Improving Teaching Does Improve Teachers: Evidence from Lesson Study

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Abstract

The authors comment on the article by Morris and Hiebert in three ways. First, they add thoughts about why improvement efforts often focus on teachers, rather than teaching. Second, they offer evidence from U.S. lesson study research that focus on teaching can improve both students’ learning and teachers’ learning. Finally, they suggest that the instructional products and common assessments advocated by Hiebert and Morris are not sufficient, and that they need to be accompanied by practice-based, collegial learning in which teachers build shared knowledge and commitments for the hard work of improvement. Their research indicates that lesson study focuses on teaching, but improves teachers as well, increasing mathematical knowledge and beliefs that support instructional improvement, as well as improving student learning.

Keywords

professional learning, teacher learning, lesson study, teacher’s manual, scale-up

A Brief Background on Lesson Study

Lesson study is an inquiry cycle conducted by a team of teachers that is centered around a “research lesson”—an actual classroom lesson designed to investigate and improve the teaching of a particular topic (Lewis & Hurd, 2011). During the research lesson, team members gather data on student thinking and learning, studying selected students to see how their thinking evolves (or fails to), and what aspects of the lesson design enhance or pose barriers to learning. Team members present these data during a postlesson discussion, drawing out implications for teaching and learning the specific topic and for teaching and learning more broadly.

In Japan, lesson study occurs as a school-based, district-based, and national activity, with the different layers working synergistically, to allow innovations to spread across the country through live public research lessons (Lewis & Tsuchida, 1997). The Japanese mathematics teaching through problem solving that attracted such attention through the 1999 Third International Mathematics and Science (TIMSS; Stigler & Hiebert, 1999) video study was developed, refined, and spread through public research lessons. In addition to

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In contrast, the U.S. text provides a rectangle predivided into square units with no rationale for this task design; it simply provides questions for teachers to ask students, such as “How could you count rows and multiply to find the area?” (Maletsky, 2002, p. 500; Grade 4, Volume 2).

Attention to student thinking is a second major difference between the examined units in the U.S. and Japanese teacher’s manuals. Anticipation of varied student thinking accounts for 28% of the statements in the Japanese units but only 1% of the statements in the U.S. manual. Figure 2 provides one example from the Japanese textbook and teacher’s manual, showing three different ways that students might reconfigure a parallelogram to find its area. The teacher’s manual provides the following explanation:

The first support we identify is high-quality instructional materials (including teacher’s manuals and common assessments). The first part of lesson study is *kyouzai kenkyuu* (study of teaching materials), to examine what is currently known about the teaching and learning of a particular topic (Takahashi, Watanabe, Yoshida, & Wang-Iverson, 2005). In Japan, the teacher’s manual is used for *kyouzai kenkyuu*. But when we first began to observe U.S. mathematics lesson study, we noticed that U.S. teacher’s manuals did not reliably support mathematically rich discussions. To understand this difficulty, we took a closer look at U.S. and Japanese teacher’s manuals for one mathematical topic—area of quadrilaterals—looking at one widely used textbook series from each country (Harcourt California, Maletsky, 2002; *Mathematics for Elementary School*, Hironaka & Sugiyama, 2006). We classified each sentence in the target units of the teacher’s manuals using a coding scheme based on Ball and Cohen’s (1996) ideas about the curriculum elements that support teachers’ learning, such as providing a rationale for pedagogical decisions and information on student thinking. We found that the Japanese teacher’s manual devotes proportionally more space to features expected to support teachers’ learning. Whereas 10% of the statements in the Japanese units are devoted to providing a rationale for pedagogical choices, such statements are absent in the U.S. units (Lewis, Perry, & Friedkin, 2011). For example, the Japanese textbook’s introduction to rectangle area asks students to compare the areas of two rectangles for which neither dimensions nor a grid is provided, and the teacher’s manual provides the following rationale:

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The three solutions . . . all involve cutting the parallelogram, but they each generate different pieces . . . But all these different pieces reassemble to give the same rectangle . . . Have the students pull together [the idea] that the area of a parallelogram can be found using area-preserving transformations to make the parallelogram into a rectangle. Stress that, in area-preserving transformation to a rectangle, it does not matter where within the parallelogram the perpendicular to the side AD is drawn. Cutting along that perpendicular generates pieces whose sizes and shapes do vary, depending on location. But those pieces always reassemble to give the same rectangle. (Tokyo Shoseki Co. Ltd., 2000, p. 112, first author’s translation)

As Figure 2 and the above quote suggest, the discussion of varied student thinking in the Japanese teacher’s manual provides a rich source of content knowledge for teachers. For example, one U.S. teacher who used the Japanese textbook and teacher’s manual in lesson study on polygon area reported learning that “Using the area of a rectangle to solve other areas is the basis for most simple area formulas” (ID No. 323).

In contrast to the varied student thinking in the Japanese teacher’s manual, the information on student responses provided in the U.S. teacher’s manual was almost always a single correct answer. Such single correct answers account for 13% of statements in the examined U.S. text and 3% of statements in the examined Japanese text.

The Japanese teacher’s manual appears to include all the elements of annotated instructional products that Hiebert and Morris call for, such as explicit learning goals (“To understand how to find the area of a parallelogram”), rationale for lesson design, student responses, and key mathematical ideas behind the activities, as well as practical guidance for conducting each lesson, such as the questions to be posed at each stage of the lesson (initially, “How do you suppose we might go about finding the area of this parallelogram?” and after students have shared their approaches, “Let’s explain Sayuri’s and Kazuya’s ways of thinking”). The Japanese teacher’s manual includes an overall unit plan for the four-lesson instructional unit on area of parallelograms, plans for each lesson, blackboard-writing plans, and discussion of key difficulties for students.

The Japanese teacher’s manual also provides assessment items for each instructional unit. As the purpose of the assessment items is to understand whether students grasped the content of the unit, a modest set of items is sufficient. Because Hiebert and Morris’s call for “common assessments” may suggest to U.S. audiences something much more elaborate (i.e., psychometrically valid item sets that can be used for high-stakes accountability), we do not break out “common assessments” as a separate item in our model. Rather, we consider common assessments as an integral part of high-quality instructional materials. As Stigler (2010) and others have pointed out, common end-of-unit tests enable teachers to investigate small variations in teaching that produce differences in learning by different classes studying the same curriculum. In addition to end-of-unit assessments, the Japanese teacher’s manual provides guidance for formative evaluation of students during lessons. For example, “major assessment criteria” for the first lesson on area of parallelograms include whether students are “making connections to area of figures already studied” and whether they “notice that . . . once the figure has been made into a rectangle by an area-preserving transformation, formulas already studied may be used to solve the problem.”

Hiebert and Morris may be correct that U.S. textbook publishers cannot be expected to create resources that accumulate and spread knowledge about how to teach particular content. We note, however, that Japanese teacher’s manuals appear to serve this function, within a competitive commercial textbook publishing system similar to that of the United States (Lewis, Tsuchida, & Coleman, 2002).

**Practice-Based Professional Learning**

Instructional materials alone, however excellent, are often insufficient to improve instruction (e.g., Remillard & Bryans, 2004). Educators need opportunities to see and to try out new approaches in practice. A U.S. teacher whose lesson study group had a detailed instructional plan and video for a series of lessons on fractions mentioned the difficulty of conducting a lesson based on a lesson plan:
I have a hard time reading other peoples’ lessons in general. It’s hard to visualize. The DVD is so much more useful to me because I can see what they are doing . . . I can see why they are doing it. (IES No. 4, 1.13.10)

Teaching is an enormously complex endeavor of juggling many concerns simultaneously (Lampert, 2001). Out-of-classroom training can take an educator only so far—and then it is necessary to integrate a new approach into practice, see what happens to the juggling act, and recalibrate.

Despite the need to try out new approaches, practice-based professional learning is not common in the United States (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Because educators have few opportunities to see each other’s practice, they may use the same terms (“scaffolding,” “group work”) to refer to varying practices, masking critical sources of difference in practice. At a public research lesson on mathematical problem solving taught in California, we were stunned to find that educators who had been working together for many years had dramatically different images of the instruction called for by the term problem solving in the state mathematics standards and sharply different opinions on whether the research lesson supported the state standards (Lewis & Hurd, 2011). In contrast, Japanese teachers have frequent opportunities to observe and discuss each other’s lessons and, thus, to develop shared instructional referents and shared know-how about goals like problem solving (Lewis & Tsuchida, 1997).

School-based lesson study allows teachers to build and spread “high-impact instructional routines” (Ball, Sleep, Boerst, & Bass, 2009; Grossman, Hammerness, & McDonald, 2009). Teachers at Matsuzawa Elementary School (2011) in Tokyo investigated teachers’ questioning and students’ note-taking (among other elements of teaching) over a 2-year period devoted to the schoolwide research theme, “Mathematics that supports students to explain their ideas to each other and learn from each other: Learning through problem solving.” Teachers developed a school report describing what they learned from studying this theme, and they handed out the report at public research lessons at their school. The report included what to look for in students during each phase of a problem-solving lesson, teacher questions that support each stage of problem solving, and the desired development of note-taking by students over the elementary grades. For example, teachers look for whether students are “trying to solve the problem using knowledge they have already learned” and “always looking for a better or faster way of thinking” during the independent problem-solving phase of a lesson and look at whether students are “speaking in front of the blackboard, with their face and body looking toward the class” and “explaining using equations and diagrams” during the stage of the lesson when students present their explanations to each other. With respect to goals of note-taking, whereas early elementary students are expected to “write down what is written on the blackboard” and middle elementary students to “write down what the teacher and others said,” upper elementary students are expected to “write down points that they thought were important by listening to their friends’ ways of thinking.” Examples of teachers’ questions include “Let’s think of other ways to solve it” for the individual problem-solving phase and “Which way of thinking can always be used?” for the discussion phase of a problem-solving lesson. These examples illustrate how teachers build shared knowledge about the specific teaching strategies and student behaviors that support learning through problem solving. They suggest the richness of studying “high-impact instructional routines” in practice, where teachers can notice what is working and what needs improvement through careful observation of teaching and learning.

**Structures for Collaboration With Colleagues**

Colleagues can help each other learn from both instructional materials and from practice (e.g., Grandau, 2005; Lewis, Perry, & Hurd, 2009; Peng, 2007; Schorr & Koellner-Clark, 2003; Ticha & Hospesova, 2006). Colleagues provide a need to make one’s thinking visible and they offer ideas, questions, and challenges (Linn, Eylon, & Davis, 2004). For example, a U.S. group conducted lesson study on area of rectangles, using a task from a Japanese textbook that has students compare the size of two class newsletters posted on bulletin boards and surrounded by drawing papers. Not all teachers initially noticed that the drawing papers around the perimeter might encourage students to think about measuring side length and might surface important misconceptions about area and perimeter. When one teacher suggested that it was not necessary to use the task in the book, another disagreed, pointing out that the task was set up to elicit certain kinds of student thinking, to get kids to look at both things—the poster and the paper in the background because the kids might begin to get some ideas about how they could measure . . . Some of the kids might be counting the . . . drawing papers and confusing the idea of perimeter and area.

As group members then took a closer look at the task and reread the teacher’s manual, they gradually recognized the difficulty of “tweaking” the task and keeping it as mathematically meaningful. The teacher who had originally suggested that it was not important to use the task in the textbook said, “Now it seems harder and harder to create our own thing . . .” (Lewis, Perry, & Friedkin, 2011).

In addition to building teachers’ knowledge, collaboration can build shared professional norms and motivation. Richard F. Elmore (1996) makes the case that U.S. education suffers
not from inadequate supply of good educational programs but from inadequate demand for them on the part of practicing teachers: “The primary problem of scale is understanding the conditions under which people working in schools seek new knowledge and actively use it to change the fundamental processes of schooling” (p. 4). In a lesson study community, it is not unusual for teachers to take initiative to build, test, refine, and spread instructional improvements through their collegial networks. For example, educators in the Silicon Valley Mathematics Initiative lesson study network developed and spread a technique called reengagement, that presents strategically selected examples of student work from a prior lesson for students to analyze to reengage in thinking about a topic for which student thinking is fragile or problematic (Lewis et al., in press). Reengagement addresses a persistent problem of practice—how to make students’ thinking visible and available for close examination. So it is not surprising that teachers have taken the initiative to develop the reengagement strategy and spread it across the boundaries of classrooms, schools, and districts.

Although some teachers manage to invent such techniques on their own, many more teachers could probably learn them if they had systematic opportunities to learn from colleagues. In addition to lesson study, another example of a collegial, practice-based learning structure is the NWP, a network that has grown from one site in 1974 to almost 200 sites across all 50 states today and includes explicit attention to building collegial networks, practice-based learning (e.g., demonstration lessons), and use of research-based resources (Gallagher et al., 2011; NWP, 2010).

What Happens When U.S. Teachers Have These Three Supports for Learning?

School-based lesson study, in which all teachers at a school conduct lesson study around a shared research theme chosen by the staff, is rare in the United States (see, for example, Lewis & Hurd, 2011). One U.S. elementary school case shows that, over an initial 3-year period of schoolwide lesson study, teachers increasingly drew on external intellectual resources (e.g., research, local experts) and internal resources (e.g., each other’s practice, student thinking), and that students’ standardized test scores in mathematics increased at nearly 3 times the rate of the district as a whole (Lewis, Perry, Hurd, & O’Connell, 2006; Perry & Lewis, 2010). Analysis of discourse in selected lesson study groups in years 1 and 3 of the schoolwide effort indicates that teachers increased their focus on student thinking and student work (from 18% of statements in year 1 to 43% in year 3) and decreased their use of global and fixed-ability evaluations (from 8% in year 1 to less than 1% in year 3).

Recent results from a quasiexperimental study and a randomized-controlled trial conducted by our team (Perry, Lewis, Friedkin & Baker, 2012; Perry & Lewis, 2011; Perry & Lewis, under review) also find that lesson study supported by mathematical resources increases teachers’ and students’ mathematical knowledge. Small teams of teachers conducted lesson study on a selected mathematical topic (area of polygon, proportional reasoning, or fractions), using translated excerpts from the Japanese teacher’s manual, as well as other mathematical resources (e.g., mathematical tasks to solve and discuss). Participating groups organized themselves locally and applied to participate, and our staff provided little guidance other than to design and send out the mathematical resources along with a suggested process for conducting lesson study. As the quantitative findings are under review, they will not be presented here, but across studies they indicate an impact of lesson study with mathematical resources on teachers’ mathematical knowledge for teaching (on established and/or project-developed or established measures), on teachers’ beliefs (such as perceived efficacy to influence student learning and collegial learning effectiveness), and on student learning itself (looked at only in one study). In other words, a focus on improvement of teaching improved not only student learning but also teachers’ knowledge and efficacy beliefs. Some excerpts from the teachers’ written reflections on lesson study illuminate the power of collegial, practice-based work and the ripple effects beyond a single research lesson.

I . . . realized that students have many misconceptions about fractions. We never would have understood how many misconceptions there were if we hadn’t done this lesson and had extra eyes to observe this lesson and gain that insight. [10-556]

Since the lesson study I have been much more aware of the ways in which I tend to focus too much on completing the activity or playing the game, and my math teaching has become more purposeful and focused as a result. [5-739]

I was surprised at how many students in each class, including my own, did not successfully complete the objective of the lesson. This made me think not only about math, but about how often students do not understand what is being taught in other subject areas as well. Having the opportunity to observe students in class, examine their work afterwards and discuss it was also valuable because we typically do not operate like that, but the knowledge we gained from that process was critical and worthy of our time. [15-620]

I need to spend more time at considering the lessons I plan from the perspective of my students. I need to put myself in their shoes. (ID No. 312)
Final Thoughts
Supporting Teachers’ Motivation for the Ongoing Work of Improving Teaching

Discussions about improving teaching often neglect teachers’ motivation or conceive of it only in terms of extrinsic rewards (e.g., monetary bonuses for student performance). Improving teaching requires ongoing effort, as teachers try out new approaches, observe the effects, and refine their strategies. What motivates teachers to continue this “steady work?” (Elmore & McLaughlin, 1988). The satisfaction of seeing students learn and the identity and support gained as part of a professional community devoted to improvement are, we think, two powerful and sustainable sources of motivation that are often neglected by current policy and research. Theories of motivation suggest that intrinsic motivation is fostered in contexts that meet three basic human needs: agency or self-determination, competence (developing skill at tasks one values), and human connection (belonging, in mutually valued relationships; Deci, Koestner, & Ryan, 2001; Deci & Ryan, 1985). Contexts that meet these needs elicit persistent, high-quality, self-sustained work, rather than perfunctory work that is designed primarily to meet minimum standards and fades when external pressure or rewards are not salient. Well-designed lesson study (and other forms of teacher-led learning) provides opportunities for practitioners to experience agency as they choose the topic to work on and the methods to improve its teaching, competence as they improve skills directly applicable in their classroom teaching, and human connection as they work on “our” lesson for “our” students, in a professional community that expects and values contributions from every member.

How Can We Build Attention to All Three Conditions?

We know of few U.S. sites where collegial, practice-based learning, using high-quality instructional materials, is routine. Simultaneous, close attention to all three conditions is needed, we think, for teachers to be able to improve teaching. So how can these three conditions be established more broadly? The good news is that public research lessons are a natural way to spread improvements in practice, and lesson study networks in several regions of the United States now regularly hold public research lessons (e.g., http://www.svmimac.org/lessonstudy.html, http://www.harlemvillageacademies.org/pages/pd2/, http://www.lessonstudygroup.net/, http://www.scoe.org/pub/htdocs/lesson-study.html). The teacher-led growth of these networks suggests a powerful potential for spread that has not been systematically tapped, or noticed, by many policy makers.

In Japan, lesson study is strongly linked to national and local policy through a system of small grants to schools to study a teaching innovation and share their work through public research lessons (Lewis, 2010). For example, during the 2 years before solar energy would become a new part of the elementary science curriculum in Japan, hundreds of Japanese schools applied to become designated research schools to develop materials and strategies for teaching solar energy. Often working in collaboration with university-based educators, they tested approaches through lesson study, culminating in public research lessons attended by tens of thousands of educators, policy makers, and researchers. Through these activities, knowledge about how to teach solar energy spread rapidly across the country—knowledge about the practical aspects (such as which toys best make key ideas visible), the student thinking to expect, and the scientific content itself. In addition, policy makers who attended the public research lessons could see how teachers and students were enacting the new curriculum.

When we have pitched a similar idea to U.S. funders—to use lesson study to build and spread knowledge about implementation of the Common Core Standards—we have been rebuffed on the grounds that model lesson plans and model lesson videos are already being developed, and that these will be safer than having teachers “mess around” with a lesson that is already well designed. This reaction suggests an insufficient grasp of the actual classroom experimentation needed to master a new approach. We would not expect surgeons or tennis pros to learn just from books or videos, and we should not expect teachers to learn without actual practice and feedback from colleagues.

Too many policies assume that teaching can be improved by weeding out low-performing schools or teachers without changing substantially the opportunities that all teachers have to learn. It is time to change that.

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