. Integration levels, referring to the shared values, mutual expectations, levels of trust, and norms, were reported low for those teachers who described it as unlikely to engage in lesson study with their colleagues. For instance, both Bertha and Carmen reported shared values of what constitutes effective teaching and mutual expectations in terms of wanting professional collaboration time to focus on students' mathematical thinking and designing lessons that elicit their thinking. Yet their two colleagues in their formally arranged grade-level PLC did not share similar goals (See Figure 1). Bertha exemplifies this theme in the following data:

And then on my team, not everybody values math the same way, not that I love math. I really don't really like math, but it intrigues me because I don't know about it and I want to know more about it. But I think that. I'll say some teachers on our team don't really see the value behind the lesson study because they haven't been through it. They don't know what it is, and they just know that it's, oh it sounds like a lot of work. It sounds like a lot of time. It sounds like a lot of planning. I don't have time for that. I'm just going to do the lesson that I've always done.

Thus, Bertha reported a difference in the way her PLC members valued mathematics. Carmen, her fellow PLC member also interviewed for this study, explains that one reason for the difference in values on mathematics could be explained by the engagement in union policy by the other two members.

There's a clause in there that says in PLC that it has to be teacher driven, and teacher, like, decided upon. So, if two of the four people on the grade level want to do lesson study, but two other people, or one other person who doesn't want to do lesson study, we can't make those people do lesson study.

These data exemplify instances of low levels of integration and signify a challenge of continuing lesson study with these colleagues.

To exemplify linkage, I present egocentric network data in Figure 1. In this figure, vertices indicate participants and undirected edges between a pair of vertices indicate a reported significant professional relationship in the form of work related activities between the two participants. For instance, the single edge BC between vertices B and C represent activities such as engaging in planning conversations, focusing on students' mathematical thinking, and also conversations about mathematics content.

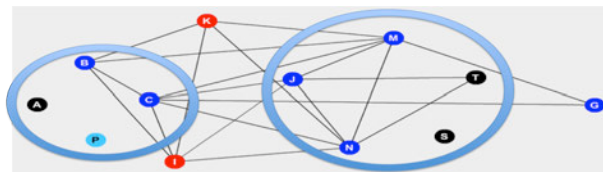


Figure 1. Network of participants derived from interview data. Formally arranged grade level groups are indicated by a circle. Red vertices represent administrators, blue vertices represent participants interviewed for the current study, light blue vertices represent former grant teachers not interviewed for the study, and black vertices represent teachers not interviewed for the study and not a former grant teacher. The circles each represent a formally arranged grade-level PLC group.

The *size* of each participant's neighborhood, or the other vertices that each vertex is connected to, range from two to six. In other words, teachers reported to exchange information while engaging in activities ranging with two to six specific colleagues, with an average number of connections to

others out of participants for this study being 4.75 (vertices A, P, T, and S were not participants for this study and consequently are not calculated for size). The *density*, or the extent to which a participant's connections are connected to one another, is found by dividing the number of ties for one participant by the total number of potential ties to other participants. For instance, the total number of ties in this network can be calculated as $8!/2!(8-2)!$. This number, which counts the total number of ways 8 participants could be connected to one another exactly once, is 28, making the density of this network a total of $19/28$, or approximately 67%. The *distance*, or the mean of the shortest path lengths among all connected pairs of participants, for each participant ranges from 1.14 (for instance, vertex C is connected to all but one by 1 path, and connected to K by a path of length 2, making the mean of $1+1+1+1+1+1+2$ equal to 1.14) to 1.5 (for instance, vertex G is connected to all but two by a path of two, and connected to M and C by a path of length one, making the mean of $1+1+2+2+2+2+2$ equal to 1.5).

These three measures – size, density, and distance – suggest a way to quantify the measure of linkage. These moderate levels of linkage suggest some potential in continuing lesson study.

Conclusion

Little research exists on issues surrounding the sustainability of lesson study for mathematics teachers. This research examined practices of teacher communities that get reorganized when relationships among teachers shift; in particular, when relationships and funding between teachers and university faculty who engaged in mathematics lesson studies end.

Findings from this study highlight teachers' conceptions of what it means to engage in lesson study and reported practices of lesson study that continued past the end of the grant. Findings also highlight the need to attend to social relations among teachers and administrators in one district to better understand issues of sustainability. It was evident that many teachers from the former grant wanted to continue to engage in lesson study. Additionally, districts attempted to put in place supports for these teachers to continue to engage in lesson study. Integration and linkage were shown to be important factors in continuing lesson study; low levels of integration or linkage suggested low potential for continuing while high levels of integration or linkage suggested high potential for continuing.

Endnote

¹All names used in this report are gender preserving pseudonyms.

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