Chapter 9
Teaching Mathematics Teachers Online:
Strategies for Navigating the Intersection of Andragogy, Technology, and Reform-Based Mathematics Education

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ABSTRACT

Online course offerings in continuing teacher education are rapidly becoming standard features for faculties of education involved with the professional development of in-service teachers. However, instructors of mathematics education courses which are offered online must navigate certain formidable obstacles in the planning and delivery of their online learning experiences. In an era of reform-oriented mathematics education (National Council of Teachers of Mathematics, 2000; Ontario Ministry of Education, 2005), which emphasizes the increased use of manipulatives, technology, groupwork, problem-based learning, and varied assessment, the "virtual" instructor must develop creative methods for modeling these important aspects of teaching and learning. Drawing upon the relevant research literature, and based on nearly a decade of online instructor/course evaluation feedback and on the author's own observations, the following paper presents five key strategies for bridging this technological gap, and for navigating the intersection of andragogy (i.e., adult education), technology, and reform-based mathematics education within emergent online teaching models.

INTRODUCTION

Online learning, or distance education, is quickly becoming a commonplace feature of the post-secondary education landscape (Guruz, 2008; Howell, Williams, & Lindsay, 2003; Varnhagen, Wilson, Krupa, Kasprzak, & Hunting, 2005). This reality is clearly, and in an ever-expanding manner, evidenced within pre-service and in-service teacher development programs across North America, and internationally. Online professional learning in higher education presents certain affordances and challenges for participants, and for the online instructor (Juan, Huertas, Steegmann, Corcoles, & Serrat, 2008). A list of the former would include such benefits as greater flexibility and choice regarding course selection and the actual times at which learning takes place; increased access to different courses, particularly for those in remote areas; the ability to take part in "threaded" discussion forums, allowing time for reflection and an historical record of conversations; and, an overall broader and deeper fostering of shared knowledge throughout educational jurisdictions.

The challenges of online learning often hinge on technological limitations (e.g., lack of highspeed Internet connection, difficulty with typing and/or related computer skills, Content Management System (CMS) software malfunction—particularly in terms of different Internet browsers being used), a preference for face-to-face interaction among participants, and the amount of required reading/posting, often done at length in front of a computer monitor. Further, as noted by Russell et al. (2009), some have questioned the effectiveness of online delivery in terms of the achievement of actual learning outcomes.

[S]ince its introduction more than a decade ago, educational leaders have questioned whether professional development delivered in an online environment is as effective as traditional face-to-face sessions in increasing teachers' content and pedagogical knowledge and in improving their instructional practices. . . . While researchers have reached a broad consensus on the general components of high-quality K–12 teacher professional development in face-to-face contexts, many questions remain about the design and delivery of effective online professional development. (pp. 71-73)

Mathematics education, by the very nature of its thick content and varied representations (e.g., symbolic, numeric, textual, graphical), brings with it a unique set of challenges and opportunities when taught online, particularly from a reform-oriented perspective such as that encouraged by the National Council of Teachers of Mathematics (National Council of Teachers of Mathematics, 2000). Beyond the lack of face-to-face social connectedness that often is perceived as characterizing online learning environments (Slagter & Bishop, 2009), the added challenges of mathematics education courses offered in such a format are significant, particularly in light of reform-oriented pedagogy and practice. What are these particular obstacles? Some of the main components of reform-oriented mathematics are the use of manipulatives (hands-on learning tools, either physical or virtual), groupwork, increased communication, incorporation of technology, problem-based learning, and varied assessment. How can instructors facilitate meaningful interaction and select appropriate activities that will serve to enhance the learning and professional growth experience within an online environment?

Several research studies have recently examined the effectiveness of online professional development models for mathematics educators (Carey, Kleiman, Russell, Douglas-Venable, & Louie, 2008; Russell, Carey, et al., 2009; Russell, Kleiman, Carey, & Douglas, 2009; Silverman & Clay, 2010). Russell et al. (2009) compared the effects of a professional development course delivered in an online and a face-to-face format, examining changes in teachers' pedagogical beliefs, instructional practices, and understanding of

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