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## Examining Teacher Learning in Lesson Study: Mathematical Knowledge for Teaching and Levels of Teacher Activity

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In this contribution, we analyzed and detailed the knowledge incorporated by mathematics teachers in their participation in lesson study. Utilizing an extended model of knowledge for teaching mathematics, combining the cognitive and situated theoretical frameworks of Mathematical Knowledge for Teaching (Ball, Thames, & Phelps, 2008) and Levels of Teacher Activity (Margolinas, Coulange, & Bessot, 2005), we have described the relevant pedagogical and content knowledge included in teachers' collaborative lesson study conversations during the phases of a lesson study cycle (Lewis, Perry, & Murata, 2006).

Data was generated from a case study of grade 3 and 4 in-service teachers' participation in a cycle of lesson study about place value in Switzerland. The eight meetings and the two research lessons were videotaped, transcribed and analyzed with a qualitative analysis software (NVivo).

We examined the knowledge articulated and incorporated by these teachers in their conversations around planning, conducting, observing and reflecting on a research lesson in mathematics. We used our model as a theoretical tool to investigate the content of these meetings in terms of Mathematical Knowledge for Teaching, Levels of Teacher Activity and lesson study phases. Several graphical representations have demonstrated the repartition of each of these elements across a cycle of lesson study. Analysis of the data has evidenced the presence of all the categories of Mathematical Knowledge for Teaching and Levels of Teacher Activity at each phase of the lesson study cycle and a predominance of certain types of Mathematical Knowledge for Teaching and Levels of Teacher Activity at certain phases.

We advocate that such coherence and distribution of the different types of teacher knowledge, made explicit across a cycle, is a key element of teacher learning in lesson study. We hope this contribution will add to the research literature on teacher learning in lesson study, underpinning such learning with theoretical frameworks of teacher knowledge.

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## Analysis of Teachers' View Using an Eye-tracking Camera System -- Improvement of Lessons of a Novice Teacher --

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We have been recording movies and gaze points of teachers in their classes using an eye tracking camera as well as conventional multi-angle movie record. We are studying relations between the class practice abilities of teachers and gaze points at which a teacher is looking during class.

In this study, we recorded the lessons of the two classes of Teacher I, a junior high school science teacher. The lessons of these two classes were the same unit (for the second grade, science, the first field, "static electricity and current"). In the first period, she carried out a lesson in one class. In the second period, we looked back at classes with Teacher I, supervisor of teacher I, and three of us. After that, Teacher I did the same unit lesson in another class.

Teacher I was a faculty member who graduated from undergraduate department of biological system and had little consciousness because of lack of expert knowledge on this unit (electric field, physics). Nonetheless, she had understood the contents of the subject and was able to give lessons to the students even in the first period class. In the third period, the class was improved greatly, reflecting the review and advices in the second period. In other words, the field of view became wider and the way of taking intervals was improved, such that she slowly looked at all the students after questioning, nominated them, and explained. As the class was very successful, the activity of students increased and the class became very active.

We analyze and quantitatively evaluate these on the basis of multi angle images and the numerical gaze data of the eye tracking camera.

## Development of Mathematics Teacher Pedagogical Content Knowledge On Algebra through Lesson Study

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Pedagogical Content Knowledge (PCK) is a kind of special knowledge for teacher that integrating among content knowledge, pedagogy, and student knowledge that can be developed through lesson study. This research is an experiment research that involves collaboration of lecturer and teacher in planning, conducting and do reflection of mathematics learning. Component of PCK in this research are knowledge of subject matter, knowledge of pedagogy, and knowledge of students. This article focuses in describe pck of mathematics teacher in junior high school in overcome student's misconception on algebra at grade 8. PCK of teacher in overcome student misconception in learning mathematics on algebra through teacher knowledge about the causes and how to overcome student's error, difficulties, and misconception. The results show PCK of mathematics teacher in junior high school in overcome student's misconception on algebra before lesson study, teacher only identifies that causes of student's error and misconception on the material are student is lazy to study, while how to overcome student's error and misconception is giving example of question. PCK of mathematics teacher in junior high school in overcome error and misconception of student after through lesson study program shows mathematics teacher in junior high school identifies clearly causes of student's error on algebra. Thus mathematics teacher in junior high school overcomes student's error based on kinds of error and misconception that student experience on algebra.