

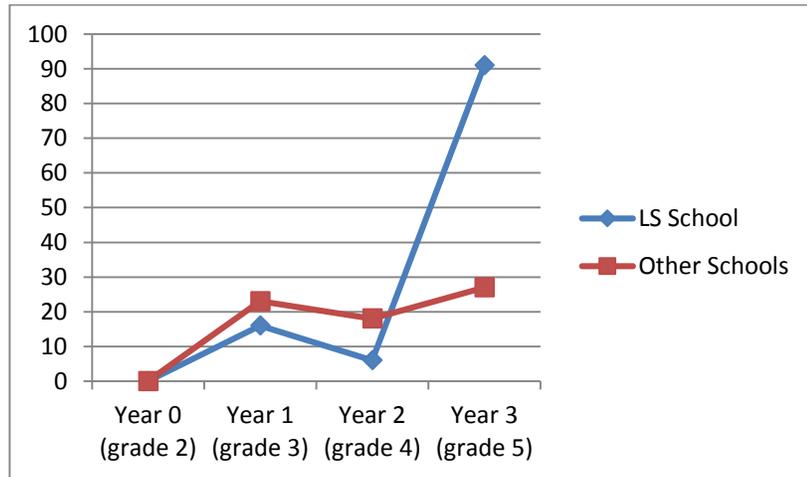
Understanding and Implementing Japanese Lesson Study

Dohyoung Ryang

We looked for a new way of increasing future mathematics teachers' instructional ability in the classroom. We focused on lesson study (or study lesson, or sometimes lesson research) developed in Japan, and currently are spreading to many countries such as China, Hong Kong, Taiwan, and Korea. These countries are top class in the students' mathematical performances. It is our belief that the lesson study will help to increase our UNCG student's efficacy and ability to teach mathematics.

There has been efforts to implement Japanese lesson study into the United States. For example, a school in California was selected from lower-average schools, and LS was implemented to the 2nd grade students in mathematics for three years. For the first two years, LS school mean is lower than the other district school mean; in the third year, LS school mean dramatically changed to a high level of the test, while the other district school mean was not much changed (see Table 1)

Table 1
Mean three-year math gains of grade 2 students on the California STAT test



Perry and Lewis (2010)

We wanted to make an opportunity for our UNCG students to listen and learn Japanese lesson study so hopefully, it will motivate them to teach mathematics effectively and continuously develop professionalism as mathematics teachers.

Participants

We organized sort of a reading group which conducted activities for understanding Japanese lesson study. The participants were UNCG faculty from Mathematics Department and Teacher Education Department and students seeking mathematics teaching certificate. The student participants commonly took two mathematics content courses of MAT 303 (Topics in Mathematics) and MAT 304 (Introduction to Foundation of Geometry) in a row. Also, they are members of a student organization Alpha which is affiliated to North Carolina Council of Teachers of Mathematics. The list of the participants follows:

Faculty

Dohyoung Ryang	Assistant Professor of Mathematics Department
Carol Seaman	Associate Professor of Mathematics Department
Stacy Howell	Academic Specialist of Mathematics Department
Holt Wilson	Assistant Professor of Teacher Education

Graduate Students

Phil Gerringer, Frank James

Undergraduate Students

Mary Carter, Giffany Golphin, Laken Hall, Jennifer Lovato, Leanna Peedin
Abhishek Pratap, Rouleau Charles

Activities:

During the academic year of 2013-2014, there were 4 meetings in which participants addressed shared, and discussed their findings. The meetings were schedules for an hour from 5p to 6p on Wednesdays. The participants were assigned to visit some webpages and to read articles introducing Japanese lesson study before the first three meetings. In order to select articles effectively, we first selected original Japanese experts of lesson study. We contacted Dr. Tadanobu Watanabe in Kennesaw State University, GA and Dr. Akihiko Takahashi in DePaul University, IL and some articles were suggested for us to read. The assignment were followed:

Meeting 1 (September 25, 2013)

Webpage: Teachers' College at www.tc.edu/lessonstudy

Article:

- Watanabe, T. (2002). Learning from Japanese Lesson Study. *Educational Leadership*, 59, 36-39.
- Watanabe, T. (2006). Teaching and learning of fractions: A Japanese perspective. *Teaching Children Mathematics*, 12, 368 - 374.

Meeting 2 (November 13, 2013)

Webpages: Global Education Resources at www.globaledresources.com and www.lessonstudy.com

Articles

- Watanabe, T., Takahashi, A., & Yoshida, M. (2008). Kyozaikenkyu: A critical step for conducting effective lesson study and beyond. In F. Arbaugh & P. M. Taylor (Eds.), *Inquiry into Mathematics Teacher Education*. Association of Mathematics Teacher Educators (AMTE) Monograph Series, Volume 5, 131 - 142.
- Watanabe, T., Takahashi, A. & Yoshida, M. (2010). Supporting focused and cohesive curricula through visual representations: An example from Japanese textbooks. In B. Reys & R. Reys (Eds.), *Mathematics Curriculum: Issues, Trends, and Future Directions NCTM Seventy-second Yearbook*, 131 - 144.

Meeting 3

Date: February 5, 2014

Webpages: Lesson Study Alliance at www.lsalliance.org and Chicago Lesson Study Group at www.lessonstudygroup.net

Articles:

- Takahashi, A. (2014). Supporting the Effective Implementation of a New Mathematics Curriculum: A case study of school-based lesson study at a Japanese public elementary school. In Li, Y. & Lappan, G. (Eds), *Mathematics Curriculum in School Education*, New York: Springer.
- Takahashi, A. (2011). The Japanese approach to developing expertise in using the textbook to teach mathematics rather than teaching the textbook. In Li, Y. & Kaiser, G. (Eds), *Expertise in Mathematics Instruction: An international perspective*, New York: Springer.

In each meeting, we discussed the webpage recourses and the articles as assigned above. The lesson study cites reported its usefulness as boosting teachers' professionalism. There were changes in collaboration including asking more questions of colleagues, more use of print resources to inform discussions with colleagues, increased discussion of student thinking, and increase interest in observing other teacher and discussing observations. From the articles, we learned the basic structure or cycle of a lesson study and its characteristics. Many aspects of implementing lesson study was discussed among the participants, and those were briefly reported in the conclusion at the end of this document.

In addition the meetings, there were two 2-day sessions in which early mentioned Japanese lesson study experts were invited to the UNCG and gave talks about lesson study and its implementation in a mathematics classroom. The sessions were open to everybody who were interested in Japanese lesson study. Even though we did not check all attendants, many outside members, even faculty from other institutions, for example, Dr. Hyunju Oh from Bennett College, were attended

Session 1

Dates: October 16-17, 2013

Invited Speaker: Dr. Tadanobu Watanabe, Kennesaw State University, GA

Talk #1 "Mathematics education in Japan"

Talk #2 "Fraction teaching and learning in Japan"

The next two figures are the first pages of Dr. Watanabe's two articles which were mentioned in his Talk #1 and #2. One question from the speaker after Talk #1 is memorable: When you as a teacher write the area formula of a triangle, which of the following is preferred, $A = \frac{1}{2}ab$ or $A = \frac{ab}{2}$? Do you see the difference between the two expressions? Which do you think is better for students? It was suggested as a typical discussion among teachers in a lesson study project. After a short discussing in a small group, we opined that $A = \frac{ab}{2}$ will be better as a form of triangle area formula because the triangle area is introduced to the students after learning the area of rectangle ($A = ab$). We all felt that this sort of discussion on a concept taught in the mathematics classroom would be very helpful to the teachers.

Learning from Japanese Lesson Study

In Japan, lesson study helps foster professional development and learning communities.

Tad Watanabe

From the classroom and hallway, 30 teachers are observing Mr. Yokota's 6th grade class of 40 students. As the observers take notes, Mr. Yokota teaches a lesson on division with fractions. He writes four problems on the board— $3/5 \div 1/5$, $2/5 \div 3/4$, $1 \div 2/5$, $2 \div 1/4$ —and asks the students to find the answers using what they know about division and fractions. After the students work with the problems for a few minutes, Mr. Yokota starts a class discussion of the $2 \div 1/4$ example.

After 45 minutes, a professor from the university—an invited speaker—offers his comments on the lesson and gives a talk on the elementary school mathematics curriculum.

Inquiry Groups

Research lessons such as these, which take place within traditional Japanese lesson studies, have inspired the interest of U.S. educators. Stigler and Hiebert (1999), for example, have suggested that Japanese lesson study, or *jugyuu kenkyuu*, produces gradual but continual improvement in teaching. In *Before It's Too Late*, the U.S. National Commission on Mathematics and Science Teaching for the 21st Century (U.S. Department of Education, 2000) recommended the creation of inquiry groups modeled after Japanese lesson study.

A wide range of activities characterizes this kind of professional development, offering teachers opportunities to examine all aspects of their teaching—curriculum, lesson plans, instructional materials, and content. The research lesson is often the main component of lesson study and involves observations and critical analysis by many teachers (Lewis, 2000; Lewis & Tsuchida, 1998). An individual teacher or group of teachers plans a research lesson by studying the lesson's topic, ascertaining where the topic fits into the curriculum, evaluating the strengths and weaknesses of typical approaches, and trying new ways to address weaknesses in the traditional approaches.

Where Do They Take Place?

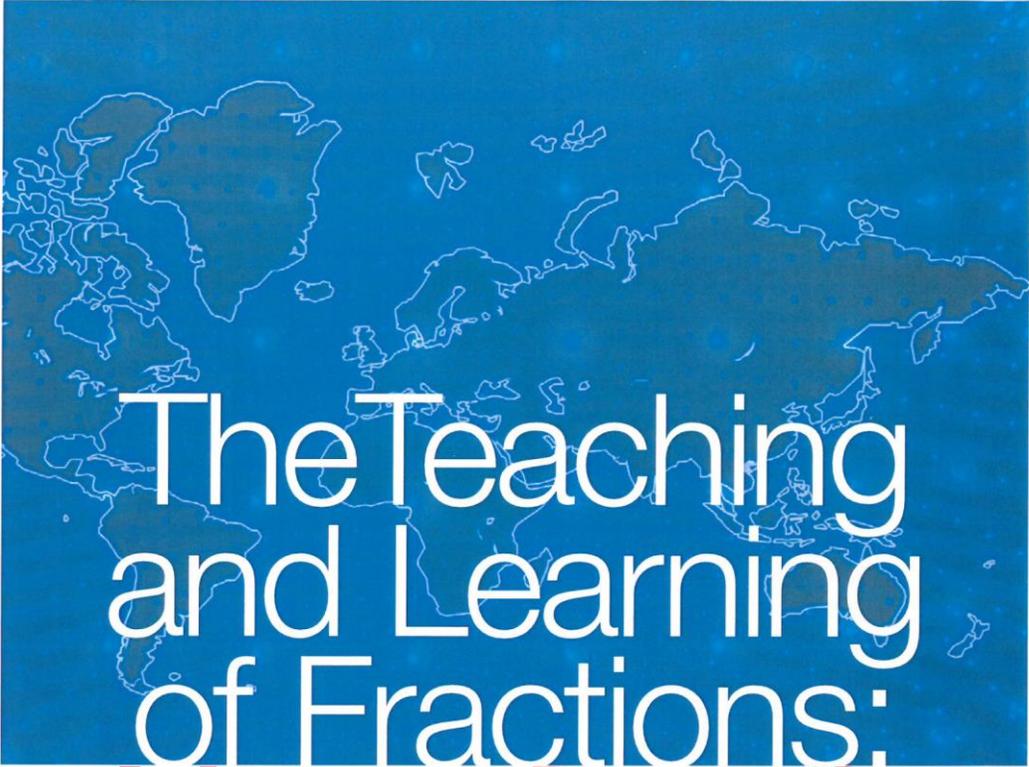
The most common type of lesson study group is school-based (Stigler & Hiebert, 1999), with teachers from a single school collaborating on lesson plans. Lesson study groups at schools affiliated

Lesson study is a shared professional culture, not just a professional development activity.

After the lesson, the observing teachers take the departing students' seats. Mr. Yokota describes how he prepared the lesson and then opens the floor for discussion and comments. One teacher asks why he did not start with an easier problem, $3/5 \div 1/5$. Mr. Yokota responds that he thought about starting with this example, but he wanted his students to explore how division is connected to multiplication, and he believed that $3/5 \div 1/5$ was too simple to promote a variety of solution methods. The discussion continues for about 90 minutes.

The 15 observers in Mr. Takahashi's 5th grade class include the principal and vice principal. One of the teachers videotapes the lesson. After the class, the principal offers brief comments, and then the leader of the group of 5th and 6th grade teachers who planned the lesson explains briefly how they developed it. The group then follows the school's four-stage lesson development model to discuss the specifics of the

Fig. 1 The first page of Watanabe's article, Learning from Japanese Lesson Study



The Teaching and Learning of Fractions: A Japanese Perspective

The teacher posts a picture of two tree stumps on the blackboard (see fig. 1) and says, "I saw these two tree stumps at a park near my house yesterday. I was curious how big each stump was, so I wrapped a paper tape around each one so that I could measure them." Posting the first paper strip on the board (see fig. 2), she asks, "How much of a meter is the extra part?"

"We can use a decimal number!" a student says. The student goes up to the board to point out the equally spaced marks inside the one-meter segment of the paper strips. The teacher cuts off the extra piece.

"Can someone measure this length using his idea?" the teacher says.

Another student goes up to the board and places the extra piece underneath the one-meter segment. "It's 0.2 meters long," she says (see fig. 3).

The teacher cuts off the extra piece from the second paper strip and asks, "Can someone else measure this piece?"

A third student goes up to the board and places the extra piece underneath the one-meter segment. "Oh no, it doesn't match up," he says (see fig. 4).

"Move it a bit to your left," a student suggests. Another says, "No, you have to have the left end lined up."

"Hmm," the teacher says. "Maybe we can't use a decimal number to measure the length of this extra piece. Let's explore how we can express this length using a different idea."

By Tad Watanabe

Tad Watanabe, tw17@psu.edu, teaches graduate and undergraduate mathematics education courses at the Pennsylvania State University. He is interested in all aspects of teaching and learning fractions.

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Fig. 2 The first page of Watanabe's article on fraction teaching and learning

Session 2

Dates: January 22, 2014

Invited Speaker: Dr. Akihiko Takahashi, DePaul University, IL

Talk #1:

Lesson Study: a fundamental driver for mathematics teacher development

Abstract: How do Japanese teachers develop their knowledge and expertise for teaching mathematics effectively? Their journey begins when they are in teacher preparation program in a university. Lesson Study has been a fundamental driver of improvement in teaching and learning in Japan. Based on the results from some of the latest research to discuss how various forms of Lesson Study support teachers to grow continuously to become effective teacher of mathematics.

Talk #2:

Supporting the Effective Implementation of a New Mathematics Curriculum: A case study of school-based lesson study at a Japanese public elementary school

Abstract: The Japanese national standards, known as the Course of Study (CoS), is revised about every 10 years. After a revised CoS is released, Japanese elementary schools usually use lesson study with the entire faculty to seek an effective implementation of the new CoS. This talk, based on a case study, documents how Japanese teachers and administrators in a public school work collaboratively to implement the new curriculum through lesson study, and identifies elements that seem important for connecting the curriculum, teachers, and teaching. The results of the study suggest that Japanese educators' use of school-based lesson study is an effective way to implement a new curriculum. Unlike many lesson study projects outside Japan, which are often conducted by a few volunteers within a school and supported externally, school-based lesson study in Japan is a highly structured, collaborative effort of school administrators, teacher leaders, and all the teachers at the school, with additional support from the local district.

Conclusion

The last meeting, *Meeting 4*, was on March 4, 2014. In the meeting, we discussed our activities searching the webpages, reading the articles, experts' talks, and wrapped up the activities. Participants were compared Japanese lesson study to American lesson plan. We found that the most unique characteristic of Japanese lesson study looks includes lesson plan in it as a part completing a lesson study as a research. However, the lesson plan in a Japanese lesson plan is much more rich and

two-way communication and so looks like a play scenario. And, lesson study is not an individual work but a collaborating on a target lesson as well as kind of a whole unit plan and concept mapping. But, we found a cultural aspect as an underpinning principle that makes lesson study really working that teachers participating in the same lesson study group talks a lot, plays a lot, and are sharing almost everything. That means they first becomes close friends, and then they do work lesson study together. Participants opined that it might be a barrier blocking the flow of implementing of lesson study in a classroom of the United States because American culture surrounding a school and teachers are unfamiliar in sharing many things which is not related to work stuffs. Another concern discussed in the final meeting is that even though such effort (becoming friends first) would be made, time would be a big factor to power to being successful in conducting a lesson study project.

The participants agreed that the lesson study is a potential tool through which teacher can acquire better idea of teaching mathematics if it is innovated smartly in a school. Preservice teachers showed likeliness to attempt of doing lesson study if an opportunity would be given in the future.