Chapter 29
STEM Education for Girls:
Perspectives of Teachers During a Makeathon

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ABSTRACT

Makerspaces are common learning spaces providing hands-on opportunities for students to make, create, plan, and play. This chapter describes an equity-oriented (girls) makeathon day. Teacher and teacher candidate participants (n=15) acted as mentors for 22 girls creating wearable technologies, augmenting reality using old t-shirts, and creating a mobile app related to an issue that teen girls face today. The results of this case study focus on results from an adapted questionnaire (teacher efficacy and attitudes toward STEM [T-STEM]) and semi-structured interviews. Qualitative data of this case study research was analyzed through open-coding and triangulated with quantitative data and Mann-Whitney U tests. Participants identified the importance of technologies for their growth as educators and to create safe and supportive environments for girls. Participants highlighted the importance of professional development and support and how to create effective makerspaces. Continued research and opportunities need to be created to encourage diverse educational makeathon events.

INTRODUCTION

The pendulum of educational training swung from traditional, lecture style, and fact memorization techniques to exploratory, hands-on, guided learning, and back again throughout the 20th century. Some of us have experienced one or the other type when we were in school. And some of us have had the opportunity for both. As the pendulum continues to swing, we move into the 21st century in which learning has taken on a more project or problem-based learning (PjBL and PBL) approach with hands-on opportunities for students. Not only are many schools diving into PjBL/PBL, there has been an increase in incorporating digital technologies into day to day educational practice. This PjBL/PBL and techno-logical shift has challenged current structures of several teacher education programs and professional development to once again to focus on more 'doing' and less 'showing'. In particular, with increased demand for educational technology to be integrated into classrooms (through administrative or policy requirements or parent demands or educator interest), many educators are asked to be more innovative and provide opportunities for students to get hands on, technological experiences. Based on some of these demands, there has been an increased interest with one such innovation: makerspaces in learning. Makerspaces are common learning spaces in which people can partake in hands-on experiences by de-signing and re-designing, analyzing and re-analyzing, iterating and re-iterating, building and unbuilding, and creating and re-creating (Anderson, 2012; Bevan, Petrich, & Wilkinson, 2015; Bullock & Sator, 2015; Thomas, 2014). As these makerspaces have broadly swept into community areas, they have also taken their hold in schools. Educators, both practicing teachers and pre-service teacher candidates, are developing skills and discovering makerspaces while attempting to incorporate diverse learning experi-ences in their classrooms. As pressure increases for these innovative practices there is also an increase in maker pedagogy. As defined by Bullock and Sator (2015):

Maker Pedagogy is an approach that utilizes the principles of ethical **hacking** *(i.e., deconstructing exist-ing technology for the purpose of creating knowledge),* **adapting** *(i.e., the freedom to use a technology for new purposes),* **designing** *(i.e., selecting components and ideas to solve problems), and* **creating** *(i.e., archiving contextual knowledge obtained through engaging in the process of making, as well as the actual tangible products) as part of an overall way of working with those interested in learning about science and technology.*

This chapter will focus on the perspectives of practicing teachers and pre-service teacher candidates in an equity-oriented, 'girls only', makeathon day (one day, multiple hands-on and technological activi-ties). Teachers and pre-service teacher candidates reflect on the role of maker pedagogy and science, technology, engineering, and math (STEM) education for girls and training (or lack of) and professional development. Grounded in constructionist and design-based learning theories, this chapter will explore the growing role of makerspaces in 21st century education (Harel & Papert, 1991; Papert, 1993; Papert, 1980; Piaget & Inhelder, 1969). This chapter will ask what do practicing teachers think of makerspaces and STEM education in the 21st century? What do pre-service teacher candidates, who are still finish-ing their teaching degree, think of makerspaces and STEM education in the 21st century? And where do they 'girls' fit in these learning environments?

The chapter will present the findings of fifteen practicing and pre-service teachers who voluntarily participated in a one-day intensive maker event with several educational technology activities. These participants completed a Teacher Efficacy and Attitudes Toward STEM (T-STEM) survey (Friday Institute

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