Introduction

There is a current disconnect in our educational system. Eric Sheninger speaks about it in his recent book, *Digital Leadership* (2014). He calls for a transformation that will turn schools into vibrant places for learning that unleash student creativity and open new pathways to innovation. One pathway is the integration of relevant, engaging learning for students in science, technology, engineering, and math (STEM).

Educators are under pressure to increase the amount of integrated STEM content taught to students (National Research Council, 2011), but few teachers have had significant opportunities to learn and develop the skills necessary to provide this instruction. During the next decade, U.S. demand for scientists and engineers is expected to increase at four times the rate for all other occupations!

In order to equip future leaders with the necessary skills to power innovation and economic growth, students must be more than proficient readers and writers, they must be literate in science, technology, engineering, art, and math. Schools, libraries, community groups, and institutions of higher education are beginning to observe this trend and infuse new opportunities into their programming.

These types of programs have increased student skills in the 4C's: creativity, collaboration, communication, and critical thinking. Often called 21st Century Skills, these are future-facing dispositions that young people need to possess. (Since we are fifteen-plus years into this century, we should probably call these skills something else.)

Subjects in school cannot be addressed in isolation. The integration of concepts is an important prerequisite for students going to college and entering careers. Innovation is not exclusive to scientists, programmers, and engineers; it requires input from artists, designers, and creative problem solvers as well. Tapping into innovation and creativity, STEM has shifted to STEAM, adding the *A* for the arts.

Elementary students are naturally curious and often willing to engage in new ideas. Implementing STEAM and making at this level is a natural fit for students at this age. These types of learning experiences can be powerful learning opportunities for children. STEAM and making are on a rising trajectory.

Some schools have redesigned spaces within their buildings; others revamped their curriculum to include programming, robotics, and digital media. Young learners need to engage in authentic tasks: brainstorming, setting goals, gathering materials, sketching, questioning, constructing, and fixing things, which can happen in and out of schools.

STEAM-Makers

To read a QR code, you must have a smart-phone or tablet with a camera. We recommend that you down-load a QR code reader app that is made specifically for your phone or tablet brand.

Pinterest

It is my hope that this book will provide a background in what I call STEAM Making, while providing guidance to make these instructional shifts. To help readers find inspiration in the schools and organizations that are already engaging in this exciting work, links and resource lists have been interspersed throughout the book. In addition, a website has been set up at **www.STEAM-Makers.com** as well as a Pinterest account at **https://www.pinterest.com/jaciemaslyk/steam-makers**, where you can access additional resources.

Chapter 1 will provide a brief history of STEM and its transformation into STEAM. The Maker Movement will be discussed as well as the mindset needed to engage in this type of work. The connection between the two forms the integrated model of learning called STEAM Making.

The reality of the Common Core and the Next Generation Science Standards will also be aligned to the STEAM Makers model.

In Chapter 2, the changes in STEAM Making are reviewed, including the impact at the district, school, and classroom level. We will look at schools that have embraced changes in culture, curriculum, and physical space. Innovative schools and organizations will be highlighted.

Chapter 3 hits on the important theme of failure. Developing the Habits of Mind and the Engineering Habits of Mind establish the characteristics needed in learners. Assessment is discussed in this chapter, with an emphasis on badging. STEAM Making is an all-inclusive practice that can positively impact all types of learners. Examples will be shared regarding students with learning disabilities, speech and language impairments, and those with autism. Stories about several student STEAM Makers are shared within this chapter, as well.

Creating connections between STEAM and making is explored in Chapter 4. This chapter will highlight the journey of one elementary school as it transformed its programming and developed a dedicated makerspace for K–6 students. Student stories and teacher challenges will be shared throughout the chapter. Numerous resources developed by the school are also included.

In Chapter 5, the concept of building will be explored. Schools and districts are building physical learning spaces. They are building new programs and curriculum to meet the needs of their students. District leaders are building a culture for the STEAM Maker movement, a culture that promotes growth

and design thinking. We will share stories from amazing schools like The Ellis School, Elizabeth Forward School District, Kiski Intermediate School, and the South Fayette School District.

The importance of creating a STEAM Maker network is shared in Chapter 6. The work of Pittsburgh's Remake Learning is highlighted along with the learning ecosystem that is being nurtured within this region. Stories from innovative organizations within the Remake Learning network are provided to show the possibilities of learning partners. The Millvale Community Library, Assemble, and the Allegheny Intermediate Unit will be highlighted. Expanding the network to higher education, new ideas will be shared from the Center for Arts and Education at West Liberty University and Robert Morris University.

Chapter 7 will provide some tools to help anyone start their STEAM Making journey. We will discuss planning for student engagement and the importance of connecting to local experts. In-text tools will help readers to focus on an action plan, including getting resources and pursuing grants funds to support STEAM Making.

NOTE FROM THE PUBLISHER

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