

# Preface: Mathematics Teacher Preparation and Lesson Study



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Lesson study has been increasingly incorporated in global teacher education programs as a professional learning approach. Yet, there has been a call for further detailing the use and adaptation of the lesson study structures that support prospective teachers' learning (e.g., Larssen et al. 2018; Ponte 2017). Research has revealed that there are significant differences in educational cultures and systems (e.g., Stiegler and Hiebert 2016), and it is necessary to consider organizational and logistical variation when incorporating lesson study in teacher education programs (e.g., Davies and Dunnill 2008). The chapters in this section address some of these issues, reporting from experiences with incorporating lesson study in teacher education programs from many parts of the world.

Based on 15 years of developmental work from experiences and research on lesson study within teacher education in Iceland, Guðný Helga Gunnarsdóttir and Guðbjörg Pálsdóttir report in their chapter from a recent study in which prospective mathematics teachers ( $n = 21$ ) participated in a yearlong teacher education program where lesson study was incorporated as a professional learning strategy. One important finding reveals that the prospective teachers were clearly influenced by resources given by their teacher educators in the courses at the study program. The prospective teachers were eager to discuss and try out ideas in practice, and they become more aware of the complexities of teaching during this structured and inquiry-oriented approach to teaching and learning. This study emphasizes the important role of the teacher educators as the knowledgeable others since the prospective teachers had the opportunity to discuss the progress of their work and get immediate feedback from the teacher educators during the lesson study process.

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These authors have found that a crucial driver for learning to take place for prospective mathematics teachers within lesson study is the significance of establishing and participating in learning communities of practice.

Jennifer Lewis presents another study carried out in a methods class for elementary preservice teachers in the United States, showing that lesson study can serve as a bridge between theory and practice. Lewis argues that the research lesson is the main component of the lesson study model in bridging the theory-practice divide since it is the actual enactment of a lesson with careful planning of a real-time lesson and reflection and revising afterward. This author points to the challenges of incorporating lesson study with preservice (prospective) teachers since it differs from settings in schools with collaborative and experienced teachers with shared leadership. In Lewis' study, there were little contributions from the preservice teachers in planning of the research lesson. Lewis was the instructor with a "top-down" mandate that, together with a team of university instructors, did most of the design of the research lesson. However, with a more fine-grained examination of the lesson study process, Lewis found that the preservice teachers interacted more equally with the university teachers in the post-lesson discussions based on observations of the enacted lesson. The value of this study lies in its illustration of the challenges and affordances of lesson study with preservice teachers. It shows the important role of the university instructor as the knowledgeable other, particularly in the design of a research lesson in which the university instructors have the expertise to find and pose possible tasks which the preservice teachers do not yet possess. In accordance with previous studies (e.g., Stiegler and Hiebert 2016), Lewis suggests that lesson study with preservice teachers requires extensive adaptations, but this case study indicates that lesson study provides preservice teachers with important experience to cultivate mathematical care for children's learning of mathematics in a fourth-grade classroom.

In contrast to the approaches of the studies reported on from cultural settings in Iceland and the United States, Koichi Nakamura takes on the task of making visible to readers how Japanese prospective teachers learn to teach mathematics through problem solving through a lesson study approach. This author attempts to capture the process of improving lessons, focusing on one prospective teacher's activities throughout the process of planning and enacting research lesson, and reflecting on the lesson over 3 weeks of teaching practice. In Japan, it is common that prospective teachers experience three steps of a lesson study cycle. They write a lesson plan with learning goals and main questions and anticipate student solutions to the math problem given to the class (step 1). The prospective teachers teach their revised lesson plan, while other prospective teachers and the supporting teacher make observations and collect data (step 2). The prospective teacher participates in a post-lesson discussion with those who observed the lesson (step 3). As readers, we learn that a typical Japanese lesson consists of four main activities: "the teacher presents the problem, students try to solve the problem on their own, the class discusses solution methods, and the teacher gives a wrap-up summary." Nakamura concludes that the supporting teacher as a qualified highly skilled knowledgeable other plays an important role in order to facilitate prospective teachers to learn teaching mathematics through problem solving. This finding resonates with findings

from the studies conducted by Lewis and by Gunnarsdóttir and Pálsdóttir in which university teachers are knowledgeable others, helping prospective teachers to refine their understanding of what their students need to learn.

Reflecting on 15 years of using lesson study in a mathematics methods course in the United States, Blake E. Peterson, Dawn Teuscher, and Thomas E. Ricks describe that they have struggled to help secondary preservice teachers (PSTs) to develop a rich conceptual understanding of mathematics. These authors have made an effort to encourage PSTs to have rich conversations about the mathematics of their lessons and be aware of how students think about this mathematics. Two crucial US cultural views prevented the PSTs from engaging in rich mathematical conversations. The PSTs' views of mathematics were mostly procedural, and they were also more concerned with their own teaching performance rather than paying attention to student learning. This finding resonates with findings from studies in Western Europe (e.g., Bjuland and Mosvold 2015). From the reflections on the revisions and changes made to their methods course, addressing the two US cultural barriers that made it difficult for the PSTs to engage in rich mathematical conversations, the authors noticed that these adaptations have much in common with authentic Japanese lesson study (JLS). Critical facets of JLS include (1) *the knowledgeable other*, (2) *structured reflection meetings*, (3) *PSTs working in groups*, and (4) *the iterative process*. The value of this study “highlights the importance of consistent, multi-cycle lesson study implementations by educational researchers, with continual refinement through multiple iterations, to account for unforeseen issues that will naturally arise.”

There is a danger in lesson study research that many studies report from descriptions of stories without including a theoretical framework for analyzing data collected from lesson study cycles and without relating discussions of findings to theories (e.g., Bjuland and Mosvold 2015; Larssen et al. 2018). This is not the case with the chapter written by Suanrong Chen and Bo Zhang. These authors report from a research study, aiming at improving prospective teachers' (PTs) lesson planning knowledge and skills through an adapted lesson study cycle. Thirty-nine prospective teachers (PTs), enrolled in a methods course at a teacher preparation program in China, participated in a program of developing the work of planning a research lesson. The framework of mathematical knowledge for teaching (MKT) developed by Ball et al. (2008) was used to make an in-depth analysis of the PTs' lesson plans in order to capture the PTs' existing knowledge and the progress they made through revised lesson plans. One important finding from this study illustrates that the PTs had difficulties in combining both theory and content into practice in their individual lesson plans, but after experiencing the lesson study process, “the participants demonstrated significant improvements in thinking about learning objectives, analysis of content and students, anticipating students' solutions and sequencing mathematical tasks.”

In the last chapter of this section, Fay Baldry and Colin Foster take us back to the importance of establishing productive partnerships between university and school in a UK context when exploring the potential of incorporating lesson study in initial teacher education (ITE). The authors highlight the need for mathematics preservice

teachers to develop pedagogical learning based on collaborative lesson planning and observation. In line with Bjuland and Mosvold (2015), Baldry and Foster emphasize the importance of formulating a clear research question that relates to student learning of mathematics. The authors propose a theoretical model that illustrates key features of a lesson study for mathematics preservice teachers in ITE. They also emphasize the important role played by knowledgeable other(s) in England. There are two facets of the role: one focusing on the lesson study process itself and one being more concerned with mathematics pedagogy. Baldry and Foster make it clear that there are considerable challenges when trying to modify and adapt Japanese lesson study in a new context or country. But according to these authors, “lesson study has been successfully operationalized in our country by making numerous adaptations and compromises.”

The chapters in this section have addressed the important role played by a knowledgeable other (e.g., university educators) when prospective teachers are presented for lesson study within teacher education programs. In a recent study, Bjuland and Helgevold (2018) have explored a more detailed analysis of facilitation in which lesson study was used as a context for establishing a dialogic learning community, investigating dialogic processes in prospective teachers’ mentoring conversations in field practice. In line with Warwick et al. (2016), these authors have applied an analytic framework involving five dialogic moves that have the potential to illustrate dialogic chains of utterances produced by a mentor teacher (the knowledgeable other) and a group of four prospective science teachers. By applying a fine-grained dialogic framework, it is possible to identify how a dialogic space of interthinking is created in the mentoring conversations where the mentor teacher and the prospective teachers act together (interact) and think together (interthink) (Warwick et al. 2016). From such a framework, it is possible to identify how the mentor teacher challenges the prospective teachers to make predictions of chosen activities for the research lesson and bring the reflections about student learning forward.

In a systematic literature review of 200 recent English language studies, focusing on the exploration of lesson study with in-service teachers beyond Japan, Seleznyov (2018) confirms the complexity and challenges of translating critical components of Japanese lesson study in new contexts or countries. From another systematic and structured literature review on lesson study in initial teacher education, we learn how the concept of learning is represented and discussed and how observation is used to capture evidence for student learning from the lesson study cycle (Larssen et al. 2018). This review indicated that most of these studies did not have structured observations, illustrating no universally held understanding of the observation process. The review also indicated a lack of clarity how learning was defined in order to use learning theory to support observations. The chapters of this section, with emphasis on incorporating lesson study in teacher education programs, are in line with these literature reviews, illustrating the complexity of challenging traditional approaches to learning how to teach. They provide a significant and added value since these studies illustrate the demanding process for prospective teachers to

design good tasks and to make structured observations for the lesson study cycle, paying more attention to student learning rather than being concerned with their own teaching performance. Following Larssen et al. (2018), these studies show how research on the use of lesson study in initial teacher education can be rigorous in the ways they incorporate and discuss critical components of lesson study in teacher education programs. Future studies must keep this direction, assuring great clarity of how learning is defined and to be more explicit about the use of conducting structured observation with emphasis on student learning.

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