

Title of the symposium: Lesson Study and problem solving approach: a comparison of Japanese, Australian and, US contexts

Subtheme: pedagogy

Strand: Lesson Study in different cultural, subject, and learning contexts

Keywords: Japanese Lesson Study, teaching approach, problem solving

Abstract of the symposium

Japanese mathematics teaching, particularly in primary schools, is influenced by the practice of Lesson Study. This practice is developed within a problem-solving teaching approach that promotes mathematical thinking, creativity of students and, students' interests in mathematics.

This symposium presents the specificities of the Japanese mathematics teaching using a problem-solving approach. We focus on the teachers' practices promoted in this context and interrogate some adaptations of Japanese Lesson Study (JLS) and a problem-solving approach in other countries: Australia and the US. Lesson Study in Australia and in the US use Japanese textbooks or resources, translated in English, with a problem-solving approach. The following questions will be discussed:

How does JLS with teaching approach by problem solving transfer? What are the promoted practices in these adaptations of JLS?

The methodology used is a qualitative study using a case study of Lesson Study implementations in the contexts of Japan, Australia and, the US.

Summary of the symposium

This symposium clusters three researches: the first one is about the Japanese Lesson Study with a point of view on promoted practices in Japanese context presented by Valérie Batteau, the two other researches focus on adaptations of Japanese Lesson Study with Japanese textbooks or resources in US context presented by Tom McDougal and in Australian context presented by Wanty Widjaja. The discussant of this symposium, Stéphane Clivaz, is also interested in the comparison of teacher's practices developed in Japanese Lesson Study and Lesson Study in Switzerland.

Japanese mathematics teaching in primary school is influenced by the practice of Lesson Study. This practice of Lesson Study in mathematics is developed with a problem-solving approach and the importance to mathematical thinking (Baba, Ueda, Ninomiya & Hino, 2018; Batteau & Miyakawa, submitted ; Fujii, 2018). This joint development influences mathematics textbook, Course of Study and, teachers' practices. Some Japanese researchers claim that problem solving approach is a consequence of Japanese Lesson Study (Isoda, 2012; Isoda & Nakamura, 2010; Isoda, Stephens, Ohara & Miyakawa, 2007) and one can't succeed without the other (Fujii, 2018). This symposium will discuss the teachers' practices promoted by the couple Lesson Study and problem-solving approach in the context of Japan and the impacts of the couple Lesson Study and Japanese textbooks in US and Australian contexts.

The research in the US context highlights that the use of Japanese textbook and the intensity with which teachers study the Japanese text during *kyozaikenkyuu* has a direct impact on the quality of the lessons, and teachers' growth in understanding of content and pedagogy.

In the Australian context, the presentation focuses on implementing structured problem-solving mathematics lessons through lesson study. This research explores the influence of diversity of teachers' experience and knowledge in cross-school planning team on the level of

discussion and reflection during lesson study process. Cultural differences in mathematics teaching is highlighted: in Japan, the collective dimension is an important value in teaching, with whole-class teaching, contrary, in Australia, the teaching culture emphasizes on small-group. This research shows this cultural difference as a constraint to a high-fidelity implementation of Japanese Lesson Study.

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Individual paper presentation 1 – Batteau - abstract

Japanese mathematic teaching is influenced by specificities: the practice of Lesson Study, a problem-solving approach and, the importance of mathematical thinking. The problem solving approach promotes the mathematical thinking, the creativity of students' activity and, the students' interests.

This study questions how do these specificities translate in ordinary teacher's practices?

The theoretical framework is a double didactical and ergonomical approach in order to analyse teachers' practices related to students' activities (cognitive and mediative components of practices) and in taking into account professional aspects (personal, institutional and, social components). The research question is how do these specificities translate into these five components of teacher's practices?

For this qualitative research, we collected data for two primary school teachers: written data (chalkboard, lesson plan, reports, textbooks, guide) and videos of research lessons of JLS school-based and at prefectural level.

These specificities translate into teacher's practices: the choice of tasks (cognitive component), the structure of lessons (cognitive and mediative components), interactions teacher-students (mediative component), the representation of mathematics teaching (personal component) and, the participation of JLS that implies reflexivity on their own practices (social and institutional components).

Individual paper presentation 1 – Batteau - summary

In Japanese primary schools, mathematics lessons are in a problem solving approach, structured in several phases that serve both to prepare and to teach the lesson. One of these phases is called *neriage*, a whole-class discussion about different solutions of a problem. Teachers consider this phase as the heart of teaching mathematics through problem solving (Takahashi, 2008).

In Japan, it exists different kinds of primary schools: *fuzoku*, school attached to University of Education, research school designated by the Ministry of Education and, ordinary schools. There are also different kinds of lesson study: school-based, at Prefectural level and, at National level. The objectives of lesson study differ according to the kinds of school. In the school *fuzoku*, the main objectives of lesson study (called *kenkyukai*) is to show and to share new teaching approach in class (Shimizu, 2002; Takahashi, 2015) and to try innovative approaches based in research (Lewis, 2016).

This research focus on how a teacher manages *neriage* phase. Teacher practices are analyzed in the double didactical and ergonomical approach (Robert & Hache, 2013). This framework focuses on the relation between teachers' and students' activity in class, but also the constraints on teachers in the context of their profession. Teacher practices are analyzed with two specific components of practices in the class, the organization of the tasks for the students, the *cognitive* component, and teachers' interactions with students, the *mediative* component (Robert & Hache, 2013; Robert & Rogalski, 2005).

The research question is: what are specific tasks (*cognitive* component), interventions, validation of solutions, helps and, explanation of knowledge (*mediative* component) managed by the teacher during *neriage*? We compare teachers' practices during *neriage* in different kinds of school during school-based and prefectural level lesson study in order to identify regularities or specificities in practices.

Data is videos of lessons of three teachers and LS meetings school-based in an ordinary school and at prefectural level in the research school and the school *fuzoku*. We collected also written data (bansho, lesson plan, report of the lesson, textbook and, teacher guide). In order to understand teachers' practices during the *neriage*, we analyse what the teacher anticipated before the lesson (lesson plan, LS meetings, textbook and, teacher guide) and reflected on after the lesson (teacher's report and LS meeting).

In this ongoing research, the first analysis highlighted characteristics of practices of a teacher in a school *fuzoku* during *neriage* promoted in the problem solving approach: to create interest in mathematics and stimulate creative mathematical activity (Takahashi, 2006). For this teacher Kazu, the *mediative* component of practices during *neriage* is characterised by an affect dimension and the importance of various strategies. He compares students' results, asks students to explain their own strategy and, to adopt reflexive attitude about it. Before the lesson, he analyzed the given task in the lesson plan, anticipated the target mathematical

expression and his interventions during the *neriage* are guided toward the target mathematical expression.

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Individual paper presentation 2 - Mcdougal

In Chicago, most of the lesson study work that we have supported has tried to incorporate the Japanese approach of teaching mathematics through problem solving. Because the Japanese mathematics textbooks are designed to support this type of teaching, we have been encouraging teams working in mathematics to consult, during their *kyouzai kenkyuu*, translations of the elementary mathematics textbook series from Tokyo Shoseki. Some teams have designed their lessons to use tasks from the Japanese text; some have consulted the Japanese text but chosen tasks from other texts; some have ignored the text entirely. We have observed that the quality of the lessons, and teachers' growth in understanding of content and pedagogy, is typically directly proportional to the intensity with which they study the Japanese text. And, most schools that have continued with Lesson Study for more than two years have ultimately begun using the Japanese texts as their primary curriculum. We plan to discuss why the Japanese texts may be so valuable for supporting Lesson Study.

Individual paper presentation 3 - Widjaja

Lesson Study, which originated in Japan, is viewed around the world as an effective platform for teacher collaboration and professional learning. However, relatively little is understood about the theoretical underpinning of teachers' collaboration and their professional learning. This presentation draws on data from a small-scale research project, *'Implementing structured*

problem-solving mathematics lessons through lesson study, carried out in three Australian schools. This presentation explores to what extent the diversity of the different teachers' experience and knowledge in a cross-school planning team, including the observers and outside experts, contribute to deep levels of discussion and reflection in the context of Lesson Study. Finding suitable tasks to match the Australian curriculum proved to be a challenge. The teaching culture in Australia emphasizes on small-group rather than whole-class teaching also presented a constraint to a high-fidelity implementation of Japanese Lesson Study. The cross-school structure of the teams was found to be effective in allowing the diversity of the planning team and minimizing the impact of power relations.

Stéphane Clivaz's research

This paper presents the results of the collaboration between two researchers in mathematics education, one from Japan and one from French-speaking part of Switzerland. This manuscript analyses two Grade 4 mathematics lessons conducted in Switzerland and in Japan in a lesson study process by pre-service teachers in the context of a project-based international exchange program. The lesson, initially planned in English, together by nine student-teachers of the two countries, was implemented in French and in Japanese. Both lessons were conducted in rather different ways in Switzerland and in Japan. The underlining theories used for the preparation of the lesson came from the Japanese structured problem solving approach and the French theory of didactical situations (TDS). The data analysis (lessons and meetings filmed and analysed with a qualitative analysis software), relies on the TDS and on the anthropological theory of the didactic TAD. It makes explicit the differences of the two lessons and identifies cultural elements that shape such lessons.

Participants of the symposium: Valérie Batteau (chair), Wanty Widjaja, Tom McDougal, Joshua Lerner

Discussant: Stéphane Clivaz

