Chapter 2
The Role of Digital Fabrication in Today's Society

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ABSTRACT

Digital fabrication and the "maker movement" can play a major role in bringing computational technology into the 21st century classroom. Digital fabrication is defined as the process of translating a digital design developed on a computer into a physical object or any process for producing/printing a three-dimensional (3D) object. The maker movement is a platform for today's futuristic artisans, craftsmen, designers and developers to create, craft, and develop leading ideas and products. Digital fabrication and "making" could provide a new platform for bringing powerful ideas and meaningful tools to students. Digital fabrication has the potential to be "the ultimate construction kit." Digital fabrication has strong ties to the maker movement. Maker spaces provide students with safe areas that allow students to safely use digital fabrication to make, build, and share their creations. This chapter will look at the role that digital fabrication can play in incorporating computational technology into the K-12 classroom.

INTRODUCTION

Digital fabrication and "making" will provide a new platform for bringing powerful ideas and meaningful tools into today's classrooms (Blikstein, 2013). Digital fabrication has the potential to be "the ultimate construction kit" (Briones, 2019). With strong ties to the maker movement, digital fabrication perpetuates innovation. Maker spaces support innovation and provide students with safe areas to use digital fabrication to make, build, and share creations" (Blikstein, 2013, p. 6).

BACKGROUND

Computational technology "involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science. This chapter will look at the

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role that digital fabrication can play in incorporating computational technology into the k-12 classroom. Although digital fabrication has been available for the last 15 years (Cutcher-Gershenfeld, Gershenfeld, & Gershenfeld, 2018) until the last few years the cost of the technology made classroom use probative. Currently, many schools have the technology, however, integrating digital fabrication into the k- 12 classroom has presented a challenge. Innovative opportunities for incorporating digital fabrication into the classroom have been explored by various educators (Bull & Garofalo, 2009; Stansell, 2016). Educators have trouble making the new technology "fit" into what they are required to teach. There appears to be a strong relationship between engineering curriculum and digital fabrication however few countries actually employ and implement engineering curriculum in the k-12 setting. Because of a lack on integrated curriculum, digital fabricators are often used for creative opportunities for exploration with little connection to required classroom curriculum. Cutcher-Gershenfeld, Gershenfeld, and Gershenfeld (2018) believe that digital fabrication has the potential to change our day-to-day environment and even redefine the concept of work. Digital fabrication builds on two earlier digital revolutions, digital computation and communication. These two factors are key components of computational technology and hold the basis for connecting computational technology into digital fabrication. Digital fabrication holds the potential to be an innovative technology, just as innovative as the Internet was a decade ago. To make the most of future workplace opportunities, clearly students need the opportunity to learn and work with digital fabrication in a purposeful way.

MAIN FOCUS OF THE CHAPTER

With the potential to provide infinite creative experiences for k-12 students, digital fabrication involves the conversion of a digital design into a physical object through a computer-controlled fabrication system. Personal digital fabrication makes designing and producing objects feasible. The opportunities for creative projects are boundless. At initial introduction, most students are enthralled, making, phone holders, whistles, name tags, bracelets, and other objects. Projects spring off the digital fabricator as students begin to view themselves as "creators" and "makers." Students can design and create objects with Computer Aided Design (CAD) software or even download an existing model from the massive number of Internet shape libraries that are emerging to house models. At one time, digital fabrication required industrial plants for computer-aided design and manufacturing (CAD/CAM). But today, desktop fabrication systems make these technologies available to schools and the general public. For example, the Cornell College of Engineering developed a 3D fabrication system, Fab@Home available for home users. Digital fabrication and 'making' could be a new and major chapter in a process of providing powerful ideas, literacies, and expressive tools for learners. Today, the range of accepted disciplinary knowledge associated with digital fabrication has expanded to include not only programming, but also engineering, design (Astrachan, Hambrusch, Peckham, & Settle, 2009; Yasar & Landau, 2003), mathematics (Bull & Garfola, 2009, Stansel), and language arts (Tillman, Kjellstrom, Smith & Yoder, 2011). There is a need to determine the impact that digital fabrication may play on: students' learning in STEM, students' attitudes towards STEM and students' interest in a STEM career. It is yet to be determined the role that digital fabrication will play in 21st century STEM job markets as well as the general job market. Digital fabrication is so new that we don't have a "blueprint" for predicting how this technology will change our workplaces.

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