Chapter 9

From 2D Thinking to 3D Printing: Preservice and In–Service Teacher Teams Explore a New Technology

Torrey Trust
University of Massachusetts – Amherst, USA

Robert W. Maloy
University of Massachusetts – Amherst, USA

Suzan Kommers
University of Massachusetts – Amherst, USA

ABSTRACT

Riding the wave of increasing popularity and declining costs, many schools are buying 3D printers. However, while this technology has the potential to transform teaching and learning, it remains an open question how teachers and students will use this new technology. To date, 3D printing has no agreed upon set of best practices and there are no definitive set of research findings to guide the implementation of 3D printing in school settings. In this chapter, the authors present the results of an action research study exploring how teams of preservice and in-service teachers learned to integrate 3D printing into their lesson planning and instructional practices. The authors highlight two case studies that provide an in-depth look at how preservice and in-service teacher teams implemented a 3D printing lesson plan. Based on the findings, the authors provide recommendations for supporting teachers' use of this innovative new technology to redesign teaching and learning.

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INTRODUCTION

Producing physical objects from computer files, 3D printing is revolutionizing people’s lives. Innovations in 3D printing abound and astound—medical doctors using 3D printed models to develop plans for challenging surgeries (Ubelacker, 2016); NASA printing 3D food for astronauts; the Smithsonian providing free access to 3D models of its artifacts (Clough, 2014); the manufacturing company Local Motors assembling the world’s first drivable 3D-printed car in only 44 hours; researchers in Australia printing the first ever jet plane engine (Milman, 2015).

3D printing is emerging in K-12 education as well. MakerBot, a leading manufacturer of 3D printers, plans to put 3D technology in every school in the United States (Franzen, 2013). As MakerBot CEO Jonathan Jaglom remarked after visiting a school in Connecticut where students are using 3D technology as a regular part of the curriculum: It is “incredible to see 12-year-olds sketch in 3D, print in 3D. The idea is that, 10 years down the line, that becomes natural, and that will move into the household space” (Zaleski, 2015).

Riding the wave of increasing popularity and declining costs, many schools are buying 3D printers. However while this technology has the potential to transform teaching and learning, it remains an open question how teachers and students will use this new technology. To date, 3D printing has no agreed upon set of best practices and there are no definitive set of research findings to guide the implementation of 3D printing in school settings.

In schools, the role of teachers is crucial to the success of any new technology. Teachers need to learn how to use technology and allow it to change their pedagogy before that new tool can effect changes in the classroom (Bitner & Bitner, 2002). Beyond knowing how to use a new tool, teachers need to see first-hand how technology can be leveraged to create powerful learning experiences for students (Ertmer & Ottenbreit-Leftwich, 2010). To date, there has been limited support and training to help K-12 teachers learn how to maximize the potential of 3D technology in their classrooms. Some educators wonder: Will 3D technology burst on to the scene only to recede into minimal and inconsequential use?

In this chapter, we present the results of an action research study exploring how teams of preservice and in-service teachers learned to integrate 3D printing into their lesson planning and instructional practices. In this 3D Printing 4 Teaching & Learning study, we paired 10 preservice teacher candidates (ranging in classroom experience from literacy tutors to student teachers) from a College of Education in a public land grant university in Western Massachusetts with 13 public school classroom teachers from variety of subject fields and grade levels. After providing everyone with two days of workshops designed to introduce 3D printing and modeling, each preservice/in-service pair developed a curriculum project that connected 3D printing to standards-based academic content and featured active modeling and design work by K-12 students.

Even though the number of participants in this study is small, this project represents a unique opportunity to document the attitudes, knowledge, and practices of future and current teachers at a time when a dynamic new technology is just beginning to be integrated into K-12 schools. We begin by presenting a brief overview of 3D printing as a technological innovation before describing how we used interactive workshops to introduce preservice candidates and in-service teachers to this technology’s potential for impacting academic learning. Next, we will discuss how preservice and in-service candidates went about creating a curriculum project that connected K-12 students, academic content, and 3D printing.