

# Facilitating Deep Learning in a Learning Community

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## ABSTRACT

*The purpose of this study is to explore how the integration of online discussion into a mathematics methods course affected pre-service teachers' learning. Students' transcription of online discussion was analyzed using a mixed methods approach, combining computer-mediated discourse analysis and Chi-square test analysis. The data revealed that the online discussion helped pre-service teachers not only deepen their learning of mathematics methods, but also demonstrated their abilities to teach mathematics in different ways. It also indicated that the depth of their learning depended on the levels of threads and topics of discussion. Deep learning occurs 1) more often in the first level thread than subsequent level threads, and 2) in discussion topics, primarily those related to practice-based issues rather than theory-based topics.*

*Keywords: Deep Learning, Depths of Learning, Online Communication, Online Discussion, Mathematics Education, Pre-Service Teacher Education, Surface Learning*

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## INTRODUCTION

In recent years, online learning has become prevalent in teacher education programs. Research suggests that teachers' deep learning can be effectively supported in professional environments using online discussion tools (Baek & Barab, 2005; Juan, Steegmann, Huertas, Martinez, & Simosa, 2011; Ryan & Scott, 2008; Yuen & Ma, 2008). When online learning environments are designed to support meaningful interaction between pre-service teachers, deep learning can result through reflection and articulation of belief systems (Dettori, Giannetti, & Persico, 2006; Li, 2005; Schlager & Fusco, 2004).

This provides opportunities for pre-service teachers to both accumulate knowledge and learn what it means to teach, and not only mathematics. Many mathematics teacher education programs incorporate online discussions to help pre-service teachers be actively engaged in deep learning of mathematics (Brendefur & Fryholm, 2000; Breyfogle, 2005; Cady, & Rearden, 2009; Liu, 2008). To make the process of learning to teach mathematics a successful experience, teachers need a foundation for their learning: a deep understanding of mathematics that enables them to reason from basic mathematic principles (NCTM, 2000).

Recent reforms in mathematics education have also encouraged learners to use various forms of communications in order to become engaged in deep learning of mathematics content

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through reflection (Brendefur & Fryholm, 2000; Breyfogle, 2005). Having content knowledge and being able to reflect one's own experiences cannot be overemphasized in initial teacher preparation and in-service professional development (Cady & Rearden, 2009; LaBoskey, 1994; Schön, 1987; Shulman, 1987).

The success of an online discussion can be measured by the amount of learning that has taken place or how much deep and surface learning of the topic has been demonstrated in the discussion threads (Chacon, 2005; Cheung & Hew, 2005; Gerbic & Stacey, 2005). While there have been some studies (Henri, 1991; McKenzie & Murphy, 2000) about deep and surface learning in online contexts, Gerbic and Stacey (2005) argue that deep and surface learning have not been substantially examined in a computer mediated learning environment. It is therefore important to be able to gauge whether or not learning has taken place.

In this study, we focused on the influences of asynchronous online discussion to facilitate deep learning of mathematics via reflection. Specifically, this study examined the depth of learning (deep and surface) using analytical lenses proposed by Gerbic and Stacey (2005). Next, this study examined variables (level of discussion threads and nature of discussion topics) that are related to the depth of learning.

The findings of this study will be helpful to teacher educators who are interested in incorporating online discussion to facilitate deep learning which extends classroom discussion. This study will confirm the categories to analyze deep and surface learning.

## **THEORETICAL FRAMEWORK**

### **Depth of Learning: Deep Learning and Surface Learning**

Depth of learning ranges from surface learning to deep learning. Deep learning and surface learning are two ways of processing learning materials which can be traced back to the original study by Marton and Säljö (1976a, 1976b) and were later elaborated by Biggs (1993) and

Entwistle and Walker (2002). Deep learning is described as being "towards comprehending the meaning of the material to be learned" (Richardson, 1994, p. 463). It is intrinsically motivated, promotes reflective knowledge construction through active participation, and employs high level meta-cognition. It is a process of collaboration, social negotiation and reflection by learners on their own learning practices advocated by constructivist learning theory (Duffy & Cunningham, 1996).

Surface learning, on the other hand, is described as being "towards merely being able to reproduce the materials to be learned for the purposes of academic assessment" (Richardson, 1994, p. 463). It is extrinsically motivated and a passive processing of information that lacks reflection, and employs low level meta-cognition. This tends to be rote-learning and lacks application.

### **Framework to Examine the Depth of Learning**

There have been many studies that suggest frameworks for investigating the depth of learning. Fuller and Chambers (1999) and Lizzo, Wilson, and Simmons (2002) suggested a framework for the analysis of the depth of learning in a face-to-face environment. Gerbic and Stacey (2005) proposed a generic framework for the content analysis of deep and surface learning that can be used both for face-to-face and various online learning environments. Their framework was influenced by Entwistle and Ramsden (1983), Henri (1991), and McKenzie and Murphy (2000). Because of its comprehensive and versatile nature, this study adopted the framework of the Gerbic and Stacey (2005) model.

According to Gerbic and Stacey's analytical framework (2005), deep learning is defined in this study as the ability of learners to demonstrate critical thinking skills by (a) looking for meaning in course content, (b) relating course topics to prior knowledge and real world examples, (c) interpreting content through synthesis, analysis, and evaluation, and

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