Fusing Japanese Ways of Mathematical Thinking into US Mathematics Lessons through Lesson Study

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Teaching is a cultural activity in content and pedagogy (Stigler & Hiebert, 1999). Naturally, we expect teachers’ pedagogical content knowledge (PCK) is also influenced by culture. However, because of the implicit nature of PCK, it would be more difficult to identify how teachers’ PCK is affected by the cultural aspect in their teaching practices. If teachers’ PCK is restrained by cultural factors in a certain way, input from a different culture might be helpful for teachers to recognize alternative ways of teaching the concepts.

This study examines how the effect of culture on teachers’ PCK in mathematics was revealed in the process of Lesson Study. During the 2011-2012 academic year, a total of 60 teachers in 13 teams at 8 different schools participated in a Lesson Study Project conducted in the U.S. Midwest. Thirteen (13) research lessons were designed and implemented by teams during the first half of the period. Four of the teams used the English version of Japanese elementary mathematics textbooks (Tokyo Shoseki, 2006) as a reference. During the sessions, two facilitators, one is a Japanese and the other is an American, from a higher education institution helped teachers interpret the meaning of Japanese ways of thinking about mathematical concepts and fit it into teachers’ more familiar teaching context in U.S. Teachers’ discourse in the planning phase is analyzed qualitatively to examine how they perceived and reacted to different ways of teaching mathematical concepts.

The discussion process of a Grade K-1 team is presented as a case study. Teachers noticed that many first graders were unable to decompose and regroup numbers in addition or subtraction problems. Through the textbook study, teachers found that the Japanese textbook emphasizes the idea of making tens, while the US textbook (Go Math!, 2011) does not place a particular emphasis on it. It became clear to the teachers that student difficulties with regrouping may be related to the fact that they have not mastered how to make tens. The teachers decided to take “making tens” as their topic for the research lesson. They also decided to use a "Ten Case" which is a single row of ten boxes as a frame for children to work with instead of the typically used “Tens Frame” which has two rows of five boxes. In spite of this effort, however, both the initial and revised lessons did not include teachers’ explicit explanation of the meaning of making tens. Little student learning was observed in the lessons. It seemed that the teachers did not fully grasp the importance of making tens yet.

The research findings indicate that the cultural influence on teachers’ PCK is so strong that one or two discussion sessions would not impact teachers’ understanding of the mathematical concepts. Nevertheless, it was an important step. First grade teachers continued to use the ten case in the subsequent lessons. As reflecting on the lesson study cycle, one of the teachers later mentioned that “I think it has been very beneficial to focus on this skill of making tens in the first grade. These students will have a greater foundation for number sense.” It seems that implementation of multiple lessons on the strategy as their own provided teachers with an opportunity to internalize the mathematical concept. A cultural change happens in small increments over time (Stigler & Hiebert, 1999). It is also worth mentioning that the international aspect of the project personnel is contributing to bringing a change in teachers’ PCK through human interaction. A cultural change may not happen only through implementation of material.