The Role of Lesson Study in Development Science Teaching Material Based on Inquiry and Lombok Natural Potential

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Lesson Study is the form of improving learning quality and professionalism of educators by focusing on the collaboration among the team members of lesson study. The implementation of lesson study is not only limited in the trying the specific strategies or learning methods, but also can be done in developing teaching materials. The data show that the development of science teaching materials based on inquiry and Lombok's natural potential through 4 cycles's on lesson study cultivates positive interactions among teams (researchers and teachers) in developing, improving the deficiencies found in the teaching materials, improving the quality of teaching materials and enhance quality of teaching learning process.

Development of Bansho(Board Writing) as a Research Method to Enhance Lesson Study

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Japanese lesson study has first caught the attention of world, when Stigler and Hiebert (1999) made accounts of Japanese structured problem-solving lessons based on the Third International Mathematics and Science Study (TIMSS) videos. Since then, two aspects of Japanese lessons, namely problem-solving lessons and lesson study have received remarkable attention. The first aspect, 'lesson study' (jugyou kenkyuu), as the term suggests, the emphasis should be on the lesson (jugyou). Jugyou used in the Japanese context is claimed to cover concepts wider than 'instruction' 'teaching' and 'class' in Western countries; it is inclusive of those concepts and encompasses teachers' activities as well as students' learning activities (Handbook of Study of Educational Methods, 2014). Another aspect of Japanese lesson, structured problem solving, is also a distinctive characteristic that began in the post-war era in the Social Studies subject. Almost often, lessons that adopt structured problem-solving approach are associated with the use of chalkboard (Green, 2014). The significance of chalkboard writing in a Japanese classroom is proven with a technical term coined for its usage- bansho (board writing). Its importance is especially apparent in a class that emphasizes on discussion where learners' speech information (ideas and opinions) is turned into textual information displayed on the chalkboard. Consequently, that information could be sustained on the common space in the classroom, which provides learners a space to develop their own thinking. This particular function of bansho, is also one of the key features of Japanese lesson study (Groves, 2016; Shimizu, 2007; Stigler & Hiebert, 1999; Takahashi, 2006; Yoshida, 2010). With such importance placed on bansho, predictably, a significant number of studies are available, on the primitive functions of bansho as a tool to record information. Nonetheless, there has not been sufficient research examining how bansho aids in the change of learners' knowledge, and thinking processes which are based on actual lessons. One of the potential reasons could be the complexities in visualizing the relationship between bansho and learners' thinking. With that, this study is aimed to develop bansho as a research method to enhance lesson study, which could potentially visualize pupils' thinking in a lesson. A 'kokugo' (national language) lesson of Primary School Grade 6 was observed, video-taped, and later transcribed into a lesson transcript. The lesson transcript was read, re-read while important elements were highlighted, based on the principles of transcript-based lesson analysis (TBLA). The process of bansho formation was also reproduced based on the recorded video and audio data since still images of bansho do not show the flow of lesson. Combining both lesson transcript and bansho formation, we have developed a chronological table of the flow of lesson and discussion. From this table, the flow of the lesson as seen from bansho processes, shows that the lesson flows in two directions- from teacher to pupils and from pupils back to teacher. For instance, when teacher was writing on the board, pupils were not speaking. In a lesson where pupils were not taking any notes, such action is deemed vital as an evidence of classroom participation. In addition, this chronological table also reveals how pupils' opinions

appeared on blackboard, moving from one opinion to the other, and subsequently, returned to several opinions which seemed to interest them. There, observation about how pupils connect pieces of information could reveal knowledge formation that occurred in the lesson. It is hoped that, use of bansho as a research method developed in this study could lead to visualization of pupils' thinking that further encourages effective use of bansho in a classroom community.

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Using Classroom Talk to Improve Mathematical Explanation

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In line with the Singapore Mathematics Framework to develop mathematical reasoning, communication and connections (CPDD, 2013), this study explored the use of classroom conversations and teacher talk moves (Zwiers & Crawford, 2011; Chapin, O' Connor, & Anderson, 2009) to improve students' conceptual understanding of Factors and Multiples. With the additional aims to increase motivation and help students link mathematical concepts to real life experiences, the study infused the learning of mathematical concepts with baking in what was called The Culinary Math Project at Ahmad Ibrahim Primary School. Two Primary Four classes and two mathematics teachers participated in this study. One was a mixed ability class while the other was a lower ability class. A total of 53 students were involved in the study, which adopted a pre- and post-test design to assess the progress of the students before and after the project.

The first stage of the project aimed to develop an awareness of the concept of multiples by requiring students to work in groups to ascertain the number of pastries to make based on the number of group members and pastry pieces they each desired. Students then had to figure out how to divide the pastry sheet into the desired number of equal parts, considering that two parts are required to make one pastry. The second stage aimed to develop an understanding of the concept of factors. Students now used play-dough as a faux pastry sheet to explore the number of rows and columns to cut in order to obtain the desired number of equal parts. Stage three is the actual baking day during which students cut real pastry sheets to make edible pieces they can bring home. In the pre-baking stages, teachers employed talk moves to guide, clarify and deepen student thinking. All student group interactions were supported by cognitive scaffolds and recorded using interactive whiteboard technology via the Educreations app. All lessons were video-recorded.

An analysis of the recordings revealed that all students actively engaged in group discussion, even the more introverted ones. The peer coaching and dialogic interaction helped students acquire new levels of understanding. The post-test results at the end of the project showed significant improvements in the students' written answers.

Our findings suggest that the use of talk moves and dialogic interaction among students can promote reasoning and communication which help to build students' conceptual understanding in Mathematics.

Moving ahead, we plan to extend such interventions to other topics such as area and perimeter.

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