Chapter 34
3D Modeling and Printing Integrated Lesson Planning:
A Competency–Building Project to Improve Pre–Service Teachers' Readiness for Technology Integration

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ABSTRACT

This chapter presents the design and development of the competency-building 3D Instructional Video Project intended for developing pre-service teachers' technology integration competency. Unlike traditional projects in educational technology courses that are well defined and structured, involving using an educational tool to complete a task, the 3D Instructional Video Project is a semester-long project requiring pre-service teachers to plan their 3D modeling and printing integrated lesson, explore Tinkercad and design their 3D models, test their 3D models with the Makerbot Desktop, print off their 3D models with a Makerbot 3D printer, and present their 3D modeling and printing integrated lesson planning through a video created with iMovie. This 3D Instructional Video Project engages pre-service teachers in discovery learning and is designed to help pre-service teachers to build their competency for dealing with the constant changing landscape of educational technology and transforming teaching and learning with emerging technologies.

INTRODUCTION

Technology integration has long been acknowledged as an important means of improving learning experience and enhancing student achievement (U.S. Department of Education, 2001, 2004, 2013). The past two decades have witnessed incessant efforts to increase access to technology resources in schools, from the 3.8:1 ratio of students to instructional computers with Internet access in 2005 (Wells & Lewis, 2006) to one-to-one laptop or ipad and one Smart Board each classroom (Lu, Ottenbreit-Leftwich, Ding, & Glazewski, 2017; Poll, 2014) in recent years. However, these efforts have not always been accompanied with effective uses of technology. On one hand, there is high access to technology resources, and on the other hand there are technology uses for low-level learning tasks (e.g., word processing, Internet research, random video watching, and practiced drills) associated with teacher-centered instructional practices (Cuban, Kirkpatric & Peck, 2001; Ertmer, 2005; Sun, 2013). This "high-access vs. low-use" paradox (Cuban et al, 2001) is not uncommon in technology integration practices (Becker, 2001; Culp, Honey & Mandinach, 2005; Ertmer, 2005; Govender & Govender, 2014; Palak & Walls, 2009;). Behind this "high access vs. low use" paradox lies teachers' unpreparedness for technology integration (Tondeur, Roblin, van Braak, Fisser, & Voogt, 2013).

Most teachers with access to technology, teaching experience, and technology knowledge and skills are still not able to effectively incorporate technology into their teaching (Akbaba-Altun, 2006; Govender & Govender, 2014). Pre-service teachers are worse off due to their lack of experience in teaching. Grown up as digital natives, pre-service teachers are expected to be ready for integrating technologies into teaching and learning when graduating from their teacher preparation programs. Unfortunately, it has been reported that pre-service teachers lack the knowledge and skills of teaching effectively with technology and are not ready for technology integration (Brinkerhoff, Ku, Glazewski, & Brush, 2002; Brown & Warschauer 2006; Johnson 2012; Sun, Strobel, & Newby, 2017). Although teacher education programs have included educational technology courses as part of their teacher preparation curriculum (Kleiner, Thomas, & Lewis, 2007; Lawless and Pellegrino 2007; Polly et al. 2010), such courses are typically stand-alone courses primarily focusing on technological knowledge and skills rather than how technology should be used to effectively to improve teaching and learning (Admiraal et al., 2017; Angeli and Valanides 2009; Graham, Culatta, Pratt, & West, 2004; Hargrave & Hsu 2000; Jimoyiannis, 2010; Sun, Strobel, & Newby, 2017).

Technological knowledge and skills alone are not enough to prepare pre-service teachers for technology integration. As Earle (2002) noted, "integration is defined not by the amount or type of technology used, but by how and why it is used" (p. 3). It calls for paradigm shift and innovations in educational technology courses to equip pre-service teachers with an understanding of the "how and why" about technology integration and improve their competency and readiness for technology integration. This chapter introduces the 3D Instructional Video Project as an attempt to help innovate educational technology courses and identify effective ways for preparing pre-service teachers for technology integration.

The 3D Instructional Video Project was designed and developed in the big context that training or preparing teachers for technology integration may be harder than we have expected in face of the fact that we are dealing with moving targets (Valdez, McNabb, Foertsch, Anderson, Hawkes, & Raack, 2000) undergoing fast and constant upgrading and transformation and creating the possibility of teachers' being "perpetual novices" in the technology integration process (Mueller Wooda, Willoughby, Ross, & Specht, 2008). In such a big context, educational technology courses need to do more than just exposing pre-services teachers to a bunch of technology tools and requiring them to develop knowledge and skills

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