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What is successful adaptation of lesson study in the US?

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Abstract This paper features a case study of one US K-8 school district pioneering the use of "lesson study," a teacher professional development approach adapted from Japan. The case explores events that occurred in the district over more than 4 years (Spring 2000–Fall 2004) as lesson study spread nationally and within the district. We document four categories of changes that occurred in the district's lesson study approach, and describe some of the early consequences of these changes as well as conditions that enabled the changes to occur. We argue that this case illustrates much of what we would hope to see in a maturing lesson study effort, and conclude that other US sites may need to go through similar changes, organize similar supports, and persist in their learning about lesson study to successfully adapt this model to their local contexts.

Keywords Organizational change · Professional development · Educational reform

Introduction

"Lesson study," a teacher professional development approach widely used in Japan, was first brought to the attention of many US educators in 1999, with the release of Stigler and Hiebert's book *The Teaching Gap*. This book summarized the Third International Math and Science Study (TIMSS) video study of 8th grade mathematics teachers in the US, Germany, and Japan, and it included a chapter on lesson study in Japan.[1] The authors commended the Japanese professional development approach and urged US educators to

[1] The chapter was based on Makoto Yoshida's ethnographic study of Japanese teachers engaging in lesson study (Yoshida 1999), now available in book form (Fernandez and Yoshida 2004).

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try out lesson study as a way to build professional knowledge of teaching and improve teaching and learning (Stigler and Hiebert 1999; Yoshida 1999).

Lesson study is a cycle of instructional improvement in which teachers work together to: formulate goals for student learning and long-term development; collaboratively plan a "research lesson" designed to bring to life these goals; conduct the lesson in a classroom, with one team member teaching and others gathering evidence on student learning and development; reflect on and discuss the evidence gathered during the lesson, using it to improve the lesson, the unit, and instruction more generally; and if desired, teach, observe, and improve the lesson again in one or more additional classrooms (Lewis 2002b). In Japan, lesson study may be conducted at any level of the education system, sponsored by various entities (e.g., schools, teacher research circles, professional organizations), and conducted to serve various purposes (Lewis 2002b; Lewis et al. 2006; Lewis and Tsuchida 1998; Takahashi 2003), but the shared purpose of any lesson study effort is enabling teachers to improve instruction (Fernandez and Yoshida 2004; Lewis 2002a, b; Lewis and Tsuchida 1997, 1998; Yoshida 1999).

Professional development is the key to educational improvement, in the view of many researchers (Ball and Cohen 1999; Lieberman and Wood 2002; National Research Council 2001; Smith and O'Day 1990; Sparks and Hirsh 1997; Sykes 1999), and lesson study embodies many of the features of high quality professional development described in the education literature (Borasi and Fonzi 2002; Darling-Hammond and McLaughlin 1996; Garet et al. 2001; Hawley and Valli 1999). For example, it involves teachers in active learning about content, is driven by data and goals, and is sustained, intensive, collaborative, and practice-based (Hiebert et al. 2002; Loucks-Horsley et al. 2003; National Research Council 2001, 2002; Stigler and Hiebert 1999). The potential of lesson study is demonstrated in Japan, where the country's strong record of student achievement (Schmidt et al. 1997) and widespread use of lesson study as the most common form of teacher professional development (Fernandez and Yoshida 2004; Lewis and Tsuchida 1997; Stigler and Hiebert 1999) suggest a relationship (although one that has not been tested in a controlled fashion) between lesson study and student learning.

Lesson study may hold potential for promoting both individual improvement for teachers who participate and more systemic improvement for the US education system. Yet, in light of the United States' record of limited educational change under past reforms (Cohen 1990; Cohen and Ball 1990; Cuban 1990; Tyack and Cuban 1995) and tendency to rely on traditional and inadequate models of professional development (Lieberman and Wood 2002; Little 1993; Sykes 1996), the impact of lesson study on US education is uncertain. Lesson study may be the latest in a long line of education reform "fads," failing like other prior innovations that have succumbed to the difficulty of reform implementation and maintenance (Datnow et al. 2002; Fullan 1993). The fact that lesson study comes from another country and culture may create additional challenges for successful lesson study in the US educational context.

Despite this daunting backdrop, the case we present provides an "existence proof" (Shulman 1983) of lesson study's successful adaptation within a US school district, where it has continued for more than 4 years and has been successful with respect to certain key criteria outlined by Cuban (1998). Policy-makers and practitioners use different standards to judge reform success, Cuban notes. Policy-makers lean toward the use of the effectiveness, popularity (spread), and fidelity standards, while practitioners favor adaptability and longevity as standards for gauging reform success. In his study of Effective Schools, Cuban illustrates how reform is a story of adaptation (i.e., about the informative journey to an "end product") that can be viewed as either effective or ineffective depending on one's

Table 1 District lesson study participation, Fall 2000–Fall 2004

	Year 1 (2000–2001)[a]	Year 2 (2001–2002)	Year 3 (2002–2003)	Year 4 (2003–2004)	Year 5 (2004–2005)
Full-time equivalent certificated teachers in district[b]	539	526	526	502	550
First-time participants	42	40	27	5	17
Returning participants	–	28	47	48	46
Total participants	42	68	74	53	63

[a] Participant counts include attendees at summer workshop at the end of the listed year, with the exception of year 5

[b] Data for years 1–4 retrieved December 29, 2004 from the California Department of Education web site http://www.ed-data.k12.ca.us (year 5 not yet available). Data for year 5 retrieved from district human resources department January 3, 2005

criteria of success. He suggests that this ambiguity points up the need to "move away from the usual thumbs-up or thumbs-down verdict on a reform, and point to improvements in practice" (p. 471).

We heed his words, focusing the majority of this paper on describing changes and improvements in the district's lesson study practice. We primarily elect to use practitioner-defined standards of adaptability and longevity of the lesson study effort for two reasons: (1) lesson study is still in its infancy in the US and we still need an "existence proof" that practitioners will accept and sustain this innovation, and; (2) since lesson study is not yet well documented or defined, fidelity and spread standards are problematic (Brown and Campione 1996). To the extent possible at this stage of lesson study use in the district, we also describe the impact of lesson study on teachers' self-reported instructional practices, their professional capacity and their ability to work together to improve their knowledge for teaching.[2]

Selection of this case

Several criteria led to the selection of this particular lesson study case. First, at the time of initial manuscript preparation, the district had sustained lesson study for more than four and a half years, with the leadership over this entire period coming from teachers within the district.[3] The number of participating teachers grew from 28 teachers in the 2000–2001 school year to 63 teachers during 2004–2005.[4] While the overall number of teachers engaging in lesson study and the concentration of lesson study participants among all teachers in the district is still small, lesson study has continued and, we argue below, deepened.

Second, teachers express satisfaction with what they are learning from their lesson study involvement (Bauld and Hurd 2004; Hurd and Licciardo-Musso 2005; Learned and Keadle 2004), and analyses of lesson study cycles show improved lessons (Hurd and Licciardo-

[2] See discussions of the term "knowledge for teaching" in Ball et al. (2005) and Ball and Cohen (2006).

[3] Currently, as revisions to the manuscript occur, the district is in its 7th year of lesson study.

[4] An additional 14 teachers participated in the 2001 summer workshop, totalling the 42 teachers shown in Table 1.

Musso 2005; Lewis et al. 2006; Murata 2003). Third, the district is making a name for itself as a strategic US lesson study site (Lewis et al. 2004, 2006; Weeks 2001). Practitioners from other sites have frequently requested to be included in lesson study events hosted by the district and teachers from the district have been invited to participate as knowledgeable practitioners of lesson study in events throughout the US and foreign countries. Finally, both written and video materials illustrating lesson study practice within the district (Lewis et al. 2006; Mills College Lesson Study Group 2005) have been reviewed by nationally known reformers[5] who have been favorably impressed with the demonstrated lesson study practice and the evidence of teachers' learning.

Methods and data

Our research for this paper occurred as part of a broader project aimed at describing and understanding the events and changes that lesson study sites encountered as they formulated their models of lesson study, rolled them out, and observed the impact of their efforts (see http://www.lessonresearch.net/ for a more general description of our research). We relied on a case study approach to explore this relatively new area of educational research and to build theory about it (Miles and Huberman 1994).[6] Because lesson study is an emerging innovation, we relied heavily on grounded theory (Glaser and Strauss 1967), using participants' comments and our observations to identify interesting or problematic aspects of the lesson study work. Our project also utilized a theory-driven research approach (Chen 1990) to elicit participants' own theories about and goals for lesson study and steps necessary to reach those goals.

This paper is based on continuing research being conducted in "Bay Area School District" (hereafter BASD), a medium-sized California K-8 school district that was the second US site[7] and the first[8] US district to pioneer the use of lesson study, beginning in 2000. The data for this paper include transcripts of semi-structured interviews (of varying length, between ½ and 1½ h) with approximately 70 teachers and administrators; observation notes, and audio or video recordings of meetings and research lessons of about 20 lesson study groups; and collected artifacts of lesson study practice (e.g., letters addressed to district teachers; email correspondence between leaders; teachers' meeting and observation notes; research lesson plans; curriculum material informing lesson plans, etc.). We reviewed these data and tracked changes across multiple years, comparing these data with data from our other sites. Our focus here on a single district allows extended (though far from comprehensive) description of local adaptation and use. Our study of this district-based lesson study effort contrasts with many other[9] studies of continuing reform (Cooper et al. 1998; Datnow et al. 2000; McLaughlin and Mitra 2001) in three ways: a focus on a district, rather than a school organizational context; a focus on a teacher-initiated rather than externally-generated reform effort; and a focus on US practitioners' responses to an educational innovation of foreign rather than home-grown origin.

[5] These reformers include, for example, individuals responsible for mathematics education in a national teachers' association, a foundation, and numerous universities.

[6] See (Lewis et al. 2006) for a preliminary description of our lesson study theory.

[7] Lesson study was first tried at Paterson School Two in Paterson, NJ (see Fernandez et al. 2001; Germain-McCarthy 2001; Wang-Iverson et al. 2000).

[8] Bellevue, Washington also began a superintendent-initiated district-wide effort in the same year.

[9] An important exception is Lieberman and Wood's (2002) study of the National Writing Project.

This paper is based in part on previous written descriptions and conference presentations (Lewis et al. 2004; Perry et al. 2002, 2003) and was reviewed by the lesson study leaders and selected district teachers. Their suggestions, which were minor and did not change our overall findings or interpretations, were incorporated into our manuscript.[10]

Genesis of the district lesson study effort

A group of four BASD educators interested in improving mathematics—Donna Paterson, Alex O'Neil, Nancy Griffith, and June Martin (hereafter "the leaders")—were interested in finding a form of professional development that was teacher-led and relevant to teachers' individual professional needs. By 2000, they had developed some shared understanding of lesson study from reading *The Teaching Gap* (Stigler and Hiebert 1999), and they believed that lesson study embodied these qualities.

These leaders brought complementary areas of expertise to the district's lesson study effort. At a time when few American educators had seen live examples of lesson study, O'Neil had participated in lesson study during the Ninth International Congress on Mathematics Education, held in Japan in August, 2000. She also had knowledge of the Japanese language and culture from her experience as a university exchange student in Japan. Paterson was a former middle school science teacher who had developed interest and expertise in research on teacher professional development in her current capacity as instructional improvement coordinator for a consortium of district schools. O'Neil and Griffith were half-time district math coaches and half-time elementary school teachers, while Martin served as a full-time middle school mathematics coach. Their coaching positions were funded by a local foundation interested in regional improvement of mathematics education, giving them access to a network of reform-minded math educators throughout the region. The coaching and instructional improvement positions of the lesson study leaders also enabled them to span boundaries between the district administration and individual schools and teachers. The leaders took responsibility for different aspects of the lesson study work, including planning workshops, seeking funding, responding to teachers' and administrators' questions, and preparing lesson study conference presentations.

As O'Neil later reported (T19: 5-26-04),[11] the lesson study leaders hoped to use a fall (2000) professional development day to introduce teachers to lesson study, but were turned down by the district administration. Instead, the lesson study leaders wrote an open letter to all district teachers, inviting them learn about lesson study during a 1-day summer (2000) workshop.

[10] Additionally, revisions to the original submitted manuscript were informed by work conducted for and supported by the MacArthur-Spencer Meta Study (subtitled Toward Producing Usable Knowledge for the Improvement of Educational Practice; see http://www.lrdc.pitt.edu/metastudy/ for more information). Feedback from Principal Investigators Mary Kay Stein and Cynthia Coburn on that manuscript were invaluable here as well.

[11] Teachers' comments are identified by the notation "T," an identification number following the "T," and a date on which the comment was made. (For example "T19: 10-03-01" would indicate a comment made by Teacher 19 on October 3, 2001). In this manuscript, words in quotation marks or block quotes indicate direct comments by participants, either audio or video-recorded during interviews or observations, or taken down verbatim in observation notes. Words in brackets within these quotes are ours, included to add clarity to participants' comments.

Table 2 Lesson study learning opportunities, Fall 2000–Fall 2004

	Type of lesson study (LS) learning opportunity	Year 1 (2000–2001)	Year 2 (2001–2002)	Year 3 (2002–2003)	Year 4 (2003–2004)	Year 5 (2004–2005)
During school year	LS during school year	√	√	√	√	√
	District meeting of all LS groups	√	√	√	√	√
Workshops	Summer workshop	√	√	√	√	
	October workshop			√		√
Public lessons	Public research lessons and debriefings (by Japanese teachers)	√	√	√		
	Public research lessons and debriefings (by district teachers)		√		√	√
Other opportunities	Leader participation in LS events outside the district (workshops, open houses)	√	√	√	√	
	Leaders make or hear conference presentations	√	√	√	√	√
	District teachers travel to Japan to observe LS	√	√		√	

Lesson study learning opportunities provided for teachers

From these modest beginnings, leaders subsequently organized multiple structures to support teachers' learning about lesson study. Table 2 lists the primary ways that teachers in the district learned about lesson study during these first 4 years: school year participation, workshops, public lessons, and other events. The most common form of participation was for teachers to work in a lesson study group during the school year. Teachers participating in this way were asked to organize themselves into teams of three to five teachers, commit 20 h to lesson study work over the school year, and submit shareable lesson plans. A stipend of $500 was provided to each participant, and groups met at a time of mutual convenience, generally after school. Two full-day substitutes were provided to cover teachers' classrooms on days when teachers were observing and debriefing their research lessons. At the beginning of each school year, participants were given guidelines about how to proceed with lesson study and were provided with documents and tools to support the work. (We note below how these tools changed over time). A district-wide meeting was held at the end of each year for teachers to share and reflect on their experiences.

Beginning in summer 2001, the leaders offered a second type of learning structure: an intensive lesson study summer workshop. Workshops were offered each summer from 2001 to 2004, and also in the fall of 2002 and 2004 (for teachers from year-round schools who could not attend summer workshops). Teachers received a modest stipend for participation. In 2001–2004, these workshops also included Japanese practitioners who taught lessons and collaborated with US groups.

During workshops, teachers were organized into small lesson study groups. With respect to development of teachers' professional and collaborative capacity, workshops differed from school year lesson study work in several ways. First, during workshops, teachers were able to work together intensively for a number of days. As a result, they could delve deeply into subject matter and its instructional implications, negotiating joint understandings of mathematical terms and ideas, such as the foundational skills necessary to understand area of polygons. Second, participants were able to ask questions and exchange ideas not only within their own group, but with members of other groups and with participating mathematics educators, resulting in diverse sources of information for lesson planning and reflection. Written reflections at the end of each workshop day elicited many comments from teachers about the power of working with diverse colleagues. Finally, the summer workshops included in-depth mathematics activities designed to enhance teachers' knowledge for teaching; generally, the first week of each 2-week workshop was dedicated to doing mathematics (solving problems, comparing solutions, and studying curriculum and standards) and the second week to planning, teaching, discussing, revising, and re-teaching research lessons. As we shall see, these three features found useful during lesson study summer workshops were later added with increasing frequency to teachers' lesson study work during the school year.

A third type of lesson study learning structure used in the district was the public research lesson, in which one teacher, often an accomplished practitioner, teaches a class of students in front of a large group of observers. The post-lesson discussion typically begins with a selected panel of knowledgeable commentators and then moves on to solicit questions and comments from the larger audience. The first public lesson in the district was taught by a Japanese teacher at the end of the 2001 summer workshop. Over 100 educators from the region and other states attended. Participants' written reflections suggest that such public lessons provided an opportunity for teachers to see instruction that embodied an innovative and challenging vision of mathematics learning; to observe students respond to such innovative instruction; and to reexamine their own instructional views (e.g., about the "big ideas" of mathematics instruction, how to write a lesson plan, or how to encourage students to struggle with a mathematics problem) in light of those offered by other teachers. For participants new to lesson study, public research lessons also provided an immersion into the processes of lesson study, such how to collect data on student thinking during the lesson or how to participate in a structured post-lesson discussion.

Public research lessons and the artifacts they produced (such as widely distributed videos and lesson plan templates) connected district practitioners with other lesson study practitioners across the US and in Japan, resulting in the increased participation of BASD educators in presentations, workshops, and open houses within and beyond the region. This provided a fourth way of enhancing knowledge about lesson study and about teaching and learning. For example, three district teachers traveled to Japan during summer 2003 with other US educators to observe first-hand lesson study being practiced at the national, district, and school levels. This experience highlighted for the teachers who traveled (and later for their colleagues to whom they shared the information) ideas about instruction such as the value of comparing student mathematics solutions.

Changes in lesson study structure and practice

The basic structure of the district's lesson study model remained consistent over the case study period: teachers typically participated actively in lesson study either during the school year or during intensive workshops. However, the leaders made four minor modifications to this basic structure after the first year: Teachers had the option to select the content area for their lesson study work (it was no longer limited to mathematics); each group was expected to study just one topic (rather than three); groups were encouraged to involve outsiders (in order to increase outside input to the lesson study work); and groups were encouraged to revise and re-teach research lessons in a second classroom.

Organization of the lesson study effort also underwent several changes over the case study period. Lesson study leaders used district funds (Title II Eisenhower Professional Development) to support participant stipends and substitutes during year one, but had to secure external funding in subsequent years. They were able to tap funds from local and national foundations, a local reform network, and a state Math Professional Development Initiative.[12] A second change was the decision by faculty at one elementary school to adopt lesson study school-wide, resulting in a site with a critical mass of lesson study practitioners and an opportunity to use lesson study on a school-wide basis to address high-priority district initiatives (such as "standards-based instruction" and "differentiated instruction"). A third change was a shift in lesson study leadership in year two, when Paterson became principal at the school-wide lesson study site, Martin left the district to assume an administrative position within the county, and other individuals (a district administrator and several teachers) stepped into informal (and unfunded) leadership positions to help support the lesson study work.

The case data presented below indicate that participants' views of lesson study shifted over the study period, moving from emphasis on the lesson as an instructional *product*, to a view of lesson study as a *process* for instructional improvement. Four major changes contributed to this shift: (1) increased use of reflection and feedback loops; (2) refinement of protocols and tools; (3) increased use of external knowledge sources; and (4) increased focus on student thinking. Our data suggest that these four changes are interrelated, and that together they supported the evolution of a more balanced, coherent model of lesson study that emphasized practitioner learning as well as lesson planning.

Reflection and feedback loops for refinement of the lesson study model

One leader reported that they initially provided participants with "pretty minimal" guidelines for conducting lesson study, due to the leaders' own limited knowledge (T19: 2.22.02). The leaders emphasized just a few things for teachers to consider in their planning: what prior knowledge students might have, how students would likely respond to the lesson, ways to assess the lesson's success, and how the lesson fit in a unit or sequence of lessons. Perhaps in part because of these minimal guidelines, the seven first-year groups varied substantially in their lesson study approaches and in the learning that resulted from their work.

Subsequently, two feedback loops supported incremental changes in the district's lesson study approach. One feedback loop was established between our research team and the lesson study leaders after they sought our practical guidance about lesson study and we offered to help document their lesson study work. In December 2000, we began to document several BASD groups conducting lesson study and interview leaders and lesson study team

[12] See Hill and Ball (2004) for a recent description of California's MPDI program.

members. Beginning that year, we shared our observation notes and interview summaries with the leaders. Thereafter, we were invited to observe the district's major lesson study events as well as lesson study groups, a collaboration that continues to this day.

Our observations of teachers' lesson study work during the first year revealed that the knowledge shared by teachers often focused on lesson logistics and details, and that teachers typically drew on their own past experiences with students and curriculum rather than on published research materials, outside sources of knowledge, or classroom data about students' challenges and misconceptions. We encouraged the leaders to collaborate with Japanese colleagues and to consider how the various lesson study elements connected with each other: e.g., how the goals for the research lesson should dictate the instructional plan, data collection in the classroom, and the focus of the post-lesson discussion. In general, we provided information about what teachers were doing as they worked together, rather than guidance.

A second mechanism for improvement of the lesson study work was provided by the leaders, who gathered information on practitioners' experiences. Ongoing communication between lesson study practitioners and leaders and district-wide meetings held at the beginning and end of each school-year created momentum for the work, provided an opportunity for teachers to share their challenges and "best practices," and helped leaders gather information to better guide subsequent work. We were often invited to these meetings to listen and to share our reactions during the meeting or in subsequent email exchanges, thus creating an overlap between the researcher and practitioner feedback loops.

Leaders were also able to learn from their own early research lessons, and they shared what they learned with other groups. For example, O'Neil reports learning about the importance of careful data collection and structured debriefing from her own work and then sharing this information with colleagues:

> We had some real issues about how to make the debriefing process [post-lesson discussion] more effective…[O]ur…group [was] going first and … then running to other groups and saying, "Oh, let's share this information with you." …When we started off, we didn't even have any guidelines for people about what to do or how to debrief and process afterwards…. We began to suggest… that people have different jobs when they are observing…. We realized we had to have specific data that we were collecting because when we [were] getting together to talk about it, we [were] not referring to data. We [were] just referring to our subjective memories…. I didn't feel like the post-lesson discussion was deep enough and rich enough about really reflecting on content and getting at the content (T19: 5.2.01).

Individual written reflections by teachers provided an additional source of internal feedback on the work. While written reflections were solicited from teachers from the outset, leaders were initially leery about asking teachers to engage in too much documentation or written reflection because the time spent would "take away from the core work of creating and teaching the lesson" (T31: 1.18.02). Written reflections became a strongly functioning part of the lesson study model only after the first year, when the leaders began to see teacher development (not lesson development) as the central process of lesson study.

O'Neil described how her participation in an event outside the district caused her to begin to value reflection during lesson study as a way to deepen the learning potential for teachers:

> [Reflection] wasn't something that jumped out at us about the Japanese model…. When we had read…that you go to bookstores [in Japan] and buy books on lesson study and lessons that have been taught, we thought that was just a sharing of the lesson and not necessarily a sharing of everything that had been also learned along

> the way. So I think the first year, that wasn't part of what we saw as the model for lesson study. …I was beginning to get that idea [of the value of reflection] after the [first] summer school [workshop]. But when I went to North Carolina in October and met with Japanese teachers and one of the teachers said to me "Have you collected teachers' reflections about what they've learned?" And I said "No." And I thought, "Well, why aren't we? Of course we should be doing that." I thought, "Wow, that's really where all the interesting stuff is" (T19: 2-22-02).

Leaders subsequently altered tools to emphasize reflection. In the 2002 summer workshop and all subsequent workshops, leaders allocated time for groups to reflect on their lessons and document their learning. Lesson study time during the school year was also reapportioned to increase reflection time. Teachers reported that having reflection time enabled them to capture their own leaning. For example, one teacher reported:

> …Geometry is a challenge for me. This entire subject of symmetry and tessellations was a constant challenge. …I grew in my content knowledge considerably because I was creating my own understanding within the support of lesson study. …I learned that the parameters of symmetry have to be defined (at least in the teacher's mind) before students can determine if a design has symmetry…color and shape [of manipulatives] can affect symmetry. I also deepened my understanding of the role of manipulatives, examples, etc., and it really got clear in my mind when to introduce math "vocabulary" (T32: 3.21.04).

The structures for reflection and feedback of information supported each of the changes described in the remainder of this section.

Use of protocols and other organizing tools

In response to the emerging information about lesson study challenges, leaders found or developed tools to support the lesson study work, examples of which follow.

Outline of lesson study process

Feedback from the first summer workshop—when Japanese practitioners demonstrated lesson study practices dramatically different from those of local practitioners—helped leaders recognize the need for additional guidelines to help teachers use and learn from lesson study. One idea was to make the lesson study steps transparent so lesson study learners would become conscious of the new ideas and begin to practice them. Leaders created a lesson study protocol in Fall 2001 by adapting a pre-publication copy of a lesson study handbook (Lewis 2002b). The protocol suggested that teachers take the following steps: form a group, discuss curriculum, review standards, plan a lesson, prepare to teach the lesson (e.g., arrange for substitutes, select the teacher and classroom), invite others to observe the lesson, teach and debrief the lesson, and reflect on and write up their learning. Two years later, leaders added a suggested timeline for these steps, limiting the lesson planning time in order to save time at the end of the cycle for reflection and discussion of the implications of what had been learned. While this lesson study timeline was available in Lewis' (2002b) handbook, the practitioners apparently did not find meaning in the research-based protocol until they were able to learn about lesson study through their own trial and error and observe it modeled by other more experienced practitioners; a timeline tested and endorsed by practitioners was apparently more useful than one from published research.

Lesson plan template

A lesson plan developed in the context of lesson study is expected to serve multiple purposes, including guiding the lesson; explaining the group's goals and thinking about the subject matter and instruction to outsiders; and guiding data collection during the research lesson (Lewis 2002b). During the 2001 summer workshop, leaders noticed the lesson plans and lesson study processes of the visiting Japanese educators centered on carefully selected long-term goals for students. In year one, BASD teachers had been given a lesson study goal ("success for all students"), rather than choosing their own goals. As a result, teachers' first-year planning discussions and lesson plans included little in-depth discussion of goals for student learning and tended to focus on teacher actions. Leaders decided to provide more guidance regarding lesson plan structure and focus.

After observing Japanese lessons and debriefing sessions, reviewing various expert and novice lesson plans, and discussing these experiences with our research team, lesson study leaders developed a lesson plan template. They hoped that this template would support teachers to ground their planning in standards and goals for student development and achievement (in the target grade and surrounding grades); consider the rationale for instructional decisions; anticipate student responses; and specify data collection methods and the criteria by which to evaluate student learning from the lesson (for example, how many strategies students use and how well they share them) rather than, for example, just observing that "all the students seemed to be having fun."

The lesson plan template initially evoked only perfunctory responses when used by lesson study teams. For example, while the protocol and template prompted teachers to record relevant standards for prior and later grades and experiences that students might be expected to have before a given research lesson, teachers' early discussions of standards were often limited, like the following discussion in year two by a group studying fourth grade multi-digit multiplication:

> I have [mathematical standard] 3.3 as the focus and 3.4 as a focus and then 3.5 says 'select and use computational procedures for addition, subtraction, multiplication and division…' So that would be 3.5 also. So our focus would be all three of them, correct? (T34: 3-11-02)

After this comment, the team moved on to discuss the next item on the template, apparently satisfied that the relationship of the standards to their lesson had been addressed.

As time passed, however, leaders encouraged teachers to continue to use the template to make sense of and communicate their learning. As described more fully in a subsequent section, one of the elements added to the lesson plan in later years was a written rationale for the lesson. A comparison of lesson plans prepared by lesson study groups in the first and third years of the lesson study effort reveals considerable change. The lesson plan of the year one group[13] was just one page long, with a hypothesis, three lesson steps, a list of materials needed, and a note on the teacher's actions for each step of the lesson. In contrast, the lesson plan for the 3rd-year group was a 6-page document that laid out multiple lesson goals; analyzed what students already understood about problem-solving, how their understanding needed to develop further, and how the lesson would contribute to this development; and suggested data points and evaluation questions for observers.

[13] The first-year and third-year lesson plan examples were chosen by selecting the groups in which O'Neil—one of the more experienced lesson study practitioners in the district—participated.

Group norms

Initially, leaders had assumed that the benefits of collaboration would be obvious to participants and that collaborative skills were adequate or would be learned naturally as groups worked together. Griffith reported that this belief stemmed in part from the fact that early lesson study volunteers had experience with collaborative work and were able to draw on existing (although perhaps not explicit) collegial norms. As lesson study expanded within the district and groups were formed from teachers unused to working together, collaborations sometimes became difficult. In some cases, disagreements about instructional ideas arose within groups that did not know how to move toward resolution; in other cases teachers avoided conflict by being "polite" (rather than honest or constructively critical).

Grossman et al. (2001) argue that the development of norms for interaction and the ability to deal openly with group conflict are among the characteristics that distinguish a professional learning community. Building on feedback from the lesson study groups, leaders identified weaknesses in professional community and took steps to correct them. The leaders introduced (in summer, 2002) a process for all groups to establish and monitor norms. Group participants were asked to brainstorm characteristics of effective working groups, establish norms for their group's work, assign rotating facilitator and recorder roles, and select a norm to monitor at each meeting. These activities met with varying success during the summer workshop, but were subsequently added to the protocol for all groups. As the leaders passed on knowledge about using lesson study for instructional improvement to others inside and outside the district, they always mentioned norm-setting as an important component of the district's lesson study model. A videotaped lesson study cycle from the 2002 summer workshop provides evidence suggesting that the norm-setting and monitoring processes did directly help at least one group improve their collaboration (Lewis et al. 2006).

Griffith commented that the use of norms was powerful because it made clear "that we are going to value everybody's opinion, we want everybody to participate" (T31: 9.26.04). She began recommending that other non-lesson study groups within the district adopt the norm-setting process in order to better focus their discussions on teaching and learning. O'Neil commented that the continued attention to norms enabled an increasing number of teachers to feel comfortable exposing their misunderstandings and teaching challenges, thereby enhancing teacher collaboration.

Two points about the district's use of protocols and tools should be underlined. First, existing or published tools, such as the lesson study protocol or lesson plan template, may be of little consequence until practitioners have used them and can recommend them from their own experience. Second, district leaders were selective in their use of tools. When presented with a multi-page lesson observation protocol developed by East Coast researchers that was far more detailed than the one-page observational protocol they were using, leaders rejected the longer form on the grounds that it would undermine teachers' sense of autonomy.

Increased emphasis on student thinking

Initial difficulties focusing on student thinking

From the outset, the leaders knew that understanding student thinking was a central focus of lesson study. The initial version of the lesson study model assumed that teachers would

begin to understand student thinking primarily through observing students during lessons. However, not all lessons include "thought-revealing tasks" (Lesh et al. 2000) that enable observers to study student thinking; Japanese mathematics lessons elicit student thinking more reliably than do US mathematics lessons (Stigler and Hiebert 1999). Hence early research lessons posed a challenge to teachers' efforts to focus on student thinking. Teachers were often pleased to simply be observing a colleague implement the group's lesson and did not necessarily observe in ways that would support their understanding of student learning of a particular mathematical topic. Observations often focused on teacher moves or superficial aspects of student behavior, and leaders quickly recognized that these data did not support substantive conversations about pedagogy or content.

Models and guidelines to support teachers' consideration of student thinking

Summer workshop participants reported that Japanese teachers (and, in later years, experienced US lesson study practitioners) helped them re-think lesson study, especially with respect to goals, collection of data on student thinking, and the content of the post-lesson discussion. After the first workshop, several teachers commented on how they began to understand the value of collecting good data on student thinking as they were observing. One teacher said:

> A couple of the Japanese men had documented minute by minute what [students] were doing and they had suggestions for how the [lesson] plan could be improved dramatically if [the teacher] would re-allot these minutes. …It made me realize as an observer how you can just get warm feelings about some things, but it's really important to be detailed in your observation and really be critically thinking. And not just thinking about, you know, "Oh, the children look well-managed" and "there was time for wrap-up" (T35: 8.17.01).

Other teachers described how data collected and discussed by BASD teachers focused on problems with the lesson, in contrast to the Japanese educators' focus on student thinking about subject matter:

> T40: They [US teachers] get so focused on kind of like "You could have done this different, you could have done this different, why don't you do this, why don't you do that." I saw the talk go away from the mathematical understanding.
> T47: I noticed that too, but I was just thinking, "Could it be that our lesson wasn't very mathematical?" Even though it was in *Investigations* [research-based mathematics curriculum]. Because I really noticed in all the [Japanese] post [debriefing] discussions, it was very much on the mathematical content and ours really wasn't (8-15-01).

One teacher later described for colleagues how her thinking about observation and data collection changed as a result of involvement in a summer workshop:

> [At the beginning of the workshop] we thought the idea was to have perfect lessons, but really what lesson study is about is observing students' reactions. [In prior lesson study work] we totally missed the boat on studying student learning and thinking. That's going to be our emphasis this time. How interested are they? How are they working together? Are they learning? (T69: 9-30-02)

While participants began to recognize that their observations should focus on student thinking, they struggled with how to collect useful evidence. They often found themselves

trying to capture in their observation notes everything happening during the entire research lesson. Data collection methods modeled during open houses provided concrete examples of how to focus on student learning. During one spring open house, a Japanese educator was invited to teach a sequence of three lessons on area of quadrilaterals to an upper-elementary class. A team of US teachers worked alongside the Japanese teacher each day to plan, observe, debrief, and revise the lessons. They reported that the collaboration helped them learn more about what to watch for during a research lesson. One data collection technique that teachers found powerful was to follow the same student or group of students through the entire lesson, in order to document how learning developed and the particular tasks, materials and language that sparked or impeded student thinking.

Teachers began to pass on to their colleagues strategies for collecting data, and the lesson study leaders organized workshops to facilitate sharing of such information. For example, leaders organized the two October workshops to begin with live research lessons taught by district teachers. These live experiences provided a forum for experienced practitioners to share their knowledge with new practitioners about how to focus on and learn from student thinking.

Evidence suggests that with practice some teachers were able to modify student tasks to better reveal student thinking. For example, progressive redesign of a lesson during one lesson study cycle eliminated a student worksheet that had not strongly revealed or promoted student thinking and added lesson elements that asked students to record, discuss, and present their thinking to the class (Lewis et al. 2006). But data collection and analysis continued to be difficult for teachers (see also Fernandez et al. 2003). In year four, leaders were concerned that many debriefings still did not focus on student thinking, and they developed a tool to help teachers draw conclusions from their collected data. The tool asked teachers to specify the lesson goals and data collection focus, in order to support collection of individual data that could be aggregated into a meaningful larger picture. The form also asked teachers to comment on the *significance* of their observations. Finally, the form prompted teachers to reflect on "conclusions, learnings…" and "further questions raised" from the data.

Anticipating students' thinking before the lesson

Before lesson study, few teachers considered the issue of anticipating student thinking, as one teacher notes:

> "I probably could have anticipated responses, I just didn't even think about it. It never even crossed my mind. Kind of like, 'why would I do that?' And now I see why" (T34: 8-15-01).

But after the first summer workshop, leaders encouraged teachers to focus on student thinking. Both the lesson study protocol and the lesson plan template prompted teachers to anticipate student thinking. The agenda used at the school-wide lesson study site encouraged teachers to complete or solve the tasks they planned to give students in order to anticipate student thinking. By working on the task themselves, teachers surfaced their own strategies and misunderstandings, creating opportunities to correct their misunderstanding and jointly develop responses to students' expected thinking. The following example comes from a group studying a grade three mathematics problem, in which students calculated the number of buses needed for 105 riders, given buses with 28 2-person seats and one 5-person back seat. T67 reported an answer of 2 buses, provoking surprise from another teacher:

T111: Ohhh. [Expressed with questioning and surprise.]
T19: Okay, good, an ah-ha.
T111: I didn't get that. I thought there was information that wasn't needed—to have 28 seats and they hold two people. I just interpreted it as 28 seats altogether.
T19: So, 28 people on a bus kind of thing?
T111: Uh huh.
T19: So did you come up with four buses?
T111: I came up with four buses, but you know what, that doesn't make sense.
T19: But this is what we want to see. What are the misconceptions kids will have when they do the problem so that we can anticipate if a child is doing that and what would the teacher reaction be… (2-11-03).

Teachers also built their capacity to anticipate student thinking by teaching what leaders dubbed "dirty" lessons—lessons that could be taught without extensive planning in order to generate information about student thinking for use in planning the research lesson.

Although anticipating and capturing student thinking would continue to be challenging, the changes in the template and procedures helped to connect disjointed lesson study phases and make lesson study work cohere around student thinking: goals for it, observations of it, and discussions of it. Making student thinking central likely increased the quality of the professional development (Franke et al. 1998; National Research Council 2001) and enabled the lesson study effort to overcome one of the primary pitfalls of traditional professional development that "too often…focus[es] narrowly on changing teaching behaviors… with no attention to the impact… on what students know and can do" (Smith 2001, p. 41).

Using a broader array of knowledge sources

Simply knowing that it is important to anticipate student thinking does not make it happen. Japanese teachers, given the charge to anticipate student thinking, can draw on a variety of print resources (including the teachers' manual accompanying the textbook) that provide examples of student thinking and detailed trajectories of student understanding of particular mathematical terrain. Japanese teachers can also enlist experienced collaborators to help design data collection, including university-based educators and district-based content specialists. Many US teachers do not have ready access to specialists who will help them anticipate student thinking. A fourth area of evolution in BASD's lesson study work was a substantial growth over time in the use of outside knowledge sources.

Use of outside experts

Social learning situations where learners encounter disequilibrium can be an important stimulus to learning (e.g., Ball 2002; Linn and Hsi 2000; Putnam and Borko 2000; Tharp and Gallimore 1988). The mathematics and lesson study expertise brought to the 2001 summer workshop by participants from outside BASD underscored the power of encountering outside perspectives. Participants in the summer workshops in 2001 and subsequent years included BASD elementary and middle school teachers and coaches, teachers and coaches from other school districts, math professional development specialists, educational researchers, and Japanese educators. Exposure to these various individuals surfaced many new ideas. For example, during a post-lesson discussion, one Japanese practitioner asked why a student's incorrect solution had not been discussed by the teacher

in order to reveal similarities and differences among students' solution methods. This question revealed an aspect of the Japanese teacher's philosophy of mathematics instruction that was surprising to some of the US teachers and that is still talked about by the catch-phrase "mistakes can be treasures." Even years later, teachers who were part of this discussion report that they continue to consider this idea in the context of their own classroom instruction.

In the 2001 summer workshop, Japanese mathematics specialists conducted research lessons and also collaborated with local teachers to plan, observe, and comment on lessons taught by BASD teachers. The workshop ended with a large public lesson taught by a well-known Japanese educator. Both strategies—collaborative work with experienced lesson study practitioners and public research lessons—were employed repeatedly in later years. Japanese and later US practitioners were invited to the district to teach research lessons, provide feedback on US lessons, and communicate via email with lesson study groups. The leaders encouraged lesson study groups to involve outside experts in their lesson study work in person, by email, or through some combination of the two. The outside specialists expanded the groups' access to high-quality resources (e.g., curricula, student tasks, etc.) and translated ideas from research, enabling groups to streamline planning and strengthening opportunities for teachers to learn from the lesson study work. One email exchange illustrates how a Japanese colleague provided feedback to teachers in the district:

> Japanese educator: [From a bulleted list of recommendations made to the group] Please include expected students' solutions to the lesson plan. How many solutions do you think your students [will] bring to a whole-class discussion? Do you think some students [will] bring solutions with [a] wrong answer? It is very important to anticipate students' solution methods to plan a whole-class discussion. In other words, if you do not have any idea what kind of solutions students could find, you wouldn't be able to lead a whole-class discussion (2-26-02). [The recommendation continued about a week later, after reports of difficulty anticipating students responses from one group member.] In order to anticipate what your students will come up [with], you might want to think about what previous knowledge that students could use to solve the problem. In other words, it might be a good idea to make a list of what students have learned by the time of the lesson. Throughout this process, you will be able to have a broader perspective of the lesson [by] including a [curriculum] scope and sequence… (3-5-02).

Even the most experienced lesson study practitioners in the district were surprised by how much they learned by working with outsiders who pushed their mathematical thinking. In Summer 2004, a group of teachers preparing a second grade lesson on area studied curriculum materials that suggested that three ideas were important to students' grasp of area: unit iteration, transitivity, and conservation. One teacher later reported that "I knew those ideas were important. I just didn't know how" (T59: 8-18-04). After several days of talking over these ideas with planning group colleagues and Japanese educators in attendance at the workshop, the importance and relationship of the three ideas had become clearer to planning team members. The instructor reported to her colleagues at the end of the workshop how her own understanding of area and students' thinking about area had changed:

> The concept of area is very complex. We really need to look at those three components to it carefully. And I've always lumped them together…, not really breaking it down to think about where is the gap in the students' learning that isn't making this

> accessible to them. That idea of conservation was the biggest one for me… just assuming that they have it (T48: 8-18-04).

Through their efforts to involve outsiders, the BASD leaders extended their professional community both within and beyond district boundaries, often crossing traditional educational hierarchies.

Use of print resources

One noteworthy difference between lesson study in Japan and the US is the availability in Japan of a frugal, shared, educative national curriculum to guide teachers' lesson study efforts (Lewis and Tsuchida 1998; Lewis et al. 2007). The absence of frugal curricula was immediately apparent and problematic for BASD groups. During the first year, teachers spent a significant amount of time agonizing over topic selection, typically culling through district-approved curricula for guidance. These materials often failed to include a rationale for the lesson design or to explain how mathematical ideas connected with each other. As Remillard and Bryans (2004) have noted, "the ways teachers read, interpret, and use curriculum materials are shaped by their knowledge of and views about mathematics" (p. 353). Lesson study participants with more limited pedagogical content knowledge may have been unable to fully explore curriculum ideas, but the collaborative discussions in the context of their lesson study work supported their learning about unfamiliar ideas, especially when supported by other resource material. The following discussion about triangle classification illustrates how bringing lesson study collaborative processes to bear on print resources could support teachers' learning:

> T32: [In the lesson] is the teacher… identifying only the three [triangles] that are in the third grade standards? So it's just equilateral, isosceles, and right?
> T41: But what about scalene?
> T19: Absolutely we should have scalene, because if a child says "there are four kinds [of triangles]", then go with it.
> T32: And obtuse?
> T45: That's an angle.
> T32: But in here [district mathematics standards], it's an obtuse triangle.
> T19: It was an obtuse scalene triangle.
> T41: [Points to an example of a triangle] So is that a scalene?
> T19: [Refers to a teaching journal article she brought in about triangles] What does it say?: "A scalene has no equal sides and an obtuse scalene has one angle larger than ninety degrees and no equal sides."
> T45: …I guess I always picture a scalene [triangle] with an obtuse angle.
> T19: …We get locked into the pictures that are in the textbooks and we think that's that triangle.
> T41: So we're going to put right triangle under…?
> T19: Isosceles, equilateral, and scalene. I think we absolutely need to be ready for scalene.
> T45: And do we do a right triangle?
> T32: That's one of the standards.
> T19: So, actually, we should be doing four triangles.
> T41: So then we have to talk about angles. They're [students] going to ask how come it's called a right triangle and you're going to have to tell them about ninety degrees.

T32: Aren't all right triangles scalene, by the Pythagorean theorem? They have to be, right?
T45: No, you have two lengths that are the same length—that's where your right angle is. And then your longer one could be your connector…(8-7-01).

Over the years, district leaders found that by providing a small number of lessons to participants (for example, from their adopted curriculum and a research-based source such as the 2001 NCTM *Navigations* series) they could jump-start lesson planning, leaving more time for other parts of the lesson study cycle. In each workshop after 2001, leaders provided groups with published lessons, copies of the national and state standards, and relevant research articles (e.g., strategies to elicit mathematical discourse). Participants discussed the relative strengths and weaknesses of ideas presented in the materials and selected approaches they felt had the greatest potential for their students.

In the workshops, the leaders were often able to identify the topics that groups were working on and provide materials to support their work. During the school year, when topic selection was not guided by the summer workshop theme and therefore more open, teachers were often left on their own to identify resources to guide their work. As indicated above, the initiative of group members to reach out to others beyond their group for assistance made a significant difference in the knowledge resources available to some groups. Some groups called upon the leaders to help them locate written resources (e.g., a book on representations published by NCTM), or to facilitate connections with other individuals who could assist them (e.g., another teacher in the district who had conducted her lesson study work on the same topic).

Implications of these changes

Through the processes of reflection, tool use, focus on student thinking and use of outside knowledge resources, the district's lesson study model gradually became more balanced and coherent: the activities within the lesson study cycle became more closely connected with each other and time was allocated more evenly across the cycle (rather than disproportionately to lesson planning). New learning became possible as teachers became comfortable with the basic lesson study processes. During year one, when teachers were just exploring the unfamiliar territory of collaborative planning and observation and had not yet interacted with experienced lesson study practitioners, the BASD leaders made a conscious effort to avoid strong critiques of lesson mathematics, instead registering support for the collaborative effort. Even without heavy critique from the leaders, however, these early classroom lessons sometimes naturally revealed central mathematical points, enabling teachers to build their mathematics as well as collaborative skills as they observed student responses to mathematics tasks. Over time, the changes in the district's lesson study approach provided more intentional support for teachers' professional capacity building.

As groups began to draw on outside knowledge sources (including district teachers from outside of their own group) and to focus intently on student thinking, the usefulness of certain procedures and tools (e.g., including a lesson rationale in the written lesson plan) became more apparent. One group formed during the summer 2003 workshop used email during and after the workshop to share their ideas and learning. A consulting mathematics specialist recommended that the group develop a lesson rationale, so the teachers integrated into the lesson plan a clear description of their reasons for their instructional

decisions (e.g., why to use three versus four pattern blocks to help students understand line symmetry). Teachers in this group continued to use a written rationale and emailed reflections during the subsequent school years as they worked in their school-based groups. They remarked that the inclusion of the rationale helped lesson observers understand the team's decision-making and that writing the rationale helped them summarize and clarify their own learning.

The four types of evolution in the district's lesson study approach—incorporation of feedback from reflection, development of tools, focus on student thinking, and use of outside knowledge sources—continuously changed the nature of the knowledge-building and knowledge-sharing that was possible among teachers in the district. For example, feedback loops revealed the need for tools to set and monitor norms and focus on student thinking, which in turn enhanced discussion and data collection (Perry and Lewis 2006). Outside expertise highlighted the importance of reflection and provided information on the development of student thinking, enabling teachers to gather important information on student thinking during the lesson study cycles. Together, these four areas of evolution produced lesson study practice that was substantively quite different at the end of the case study period than it was at the beginning. Lesson study evolved from an activity focused on creation of polished lessons to a comprehensive system for teacher learning from practice and external knowledge sources. Within the lesson study cycle, attention shifted from lesson planning and creation to the entire cycle, with coherent connections among goal setting, lesson planning, and reflection.

In interviews conducted between 2001 and 2004, teachers reported a number of changes to their instruction and their collaboration as a result of their lesson study participation. Reported changes to instruction included: increased use of tasks that elicit student thinking and support student exploration; more experimentation with mathematical tasks before giving them to students, in order to understand task demands and anticipate student thinking; more discussion and comparison of student solutions in the classroom (including incorrect solutions); more use of student data to inform instruction; and less frequently "giving" students mathematical answers. Reported changes in collaboration included: asking more questions of colleagues; more use of print resources to inform discussions with colleagues; increased discussion of student thinking; and increased interest in observing other teachers and discussing observations. We describe elsewhere how the school-wide lesson study school showed significantly greater increases in student achievement than other district schools over the case study period (Lewis et al. 2006).

Conditions supporting lesson study continuation

The previous sections document how the BASD lesson study model developed over time in response to learning by the lesson study leaders and practitioners. What lessons does the case provide to other sites interested in developing lesson study? In this section, we propose that five interdependent conditions allowed development of BASD's lesson study model. These conditions closely mirror conditions for reform at the school level (Borko et al. 2003; Coburn 2003; Newman et al. 2000), pointing up the common requirements for reform within different education contexts.

First, from the outset leaders recognized that their understanding of lesson study was limited; they built *learning opportunities* into their design, hoping that the details of the innovation would become clearer with time. The case suggests that diverse and frequent learning opportunities over the four and a half years provided essential support to the

evolution of lesson study, and that these opportunities continued to change as leaders recognized new learning needs. The menu of learning experiences is noteworthy, because without a process for making sense of reform through both learning and *un*learning, teachers may grasp only the superficial features of a reform (Brown and Campione 1996; Cohen 1990; McLaughlin and Mitra 2001; Sarason 1990). To the extent that teachers planned and conducted research lessons and continued to participate in lesson study, their learning opportunities built upon each other and enabled ongoing refinement of their lesson study understandings.[14] Other studies of school reform sustainability have also highlighted the importance of continuous learning and adaptation of a reform (Fullan 1993; Knapp 1997).

Because organizational (in this case, district) change is dependent upon change at the individual level (Berman and McLaughlin 1978; Fullan 1993), lesson study within the district could develop only if the learning opportunities influenced individual teachers' attitudes, skills, and behaviors (Elmore and McLaughlin 1988; Franke et al. 2001). Other research suggests that attitudes, skills and behaviors are likely to change only if teachers are reflective about whether and what kinds of learning they are experiencing and if they receive support that enables them to cope with the uncertainty and difficulty of learning and change (Fullan 1993; Schön 1987). The encouragement of and guidance for reflection by leaders as the lesson study effort evolved (e.g., allocation of meeting time to discuss and document learning from each lesson study cycle) helped to develop individual teacher learning about the lesson study process and about particular topics of study (e.g., multi-digit subtraction) that could be shared by lesson study participants district-wide.

One characteristic common to many of the learning opportunities was the involvement of outsiders who provided feedback on the lesson study vision and implementation. Many lesson study groups observed (and were observed by) educators from other lesson study groups, other schools, other districts, and even other countries. Through their modeling and questioning, outsiders often exposed new and different ideas about lesson study and about instruction. Although O'Neil reported that by opening themselves up to outsiders they were also opening themselves up to significant criticism, it was through others' observations and questions that they began to understand some of the complexities of lesson study (e.g., the benefits of careful observation and data collection). This case demonstrates the value of collaboration across long-standing educational boundaries (countries, professions, districts, schools, or classrooms) to enhance teachers' opportunities for learning.

Our research suggests *professional community* as a second condition that supported lesson study success in the district, a finding that confirms other research on the value of strong professional community (Borko et al. 2003; Coburn 2003; Lord 1994; Newman et al. 2000; Perry 1996) and provides further evidence that "context matters" to reform outcomes (McLaughlin 1987; McLaughlin and Talbert 1993). When lesson study was introduced to the district, many teachers had already had positive experiences of collaboration on instruction in conjunction with previous reform efforts. This existing community facilitated the introduction of lesson study: Teachers were willing to participate, and their participation provided an important arena for further development of the district's lesson study-related community. Leaders were able to introduce new structures (e.g., norms for working within groups) upon an existing collaborative foundation and, in turn, these new structures supported further learning and professional community development, for example by creating a safe environment for teachers to expose what they did not know. By encouraging teachers' collaborative reflective practice, deprivatizing

[14] See Cohen and Hill (2001) and Perry (1996) for a discussion of how multiple opportunities to learn similar ideas can enhance learning and reform outcomes.

practice, collectively focusing on student learning, and developing shared norms and values, the very act of doing lesson study supported the development of a broader community of practice around lesson study (Kruse et al. 1994).

Groups formed during the school year and summer workshops typically worked together only for the time period in question (e.g., for one school year or a 2-week summer workshop). In fact, group membership rarely remained unchanged from year to year or workshop to workshop. As lesson study group members worked together, they engaged in joint problem solving to determine a direction for their group. To the extent that the groups involved more experienced lesson study practitioners, these members were able to provide ideas to help the group move forward. Beginning participants were able to learn from more experienced mentors, who helped advance conceptions of lesson study, for instance helping to dispel the idea that lesson study was about crafting the perfect lesson. The changing composition of the groups facilitated learning and the development of community within the district because group members were required to discuss how they would work together and to make public their assumptions about lesson study and about teaching and learning. Collaborative structures such as group norms and shared facilitation supported new groups to work through preliminary difficulties of group membership.

If a group's own problem solving did not enable them to move forward, often one member would contact one of the leaders for guidance. The leaders responded to questions about lesson study or about mathematics, and might talk amongst themselves about these issues to generate more ideas (e.g., strategies for teaching word problems to first graders). While the informal personal contact between lesson study participants and leaders seemed to facilitate participants' learning by fine-tuning information according to each group's and each individual's questions and needs, it also enabled the leadership team to learn and generalize from the experiences of small groups to inform changes for the district's overall lesson study approach. Feedback loops that developed between practitioners and researchers, and between practitioners and outside experts supported a professional community that extended across levels of the education system and enhanced practitioners' learning.

A third key condition of this sustained effort was *distributed teacher leadership*. Most studies of sustainability focus on the importance of principal leadership because externally-generated reforms are typically introduced by an administrator. In this case, the evolution of lesson study in this district was especially dependent on the dedicated efforts of both Paterson, the principal at the school-wide lesson study site, and O'Neil, a half-time math coach/half-time teacher, who both played important roles within the district's lesson study effort as cheerleaders, information gatherers and interpreters, and self-appointed guinea pigs. This case suggests that the sustainability of lesson study—and perhaps other practice-based reforms—may be dependent on strong advocacy from a teacher leader who is perceived by peers as an "insider," knowledgeable and connected to other support features, but who is also attempting the reform effort in the same way they are. Teacher leaders need opportunities to deepen their own knowledge about the reform so that their advocacy continues to be perceived as authentic and knowledgeable and they are able to impart more than superficial understanding of the reform to others.

Research suggests that sustainable success in education lies in creating cultures of distributed leadership throughout the community, not in training and developing a tiny leadership elite (Hargreaves and Fink 2003). An important characteristic of leadership in this case was its distributed nature; leadership tasks—seeking funding, planning for summer workshops, being available to answer teachers' questions—were distributed across a team of people with a range of experiences and expertise. The distributed leadership

structure provided a forum for the leadership team to discuss ideas, voice differences of opinion or doubts, and develop a vision for the lesson study work; it also enabled the work logistically by spreading it among several people (some who had their own classroom responsibilities), instead of relying on one person to do it all, and by providing group support likely to reduce individual burnout.

Both to help relieve time pressure on the leaders and to "spread the wealth" provided by leadership opportunities, lesson study leaders frequently tried to recruit other participants as co-creators and co-leaders of the work. It may be beneficial to ongoing reform efforts to diversify and distribute leadership roles among people in various school sites (Spillane et al. 2003). The sustained invitation to participants to help lead the effort—and the existence of a community of teachers willing to help carry the leadership baton—shaped how lesson study unfolded. Experienced teachers were able to pass on both their enthusiasm for lesson study and their vision of its purpose (e.g., to look at student learning) to colleagues.

Lesson study leaders' access to and willingness to develop, use, or continue to adapt vital *technical resources*—tools such as the protocol, lesson plan template, and observation forms; innovative curriculum; research materials; and outside experts—also contributed to lesson study's continuation in the district. These resources helped to socialize teachers new to lesson study and to support teachers' learning about lesson study, pedagogy, and content. Protocols and tools were revised over time with an increasing focus on reflection, anticipated student responses, observation of students, and inferences about student learning and development from the work.

The fact that lesson study has never been supported out of the district's general fund may demonstrate its existence on the fringe of district priorities (potentially impacted by other competing ideas), the district's troubled financial state due to declining enrollment, or teacher autonomy and freedom from district funding constraints. Because reform efforts may dissipate when funding dissolves (Berman and McLaughlin 1978), the ability to identify *fiscal resources* outside the district has continued to be an important consideration for lesson study continuation. There is no indication of what may happen to lesson study in the district when and if funding dissolves, although leaders report that many of the teachers who have been involved are motivated to continue and the principal at the school-wide site has made lesson study standard practice. Limited funding in year four did constrain district-wide teacher participation (see Table 1) and such funding limitations were one reason leaders sought to integrate lesson study with other reforms happening in the district (e.g., in year five many teachers did lesson study in science in conjunction with a new district science initiative). Lesson study may stand a better chance of survival than specific instructional reforms because it is a means for bringing practice into line with goals that can be used flexibly to support various reform ideas. Changing perceptions of lesson study as flexible professional development that can *cohere with other district policies and programs* also seemed to contribute to its ongoing use in the district, especially in the school-wide lesson study site (Cohen and Ball 1990; Newman et al. 2000; Smith 2001).

Given its nature as a teacher-initiated reform effort, there is a danger that those not intimately involved in lesson study may not be convinced of lesson study's usefulness and coherence with other policies in the same way teachers are, which may challenge teachers' ability to use lesson study. According to O'Neil (T19: 10-21-02) one school in the district, deemed a "low performing" school according to state accountability measures (Academic Performance Index, or API score),[15] was "under a lot of pressure and scrutiny… crawling

[15] See http://www.cde.ca.gov/ta/ac/ap/ for more information on California's accountability policies (information retrieved 9-22-06).

with 'outsiders' at their school observing them and telling them what to do. [We] are very concerned and hope that lesson study can be a positive that is happening for them this year and our vehicle for helping them out and balancing all the other messages they are getting." Teachers at the school interested in participating in lesson study believed that lesson study could help them turn their instructional program around to meet the needs of their students. County, district, and school administrators, on the other hand, believed that lesson study would not provide the immediate results that would help the school increase their API scores. In the end, administrative pressures won out: Teachers were not allowed to do lesson study, and instead were encouraged to focus on activities that administrators believed would create more immediate results. Events at this school and other district schools suggest that administrators who have not been actively immersed in lesson study themselves or experienced personal benefits from it may not understand its coherence with other reform activities and may inhibit its use at either the school or district levels.

Conclusion

Lesson study is designed to influence change in a slow and steady way (Stigler and Hiebert 1999), and this case demonstrates dramatically why change takes time. At the time of final preparation of this manuscript, in their 7th year of the lesson study effort, district lesson study leaders and teacher participants are still having significant "a-has" about how to do and support lesson study. Time has been critical to the learning that occurred; many of the "a-has" about lesson study did not occur, and probably could not have occurred at the outset. Some essential ideas about lesson study became clear only with teachers' sustained effort to practice lesson study and see what was working and what needed to be changed. First, teachers wove some of the simpler components of lesson study (such as collaborative lesson planning) in with their existing practices, and only later did they grasp the significance of other ideas such as developing a lesson rationale and documenting their own learning. BASD educators' sustained commitment to keep trying lesson study and keep learning how to do it better enabled their lesson study tools, structures, culture, and understanding to grow. This sustained commitment is important to note for other sites interested in replicating or scaling the model.

One implication of this case is that other US sites may have to go through similar steps to build successful lesson study efforts: establishing authentic professional communities able to address conflicting ideas and build teachers' knowledge; breaking down traditional hierarchical relationships within the system and walls that keep classroom practices private; focusing on student thinking; taking initiative to draw on external knowledge sources; and realizing that the shared research lesson (an unfamiliar form) can provide a solid basis for collaborative reflection about students' progress toward instructional goals. While this case provides an "existence proof" that lesson study can be practiced, adapted, and sustained by US educators, it also highlights the persistent, extended learning by practitioners needed to adapt this form of teacher professional development to the US.

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