Chapter 10
Technology–Mediated Mathematics Teacher Development:
Research on Digital Pedagogies of Practice

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ABSTRACT

This chapter focuses on how digital technologies provide affordances for Practice-Based Mathematics Teacher Education (PBMTE) and maps needed research on technologically mediated teacher education. The chapter elaborates on Grossman's pedagogies of practice, describing how they can be enacted in digital environments. Using LessonSketch as a prototype of an online platform for PBMTE, the chapter describes what those pedagogies look like when mediated through technology by narrating three cases. The chapter maps needed research by describing how various research approaches including design research, teaching effectiveness, ecological, and instrumental genesis might be used to organize research on environments that support technologically mediated, practice-based mathematics teacher education.

INTRODUCTION

This chapter is dedicated to the technological mediation of practice-based mathematics teacher education (PBMTE). The practice curriculum of teacher education has traditionally been delivered face-to-face. An emerging practice exists, however, in which information technology platforms are used to engage teachers in learning to teach mathematics—in online or blended learning. What are those platforms like? What are the practices of mathematics teacher development in those environments? And, what research needs to be carried out in those environments? The novelty of these practices is such that this chapter cannot be a review of research and practice. Rather, it articulates some organizing ideas to use in structuring an agenda for research and practice while it reviews emerging research and practices.

We focus on how technology provides affordances for pedagogies of teacher preparation and for research on technologically-mediated PBMTE. We discuss such technologies and their potential uses, and then explore problems and practices of teacher education and its research from the perspective of the affordances that innovative technological tools provide. We first provide conceptual framing and then share cases from our own work detailing the problems of practice we encounter as teacher educators and the technological tools that allow progress through those problems. We then generalize from our experiences to consider implications for problems of practice and its research and essential characteristics of technological tools that could allow our field to make progress on these problems.

The work of teaching, while requiring substantial explicit knowledge (e.g., factual and conceptual mathematical knowledge), also requires important tacit knowledge: As teaching is a profession of human improvement (Cohen, 2005), done in the midst of relationships with students, the teacher needs to learn to do relational work that requires what Collins (2010, p. 124) calls *collective tacit knowledge*, the knowledge of how to act according to different expectations depending on the interpersonal construction of the situation. The sense that sometimes a mathematical error needs correction, but other times it might be ignored, for example, is part of what a mathematics teacher needs to know. It becomes important to create opportunities for novices to develop this tacit knowledge; it is also important to conceive of research studies that examine how and how well teacher education programs realize those opportunities. These considerations highlight the importance of representations of teaching knowledge: Informational text has difficulties communicating tacit knowledge, but the emergence of digital media has opened an opportunity for representing teaching knowledge.

On account of the crucial role of tacit knowledge in professional practice, scholars have argued for the need to learn teaching practice *in*, *from*, and *for* practice (Lampert, 2010). Teacher preparation should draw its curriculum from the work of teaching, locate the learning of such curriculum in the doing of the work of teaching, and be oriented to competently performing the work of teaching. Scholars have envisioned teacher education that is practice-based (Ball & Forzani, 2009) by identifying practices of teaching that are needed by beginners to promote students' learning as well as enable continuous learning from practice. Additionally, research on practice-based professional education of teachers, therapists, and ministers has described pedagogies that successfully center learning on practice by engaging novices in activities of *representation*, *decomposition*, and *approximation* of practice (Grossman et al., 2009). Within *representations* of practice, professional educators offer novices the opportunity to observe how practices are carried out; within *decompositions* of practice, professional educators involve novices in parsing practice into components, which are described and named; and within *approximations* of practice, professional educators shepherd more or less authentic environments for novices to enact such practices (see Lampert et al., 2013).

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