Chapter 34
Designing and Teaching an Online Elementary Mathematics Methods Course: Promises, Barriers, and Implications

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ABSTRACT

This chapter discusses a longitudinal examination of a mathematics methods course for teacher candidates taught in hybrid and a 100% asynchronous online format. Using Guskey's (2000) framework for evaluating learning experiences for teachers, thematic analysis was conducted on teacher candidates' course feedback and two major course assignments. Data analysis indicated that teacher participants valued the amount of support provided by the instructor and communication with classmates, had mixed comments about having to take ownership of their learning, and disliked the amount of work in the course. Participants' work samples reflected the application of emphasized pedagogies in lesson plans and course projects, and participants also positively impacted student learning during their clinical project. Implications for future courses as well as the examination of online methods courses are shared.

INTRODUCTION

Online Learning Opportunities

During the last decade the demand to develop online methods courses in teacher education programs has increased dramatically (Ko & Rosen, 2010). While the benefits of online courses have been established (Tallent-Runnels et al., 2006), online courses in teacher education, especially mathematics education, provide a set of design issues that differ from other online courses outside of teacher education programs or other content areas (Delfino & Persico, 2007; Tallent-Runnels et al., 2006). To address these challenges, researchers have identified specific tools for online teaching that expand learning opportunities. These include: accessibility to the Internet and Web 2.0 technologies, a collaborative framework, and other course structures.

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Higher education has embraced the possibilities of using the Internet as a medium to teach college courses. Nelson, Christopher, and Mims (2009) suggested that "the Internet and Web 2.0 technologies afford teachers ready access to collaborative, authentic opportunities for students to engage in meaningful experiences related to the curriculum" (p. 85). Oliver (2010) noted that the use of Web 2.0 technologies advances online learning opportunities that were not readily available before. There are numerous technologies to support teaching mathematics online (Hodges & Hunger, 2011). Blogs and wikis have been recognized by faculty as effective tools, especially in mathematics courses (Ajjan & Hartshorne, 2008; Carter, 2009; Peterson, 2009).

These technologies increase opportunities for student interaction and discussion; an essential component of online courses (Levin et al., 2001; Tallent-Runnels et al., 2006). In their comparison study of discussion formats, Im and Lee (2004) found that synchronous discussion was more effective at social interaction, while asynchronous discussion was better suited for task-oriented interaction. Regardless, the presence of peer collaboration and discussions in online courses is empirically-linked to students' perceptions of the course (Schlager & Fusco, 2004).

Further, specific course structures have been found to be effective in online courses. Greene and Land (2000) found that both guiding questions and frequent feedback from instructors helped them understand assignments and led to higher quality work products. Experts have highlighted the importance of relevant and challenging assignments (Levin, Waddoups, Levin, & Buell, 2001), clear expectations and evaluation methods (Moallem, 2003), and opportunities to reflect on assignments (Levin et al., 2001). Furthermore, online courses create new learning spaces for teachers and engender an environment that is learner-centered and align to characteristics of effective learning environments.

Online Learning Opportunities for Teachers

The research base regarding online learning opportunities for teachers includes studies regarding online professional development opportunities for teachers who are currently in classrooms and either working on advanced degrees or pursuing a deeper understanding of either content or pedagogy (e.g., Russell, Carey, Klieman, & Venable, 2009; Signer, 2008). Researchers that have compared online professional development to face-to-face models for mathematics teachers noted that there was no significant difference between the influence of the learning experiences on teachers' beliefs, knowledge or skills (Russell et al., 2009). Online learning experiences have found that the increase in written communication helps to promote more reflective inquiry about course content (Spicer, 2002; Treacy, Kleiman, & Peterson, 2002). In their five-year longitudinal study, Delfino and Persico (2007) found that teachers' written work in the online courses contained frequent instances of critical thinking and in-depth reflection. Further, on the whole teachers enjoy online learning opportunities and are willing to take more in the future (Russell et al., 2009; Signer, 2008).

However, while research on pre-service courses for pre-service teachers with limited or no teaching experience is scant. In a hybrid mathematics education methods course, Schwartz (in press) posed a task to a group of students in an online asynchronous format and compared their strategies and reactions to those in a face-to-face format. While pre-service teachers approached and solved the task in the same way, there was a lack of opportunities for the instructor and pre-service teachers to discuss the pedagogy and in-the-moment teacher decision making. O'Connor (2011) found that while pre-service teachers learned technology and formed effective collaborative relationships with their colleagues, videos of teaching experiences reflected a lack of student-centered pedagogies that were emphasized in the course.