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Lesson Study as a Model for Building Pedagogical Knowledge and Improving Teaching

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This paper proposes a model for building pedagogical knowledge and improving teaching based on the practice of lesson study. In lesson study a small group of instructors jointly designs, teaches, studies and refines a single class lesson called a research lesson. We describe how college teachers can do lesson study in their classrooms. We explore how the practice of lesson study creates multiple pathways for improving teaching and how the knowledge teachers create can help to advance the practice of teaching in their fields.

On any given day thousands of college instructors enter similar classrooms to teach similar, if not identical, subjects. Despite similar pedagogical goals, approaches and experiences, teachers typically work alone when planning instructional activities and assignments. Such isolation limits efforts to improve college teaching on a broader scale, both within and across disciplines. Although individual teachers may reflect on and improve their practice, there are few occasions to converse with colleagues about what they discover about teaching and learning. When they do share their ideas about teaching, it likely takes the form of knowledge they develop from their experiences in the classroom. Although practitioner knowledge is immediately useful for the teacher, it tends to be tied to concrete and specific contexts (Hiebert, Gallimore, & Stigler, 2002). It is not always in a form that can be accessed and used by others. In order to become professional knowledge, practitioner knowledge must also be made public, shareable, and verifiable (Hiebert et al., 2002). How can college teachers improve teaching practice in their fields and, in the process, contribute to the formation of a professional knowledge base?

One answer is *lesson study*, as Hiebert et al. (2002) suggest. Lesson study is a teaching improvement and knowledge building process that has origins in Japanese elementary education. In Japanese lesson study teachers work in small teams to plan, teach, observe, analyze, and refine individual class lessons, called research lessons. Nearly all Japanese teachers participate in a lesson study team during a school year. In addition, they observe research lessons regularly in their own schools and at schools that host lesson study open houses. Research lessons are published and widely disseminated throughout the country. In essence Japanese lesson study is a broad-based, teacher-led system for improvement of teaching and learning.

In this article we propose a model of lesson study for the college classroom, and explore how college teachers can improve their practice and the practice of teaching in their fields through lesson study. We draw from our experience with the College Lesson Study Project (CLSP), which began in fall 2003 with four lesson study teams in Biology, Economics, English, and Psychology. By spring 2006, participation increased to 40 teams involving more than 150 instructors in approximately 25 disciplines on 10 campuses in the University of Wisconsin System. At the University of Wisconsin-La Crosse nearly 24% of fulltime instructors have participated in lesson study since fall 2003. As practitioners of lesson study and coordinators of the College Lesson Study Project, we are in a unique position to discuss the opportunities as well as the challenges of doing lesson study at the college level and to comment on how lesson study makes possible the creation, exchange, and use of professional knowledge in teaching.

A Model of Lesson Study for the College Classroom

In developing a model of lesson study for college teachers, we have attempted to retain essential features of the Japanese model, making necessary changes to adapt to the contexts and purposes of American higher education, which are in no way uniform across institutions or disciplines. We acknowledge the Japanese model as the intellectual inspiration for our work and recommend the work of scholars who have brought lesson study to the attention of Western educators and researchers (Chokshi & Fernandez, 2004; Fernandez & Chokshi, 2002; Fernandez & Yoshida, 2004; Lewis, 1998a, 1998b, 2002; Lewis & Tsuchida, 1997, 1998; Stigler & Hiebert, 1999; Yoshida, 1999).

Whether in Japan or the United States, lesson study involves a small team of instructors working together to design, teach, study, and refine a single class lesson. This work culminates in at least two tangible products: (a) a detailed, usable lesson plan, and (b) an in-depth study of the lesson that investigates teaching and learning interactions, explaining how students responded to instruction, and how instruction might be further modified based on the evidence collected. Aspects of lesson study resemble other teaching

improvement strategies such as backward design (Wiggins & McTighe, 1998) and classroom assessment (Angelo & Cross, 1993). A closer look at how the lesson study process plays out in higher education, however, reveals important differences with other teaching improvement activities in the United States as well as differences with the Japanese model. Below we briefly discuss key steps in the process.

Formulating Learning Goals

Lesson study teams usually consist of 3-6 instructors from the same discipline although there could be interdisciplinary teams. They begin by selecting a course, topic and goals for student learning. Instructors select a topic of interest to them, usually one that is important in the discipline or course, one that poses problems for students, or one that is new to the curriculum. Ideally, a research lesson addresses immediate academic learning goals (e.g., understanding specific concepts and subject matter) and broad goals for development of intellectual abilities, habits of mind and personal qualities.

In Japan, schools often have a "research focus" that specifies important school-wide goals that include qualities of character, dispositions and sensibilities such as curiosity, independent thinking, tolerance of individual differences and so forth. In lieu of an institutional research focus, college teachers can link their research lessons to institution-wide aims for student learning (e.g., critical thinking) or learning goals specific to an academic program or discipline. For example, a CLSP team in psychology designed a lesson to promote understanding of specific psychological concepts, but to do so in a way that more broadly helped develop students' ability to analyze and explain human behavior in terms of multiple factors or variables. The team identified this ability as an important element of social science reasoning, and a goal that should be addressed in the introductory course and developed throughout the undergraduate program.

Designing the Research Lesson

The team creates a lesson intended to "bring the goals to life" (Lewis, 2000). They may modify an existing lesson or start anew. Teachers, who may be virtual novices or seasoned experts, share their previous experiences teaching the topic, and discuss possible ways to address the lesson goals. Planning a research lesson differs from everyday class preparation in several ways. An obvious difference is the degree to which teachers collaborate with one another in creating the lesson. Moreover, as the team proposes instructional activities, they consider how they will help students achieve the goals, a process similar to backward design (Wiggins & McTighe, 1998).

More significantly perhaps, teachers doing lesson study practice *cognitive empathy* and work to make student thinking visible. Japanese teachers have a well developed sense about how their students learn and think (Yoshida, 1999). In planning a lesson, they predict how students are likely to respond to specific questions, problems and exercises. Teachers try to put themselves in the position of a student and imagine what it would be like to experience the material and lesson activities as a novice, an approach that fosters the development of pedagogical content knowledge. In order to investigate student learning during the class period, teachers try to design a lesson that makes students' thinking visible—that is, open to observation and analysis. Not surprisingly, lesson study involves more time and greater depth of planning than typical class preparation. CLSP teams meet multiple times to plan a research lesson.

Designing the Study

The team develops a plan to investigate how students learn from the lesson. The plan specifies the type of evidence the team will collect and how observers will observe and record data during the lesson. Planning the study coincides with planning the lesson. As teams design the lesson they discuss what types of data they will collect as evidence of student learning and thinking. For example, one CLSP team used students' explanations as a measure of conceptual understanding. The team designed several exercises in which students explained key ideas, both orally and in writing. During the lesson, observers attended to how students explained the material and also collected students' written explanations for later analysis (Cerbin, Cary, Dixon, & Wilson, 2006).

A common misconception about lesson study is that the study is intended to determine the lesson's effectiveness (e.g., whether students learn what they are supposed to learn and achieve the lesson's goals). Of course this is an important question, and one that most teachers want to answer. However, the primary focus of lesson study is not *what* students learn, but rather *how* students learn from the lesson. To investigate *how* students learn, teams focus on student thinking during the lesson, how they make sense of the material, what kinds of difficulties they have, how they answer questions, how their thinking changes during the lesson and so forth. This is different from efforts to determine a lesson's effectiveness that might use pre- and post-lesson evaluation of student learning or comparisons between the performance of students in the research lesson with a suitable comparison group (e.g., students taught the material in a different lesson).

To assist in data collection teams prepare observation guidelines that describe the lesson and indicate what kinds of data to collect. Data typically consist of detailed observations of student activity and written work during the lesson. (Teams interested in the question of effectiveness may collect additional data for that purpose such as pre- and post-lesson evaluations of student performance.)

Teaching and Observing the Research Lesson

The lesson is taught at the scheduled time during the term. One member of the team teaches the lesson and other members attend the class to collect data. Teams may also invite guest observers (e.g., departmental or professional colleagues, administrators, graduate students).

Instead of observing how the teacher teaches, as in typical classroom observations, observers focus on how students respond to the lesson, which was designed by the team rather than by the person who happens to be teaching. The collective ownership of the lesson helps pave the way for public knowledge building.

Observers gather rich evidence related to the learning goal during the lesson, capturing the complexity of actual teaching and learning. Depending upon the team's data collection strategy, observers may record detailed field notes, focus on specific types of student activity, or use checklists or rubrics to categorize or monitor student engagement, performance, thinking, and/or behavior. They may observe the entire class or focus on specific students during the lesson. The lesson is videotaped, sometimes from multiple vantage points, for future reference and review.

Lesson studies are approved by campus Institutional Review Boards. Students are briefed on the purpose and nature of the study, and sign informed consent. Instructors explain the reason for observation and how the data will be used to improve the lesson.

Analyzing the Evidence

Soon after the lesson is taught the team holds a debriefing meeting to examine evidence related to the learning goals and to reflect on the experience. Participants include the lesson study team members and guest observers. Teams may adopt ground rules to guide discussion (e.g., the lesson instructor talks first followed by team members, and guest observers) but there is no standardized process for data analysis and reflection. Participants share their observations and examine additional evidence from the lesson, such as student written work, searching for patterns that may reveal important insights into teaching practice and student learning.

Repeating the Process

Following the debriefing session, the lesson study team holds one or more meetings to organize and analyze the data further and discuss possible changes to the lesson and/or the study. Based on the evidence, the team revises its approach. In addition to revising the lesson and the method for collecting data, some teams reconsider their learning goals in light of the findings.

During the second iteration, the lesson study team teaches the revised lesson in another class, usually the following term. Again, the team members observe the lesson, collect data, and hold a follow up debriefing session to analyze and revise the lesson. Most college teachers do not have special training in either instructional design or formal educational research. This iterative design process offers teachers a chance to explore ideas and different approaches, making evidence-based improvements as they go.

Documenting the Lesson Study

Teams document their lesson studies so that other instructors can review and learn from their work. A lesson is a recognizable unit of instruction and a lesson plan is a familiar genre, increasing the likelihood that others who teach similar courses can actually use the lesson materials. The field-tested lesson plan is accompanied with an explanation of the context and the results of the investigation.

The final lesson study contains two closely related parts: the lesson and the study. The lesson documentation includes: (a) the learning goals, (b) the lesson plan, (c) a rationale for the lesson topic and lesson design, and (d) supplementary materials such as student handouts, video clips of the lesson and instructors' notes. The study documentation includes: (a) the student learning goals, challenges, problems, and issues investigated; (b) a description of the types of data collected and the method used to study the lesson; (c) an explanation of data analysis and summary of findings; (d) conclusions about the lesson, especially with respect to student learning goals but also about the methods used to study it; and (e) supplementary material such as data collection instruments, checklists, rubrics and observation guidelines so that interested instructors could replicate the study.

In short, the lesson is described in enough detail that fellow teachers could adapt it to their own classrooms; likewise, the study is described in enough detail that other teacher-researchers could replicate or modify it.

To help teachers through the process described above, we ask that each CLSP team:

1. participate in lesson study "start-up" training, consisting of a workshop or self guided tutorial designed to get teams started doing lesson study;
2. conduct a year long lesson study (i.e., carries out two iterations of the lesson study cycle);
3. participate in a mid-year review, summarizing their lesson study after one iteration of the cycle and receiving feedback and suggestions about how to improve their study; and,
4. write a final lesson study that will eventually make a contribution to a knowledge base for other teachers in the same discipline or field.

College Lesson Study in Practice

Teams in the College Lesson Study Project (CLSP) range from 3-9 instructors. Team members are usually from the same discipline but some teams are interdisciplinary (e.g. a team consisting of faculty from the Library and Communications Studies Department is working on a research lesson about information literacy). A common approach is for a group of instructors who all teach the same class to focus on a topic they all teach. However, some teams include members who do not teach the course or topic of the research lesson. This underscores the idea that producing a lesson for use in class is only one benefit of lesson study. Instructors also benefit from careful analysis of learning goals, teaching practices, evaluation of student learning, and observation of student thinking in the classroom. In addition, instructors report that talking about teaching and learning with colleagues is rewarding in and of itself (Cerbin & Kopp, 2004; 2006).

Teams set their own schedules, decide how often and how long to meet, and distribute their work over an entire academic year – typically 15-20 hours during the year. Work is highly collaborative; instructors participate fully in all phases of the cycle. The result is a sense that the research lesson is team product, in the same way that a collaborative research project yields a team product.

There are several reasons why the actual practice of lesson study appeals to instructors. Teachers control the process, and adapt it to their work schedules. It affords an opportunity for teachers to examine collectively teaching and learning issues that matter to them and have direct application to their classrooms. Lesson study is low risk; changing a single lesson is less risky than changing an entire course or adopting a significantly different pedagogical approach.

Lesson Study as a Teaching Improvement Process

Teaching is a multidimensional process. Shulman (1998) proposes:

> Too often teaching is identified only as the active interactions between teacher and students in a classroom setting (or even a tutorial session). I would argue that teaching, like other forms of scholarship, is an extended process that unfolds over time. It embodies at least five elements: *vision, design, interactions, outcomes, and analysis* (p.5).

Perhaps because it embodies all five of these elements, lesson study is highly valued by Japanese teachers and an effective way to promote long term teaching improvement. In a survey of 125 active lesson study practitioners in Japan, 98% reported that lesson study helped them improve their teaching and 91% believe that lesson study is the most effective form of professional development (Murata & Takahashi, 2002). Moreover, researchers argue that lesson study has helped improve the quality of instruction in mathematics and science at the elementary level in Japan, resulting in higher student achievement in these areas over the past two decades (Stigler & Hiebert, 1999; Lewis, 1998).

Murata and Takahashi (2002) note that lesson study incorporates features associated with effective professional development such as,

> using concrete practical materials to focus on meaningful problems, taking explicit account of the contexts of teaching and the experience of teachers, and providing onsite support within a collegial network. It also avoids many features noted as shortcomings of typical professional development, e.g., that is short term, fragmented, and externally administered (p. 1880).

In our view, lesson study is an exceptionally fertile context for college teaching improvement. It scaffolds reflective practice in which instructors carefully examine goals for student learning and development, design goal-oriented learning experiences, conduct a lesson, observe and analyze student learning and revise the lesson design to improve learning. Teachers examine and discuss a wide range of key issues including,

1. what are the most important goals for learning and development in the course and academic program,
2. what are the differences among students that matter most in their classroom performance,

3. how do specific strategies support changes in student thinking,
4. what knowledge do students have that serves as a foundation for the lesson,
5. what misconceptions do students have that hinder their learning, and
6. what aspects of their written work or actual classroom interactions indicate how they interpret and make sense of the topic.

Lesson study encompasses the full complexity of teaching and learning in the context of a single class lesson. Essentially, teachers have opportunities to question, explore and reflect on every phase of the teaching and learning process.

Lewis (2005) suggests that lesson study creates multiple "pathways for learning" that lead to instructional improvement. According to her model, teachers' thinking and practice may improve in multiple ways as a result of,

1. increased knowledge of subject matter,
2. increased knowledge of instruction,
3. increased ability to observe students,
4. stronger collegial networks,
5. stronger connection of daily practice to long-term goals,
6. stronger motivation and sense of efficacy, and
7. improved quality of available lesson plans (p.115)

Lesson study offers a different way of thinking about teaching and learning. For many college teachers entering into a lesson study means approaching teaching with different assumptions and expectations. This is most evident in the way that lesson study is oriented toward student learning. An underlying principle of lesson study is that teachers need to know how their students learn in order to teach them effectively. Thus, how students learn is central at every step in the lesson study process. In the lesson planning phase teachers consider how their students are likely to interpret, construe and respond to the parts of the lesson. Observers attend to learning and thinking as the lesson unfolds. Data collection focuses on student learning and thinking throughout the lesson. After the lesson the group analyzes the evidence of student learning as a basis for making changes to the lesson.

We propose that certain features of this learning-oriented inquiry are likely to mediate changes in college teachers' pedagogical thinking and practices. The patterns below have emerged in our work, but further research is needed to verify that these are, in fact, what teachers learn about teaching through lesson study.

Collaborative Involvement Fosters Mutual Understanding of Goals, Teaching Practices and Student Learning

Researchers suggest that the educational community in the United States "lacks a shared language for describing teaching" (Stigler & Hiebert, 1999). When teachers ascribe different meanings to the same basic concepts, they do not communicate effectively about the nature of teaching and how to promote better learning. We observe instructors in the same field who mean very different things for fundamental terms such as learning, assessment, and understanding. Variations in meaning make it difficult to discuss teaching coherently and are a formidable impediment to teaching improvement. Teachers who conduct lesson study can develop a shared language for teaching and learning. Common meanings arise because instructors observe and discuss the same problem in the same context over an extended period of time. Members of a lesson study group are like members of any research team that develop increasingly precise ways to describe what they study.

Focus on Goals for Learning, Thinking and Development

Teachers carefully consider what they want students to know and what kinds of abilities and personal qualities they should develop. Some instructors report that they rarely if ever start with learning goals as the basis for their teaching, and that the experience of lesson study makes them more goal-aware in their other classes (Cerbin & Kopp, 2004, 2006).

Design Instruction with Learning Goals in Mind

Learning goals are the focal point of lesson design. As instructors plan the lesson they speculate about how specific instructional and learning activities will help students achieve the goals. This type of backward design is markedly different from typical class preparation. Even teachers who try to keep goals in mind when they teach may not actually design instructional experiences deliberately intended to foster the goals. In lesson study teachers ask the question, "Why do we think that will work?" We believe this can prompt theory building as teachers examine their assumptions and beliefs about teaching and learning.

Make Student Thinking Visible

Teams try to design activities that will externalize student thinking, making it open to observation and analysis. We suspect that making student thinking

visible affects the types of exercises and activities teachers incorporate in the lesson. It is challenging to design ways to make student thinking visible that are also pedagogically purposeful. For example, instructors could access student thinking several times during a class period merely by pausing and asking them to write what they are thinking. However, this is unlikely to facilitate their learning. In contrast an exercise in which students analyze and explain material in small groups creates opportunities for students to articulate their ideas, compare them to other points of view and receive feedback from the instructor and fellow students. Not only does the exercise externalize thought but it helps foster the lesson's goals.

Observe Student Learning and Thinking in the Classroom

On average Japanese teachers observe 10 research lessons per school year. They appear to be keenly aware of how their students think about subject matter, what concepts might be difficult and what kinds of misconceptions students may have about the topic (Fernandez & Yoshida, 2004; Lewis, 2002; Lewis, Perry, & Hurd, 2004; Lewis, Perry, & Murata, 2004; Yoshida, 1999;). Surely their deep understanding of student learning develops from these extended opportunities to observe learning and thinking in the classroom.

College instructors rarely observe lessons and have little opportunity to learn about their students' learning. Lesson study is one of the first times instructors systematically observe and analyze students' classroom activity.

Evidence-based Improvement

Lesson study is an evidence-based approach to teaching improvement. In the best cases, teachers get important insights into how their students learn from the lesson, where they get stuck, what changes take place, and how they interpret ideas. We believe that observations of classroom thinking can provide the kind of data that is directly applicable to making improvements in the lesson. These data are different from more general information about student performance on tests, quizzes and papers.

Lesson Study as a Knowledge Building Process

Lesson study is a form of practitioner research in which teachers investigate issues of teaching and learning in their own classrooms (Zeichner & Noffke, 2001). It can be a method for generating not only practitioner knowledge but also professional knowledge if it becomes a way to carry out the scholarship of teaching and learning (Hutchings, 2000). Lesson study is scholarly inquiry to the extent that instructors: (a) systematically investigate teaching and student learning, (b) collect and analyze evidence of student learning, (c) connect findings to relevant scholarship, and (d) put forward their work in a form that can be peer reviewed and built upon by others.

In Japan, lesson study is a system for creating professional knowledge about teaching (Hiebert, Gallimore & Stigler, 2002). Teachers produce several thousand research lessons and articles each year. These are disseminated widely throughout the country and are an important source of knowledge about teaching. We see similar potential at the college level. Lesson study could be a training ground for college teachers to learn how to do scholarly inquiry into teaching and learning, and the actual studies could be the basis for specific knowledge about teaching core concepts and ideas in ones' discipline.

Learning to do Scholarly Inquiry into Student Learning

Most college instructors are not trained to investigate their own teaching and student learning. The lesson study process structures systematic inquiry in which instructors: (a) formulate a learning goal, (b) design a lesson that addresses the goal, (c) collect systematic data about student learning and thinking, and (d) analyze the data and draw conclusions about student performance. Lesson study is a framework in which instructors can learn to investigate teaching and learning in the classroom. Moreover, the group can pool its expertise which reduces the demands on any individual instructor to be a classroom research expert.

Building Pedagogical Knowledge Based on Lesson Studies

Many disciplines have periodicals that publish work on teaching in the field. We suggest that lesson studies could be valuable additions to these publications. In particular, lesson studies could generate specific and usable pedagogical content knowledge. Shulman (1987) defines pedagogical content knowledge, as an understanding of "the most useful forms of representation of [topics], the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, the ways of representing and formulating the subject that make it comprehensible to others" (p. 9).

We noted that the *lesson* is a meaningful and manageable level of analysis for investigating teaching and learning. Day to day instruction is organized around individual class periods. Even when the work in one period carries over to the next, the individual lesson is a distinct unit with specific goals, purposeful learning

activities, expected learning outcomes, and a specific time frame. Moreover, studying a lesson is a manageable task in the context of one's other professional responsibilities. Teams can schedule meetings as needed and the actual data collection takes place in one class period.

In addition the lesson may also be a highly transportable entity. If research lessons were readily available we suspect that teachers would be able to adopt and adapt them to their own classes and circumstances. Toward this end, we have developed an online format for documenting and sharing college lesson studies (http://www.cfkeep.org/html/gallery.php?id=75749626546865) Our aim is to represent the work in ways that make it accessible for peer review and for use by interested instructors and classroom researchers as well as others (Cerbin, Cary, Dixon, & Wilson, 2006; Cerbin & Kopp, 2006).

College lesson study is an opportunity to work with colleagues on substantive issues and problems related to teaching and learning. Although instructors design only a single lesson, what they learn from the experience applies to other classes and contexts. The aim of lesson study is not merely to produce a well-crafted lesson, but also to build capacity, expertise, and knowledge to improve teaching and learning in a broad spectrum of disciplines and fields. Hiebert, Gallimore & Stigler (2002) observe that "as much as they might benefit from the knowledge of their colleagues, most teachers have not accessed what others know and must start over, creating this knowledge anew (p.11)."

We hope teachers will one day have at their fingertips a collection of field-tested lessons related to the subjects they teach; lessons that can be adapted for classroom use and that can serve as springboards for systematic inquiry into teaching and learning. Broad scale teaching improvement is perhaps possible in higher education if teachers work together to build a professional knowledge base—one lesson at a time.

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