How is Science Lesson Study Different from Mathematics Lesson Study in the United States? Coaches' Perspectives

Sharon Dotger, *Syracuse University*

Jessica Hehl, *Syracuse University & OCM-BOCES*

Kevin Moquin, *Syracuse University & OCM-BOCES*

CurrentCurrent examples of lesson study, published in English, often highlight lesson study in mathematics contexts (i.e. Lewis, Perry, & Hurd, 2009; Yoshida, 2012). This study expands on the cases of lesson study in the United States by reporting on coaches' learning as they supported four teams of elementary teachers in developing science research lessons for a regional lesson study conference. Science is an important area for two reasons: there are new science standards in the United States and there are few descriptions of large, public lesson study conferences that focus on science outside of those in Japan.

Recent lesson study research in the United States emphasized the role of the knowledgeable other in the process (Takahashi & McDougal, 2016). For this study, we were the knowledgeable others, or coaches, that worked with teachers in preparing research lessons. We drew from a design-based research framework (Cobb, Jackson, & Dunlap, 2016) to articulate design conjectures for the conference. The design-based research framework was linked to lesson study in other literature (Zawajewski et al., 2008) and the nature of the intervention was novel. To generate data, we kept reflective notes on our experiences as coaches. We drew from the lesson study research proposals, introductory slides, and post-lesson discussion guides we helped teachers construct as additional data.

From our retrospective analysis, we noted several ways we used examples from mathematics to inform our lesson study coaching, and we identified rationales for departing from these examples in science. For example, many mathematics research teams organized their research lessons around problem-solving; teachers promoted student understanding by leveraging instructional approaches for students to determine solutions in multiple ways. We notice that these mathematics lessons, while located and connected to a broader unit of instruction, can be completed within a single class period, ranging in 45 to 60 minutes of duration. In science, investigations of natural phenomena often require more time in science than is allotted in elementary mathematics, particularly in the US.   Effective science instruction requires teachers to teach a single idea over multiple days. Therefore, the focus of the research lesson is on a smaller portion of the overall learning trajectory.

Similarly with mathematics instruction, we claim that US teachers were challenged with science content, had difficulty allowing students to struggle to develop a solution to a scientific problem, correlate the work of teaching with addressing the whole class, and need additional opportunities to learn about science teaching that emphasizes conceptual understanding.

This study can impact our understanding of lesson study in two ways: by focusing on a science case and by deeply discussing the role of public lesson study conferences in building lesson study understanding among US coaches.

Cobb, P., Jackson, K., & Dunlap, C. (2016). Design research: An analysis and critique. Handbook of international research in mathematics education, 481-503.

Lewis, C. C., Perry, R. R., & Hurd, J. (2009). Improving mathematics instruction through lesson study: A theoretical model and North American case. Journal of Mathematics Teacher Education, 12(4), 285-304.

Takahashi, A., & McDougal, T. (2016). Collaborative lesson research: maximizing the impact of lesson study. ZDM, 48(4), 513-526.

Yoshida, M. (2012). Mathematics lesson study in the United States: Current status and ideas for conducting high quality and effective lesson study. International Journal for Lesson and Learning Studies, 1(2), 140-152.

Zawojewski, J., Chamberlin, M., Hjalmarson, M., & Lewis, C. (2008). Designing design studies for professional development in mathematics education: Studying teachers' interpretive systems. Handbook of design research in education: Innovations in science, technology, engineering and mathematics learning and teaching, 219-245.

Theory into Practice: Developing Model Lessons Based on New CBC Curriculum through Lesson Study in Rwanda

Antoine Mutsinzi, *Rwanda Education Board*

Kana Yamashita, *Naruto University of Education*

Yumiko Ono, *Naruto University of Education*

Tateo Abe, *Tohoku Bukyo University*

Keiichi Naganuma, *Ilink*

Kenji Ohara, *Padeco*

Sayaka Matsuzuki, *Padeco*

Ryuichi Sugiyama, *Padeco*

In 2015, Ministry of Education in Rwanda announced an introduction of a new curriculum to phase in primary and secondary schools from 2016. Competence-Based Curriculum (CBC) emphasizes creativity and application of knowledge and skills instead of acquiring and accumulating them (REB,2015). The authors studied how teachers receive CBC and interpret it into lessons (Yamashita et al., 2017). The case study of five mathematics lessons revealed that the teachers wrote the objectives, planned activities and expected competencies in their lesson plans in line with CBC guidelines.

However, many activities implemented by the teachers did not contribute much to mastering pre-requisite knowledge, understanding, and skills utilized to develop competencies. The dicourse analysis indicated that more questions were related to task presentation and giving instructions. There were few regarded essential for nurturing mathematical thinking or attitudes. Because learning resources and teacher development opportunities are scarce, it is crucial to improving classroom communication and interactions for quality learning for all (Hardman, Abd-Kadir, & Smith, 2008).

This study focuses on the model lesson development through lesson study approach in a project. Using our case study result as a baseline, we explore how the lesson plans and the classroom communication and interaction have been revised and improved during the lesson study cycle.

SIIQS is a joint project of Rwanda Education Board (REB) and Japan International Cooperation Agency (JICA). Its overall goal is to strengthen CBC lesson implementation through SBI. Two components of activities are planned to achieve this aim: develop training materials for CBC dissemination workshops at different levels, and capacitate district and sector officers in their monitoring and evaluation skills. One of the activities for the material development component was to create CBC lesson videos. We explore how the lesson plans and the classroom communication and interaction have been revised and improved during the lesson study cycle.

Five schools in three districts agreed on participation, and six sessions were conducted per school from May to June 2017. Each time, at least one member of the project was present and provided technical support. The lesson study cycle in this study was as follows and all sessions were videotaped for analysis. We transcribed the mathematics model lessons for a quantitative and a qualitative discourse analysis and wait-time for students' answers.

0. Orientation
1. Lesson Study Group / Discussion on "Lesson Study Theme."
2. Lesson Plan Development
3. Micro Teaching (x2): post lesson discussion and revision of lesson plans
4. Model Lesson Practice at Classroom (Video Recording)

The preliminary results show an increase of open questions and of the type of questions that promote students' thinking. Some challenges and strategies to sustain lesson study in resource scarce countries will be discussed.

Reference:

Hardman, F. & Abd-Kadir, J., Smith, F. (2008). Pedagogical renewal: improving the quality of classroom interaction in Nigerian primary schools, International Journal of Educational Development 28(1), pp. 55-69.

Ministry of Education. (2015). COMPETENCE-BASED CURRICULUM, SUMMARY OF CURRICULUM FRAMEWORK PRE-PRIMARY TO UPPER SECONDARY 2015.

Yamashita, K., Mutsinzi, A., Abe, T., Ono,Y., Sugiyama, R. & Matsuzuki, S. (2017) Implementation of competence-based curriculum (CBC) in Rwanda: The case of mathematics. Poster presented in DETA, University of Rwanda.

Chinese Primary Teacher Reflective Thinking in Using Thinking Tools

Zhang Xiaohong, *Kansai University*
Makiko Kishi, *Meiji University*
Kenichi Kubota, *Kansai University*
Kikuko Miyake, *Kansai University*
Kedong Li, *South China Normal University*

The purpose of this study is to clarify how Chinese primary school teacher improve their lesson design with using thinking tools. The authors have been working on a China-Japan collaborative research program in which thinking tools were introduced to primary schools in China. The authors interviewed four Chinese teachers and focused on self-reflection of Chinese teacher with using thinking tools. To analyze the interview data, the authors used Trajectory Equifinality Approach to analyze their lesson design. Trajectory Equifinality Approach is one of new analysis approaches which is to clear the process of people's multiple decision-making during a certain period. The authors found teacher's reflection could be divided into 5 stages: stage without reflection, reflection after lesson, reflection before lesson, reflection on traditional teaching viewpoint, and reflection during lesson. All of the interviewees experienced some of the stages above   tage without reflection, reflection after lesson   However, only one interviewee experienced the stage of reflection during lesson, guiding students use thinking tools to cultivate thinking skills. Three factors impact on the stage of reflection during lesson. Firstly, teacher realized the importance of students' active thinking. Secondly, Chinese researchers in China-Japan collaborative research program gave interviewee some special support of using thinking tools. Thirdly, Counseling of old teachers and resource supplied by school helped interviewee reach high level of self-reflection.

Key words: Self-reflection, thinking tools, class design, Trajectory Equifinality Approach, Primary School