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Examining Programmatic Lesson Study in Preservice Teacher Education

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**Proceedings for the 49th Annual Meeting
of the
Research Council on Mathematics Learning**

*Moving Forward, Leaning in: Acceleration over
Remediation*



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RCML History

The Research Council on Mathematics Learning, formerly The Research Council for Diagnostic and Prescriptive Mathematics, grew from a seed planted at a 1974 national conference held at Kent State University. A need for an informational sharing structure in diagnostic, prescriptive, and remedial mathematics was identified by James W. Heddens. A group of invited professional educators convened to explore, discuss, and exchange ideas especially in regard to pupils having difficulty in learning mathematics. It was noted that there was considerable fragmentation and repetition of effort in research on learning deficiencies at all levels of student mathematical development. The discussions centered on how individuals could pool their talents, resources, and research efforts to help develop a body of knowledge. The intent was for teams of researchers to work together in collaborative research focused on solving student difficulties encountered in learning mathematics.

Specific areas identified were:

1. Synthesize innovative approaches.
2. Create insightful diagnostic instruments.
3. Create diagnostic techniques.
4. Develop new and interesting materials.
5. Examine research reporting strategies.

As a professional organization, the **Research Council on Mathematics Learning (RCML)** may be thought of as a vehicle to be used by its membership to accomplish specific goals. There is opportunity for everyone to actively participate in **RCML**. Indeed, such participation is mandatory if **RCML** is to continue to provide a forum for exploration, examination, and professional growth for mathematics educators at all levels.

The Founding Members of the Council are those individuals that presented papers at one of the first three National Remedial Mathematics Conferences held at Kent State University in 1974, 1975, and 1976.

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EXAMINING PROGRAMATIC LESSON STUDY IN PRESERVICE TEACHER EDUCATION

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This study of mathematics preservice teachers investigates their experiences with a program requirement to learn about and engage in multiple iterations of open approach lesson study. Inductive analysis revealed four experiential themes: Variable Contexts, Professional Community, Challenges, and Transformation. Preservice teachers attribute their transformation to reform-based mathematics instruction involving iterative experiences and processes of open approach lesson study. Other experiences and implications are examined.

Teachers are the critical instructional element in the classroom (National Council of Teachers of Mathematics [NCTM], 2000). They manage instructional norms, discourse, tasks, and tools (Franke et al., 2007). They are also expected to deeply understand mathematics, mathematics pedagogy, and potential outcomes for students. Professional learning should support teachers to establish effective instructional contexts and adapt to new challenges. One such form of professional learning is called lesson study. Lesson study originated in Japan and has been used by in-service teachers (ISTs) across the world (Stigler & Hiebert, 1999). More recently, teacher educators have begun involving pre-service teachers (PSTs) in the lesson study practice. Lesson study provides an authentic window for researchers to view teacher professional learning (Matney et. al, 2020). Although there are studies that share about PST's doing short bursts of lesson study in courses (Angelini & Alvarez, 2018; Guner & Akyuz, 2020; Roberts et. al., 2017), this study takes a wider look at the possibilities of integrating lesson study in PST learning throughout each year of the program. As such, this study fills a need for research looking at impacts of lesson study when it is incorporated throughout a mathematics education program.

Relevant Literature

Lesson Study and Initial Teacher Education

In 1999, *The Teaching Gap*, called for lesson study to be tried and tested in the United States (Stigler & Hiebert, 1999, p. 131). Following this call, several researchers have shown that when lesson study is implemented well and for sufficient duration, similar results to Japanese lesson studies are found (Lewis & Hurd, 2011; Lewis et al., 2009). Lesson study engages teachers in a “comprehensive and well-articulated process for examining practice” (Fernandez et al., 2003, p. 171). The lesson study approach is a method of professional learning that encourages teachers to

reflect on their practice through a cyclical process of studying curriculum and setting goals, collaboratively planning a research lesson, observing the research lesson being taught, and reflecting on student learning (Lewis et. al., 2009). Research has shown that district support, lesson study has built strong professional learning communities within schools, resulting in instructional improvement and increased teachers' knowledge (Stewart & Brendefur, 2005).

Lesson study has most commonly been utilized for developing ISTs, however, many universities have begun to implement this practice in their initial teacher education (ITE) programs as a method for training and developing PSTs. Although ITE programs often focus on reform-oriented pedagogy, PSTs are exposed to traditional, lecture-based practices in many of their field experiences (Post & Varoz, 2008) causing disconnect between theory and practice (Cheng, 2011; Fernandez & Robinson, 2006). Sims and Walsh (2009) state that "Learning from teaching is a critical component of successful teacher education" (p. 732), however, passive observation of traditional teaching is not providing PSTs the opportunity to do so. On the other hand, the collaborative nature and debriefing elements of lesson study supplement the learning of best practices that PSTs undergo in their undergraduate coursework (Roberts et al., 2018). Additionally, the emphasis of collaboration rooted in lesson study improves the pedagogical knowledge of teams of teachers rather than individuals (Rappleye & Komatsu, 2017). Lesson study is an avenue in which PSTs can engage in meaningful learning through collaboration, teaching, observation, and reflection that will help bridge the gap between theory and practice (Angelini & Alvarez, 2018).

Open-Ended Approach & Open Approach Lesson Study

Important to the context of the study is the pedagogical idea of the open-ended approach for teaching mathematics through problem solving. Open-ended approach was originally researched in Japan as a method to evaluate higher order teaching skills and then for potential to improve teaching and learning (Becker & Shimada, 1997). Open-ended approach is a student-centered teaching practice in which the teacher poses a problem to students that has many possible solution paths or multiple correct answers. These open-ended problems are designed to be accessible and sufficiently challenging to students at all levels (Munroe, 2015). Becker and Shimada (1997) found that teaching which utilized open-ended approach allowed students to develop knowledge and skills as components of higher order thinking.

We use the term, open approach lesson study, to denote the kind of lesson study in which open approach is used in the design of the research lesson. Researchers have found open approach lesson study to engage teachers in critical reflection that shifts their long-held beliefs that lecturing is a sufficient means to teach mathematics, and begin forming new beliefs about the effectiveness of more student-centered approaches to teaching (Inprasitha & Changsri, 2013). Inprasitha (2006) found that open approach lesson study also changes and develops PSTs views of teaching and learning. Inprasitha noted that PSTs developed a broad view of teaching in which teaching mathematics is more than just covering the content, rather students' learning processes, ideas, and attitudes towards mathematics are emphasized.

In this study, we inquire about PSTs programmatic experiences as they learned about and enacted open approach lesson study. We do this to build upon the current research literature about this practice in the context of initial teacher education. By doing so, we hope to illuminate the perspectives of those who are learning about what it means to be a mathematics teaching professional through a program focusing on open approach lesson study. In what follows, all references to lesson study infer the contexts of mathematics and open approach lesson study.

Method

The study here was a phenomenological qualitative investigation about PSTs experiences of lesson study during their five-year undergraduate mathematics education program. The program includes course-based learning about open-approach lesson study in years one through four, including some time observing lesson study. In year five, the PSTs conduct weekly lesson studies during their yearlong internship.

Participants and Context

Participants were recent graduates and professors of an undergraduate program at a university in Southeast Asia. The PSTs participants were in a program that certifies mathematics teachers to teach all grade levels, K-12. The participants described their K-12 educational experiences as traditional, in the sense that their mathematics classroom experiences involved lecture-based teaching about mathematical processes that were then to be memorized and used to solve exercises. Their first experience with reform mathematics education involved learning about teaching through problem solving (open approach) during their initial teacher education program. Participants were selected for the study based on three key criteria. First, they must have completed the program in its entirety. This enabled the participants to offer holistic

perception of the role and experience of lesson study during the program. Secondly, the participants must have continued to teach, or continued their study of teaching, post-graduation. These criteria were chosen to inform the research about connections between the lesson study experience as an undergraduate and their identity as a teacher. Thirdly, the participants were proficient in English so that they could clearly articulate their thoughts and ideas about the lesson study experience to the researchers. In order to certify participants met the criteria of the study, we consulted with mathematics education faculty of the university. Twenty-four program completers agreed to be participants. Furthermore, two current mathematics teacher educators holding PhDs and who currently teach about lesson study in the program agreed to be participants, in the sense that they could offer insights on the program and help in the selection of participants. All names of participants are pseudonyms. The study was approved by the IRB.

Data Collection and Analysis

We conducted in-depth interviews with each PST participant. The interviews were conducted in English. Each interview was audio recorded and transcribed for textual analysis. We modeled our inductive thematic analysis from Hatch (2002) as a systematic procedure for coding data. Data statements were analyzed and categorized into salient themes that represented the phenomenon of interest, i.e., PSTs programmatic experience of open approach lesson study. Throughout the analysis procedure, we attended to the trustworthiness criteria for qualitative research recommended by Lincoln and Guba (1985) and Nowell et. al. (2017).

Findings

Inductive analysis revealed four themes involving PSTs experience of open approach lesson study: experiencing variable contexts, experiencing professional community, experiencing challenges, and experiencing transformation.

Experiencing Variable Contexts

As PSTs were going through the program, they experienced learning about open approach lesson study in various ways. They began hearing about lesson study in coursework and their mathematics education professors were engaging them in mathematical learning through open approach. They were given assignments to plan tasks and events together that followed the lesson study process such as Children's Day and Math Camp. PSTs had the opportunity to go with their professor to see an open lesson occur at a school. These events occurred in the early years of the program and gave PSTs initial notions about lesson study.

However, the PSTs noted that these notions did not coalesce for them until their internship when they enacted lesson study with their mentor teacher/team multiple times. Once the PSTs reached their internship, they enacted the lesson study process for each lesson. They revealed that several aspects of the lesson study format were different for each one of them. These aspects included, team size, who was on a team, who was planning, who was observing, who was reflecting, and how often reflection occurred. These differences were accounted for by each of their school's unique context. Teacher and school schedules would often determine who could be on a team, who was available for planning, observing, and reflecting. Some teams would reflect immediately after the lesson. Other teams would reflect after school. Another school's context dictated that PSTs reflect once a week on the series of lessons and that reflection was led by the principal. Though the PSTs all experienced variable and different organizational features, their descriptions all revealed that the main aspects of lesson study (research, plan, enact, and reflect) persisted.

Experiencing Professional Community

The PSTs each revealed that lesson study gave them a rich and vibrant way to learn about teaching from a professional community. PSTs came to see a real power in doing the four steps of research, plan, enact, and reflect as part of a community and described that they would feel alone in the classroom without lesson study. Their experience of lesson study has awakened them to understand that alone, teachers cannot see everything that is important. Amy shared, "Even if there are only five students in the classroom... I cannot see [all] five students in every process in the classroom. So, we can share the opinion and view with the teachers in the team" (Interview, December 18, 2019). The PSTs valued the ideas and alternative points of view that ISTs on the team provided and attributed that as a factor in their growth. Participating in lesson study with a professional community also strengthened PSTs communication skills. Lesson study allowed PSTs to learn how to effectively share their ideas about students' mathematical thinking. Furthermore, conducting lesson study with ISTs deepened their knowledge of the students. The multiple perspectives allowed the PSTs to gain better insight on all students' learning, not only the select students they could observe individually. Additionally, ISTs often contributed a longitudinal perspective about students. According to Cathy, when reflections occurred, mathematics teachers who had her students before chimed in; "they will share something that they know about the students with me" (Interview, December 16, 2019). Moreover, the lesson

study process provided a supportive professional community that opened a space for PSTs to think through the development of the problem situation and the lesson plan relative to their particular students.

Experiencing Challenges

The prior K-12 learning experiences of the PSTs were described as vastly traditional, which they explained as teaching directly from what the textbook says. For this reason, the PSTs found the planning phase of lesson study challenging, since they were moving beyond the textbook to anticipate student interests and open-ended ideas about the mathematical problem. In the traditional approach, there was less feedback during instruction about what students found interesting. As PSTs sought to plan the problem-solving situation using open approach, they saw the need to draw on deeper knowledge about who students were. Having few experiences with the need to connect students to mathematics made this specific part of planning demanding. In the traditional approach, each teacher developed the flow of the lesson strictly according to the textbook and consensus with other teachers was not seen as a necessity. However, when conducting lesson study, team consensus on the research lesson plan is important. The PSTs recognized there was sometimes difficulty in coming to consensus about each element of the research lesson. PSTs explained that sometimes the ISTs have a different idea, and the team goes with that idea because the ISTs have more experience. The PSTs recognized the challenges that arose from engaging in lesson study took time to overcome, but they considered the time spent in the process a valuable effort for their professional growth.

Experiencing Transformation

The PSTs reflected upon how their experiences with open approach lesson study transformed their beliefs and abilities involving teaching mathematics. PSTs explained that teaching mathematics during internship would have been isolating without the lesson study process. Alone, the PSTs felt they would have reverted to teaching exclusively by lecture via the textbook. Cathy exemplifies this sentiment when she discusses that without lesson study “I would have read the textbook and told them the concept that I wanted them to know in my class; the same way that that I was taught” (Interview, December 16, 2019). The PSTs attributed their transformation to having a professional community through open approach lesson study and to having experienced the process many times throughout their program. They each shared that they

teach differently from the way they were taught and that these transformations occurred because of the positive learning they observed from their students in their many research lessons.

Discussion

We note that each PSTs experience during internship had the same lesson study frame of study, plan, teach, and reflect (Lewis et. al., 2009) but was enacted differently according to their school context. In spite of these differences, the PSTs perceive the same kinds of positive impacts and challenges from their involvement in lesson study. Furthermore, the program in which these PSTs where learning provided direct opportunity and intentional connections to lesson study prior to internship and this provided a solid basis to understand and enact lesson study with a professional community. The PSTs went into internship with strong notions of working as a community to overcome professional challenges and this in turn supported their transformative experience. These findings connect with previous research findings showing that with time and school support, lesson study has built strong teacher professional learning communities within schools (Stewart & Brendefur, 2005). In other words, the understanding and multiple enactments of open approach lesson study throughout the program helped the PSTs not fall back into traditional teaching tendencies (Owens, 2013). Furthermore, the findings here support Fernandez et al.'s assertion that lesson study is a “comprehensive and well-articulated process for examining practice” (2003, p. 171). Open approach lesson study helped the PSTs to connect theory and practice, overcoming an important dilemma noted by prior research (Cheng, 2011; Fernandez & Robinson, 2006). The process of researching, planning, teaching, and reflecting as a professional community allowed them to move from seeing learning only occur from traditional forms of teaching and into teaching through problem solving. The PSTs were given multiple opportunities, as both the observer and the teacher, to experience student learning through problem solving. These experiences acted as authentic verifications of a methodology that moved PSTs from the theory of teaching through problem solving into practitioners of teaching through problem solving (Matney et. al, 2020). In conclusion, the program's inclusion of open approach lesson study provided a professional space through which PSTs learned about the processes of teaching, critically examined student learning, and hence transformed their own teaching practice.

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