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Supporting the Principal's Data-Informed Decisions

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Improving Mathematics Through Lesson Study

By Jennifer Stepanek, Melinda Leong, and Rhonda Barton

The professional development practice of lesson study—or *jugyokenkyu*—has a long history in Japan. But it is only within the past decade that it has been increasingly implemented by educators in the United States. Lesson study first gained widespread attention in *The Teaching Gap* (Stigler & Hiebert, 1999). Still greater interest in lesson study was generated by Japan's high rankings in the Third International Mathematics and Science Study (TIMSS) (Gonzales, Guzman, Partelow, Pahlke, Jocelyn, Kastberg, & Williams, 2004).

The TIMSS results, which reflect student achievement at the fourth- and eighth-grade levels, showed Japanese students outperforming their U.S. peers in mathematics by 47 and 66 points in primary and secondary school,

respectively. The National Council of Teachers of Mathematics has also drawn attention to lesson study in recent years as a way to help teachers develop effective pedagogy for standards-based instruction.

What is lesson study? It is essentially a practice in which teachers collaborate to plan, observe, and refine a research lesson:

Teachers work in teams to plan research lessons and investigate questions related to the schoolwide goal [which comes from looking at assessment data or defining qualities they want students to develop]. They often begin with a whole unit and then narrow their focus to a specific lesson. One teacher from the team

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Just the Facts

- Teachers [in Japan] have reported improved instruction, gained greater understanding of subject matter, made a stronger connection between their work and long-term goals for students, and developed an improved ability to "see children" (Lewis, 2000; Lewis & Tsuchida, 1997).
- Teachers develop a common language and a shared vision when planning a lesson together and discussing evidence of student learning (Liptak, 2005).
- "Without at least one administrator who understands and values lesson study, it will be difficult (if not impossible) to sustain it" (Stepanek, et al., 2007, p. 18).
- Rather than relying on researchers, teachers develop and use their professional judgment; hone their ability to gather, analyze, and interpret data; and verify what works in the classroom. Teachers report feeling more like professionals as a result of their lesson study work (Wilms, 2003).

presents the lesson in his or her classroom. The other teachers observe the lesson, taking notes on what the students are doing and saying. The observations are guided by specific evaluation questions. Later, the lesson study team and any other observers meet to discuss the lesson and their observations. This is an engaging interaction of ideas and suggestions, with the focus always on the students. The group may meet several times to improve the lesson and prepare for a second implementation, although the teachers may decide not to reteach it. The lesson is presented again, using the same process for observation and discussion. The teachers often publish a report about their research lesson, including the teachers' reflections and a summary of group discussions. (Stepanek, 2003, p. 5)

By using lesson study, teachers take on the role of researchers to verify what works in the classroom. They deepen their own understanding of how different topics complement and build on each other. And they reflect on their curricula and how to translate their content knowledge into experiences for students. When lesson study is implemented on a schoolwide basis, it benefits every classroom.

Building a Research Base

Lesson study has spread throughout the United States: Chokshi and Fernandez (2005) identified 150 clusters of lesson study activity, involving at least 2,200 teachers in practices that ranged from small groups in single schools to large initiatives. However, most of the results of the impact of lesson study come from Japan. Teachers there have reported improved instruction, gained greater understanding of subject matter, made a stronger connection between their work and long-term goals for students, and developed an improved ability to "see children" (Lewis, 2000; Lewis & Tsuchida, 1997).

Lewis, Perry, and Murata (2006) argued that "three types of research on lesson study are critically needed: expansion of the descriptive knowledge base

on lesson study; explication of lesson study's mechanism; and iterative cycles of testing and refinement of lesson study" (p. 3). Until such rigorous research is carried out on lesson study in both the United States and Japan, it's necessary to look to the literature on professional development to build a strong rationale for lesson study in this country. (See figure 1 for comparisons between effective professional development and lesson study.)

Lesson Study and Mathematics Instruction

Although lesson study can be applied to any content area, it is most frequently associated with mathematics and the problem-solving approach to that subject in Japan. One of the most documented examples of lesson study and its impact on mathematics achievement in the United States comes from a study of Highlands Elementary School (Lewis, Perry, Hurd, & O'Connell, 2006), one of the first U.S. schools to adopt this practice.

The researchers found that Highlands students' scores on the California mathematics achievement test exceeded those of comparable schools in the San Mateo-Foster City School District and the state during a three-year period. They reported "for the same period, the net increase in mathematics achievement for students who remained at Highlands School was more than triple that for students who remained elsewhere in the district as a whole (an increase of 91 scale score points compared to 26 points), a difference that was statistically significant" (p. 276). Lewis et al. (2006) cautioned that they can't claim that lesson study was wholly responsible for the increase, though other variables were ruled out and schoolwide lesson study appears to be the main difference in professional development between Highlands and other district schools during the study.

A four-year study by Education Development Center (EDC) (Lesson Study Communities Project, n.d.a), funded by the National Science Foundation, examined how lesson study affected secondary mathematics instruction in 20 schools in eastern Massachusetts. Because most lesson study in Japan and the United States has focused on the elementary school

level, Jane Gorman and colleagues at EDC were interested in how the model could be adapted to middle and high schools. They found that the impact and benefits reported by secondary school teachers were consistent with the research in elementary school settings—including improved understanding of content and pedagogy and changes in the level and nature of their collaboration with colleagues. Teachers in the study reported that “they thought about instruction in different ways, the questions they asked themselves before teaching were different, and they had raised their expectations of how challenging the work they could give to students was. We also know from observations that the teachers were testing new forms of instruction and the lessons tended to become more problem-solving or inquiry-based,” said Gorman, who is a former high school mathematics teacher (personal communication, August 7, 2008).

Lesson Study in the Classroom

Lesson study groups in the EDC project covered such diverse topics as slope as a rate of change; the relationship between position and velocity of a moving object; and solving multi-step linear equations. Lexington (MA) High School used the “heat values” of chili peppers as a way to explore a key concept in pre-calculus (Lesson Study Communities Project, n.d.b). Teachers agreed on the big goal of the lesson—introducing properties and logarithms—and then met in small teams to craft a lesson plan that incorporated thought-provoking questions, use of tools, and ways to assess student understanding. During the lesson, students collaborated to create an exponent ruler that measured the relative heat of different kinds of peppers with habaneros scoring the highest at 200,000 units of heat, jalapenos at 5,000 units, and sweet banana peppers at a mere 50 units. While a team member taught the lesson, others in the group observed the students’ work and took copious notes on whether students appeared to understand the lesson and how the lesson goals were achieved. Then, the team met to critique the lesson and make revisions before a second teaching in another classroom. A detailed lesson plan and written

Questions for Principals

In determining if their schools are ready for lesson study, principals should consider:

- Do teachers and staff share a sense of collective responsibility for student learning and believe that their work together can improve outcomes for students?
- Does the school climate allow for intellectual risk taking and respectful feedback on ideas and practices?
- Are teachers willing to talk about their beliefs and practices, learn from one another, and try new ideas?
- Do teachers already have a high-quality curriculum to work with?
- Do teachers have time set aside to plan, observe, and discuss research lessons?

(Adapted from Stepanek, Appel, Leong, Mangan, & Mitchell, 2007)

reflections on what the group learned brought the lesson study cycle to a close.

Principal Support for Lesson Study

Principals play an active role in lesson study. The EDC study highlighted the need for principals to engage in lesson study as learners and researchers. Administrators also can help teams broaden their impact by sharing lessons districtwide, presenting at conferences, or disseminating their work through publications.

In Japan, principals are active participants in the lesson study process. Their involvement ranges from conducting research lessons to endorsing teachers’ contributions to lesson study during out-of-school hours. Some principals even showcase their teachers’ lessons at open forums, inviting teachers from other schools to observe the host school’s classrooms. In

these forums, “visitors are able to see the results of sustained application of lesson study for both teachers and students—in particular, how well [a] teacher has taught and how well a teacher has cultivated student learning. In this sense the quality of what students have learned over time is showcased for all to see” (Isoda, Stephens, Ohara, & Miyakawa, 2007, p. xviii).

In the United States, principal support is more likely demonstrated through working with teachers to create an environment in which lesson study can thrive. “Without at least one administrator who understands and values lesson study, it will be difficult (if not impossible) to sustain it” (Stepanek, Appel, Leong, Mangan, & Mitchell, 2007, p. 18). This includes:

- Providing time for collaboration, including release time from classroom duties to observe lessons taught during regular school hours
- Fostering a collaborative school climate that nurtures teacher learning
- Encouraging—but not requiring—teachers to participate in the process
- Engaging an outside facilitator, if needed, to ensure that teachers are doing more than a superficial job.

Stepanek and colleagues point out that the principal must step out of the role of evaluator during lesson study and promote an atmosphere where teachers feel safe in constructively commenting on their practice.

Lessons Learned

Principal support has been a critical element of lesson study in Spokane, WA, an urban/suburban district with 28,000 students. Each of Spokane’s middle and high schools has science and math instructional coaches who coordinate the lesson study effort. However, “unless the principal is on board, what the coaches are doing doesn’t matter as much,” according to Sharon Robinson, director of professional learning for Spokane Public Schools (personal communication, August 6, 2008).

Robinson explained that the coaches receive three hours of professional development training

twice a month. During that time, they discuss the progress of their lesson study teams—which meet weekly for one hour during the school day—and the data generated by the groups. Teams of four to nine members conduct one lesson study during the fall and one during the spring. Although coaches lead some of the teams, others are led by department heads or the principal with the coach’s support.

“Lesson study has helped us use data in a focused way, focus on one piece of district curriculum actually practiced in the classroom, and provide a vehicle for classroom observation that’s brought about some real change in practice,” noted Robinson (personal communication, August 6, 2008). She added that while it is difficult to isolate the impact of lesson study on student achievement, the district has seen qualitative differences in teaching and learning. “There’s much more of a sense of constructivism in mathematics classes,” said Robinson. “We see more kids in groups struggling with a concept and teachers asking good questions instead of saying, ‘You can find the answer here.’ In science, the instruction is much more student-centered and hands-on, with an emphasis on using technology.”

Spokane began its lesson study initiative six years ago, with training and technical assistance from the Northwest Regional Educational Laboratory. Robinson advises schools interested in lesson study to consult an outside expert to get a pure model in place first. “We have a tendency to look at a model and say we’re going to do 80% or 60% of that; one of the nice things we did is bring in people who held our feet to the fire so we recognized what [the model] should look like and said we’re going to do this 100%,” she said (personal communication, August 6, 2008).

Conclusion

As Sarason (as cited in Fullan, 1993) pointed out, “You cannot have students as continuous learners and effective collaborators, without teachers having the same characteristics.” Lesson study provides a model for that collaboration. It gives teachers a unique opportunity to work together on designing lessons, observing classroom practice, and under-

Figure 1.

Comparing Professional Development and Lesson Study

Qualities of effective professional development	Attributes of lesson study
<p>Collaborative, comprehensive, and ongoing: Professional development has a greater impact when it involves groups of teachers organized around common subject areas or grade levels rather than individual teachers (Garet, Porter, Desimone, Birman, & Yoon, 2001).</p>	<p>Lesson study often results in increased collaboration among teachers (Byrum, Jarrell, & Munoz, 2002). Lesson study teams experience less isolation, increased trust, and collective effort toward common goals (Wilms, 2003). Teachers develop a common language and a shared vision when planning a lesson together and discussing evidence of student learning (Liptak, 2005).</p>
<p>Focused on subject matter: Professional development focused on curriculum, content knowledge, and how students learn specific content is more likely to impact teacher practice and student learning (Cohen & Hill, 1998; Kennedy, 1998).</p>	<p>While developing their lessons, teachers delve deeply into the subject matter and increase their content knowledge (Turner, 2004). Lesson study also helps teachers identify gaps in their own understanding and offers motivation to learn more (Fernandez, Cannon, & Chokshi, 2003).</p>
<p>Teacher driven and classroom based: Professional development is effective when it is explicitly connected to teachers' work with their students (Corcoran, 1995; Darling-Hammond & McLaughlin, 1995).</p>	<p>Lesson study focuses on a well-defined task (lesson planning) and a common demonstration of teaching that teachers can analyze and discuss (Hiebert, 2000; Yoshida, 1999). It makes the process of reflection more concrete by providing goals and questions that teachers can use to examine their classroom experiences. Teachers in the Northern Michigan Lesson Study Initiative reported improvements in their questioning strategies and their approach to gauging student understanding (Turner, 2004). In New Jersey's Paterson School No. 2, teachers say that lesson study has led to more opportunities for students to share and discuss their thinking (Jackson, 2005).</p>
<p>Active and hands on: Effective professional development provides opportunities for active learning as teachers become inquirers and problem solvers (Garet et al., 2001; Wilson & Berne, 1999). Professional development involves teachers in identifying problems and questions, thinking about and discussing their work, gathering data, and using what they learn to inform their practice (Borasi & Fonzi, 2002; Thompson & Zeuli, 1999).</p>	<p>Through lesson study, teachers have a way to articulate and organize their knowledge (Saul, 2001). Rather than relying on researchers, teachers develop and use their professional judgment; hone their ability to gather, analyze, and interpret data; and verify what works in the classroom. Teachers report feeling more like professionals as a result of their lesson study work (Wilms, 2003).</p>
<p>Centered on student outcomes: The success of professional development is ultimately measured by changes in student outcomes. Gaps between goals for student learning and actual student performance should drive teacher learning (Hawley & Valli, 1999).</p>	<p>A focus on student learning permeates all stages of lesson study, from identifying goals for students to researching how students learn and observing student engagement while the lesson is presented. Lesson planning inspires teachers to anticipate how students will respond (Byrum et al., 2002; Stewart & Brendefur, 2005). Teachers explore student thinking and how to facilitate it (Fernandez et al., 2003). And, lesson study helps teachers gain a better understanding of students and their learning needs (Lewis, Perry, & Murata, 2006; Petrescu, 2005).</p>

(Adapted from Stepanek, Appel, Leong, Mangan, & Mitchell, 2007)

standing how students think and learn. Principals can participate in this effort as observers and learners, and they can play an important role in sustaining the work by providing the time and organizational structures that allow lesson study to grow and develop. PRR

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Authors' note: For more information on lesson study groups visit Teachers College, Columbia University, Lesson Study Research Group at www.tc.edu/lessonstudy/lsgroups.html.

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