

Chapter 10

Using Arts Education in STEM With the Science and Engineering Practice of Developing and Using Models

Lizette A. Burks
University of Arkansas, USA

ABSTRACT

Since 2013 more than three-quarters of the United States has adopted science education standards based on the Next Generation Science Standards (NGSS). Science education is often integrated with multiple disciplines including technology, engineering, and mathematics (STEM) and in more recent movements integrated with the arts (STEAM). This chapter examined preservice teachers' preconceptions about the practice of developing and using models in science education and practical integration of the arts through this central practice. The results of the study indicated preservice elementary preconception survey scores were higher when describing the practice as a social endeavor than any other aspect of the practice. Using social endeavors as a lever in elementary teacher education can help preservice teachers utilize this critical practice in more expansive ways (investigatory, sensemaking, critiquing). Examining the way the arts manifest in the practice of developing and using models within the NGSS serves as a first step to finding meaningful ways for integration.

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INTRODUCTION

“The fundamental creative practices of imagination, investigation, construction, and reflection...are essential in the arts but equally important for science and mathematics learning” (National Coalition for Core Arts Standards, 2014, p. 19). The term STEAM (Science, Technology, Engineering, Arts, and Mathematics) was coined by the Rhode Island School of Design and was created to potentially enhance STEM (Science, Technology, Engineering, and Mathematics) (Allina, 2018). The acronym STEM is not a new term and has had challenges as it continues to evolve from being used primarily as an educational slogan and into more meaningful and practical opportunities for reforms (Bybee, 2013). Just as stating STEAM stands for science, technology, engineering, arts, and mathematics only clarifies the acronym, Bybee (2018) states doing the same for STEM over the last decade has not provided a definition with implications for coherence in K-12 education programs. Although slogans can be rallying symbols for potential unity in educational movements, capitalizing on the support before the term “loses the power to rally and instead becomes the subject of criticism” (Bybee, 2018, p. 6).

Since 2013 more than three-quarters of the United States has adopted science education standards based on the *Next Generation Science Standards (NGSS)* (NGSS Lead States, 2013) and/or *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (the Framework)* (NRC, 2012) (NSTA, n.d.). This new vision for science education has changed the landscape with a central focus on student sensemaking of science phenomena and has moved away from rote memorization of scientific knowledge. Central to sensemaking of phenomena in the *NGSS* (NGSS Lead States, 2013) is the science and engineering practice of developing and using models, a new practice in science standards and is the focus of the study in this chapter. With the implementation of the *NGSS* (NGSS Lead States, 2013), specifically the science and engineering practices, shifts in science preservice professional learning will be needed. In a period of time when science education is changing, integration with other disciplines can be criticized if meaningful integration is not created from a practical view point.

One way to move towards capitalizing on the support for STEAM education is to find ways the arts inherently manifest in the *NGSS* (NGSS Lead States, 2013) as a way to move towards more meaningful and practical opportunities for reform. Elementary teacher education is changing due to changes in science education standards. Teacher preparation time is limited as elementary teachers currently “take a limited number of science courses and a single science methods course” (NRC, 2012, p. 259). This chapter focuses on the way the arts manifest in the practice of developing and using models within the *NGSS* (NGSS Lead States, 2013) and seeks to find first steps in finding meaningful ways to integrate the arts in science education.

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