Chapter 18
Effect of the Collaboration Between MakerSpace, University, and Elementary Schools on Student STEM Attitudes:
Bringing the Maker Movement to Elementary Schools

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ABSTRACT

This chapter examines the effect of a STEM project developed in collaboration between MakerSpace, a public university, and a Title I elementary school on student STEM attitudes and interests in future STEM careers. There is limited research on the Maker Movement and practically no research on whether MakerSpace facilities and expertise can be effectively integrated into a standards-based elementary school curriculum. As part of this study, 5th grade students designed and built birdhouses to make connections between mathematics and science learned in the classroom and world around them. The study was conducted in urban settings, in a school with large percentages of at-risk students. Pre- and post-surveys were administered to measure student STEM attitudes, 21st century skills, and interests in future STEM careers. Results showed significant increase in scores in all these areas after students completed STEM projects. This study illustrates a successful collaboration between MakerSpace and local schools to enhance the standards-based school curriculum.

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INTRODUCTION

As technology advances and increases its reach within everyday life, the demand for STEM education and STEM professions increase as well. STEM instruction is integrated into the academic curriculum, branching from the elementary school classroom, to the secondary school classroom and beyond. However, student attitudes toward STEM vary, specifically among elementary school students. STEM educators work hard to create positive attitudes towards science, technology, engineering and mathematics in their students, in hopes of fostering a lifelong interest in these fields. A recent movement in STEM education is the Maker Movement (Hsu, Baldwin, & Ching, 2017). The Maker Movement provides a project-based approach to STEM education that integrates curriculum standards across subjects including science, technology, engineering, mathematics, art, and the humanities. The purpose of this study is to examine whether elementary school students' attitudes toward STEM, 21st century skills, and students' interests in future STEM careers were affected by introducing a real-life STEM project into mathematics curriculum.

Background

Being that STEM attitudes vary across all student levels, it is not only important to understand how to spark student interest in these fields, but also how to sustain such an interest. In 2009, President Obama issued a statement to bring forth business involvement in STEM education (Giglio, 2010). Following this statement, in 2010, more than 100 CEO's launched Change the Equation, a non-profit organization dedicated to educating students in STEM fields. "Through innovative and effective company-led programs, Change the Equation aims to fill the opportunity gap with capable and enthusiastic STEM-literate young people." (Giglio, 2010) Change the Equation is the first and only program that brings together a large number of corporate leaders, politicians, and educators to build the success of STEM education. Thus far, Change the Equation has launched STEMworks, an online database for effective STEM programs, iON Future, a series of online games that encourages STEM career opportunities, and published its Work-Based Learning Guide that illustrates ways companies can engage students in STEM careers.

Similarly, in an ongoing project, titled "STEM-Inc", junior high school students are exposed to STEM subjects through engineering and computer science projects. This project, funded by the National Science Foundation, intends to sustain student interest in STEM fields, while making students aware of STEM career opportunities. This project implements hands-on, group oriented learning experiences for students. The STEM-Inc project recruited college students from California State University Fullerton (CSUF) to serve as mentors to guide the junior high school students. This university-public school relationship in coordination with the hands-on engineering and computer science projects showed improvement in attitudes towards STEM for both, the junior high school students and their college mentors. However, this study has not yet found an increase in STEM abilities, nor interest in STEM fields. (Nair et al., 2017)

Maker Movement and Schools

More recently, the Maker Movement has become increasingly popular amongst K-12 educators. The Maker Movement is a movement in education that represents the growing interest to create and build material objects as a way of playing, and as a way of creating something useful. (Martin, 2015) The maker movement is a relatively new movement in education, but its foundations stem back to common pedagogical theories. It has been argued that children can learn from playing and building. When