

Chapter 1

A Model for Asynchronous Discussions in a Mathematics Content Course

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ABSTRACT

In this chapter a model is outlined for using asynchronous online discussions in a mathematics content course for preservice elementary teachers. The model integrates conversational discussion threads as a component of a traditional, face-to-face course. This successful approach is based on elements of the variation theory of learning, and derives from a comprehensive dissertation study examining its effectiveness.

INTRODUCTION

Innovations in the mathematical preparation of preservice teachers mirror trends in K-12 mathematics instruction, incorporating learning activities and technological tools that engage learners in mathematical explorations that promote conceptual understanding, knowledge construction and confrontation of mathematical misconceptions (Mathematical Sciences Educational Board & National Research Council, 1989, 1990; NCTM, 1989, 2000). Additionally, collaboration

and reflection are recognized as essential toward developing deep and meaningful understandings of mathematics content (Lloyd & Frykholm, 2000; Newell, 1996; Silverman & Clay, 2010; Staples, 2008).

Inclusion of online discussions has proven effective in a variety of higher education courses, providing opportunities for collaboration and for written expression of ideas. Their asynchronous nature enables individuals to read others' posts and submit their own messages at a time of their convenience, providing the opportunity for students to contemplate ideas and prepare thoughtful responses (Bender, 2003). These discussions

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can provide a learner-driven environment in which students explore and construct knowledge (Schellens, Van Keer, De Wever & Valcke, 2007; Hong & Lee, 2008). Discussions occur in threads, which are linked messages relating to a common discussion topic. New messages may be linked to the initial post or to subsequent posts in the thread, indicating the message to which the user is responding. The discussion forums are often part of larger course management systems.

DeBourgh (2002), Hofstad (2003), Brett, Woodruff and Nason (1999, 2002), and Silverman and Clay (2010) have argued that participation in online discussions can improve analytical thinking and problem-solving skills, promote development of deeper understandings of course content, and lead to the redevelopment of preservice teachers' conceptions of mathematical learning. Implementations of online discussions in college courses vary significantly, resulting in a broad spectrum of effectiveness and the lack of a clear model for meeting specific mathematics course goals. In contrast to other disciplines, mathematics content courses generally have not benefited from conversational use of online discussions, apparently due to the lack of an effective implementation model and, for face-to-face courses, a lack of understanding regarding the educational opportunities provided by online discussions. Resultantly, mathematics education has yet to fully benefit from learning experiences enhanced with online discussions.

Popular uses of asynchronous discussions in mathematics education include group work on specific problems (Kosiak, 2004) or discussions of teaching and learning strategies within subsequent methods courses or professional development opportunities (Carey, Kleiman, Russell, Venable, & Louie 2008; Slavit, 2002). Required conversations about and with mathematical concepts, however, has not been a common approach. Content courses for preservice teachers that use a conversational approach to asynchronous discussions about and with mathematics can achieve several key objectives. First, preservice teachers can gain experience com-

municating about and with mathematics in a more relaxed and explanatory fashion that aligns well with their future career needs. These mathematical discussions are not restricted by the limited time within typical classes, and the asynchronous nature allows participants to organize and reflect upon their contributions and explanations. Second, future teachers become more motivated to learn and understand the mathematics content by including discussions that frame this development as necessary for success in their future careers and to fulfill their desires to meet the needs of future students. Finally, preservice teachers' perceptions and misconceptions of the nature, teaching and learning of mathematics have been documented as limiting factors in the development of deep, conceptual understandings of mathematics content (Ball, 1990; Cady & Rearden, 2007; Ma, 1999). Incorporation of tasks or discussions that cause students to confront these notions may lead to open-mindedness regarding the intent behind their mathematics content courses and the rationale behind employed teaching strategies, subsequently leading to deeper and more meaningful understandings of course content.

This chapter presents a model for effective use of asynchronous online discussions as part of a traditional, face-to-face mathematics content course for preservice elementary teachers. The structure and elements of this model are founded upon the tenets of the variation theory of learning (Bowden & Marton, 1998; Marton & Booth, 1997; Runesson, 2005), and the effectiveness of the model is based upon the findings of a phenomenographic dissertation study (Miller, 2007, 2009) from which it derived. The design relies upon a significant role of the instructor as initiator and moderator of conversations, scaffolding students in their learning and sustaining conversations through a deep exploration of content (Fauske & Wade, 2004; Kienle & Ritterskamp, 2007; Mazzolini, 2003; Mazzolini & Maddison, 2007). The model hinges upon several main principles:

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