

## Chapter 4

# STEM Becomes STEAM: Educational Innovation in the 21st Century

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### ABSTRACT

*Education has seen many changes as we move into the 21st century. Students have been traditionally educated to contribute as specialists in the STEM fields, and now the needs to be prepared for the future are changing and driving educational transformation. The procurement of employment is no longer reliant on a set of specific skills and routines; instead, people in the workforce are being asked to collaborate and innovate solutions and processes. Educators are tasked with integrating more of the design and creative processes through arts integration, which helps students learn how to be confident learners and future contributors to the modern workforce. Throughout this chapter, the author explores the historical arch of these recent changes that brought the arts into STEAM, as well as changes related to gender and innovation in the STEAM fields as society enters the 21st century, and computer science contributions to the classroom.*

### STEM BECOMES STEAM: EDUCATIONAL INNOVATION IN THE 21<sup>ST</sup> CENTURY

Throughout history, society has adapted to technological changes as they continue to unfold. People in society have worked hard to keep up with the curve of new skills that are demanded by the workforce. The education field has paralleled these movements and focus on developing a curriculum of skills that support the needs of learners to be prepared for the workforce post-graduation. This chapter seeks to explore the history, and theory of STEM and STEAM education, identify practical instruction methods, as well as discuss modern implementation strategies that support student success in the elementary and middle school 21<sup>st</sup> century classroom.

During the Technological Revolution of the late 1800s and early 1900s, educational theorists worked with institutions and debated ideas that would best educate modern students. They were faced with a large amount of immigration, where children would need to learn a new language and American culture from their schools in addition to new skills. American education took more of a structured form as it began

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## ***STEM Becomes STEAM***

to move away from being a responsibility of the family, and was offered by the state to help a growing nation prepare for its future (Collins & Halverston, 2018).

These types of changes continued to occur as the demands of the workforce changed throughout the 20<sup>th</sup> Century. With the development and evolution of computers in the later part of the 20<sup>th</sup> century, things changed significantly, and new skills were once again needed. The education world developed standards involving the area of STEM education, which combined the areas of science, technology, engineering, and math to help prepare students for the professional needs of modern workforce requirements (Perignat, 2019). There was a lot in common that these subjects shared, and it made sense to combine them to help promote better collaboration and rigor. Specialists in these fields had the benefit of coming together and relying on one another's expertise to solve the problems of the 20<sup>th</sup> century. Schools began to embrace the incorporation of the STEM education model with their students, which lead to the development of educational innovation to meet the needs of the 20<sup>th</sup>-century workforce (Wilson, 2020).

Education for the future seemed to have an element of predictability through this time in history, but as innovations started occurring much more quickly toward the end of the 20<sup>th</sup> century, it became more difficult to know exactly how to prepare our students. So the next natural questions that need to be answered include: What happens when the world starts changing in unpredictable and rapid ways? How can we ensure that our children will have the skills to be successful when we are not sure what positions we are preparing them for (Robinson, 2010)?

## **Preparing Students for the Unknown**

Around that time, it became obvious that there was something missing from this particular model. Theorists started to consider what students would need in the 21<sup>st</sup> century, and they felt that adding arts and design to the STEM model would have a positive effect (Reitenbach, 2015). STEM then became STEAM, and adding collaborators with an arts background helped improve the process of communication. Traditionally, these types of professionals in the arts are risk-takers and bring divergent thinking to innovation. This helped make many of the creations of STEM professionals more appealing and marketable to the public (Reitenbach, 2015).

In current modern times, it seems that as soon as a physical skill is taught, it is practically replaced by another more efficient system. Technology and other aspects of the world are changing rapidly and are redefining what future competencies should be. Certain procedures are no longer needed and are replaced by more efficient operational solutions, many of which require the need for technical skills, and creativity (Land, 2013). Students are faced with being prepared for a world that they are unable to anticipate. Alongside them stand the teachers tasked with finding the best way to prepare students for this unknown future.

The skills being taught need to be developed in a way where students embrace methods to promote becoming idea makers (Papert, 2000) while supporting the infusion of STEAM into cross-curricular understanding. Skills of the 21<sup>st</sup>-century are also incorporated into the success of the STEAM model in education. These skills include collaboration, problem-solving, critical thinking, creativity, information literacy, flexibility, and technology literacy (Hunter-Doniger, 2018). The thinking behind this was to support the uncertainty of the future generation. If educators and students are uncertain as to what specific skills they would need for the future workforce, then it is important to develop skills and characteristics that would prepare them to use an interdisciplinary approach to creatively problem-solve and teach themselves so they could innovate and create modern solutions (Rao, 2014).

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