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Translating Lesson Study From Japan to the United States

Improving something as complex and culturally embedded as teaching requires the efforts of all the players, including students, parents, and politicians. But teachers must be the primary driving force behind change. They are best positioned to understand the problems that students face and to generate possible solutions.

—James Stigler and James Hiebert (1999)

Throughout the history of education, there have been efforts to improve the practice of teaching. One form of professional development that has received considerable public attention lately is lesson study, which originally emerged in Japan after the Second World War. The term *lesson study* was coined by a prominent authority of lesson study, Makoto Yoshida (1999), to describe a collaborative process in which teachers devise a research lesson, teach and observe the lesson,

and then revise and reteach the lesson in an iterative cycle of professional learning. Yoshida translated the words “lesson study” from the Japanese term *jugyokenkyu*, which is composed of two words, *jugyo* meaning lesson and *kenkyu* meaning study or research. The lesson study process in Japan is usually a schoolwide effort that takes time and thoughtful collaboration in designing, teaching, observing, and reteaching lessons. The purposes include improving teaching practice as well as curriculum development.

Today lesson study is emerging in the United States as an increasingly popular form of teacher-directed professional development designed to improve mathematics learning, though its use is now expanding beyond mathematics into additional content areas. Many attribute its growth in the U.S. to Stigler and Hiebert’s (1999) book *The Teaching Gap*, which suggests that the different cultures of mathematics teaching in Japan and the U.S. help to explain the relatively lower performance of mathematics students in the U.S. (TIMMS, 2003). In the last few years, an increasing number of books and articles have given us an excellent foundation for what lesson study is and how it has been used in Japan (see Fernandez & Yoshida, 2004; Fernandez, 2003; Fernandez & Chokshi, 2002; Lewis, 2002; Lewis & Tsuchida, 1998; National Research Council, 2000a; Takahashi, 2000).

Ironically, lesson study, like two other Japanese reform movements after World War II—Total Quality Management (TQM) and Quality Circles—was heavily influenced by ideas that originated in the United States. All these reform efforts are grounded in the notion of continuous improvements in practice, whether in business or education. Fernandez and Yoshida (2004) report in their excellent book on Japanese lesson study that the concept of problem-solving learning became popular in Japan in the 1920s and 1930s as part of the New Education Movement. Lesson study as it is practiced today in Japan borrows from American ideas related to inquiry learning and a well-established theoretical tradition, which advocates that teachers need to become involved in collaborative action research (Sagor, 1992) and reflective teaching (Connolly & Clandinin, 1992).

A primary reason why lesson study developed naturally as the form of professional development for elementary teachers in Japan is that for many years the Japanese have recognized the power of teachers helping other teachers, and saw teachers as best able to develop the curriculum and lessons to be used in their schools. Japan systematically sent experienced teachers out into rural schools to help new teachers learn how to teach. Due to limited resources for professional

development, the system of teachers teaching teachers was well established, though the emphasis on teaching was still traditional for many years (A. Takahashi, personal communication, July 12–30, 2004). Providing teachers the time needed to work with other teachers to design and evaluate lessons is another factor deeply embedded in the culture of schooling in Japan.

Several other factors contributed to the growth of Japanese lesson study. Japan has a national curriculum focused specifically on the big ideas or concepts in each discipline that students must learn at different grade levels. Regarding the mathematics curriculum, Liping Ma (1999) has shown that most Japanese teachers have a fairly deep understanding of mathematics. Because of this understanding they are able to anticipate students' thinking in relation to mathematics tasks, ask appropriate questions, and support the expansion of their thinking in ways required for successful lesson study. In the United States, teachers are often required to take only limited courses in mathematics during their preservice education, and then required by a textbook-driven curriculum to cover a much larger volume of mathematics concepts at a fairly superficial level. Some have referred to the U.S. mathematics curriculum as "a mile wide and an inch deep."

In addition, in the U.S., deep controversies—sometimes known as the "math wars"—exist within the mathematics education community over how math should be taught (for further information, see www.mathematicallycorrect.com). The same is true in reading and other subjects. We have a highly politicized schooling system that supports regional approaches to education. Local school boards make decisions, and districts and state legislatures can delimitate the kinds of curriculum that should be taught in schools both explicitly through local policy and implicitly through state testing and accountability systems.

In contrast, in Japan there is a single curriculum handbook, which covers the key conceptual mathematical ideas students should learn from first through sixth grade and suggests how teachers can help students master these ideas (A. Takahashi, personal communication, July 12–30, 2004). All teachers in Japan accept these key developmental stages of mathematical understanding and then work together, through lesson study, to research and discover the best ways to teach these ideas. These and other differences in the cultural milieu of schooling in Japan and the U.S. need to be understood if we are to design a successful framework for practicing lesson study in the United States.

Lesson Study in the United States

The story of lesson study in the United States began for us through a 5-year professional development grant from the U.S. Department of Education, 1999–2004. This grant funded the MathStar program in three states—California, Colorado, and New Mexico—and was intended to improve middle school mathematics teaching and learning using technology. Each state took a different lead role in the implementation of MathStar. The decision to use lesson study was rooted in our frustration with the results of traditional top-down professional development, in which paid experts lecture or lead teachers through exercises on how to improve their practice.

The Lesson Study Cycle

The following is a brief overview of the general lesson study cycle that we have evolved over the last 4 years. You may notice that many examples in this book feature mathematics content. However, lesson study can also be used in other content areas and is emerging in literacy and science programs, including English Language Learner (ELL) classrooms.

In the following example, teachers work together in teams to consider an area of interest or difficulty in mathematics for their students. The teachers develop student goals, research together the math content, and carefully plan a lesson. The lesson is taught by one of the teachers and observed by the team, who gather data about how the lesson is going. There are various ways to gather data, from scripting what happens in the lesson to asking members of the team to look at different aspects of the lesson, such as how students are interacting, what academic language is being used, and what students seem to understand. Following this observation, which is often videotaped, the group gathers to debrief on what happened and to plan for possible changes in the next cycle of the lesson. The research lesson is then revised through reflection and thoughtful improvement for reteaching (Lewis & Tsuchida, 1997; Yoshida, 1999).

Students' thinking, learning processes, and strategies for solving problems are the focuses of the research lessons. As a result of carefully studying student learning and misperceptions of mathematics, members of the lesson study team begin exploring in a longitudinal way the relevant mathematical concepts related to the desired learning; thus promoting their own content understanding and developing shared professional knowledge. Table 1.A provides details for the lesson study process as it evolved in the Southwest.

Table 1.A Brief Overview of the Lesson Study Process

The Lesson Study Process as Developed in the Southwest United States	
<p>Step 1</p> <p><i>Identifying the problem and establishing the overarching goal</i></p>	<p>We began with teachers and administrators looking critically at the mathematics curriculum in their schools, in relationship to what they know about their students' learning. This process involves looking at both what kids are having trouble learning and at how these concepts are currently being taught.</p> <p>We suggested:</p> <ul style="list-style-type: none"> • <i>Engaging in a curriculum alignment process.</i> • <i>Developing an overarching goal for the school.</i> • <i>Thinking about and engaging in designing for understanding.</i> <p>We also considered:</p> <ul style="list-style-type: none"> • <i>What are the enduring understandings we want our students to have?</i> • <i>How will we assess students to know if they have these understandings?</i> • <i>What learning opportunities can be designed to support students' gaining this understanding?</i>
<p>Step 2</p> <p><i>Developing the research question in the lesson study group</i></p>	<p>We reflected on the overarching goal the team, school, or district developed for their students by asking:</p> <ul style="list-style-type: none"> • <i>How can you relate this goal to the learning needs you identified in stage one?</i> • <i>Clearly identify the problem area you want to address. Then develop your question for the research you will be doing through lesson study.</i>
<p>Step 3</p> <p><i>Designing the research lesson</i></p>	<p>Once the student learning problem was identified, we addressed it here for planning. The research lesson must be developed in the context of the larger unit in which it exists and the overarching goal.</p> <p>A. We planned the context for the research lesson by considering:</p> <ul style="list-style-type: none"> • <i>The mathematics or other content you want students to learn.</i> • <i>The communication and discourse you intend students to engage in.</i> • <i>The kinds of data you want to gather to answer your questions.</i> • <i>Considering principles related to engaged learning environments.</i> <p>B. We used the research lesson format to plan the actual observation lesson. We spent time on each of the steps and put a special emphasis on what questions or problems students might have during the lesson.</p> <p>C. Prior to doing the lesson, share it with your mentor and other teachers via the Web and ask for ideas and feedback. Also, be clear about what data you want to gather and who will gather it.</p>

(Continued)

Table 1.A (Continued)

The Lesson Study Process as Developed in the Southwest United States	
<p>Step 4</p> <p><i>Doing and observing the lesson</i></p>	<p>The research lesson gave us the opportunity to try out ideas in the real world of teaching practice. The time spent completing steps 1–3 helped us to realize our goals for student learning in the observed lesson. Two rounds of lessons are usually done, with an opportunity to revise between the lessons.</p> <p>We created observation guidelines and made sure that all observers had copies of the research lesson and understood what data they would be gathering. Every effort was made to not change the lesson dates. Teachers from other schools, pre-service teachers, and staff provide valuable feedback, but would find it difficult to participate if the dates change.</p>
<p>Step 5</p> <p><i>Debriefing, reflecting on, and revising the lesson</i></p>	<p>Immediately after the lesson, all those who observed the lesson spent an hour or so in a short debrief of the lesson. The debrief started by allowing first the teacher(s) who taught the lessons to comment on their reactions to what happened, followed by the team who designed the lesson. Then comments were encouraged from the outside observers, the teachers, and the staff. We also created debriefing guidelines. A second longer meeting was held a week or two later to further reflect on the lesson using the actual video record of the lesson and the data gathered by the observers. Completing two lesson cycles allowed us to continue with step 6, otherwise we would have repeated steps 1–3.</p> <p>One way we began this meeting was by looking back at the research question and then the process used in designing the lesson related to the question.</p> <p>Design: What was the planned learning for students?</p> <p>Content: What was the concept we wanted students to learn? What evidence did we have of their understanding or lack of understanding?</p> <p>Discourse: What discourse was planned and what kind of communication occurred?</p> <p>Environment: What did we learn about the learning environment?</p> <p>We hoped that the data gathered by the observers, as well as our own experiences in doing the lesson, would help answer these questions.</p>
<p>Step 6</p> <p><i>Sharing what we learned</i></p>	<p>As teacher researchers we acquired valuable knowledge about how students learn and what kinds of instructional strategies seem to be most powerful for improving student learning. Just as sharing what they learned is an important part of student learning, sharing teacher research is a necessary final stage to each research lesson cycle. We had much to offer to the field and to our colleagues. We used the lesson study report guidelines.</p>

The templates we used for design guidelines (steps 1–3), observation guidelines, debriefing guidelines, and final report guidelines are included in the additional support materials in Resource A.

The Role of Technology in Documentation and Lesson Study Practice

Because of grant funding, we were able to videotape many hours of lesson planning, teaching, debriefing, and reteaching. In fact, our first videographers, Kalle Jorgensen and Jennifer Villa, were trained in videotaping lesson study by Stigler's lesson lab team during the summer of 2002. We have extensive videotaped documentation, not only of the research lesson process, but also of our annual lesson study conferences, where groups of teachers presented their findings and submitted final reports on what they and their students learned from engaging in two cycles of lesson study each year. Reports, lessons, and teacher conversations regarding lesson study were also preserved electronically.

The use of technology makes possible the implementation of lesson study even across geographically diverse areas. New Mexico is a large state, and teachers doing lesson study in the MathStar project, which also occurred in Colorado and California, were often separated by many miles. We were fortunate to receive a grant from Hewlett-Packard that provided 100 laptop computers for teachers across the state who were engaged in lesson study. Teachers agreed to use the computers to communicate with each other about lesson study, to participate in two lesson study cycles, and to attend the annual lesson study conference to present their findings. Much of the lesson planning was done using Web chats and e-mail, in addition to the teachers driving to each other's schools for observing and debriefing research lessons. Teachers became adept at using computer programs to support their work, including using VideoCapture software to communicate what students were learning in their classrooms. Teachers also became adept at watching their videotaped lessons in preparation for the reteaching the lessons, a step we added to the lesson study cycle.

In the United States, there is a large range of experiences afforded through lesson study because of the different formats and levels of participation, the context in which it is implemented, and the role that lesson study is intended to play in professional development within a school or district. Thus, lesson study already has a different and more diverse history in the United States than in Japan. In Chapter 2 there are examples of different types of lesson study communities

that have emerged in the United States. Further study is needed on the benefits and challenges of these diverse approaches. One of the key questions to be considered in looking at these implementation models is to what extent teachers choose to engage in lesson study. Some leaders in lesson study are adamant that teachers must choose to participate in lesson study for it to work. And yet, in some districts and schools, where those in charge of academic programs have chosen to institute lesson study or lesson modeling as the preferred methods of professional development, there have been positive responses from teachers and positive changes for students.

There has not been as much research on lesson study in the United States as we would like, partly because of its recent introduction in this country, and partly due to the lack of translated documentation in English of the process in Japan. However, this is changing. Fernandez and Yoshida (2004) have written a new book on Japanese lesson study that provides detailed guidance on the process through case studies in Japan and may be helpful to those desiring to implement it in the United States. Catherine Lewis, one of the early writers on lesson study in the U.S., first published what she had learned about Japanese educational practices in her book *Educating Hearts and Minds* (1995), years before *The Teaching Gap* (Stigler & Hiebert, 1999) was published. Lewis (2002) also published a clear explanation of the essential steps for doing this work in her book *Lesson Study: A Handbook of Teacher-Led Instructional Improvement*.

Notwithstanding the diversity of these efforts, a common theme emerges when teachers are asked about their lesson study experiences: teachers are taking increased ownership of their own work. Several months after the MathStar leaders made the change from a more traditional professional model to working with teachers on lesson study, the outside evaluator for the MathStar project (Wexford, Inc., 2003b) reported the following comment from one of the teachers about the changing focus of professional development:

Originally it was to bring technology into the classroom. So at the beginning we received laptops, digital cameras, and printers, and MS [MathStar] showed us software to use in the classroom to enhance student learning. Last summer they introduced lesson study to us. So now the purpose of MS is to support collegial respect, sharing of best practices, sharing of expertise, and bringing all those parts together.

Initial Barriers to Lesson Study in the United States

In order to provide readers with a realistic picture of lesson study implementation in the United States, the following section addresses some of the initial barriers we experienced in introducing lesson study in our mathematics and science projects.

Teachers as Collaborative Designers

The first barrier uncovered was that the teachers in our project simply had no experience in working together to develop lessons. In addition, teachers in general did not see themselves as curriculum or instructional designers. Nor did they see their jobs as involving what they develop and study with other teachers. Their training usually involved implementing curricula developed by outside experts and available through their assigned textbooks. Teachers had very little experience working together in substantive ways. They expressed reluctance about sharing lessons, and held tightly to special lessons that they had developed through hard work on their own. They focused on lessons as individual endeavors.

Associating Observation With Evaluation

Teachers, even though they had agreed to participate in the collaborative lesson study process, were still uncomfortable at first in letting other teachers and observers into their classrooms. The initial debriefs of the lessons always started with comments from the teacher groups about how good the teacher who taught the lesson was—even if she or he wasn't—because teachers associated observations with evaluations and were concerned with pleasing each other.

At first, the teacher groups had a hard time seeing the initial lessons as something belonging to the group. The traditional process of teacher evaluation in most schools requires a principal to observe a lesson, not in terms of considering what students are learning, but for required annual evaluations of the teacher. In the United States, the cultural practice of an outsider entering a classroom was accompanied by feelings of being personally evaluated. It took nearly a year for teachers to accept the idea that outside observation was not about evaluating the teacher.

I remember at one lesson study debriefing how one teacher suddenly expressed the idea that this process [of lesson study] was much better than evaluation and if we could only do our evaluations this way everyone would benefit from the process, much more than from the current system. The group began to talk about how nice it would be to involve administrators in the process so that everyone could be learning. They asked if there was a way to work with the district to replace formal evaluations with the process of working together to improve lessons for students. Several of the teacher groups, after the first year, invited principals and administrators to join in the lesson observation and debriefing. This resulted in increased administrator support for lesson study. (Karin Wiburg, November 2003)

Deciding on the Research Lesson Topic

We discovered during the first year that teachers needed help in deciding what should be the content of their first lesson. Some had the mistaken idea that lesson study required them to make up a new lesson, rather than to think about changing how they were teaching an existing lesson. It was helpful to ask teachers to focus on concepts that the students were having trouble learning and to look at student test results for additional information about areas of weakness. From the beginning, even in our initial introduction of lesson study, we grounded the work by asking teachers to examine student work. Teacher teams were asked to do some informal classroom assessment of students in order to understand what their students understood. Evaluating these formative assessments together was an enlightening process, especially for high school teachers, who were sure that their students understood fractions until they asked them to explain what they knew about rational numbers. We explicitly encouraged teachers not to make up new lessons, but to use existing lessons and to focus on how they could teach those lessons in ways that would help more of their students to understand.

Lesson Study Versus Lesson Planning

Another problem encountered fairly early was that teachers were looking at the research lesson as a traditional lesson plan. This led us to develop templates that helped teachers to plan for the lesson in the context of school and unit goals for their students. We refined the research lesson template over time, so that at each step of the lesson

teachers were asked to think about what might be common student misunderstandings and how they could plan to address these. These templates, which scaffolded the research lesson process, are included in the Resources for Chapter 1. We helped teachers to analyze how to gather data and which data would be most useful during a research lesson in order to answer their own questions.

Another basic problem seemed to be the use of the term “lesson study.” Teachers at first thought the goal was to develop a perfect lesson. They fell back on their often unsatisfying work of being required to turn in daily or weekly lesson plans, and thus confused lesson study with lesson planning. Many teachers thought of lesson plans as lists of fun activities they would do with students. They often had in mind cool lessons that would engage students in interesting-looking activities, especially for those times when they were being observed or evaluated. In order to change this idea of lessons as activities, we introduced the backwards design process (Wiggins & McTighe, 1998) and helped teachers to reconceptualize lessons in terms of what they wanted students to understand, how they would assess this understanding, and finally, which procedures or activities they might use to lead the students toward understanding.

While the introduction of unit planning around student understanding helped somewhat in improving teachers’ ideas of lessons, the real idea behind lesson study is not the lessons themselves, but rather how the lessons relate to student learning. In fact, at one point in our lesson study journey, one of us tried to rename what we were doing as *learning* study. It was thought that this new term might help teachers to focus on what students were learning or not learning, instead of worrying about how they were teaching.

The Culture of Teaching

Teachers were used to thinking of teaching as what they were telling students. We helped teachers develop an understanding of how they were working too hard at doing all the learning for their students. This was especially true when we worked with high school teachers. Together we watched videotapes of the lessons. The teachers soon recognized how anxious they were to answer students’ questions quickly. It was as if they thought it was their job to make everything as easy as possible for the students, and never to let them struggle over the answer to a problem.

When students didn’t seem to understand, the teachers would repeat the same things they had just said, maybe louder or slower,

but usually in the same way. When we first introduced the idea of presenting students with a problem and letting them work in small groups to solve it, the teachers confessed to feelings that they weren't important if they weren't telling the students how to solve the problem. In videotaped sessions, teachers watched themselves moving too quickly to give students the right answers and began to recognize that perhaps they were working harder than the students.

Curriculum Alignment

One of the more successful experiences we had with lesson study was implementing it in a district that was using only one curriculum and text across all their schools. Everyone was integrating the same units at around the same time in this district, and it was in this district that lesson study worked especially well. Not only was the curriculum the same, but also the effort to improve mathematics teaching was supported at all levels, from the superintendent to the instructional assistants. In other districts, we found large differences within schools and between schools on what teachers thought they should teach about a subject. This made it difficult for them to work together to design a common lesson.

Lack of a Common Mathematics Curriculum

Another barrier we faced while implementing lesson study was that, unlike the situation in Japan, in the United States there is no common curriculum focused on the main concepts in mathematics to be taught at a specific grade level. Our teachers were asked to cover (and in their textbook-driven curriculum they felt they *had* to cover) many different kinds of topics over the course of a year, and as a result there was very little time to teach any of the topics in depth. Where a Japanese text might cover eight topics in a year, a middle school mathematics text in the U.S. might include more than 60 topics the teacher is expected to teach during the same period of time. How can teachers teach for deep understanding with so many topics?

In addition, the teachers often didn't understand enough mathematics content to teach in a manner that supports student-directed, problem-based learning. Without deeper math knowledge, teachers were uncomfortable allowing students to ask about alternative solutions or to construct new ways of solving problems. This eventually led us to an active alliance with mathematicians in our university, who are now working with us and with teachers on lesson study teams.

Classroom Discourse

We discovered that teachers needed support in developing and sustaining instructional discourse in their classrooms and in knowing how to ask questions that facilitate learning. Teachers knew how to present in front of the class and work individually with students, but they needed help in engaging students in whole-group discussions and problem solving. In addition, many teachers were not experienced in teaching for understanding or in designing lessons to facilitate understanding, as opposed to just giving students the correct procedures and answers.

A final challenge for developing mathematics discourse in the Southwest border areas was the large numbers of English Language Learners (ELLs) in our classrooms. This situation, and ways in which lesson study can help support ELLs and bilingual students, is discussed more fully in Chapter 2.

Toward Essential Elements and Principles of Lesson Study

Lesson study is becoming increasingly popular in the United States. Yet its popularity, like that of new ways of teaching or new curriculum, has made many lesson study leaders nervous, because—based on the history of U.S. educational reform—superficial implementation could lead eventually to lesson study becoming another failed educational fad. This is not uncommon in the United States when new learning approaches, such as whole language or new math, are introduced in ways that are detached from the deeper theoretical constructs that require understanding in order to make the approach effective. Superficial implementation often leads to pendulum swings, for example from whole language to phonics or from problem-solving approaches to back-to-basics. In fact, James Stigler, in the foreword to Fernandez and Yoshida's (2004) book on Japanese lesson study, comments:

A superficial implantation of lesson study is not likely to have any positive impact on the learning of teachers and students, and given our impatient political climate, a lack of immediate results may well lead to lesson study being declared a failure before it is understood in any deep sense. (Fernandez & Yoshida, 2004, p. x)

At the 2003 annual conference of the American Educational Research Association (AERA), Catherine Lewis organized a meeting of key players involved in introducing lesson study across the U.S. She invited us all to reflect on and articulate what might be the essential elements or principles for practicing and researching lesson study. Deborah Ball, a well-respected mathematics educator, agreed to be the discussant for this presentation and provided feedback on what seemed to be common elements among all the efforts. A summary of promising principles is included below.

Common and Promising Elements of Lesson Study

1. Being instruction-centered and teacher-directed. Every presenter suggested centering reform in classrooms and under the control of teachers. Cohen and Hill (2001) write, “. . . challenging curricula have failed to impact on teaching and learning partly because teachers had few opportunities to learn and improve their practice” (p. 252). They also describe how efforts to reform teaching have failed because the professional development models used bore little resemblance to what teachers actually do with their students and how content is currently taught and assessed. If teachers are going to implement standards-based curricula and foster learning environments where inquiry, communication, and problem solving are key components, then a new, transformative professional development model must be adopted.
2. Scaffolding professional development. The lesson study process provides an organized system that helps teachers to investigate their students’ learning. As the MathStar lesson study project evolved, we found ourselves designing and redesigning templates for setting goals, designing the research lessons, debriefing strategies, and gathering and reporting data. Our lesson study involved studying and refining our tools and presentations to increase learning for the teachers as they began to implement lesson study.

Using video and technology tools helped us understand and scaffold our professional development in lesson study. We used these tools to develop video segments taken from teacher practice, exemplifying each stage of the lesson study cycle. Videotaping and video analysis also helped us to document and reflect on our work. The director for MathStar examined hours of video after the end of the first year of implementation

and found several themes that emerged: teachers openly reflecting on their practice; an interest in what students understand and don't understand; an interest in student thinking; and a great deal of discussion about how to ask students questions rather than just tell them the answers.

Scaffolding is a very important and delicate process. Professional developers need to know how to provide structure without prescription. In many ways scaffolding is at the heart of successful teaching and can perhaps be most easily understood in terms of Vygotsky's notion of the *zone of proximal development* (Mooney, 2005). With teachers as well as students, it is important to ask what teachers can do with support and where they need to start, in order to avoid requiring teachers or students to complete tasks beyond their current levels of understanding. On the other hand, it makes no sense to teach something that has already been learned.

3. The potential of lesson study to help teachers learn academic content. There seems to be evidence that teachers can improve their understanding of content knowledge as a result of participating in lesson study. This was a common theme of the presentations at the AERA conference. Researchers have found that teachers' background and knowledge in the areas they teach makes a difference in student performance (Darling-Hammond & Sykes, 1999). Observations of teachers engaged in lesson study demonstrate the importance of teachers knowing the content in order to help the lesson flow. Deep content knowledge is also necessary in order for teachers to feel that they can explore students' questions and alternative answers to mathematics problems.

As teachers watch lessons by those knowledgeable about content, they become interested in furthering their own backgrounds in an academic content area. In our own experience, after a year or two of lesson study, teachers began to want to understand deeply the content of mathematics they were teaching. During this time, we as facilitators asked the teachers to tell us: *Where is the math?* This became a familiar joke as we continued our lesson study journey. It also led us to invite content specialists to help us with lesson study work.

4. The need for redesigned time for professional development. Many of the successful lesson study programs involved grant funding, which provided release time or restructured days for

the teacher participants so that they had the time and space to engage in reflective practice. If schools and/or districts are serious about implementing this form of professional development, they must provide teachers with the necessary time. In Japan, such time is a component of the school day. School district partners in our newest mathematics grant have agreed to provide teachers with 1½ hours per week for collaborative mathematics study groups. Various options for finding time for lesson study are presented in Chapter 3.

5. Assistance from knowledgeable others. In all the presentations by experts from around the United States, the importance of mentoring by knowledgeable professionals was mentioned. In addition, expertise was necessary in areas related both to pedagogy and to content knowledge. The most successful models involve teams of education experts working with mathematicians—or other content experts—on lesson study teams. (In Japan, instructional supervisors are often involved in supporting lesson study at school sites.) Resources, electronic and print, also were deemed important. The use of videotaping and video analysis by the teachers was extremely important. Teachers in rural areas wanting to work on lesson study used interactive discussions via our Web site to further their work. Stigler has developed a Web-based Lesson Lab Program (see www.lessonlab.com) that provides scaffolding for teachers who are studying classroom events.
6. Well-aligned curricula and top-down and bottom-up support. In our work with lesson study teams, we found it easiest to work in districts that had a common mathematics curriculum, alignment of that curriculum with standards and assessment, and both top-down and bottom-up support for the curriculum, from the superintendent to the teacher in the classroom. Moreover, support from homes and communities for studying student learning and improving teaching has been helpful in facilitating lesson study. We are reminded of Robert Moses and his Algebra Project (see www.algebra.org), in which teachers, students, and parents worked together to understand algebra.

Chapter 3, on assessing your district's readiness for lesson study, will help you to decide if there are certain threshold conditions you should develop—such as a common curriculum or more time for teacher study—before undertaking lesson study. The alignment of

the content area curriculum with district testing and teaching is also an important factor, although lesson study itself may be helpful in facilitating such alignment.

Conclusion

This chapter introduced the history of lesson study both in Japan and as it relates to educational issues and barriers to implementation in the United States. Barriers were presented, and essential elements common to a range of lesson study initiatives across the United States were introduced. Those interested in adopting lesson study in their schools and/or districts should consider the essential elements required for implementing lesson study.

Extended Learning Questions

1. Discuss the challenges to doing lesson study suggested by the authors in this chapter. Decide which of these barriers are likely to happen in your setting. Write or discuss how you might overcome these barriers.
 2. Which part of the lesson study process might be exceptionally challenging for you to do? Talk about this.
 3. Are there any differences between the Japanese and American educational systems that have not been mentioned in this chapter? Spend some time investigating these differences or those already mentioned. How important do you think these differences are in terms of successfully using lesson study in the United States?
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