

Transforming Preservice Teacher Education in Mathematics through Japanese Lesson Study

Research Overview

This mixed-method study examines how a university-based Japanese lesson study program embedded in a mathematics methods course supports the development of elementary preservice teachers' pedagogical knowledge and mathematics pedagogy.

Purpose of Study

The purpose of this study was to determine the features of the university's lesson study program that are effective in preparing preservice teachers to teach mathematics successfully. A challenge for university teacher preparation programs is to prepare elementary preservice teachers to effectively teach mathematics when they are classroom teachers. Incorporating lesson study in preservice teacher preparation programs is a way to address shared standards set by the United States national government and the California state government for both preservice teachers and elementary students. Specially, the United States adopted the Common Core State Standards in Mathematics that specify eight Standards for Mathematical Practice (SMPs) for K-12 students. SMPs describe the habits of mind that foster mathematical understanding, and the skills needed to be successful in school and career. Moreover, California's Commission on Teacher Credentialing adopted the same eight SMPs for preservice teachers. That is, preservice teachers in California are expected to understand and engage students in the SMPs.

Lesson study in elementary preservice teacher preparation is a professional development tool designed and used in Japan wherein preservice teachers plan, observe, analyze, and reflect on lessons in collaboration with classroom teachers and professors. A growing body of research indicates that collaborative lesson study programs that deliberately connect professors with classroom teachers and teacher preparation coursework with elementary classroom instruction provide high-quality professional development opportunities and learning experiences for preservice teachers.

Therefore, the following research question guided this study: *How does a lesson study program embedded in a teaching mathematics course in a university teacher preparation program facilitate the development of elementary preservice teachers' pedagogical knowledge and pedagogy in mathematics?*

Research Methods

This study took place in a small, private university in the United States and elementary schools in the surrounding community. A mixed-method design was used to measure the extent to which lesson study develops preservice teachers' mathematics pedagogy, pedagogical knowledge in mathematics, and pedagogical knowledge in general, as described within the SMPs.

Post-lesson study surveys and reflective essays were created and analyzed. Participants included 66 preservice teachers in an elementary teacher preparation program at the university. Preservice

teachers were undergraduate ($n = 31$) and graduate students ($n = 35$) enrolled in one of five mathematics methods courses. A post-lesson study survey measured the impact of lesson study sessions on preservice teachers' mathematical pedagogical knowledge, pedagogical knowledge in general, and pedagogy. The researcher collaborated with classroom teachers to develop a post lesson study reflective essay assignment to measure growth in preservice teachers' pedagogy.

Results and Discussion

Lesson study integrated into a mathematics methods course through a partnership with classroom teachers has a significant impact on preservice teachers' pedagogical knowledge and mathematics pedagogy. Specifically, collaborative lesson study experiences developed preservice teachers' mathematical pedagogical knowledge of two focus SMPs, that is, SMP 1 (make sense of problems and persevere in solving them), SMP 4 (model with mathematics), and academic discourse. Preservice teachers' pedagogical knowledge in general, including assessment, reflection, student engagement, effective classroom environments, also improved. Preservice teachers' pedagogy was also impacted positively, including both their knowledge of mathematics pedagogy and their confidence and ability to successfully teach students mathematics.

In this study, a mathematics methods course was revised to integrate required standards as a central focus for understanding how to teach mathematics in elementary school. The embedded lesson study program was revised in collaboration with classroom teachers to incorporate required pedagogical knowledge and pedagogy for preservice teachers aligned with recommended standards for teacher preparation programs.

A key factor contributing to these results may be the collaborative, reflective nature of Japanese lesson study combined with a professor-classroom teacher partnership grounded in a shared vision of high-quality mathematics instruction. A common focus on required standards for both teacher preparation and elementary classrooms, modeled by the classroom teacher, and facilitated by the professor, provided critical connections between theory and authentic teaching practice for preservice teachers.

Lesson study programs that emphasize mathematical pedagogical knowledge and pedagogy through collaboration with classroom teachers can serve as models for exemplary practice in elementary preservice teacher preparation.

Keywords: lesson study, teacher preparation, mathematics pedagogy, pedagogical knowledge