

Chapter 24

Virtual STEM Stories: Blending STEM and Literacy in a Virtual Environment

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ABSTRACT

Literacy is critical for success in other areas, including science and engineering. As teachers responded to the demands of remote learning because of the COVID-19 pandemic, they developed innovative methods to teach both reading and STEM (Science, Technology, Engineering, Mathematics) subjects in virtual environments. This chapter describes how one team of teachers adapted face-to-face STEM and literacy modules for a virtual environment. The authors describe the face-to-face modules and the process the teachers followed to transition them to a virtual environment. The Analyze, Design, Develop, Implement, and Evaluate (ADDIE) framework—an approach to designing online learning—was used as a lens to analyze the process and the product of the virtual modules. Implications and recommendations for teachers seeking to adapt face-to-face lessons to a virtual environment are presented.

INTRODUCTION

Literacy is the key to students' success, as it is the critical skill required for learning all other subjects, including science and engineering. Research suggests that the most effective strategies proposed or attempted to date view literacy and Science, Technology, Engineering, and Mathematics (STEM) in a highly integrated manner (Campaign for Grade-Level Reading, 2016; Cervetti et al., 2012; National Academy of Engineering, 2008). In a 2016 report, the Campaign for Grade-Level Reading stated,

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Virtual STEM Stories

National awareness and ongoing movements promoting literacy and STEM education in the early years and early grades creates an opportunity for collaboration to improve educational outcomes for our nation's children, especially those from low-income families. Too often, education systems with scarce resources feel compelled to focus their instruction on one or the other, setting up a competition between teaching literacy and STEM subjects. However, the research on cognition, pedagogy, and brain function shows that students gain more knowledge and skills in literacy and STEM subjects when they are taught in tandem.

Further, the current context of remote and virtual learning creates both opportunities and challenges for teachers seeking to develop students' literacy and STEM skills. Quickly pivoting to remote formats in response to the COVID-19 pandemic in spring 2020 helped teachers develop an understanding of what works, and what does not work, in these unfamiliar approaches to teaching and learning. This chapter focuses on a program that integrates both STEM and literacy learning and was adapted from face-to-face delivery to virtual context to accommodate various approaches to instruction.

This project is a part of a larger project, STEM Stories, in which modules were developed: (a) using research-based best practices for attracting underrepresented students to STEM; (b) to incorporate activities that help develop the literacy (reading, writing, talking) skills of the participants; (c) using culturally relevant literature as a core component of the engineering activities to provide relatable role models and hooks for the student participants; (d) to be fun, engaging and hands-on to keep the interest of the student participants; (e) to make use of low-cost materials and supplies for prototype building; (f) to be in alignment with state curriculum standards; and (g) to include all resources for facilitation such as detailed instructions, material lists, accompanying PowerPoints, and a printable parent newsletter. Culturally relevant literature is defined as "literature where they [students] are able to see themselves, their families, their cultures, and experiences similar to what they have experienced will give them the opportunity to connect with the literature they read" (Oumet, 2011). The STEM Stories modules have been facilitated face-to-face at several after-school programs for second- and third-grade students with a direct impact of over 150 students. A full description of the STEM Stories modules is provided at <https://udayton.edu/engineering/k-12-programs/stem-stories-for-third-grade-students/index.php>.

In the 2019–2020 academic year, five classroom teachers integrated the STEM Stories modules into their traditional classroom instruction. Each lesson took approximately one to two weeks of classroom time. Teachers kept track of their impressions of the lessons, including challenges and opportunities for teaching and learning. When the abrupt shift to online and remote instruction occurred in March 2020, the teachers were unable to complete the remaining lessons as they adjusted their essential curriculum goals to the virtual context. Based on the experiences the teachers recorded when delivering the STEM Stories modules face-to-face during the 2019–2020 academic year, as well as their experiences with online and remote instruction from March to June 2020, the University of Dayton reached out to the teachers to see if they were interested in adapting the lessons for a virtual environment and potential remote instruction for the 2020–2021 academic year. Four of the five teachers agreed to participate. An additional teacher from a different school who had facilitated an after-school program with the lessons also agreed to participate.

The teachers met throughout the summer of 2020 to identify five lessons to adapt to a virtual learning experience. They kept the core of the lessons the same, including the objectives, read-aloud, and basic lesson components. However, they adapted each to be able to deliver at a distance, using a virtual platform. As they modified the activities to fit the virtual environment, they were encouraged to be cre-

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