

Exploring the Impact of Lesson Study on Developing Effective Statistics Curriculum

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This paper describes the use of Japanese Lesson study as a method of helping teachers create research lessons designed to develop students' statistical thinking. Lesson study is being used this year with two different groups of statistics instructors to discuss important goals for students and to design, teach, observe, evaluate, and revise statistics lessons focused on achieving important learning goals.

What is Lesson Study?

Lesson Study is a process that Japanese teachers have utilized to systematically examine the effectiveness of their teaching for achieving desired learning goals. The process involves teachers working collaboratively to develop a small set of lessons. Working on these lessons involves planning, teaching, observing, critiquing, and revising the lessons in a continuous cycle. This method has been studied and written about extensively and is the focus of many new research projects in mathematics and science education (e.g., Lewis, 2000; Lewis & Tsuchida, 1998; Fernandez 2002; Fernandez, Cannon, & Chokshi, 2003). It is also the subject of current studies and initiatives of the National Research Council (e.g., Bass, Usiskin & Burrill, 2002).

Rather than offer a new technique for teaching students, Lesson Study offers a mechanism for teachers to systematically investigate and improve their teaching. Japanese Lesson Study provides a model for teacher learning and a set of concrete steps that teachers can take, over time, to improve their teaching (Stigler & Hiebert, 1999).

Why use Lesson Study in College Statistics Classes?

Much has been written about the need to change and improve the teaching of statistics at the introductory college level. Some criticisms of the course are that students who complete the course are often unable to think and reason statistically, and view the course content as a set of formulas and procedures that are soon forgotten. Most recommendations for improvement and reform of first courses in statistics focus on using technology, incorporating real data, and using active learning techniques to engage students (see Cobb, 1992; Moore, 1997).

Despite the increasing use of these methods and materials, the only student outcome that seems to be changing is student satisfaction with the course. Although this is a nice

result, it is not sufficient. A new instructional method is needed to help students develop the important outcomes of being able to reason and think statistically. Based on positive results in science and mathematics class, lesson study seems to offer a method for designing research based lessons to help achieve these important learning goals.

Applying Lesson Study to College Statistics Courses

This project described in this paper was designed to explore the use of lesson study as a way to improve the teaching of statistics by creating lessons that enable students to develop statistical thinking. Statistical thinking is often cited as the most important goal for students enrolled in statistics classes (see Snee, 1990; Wild and Pfannkuch, 1999; Garfield et al, 2002). Statistical thinking involves an understanding of why and how statistical investigations are conducted and the “big ideas” that underlie statistical investigations. Statistical thinking involves an understanding of the nature of sampling, how we make inferences from samples to populations, and why designed experiments are needed in order to establish causation. It includes an understanding of how models are used to simulate random phenomena, how data are produced to estimate probabilities, and recognition of how, when, and why existing inferential tools can be used to aid an investigative process. Statistical thinking also includes being able to understand and utilize the context of a problem in forming investigations and drawing conclusions, and recognizing and understanding the entire process (from question posing to data collection to choosing analyses to testing assumptions, etc.). Finally, statistical thinkers are able to critique and evaluate results of a problem solved or a statistical study (Chance, 2002).

Methodology

The project began fall semester 2003 with a group of participating teachers who happened to be graduate students teaching introductory statistics courses in the Department of Educational Psychology at the University of Minnesota..

Unlike most lesson study projects, this group began by creating an assessment of statistical thinking to give all students in these instructors' courses. This test measured topics that are typically introduced in the first few weeks of the course (e.g, distributions, measures of center, and spread). The test was given to students in the fourth week of the semester after they had studied these topics. The Lesson study group discussed the assessment results and decided to design a lesson to promote informal and formal understandings of variability, recognizing that this is the most important component of statistical thinking.

The lesson was discussed and collaboratively developed over several weeks, and was taught later in the semester. All planning sessions as well as the teaching lesson were videotaped and transcribed so that the process may be studied and shared. At the end of the semester all students will take the test again, including those in the class that had the research lesson taught as well as those in classes that did not, so that changes in statistical thinking may be examined and compared.

This spring a similar Lesson Study group will be assembled consisting of instructors of statistics at various colleges in the area. This group will review the lesson developed by the fall lesson study group as well as view some video clips of the discussions, teaching, and evaluation of the lesson. This group will then develop a lesson and repeat the process. Again, all sessions will be videotaped and student assessment data will be gathered and analyzed.

This paper will report on the experiences of both Lesson Study groups and will address the following questions:

- *Does Japanese Lesson Study help statistics teachers design effective lessons that improve the statistics curriculum and promote students' statistical thinking?*
- *What is the impact of Japanese Lesson Study on student learning?*
- *What is the impact of Japanese Lesson Study on the way teachers view and teach the curriculum?*
- *What is needed for Lesson Study to work in the two different environments studied (e.g., Graduate students teaching in one department, and faculty members teaching at different colleges)?*

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