



## Chapter 6

# An Integrated STEM Professional Development Initiative for Connecting Environmental Education Across Middle and Secondary Mathematics


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### ABSTRACT

*This chapter reports features of a professional development (PD) initiative and results from its underpinning qualitative inquiry. The researchers designed this initiative using the integrated science, technology, engineering, and mathematics (STEM) education framework to help teachers adapt integrated teaching practices and to make connections. Middle and secondary teachers completed 50 hours of training to enhance their content knowledge, to gain understanding of integrated STEM education, to identify and use resources and manipulatives of integrate*

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*STEM lessons, and to create lessons for implementation with their students. Data were collected through interviews, audio-visual recordings, and documents from participants. The findings were (1) framing the PD with the integrated STEM education model supports changes to teaching practices; (2) tasks integrating mathematics with EE are compatible integrations that help teachers adapt integrative teaching approaches; and (3) teachers' EE dispositions towards integration improved after the PD, especially as a component of social justice.*

## **INTRODUCTION**

Frequent, rapid changes in society, the economy, and in the diversity and availability of natural resources in recent decades bring to light the need for innovative educational approaches aimed at informing and solving environmental issues. When students engage in experiences that allow them to envision resolution or mitigation of environmental inequalities, motivation and proficiency to learn in subjects like mathematics and science increase as students feel their learning will serve a greater purpose (e.g., Glackin, 2018; Julyan & Duckworth, 1996). However, for students to acquire higher-order competencies and skills to study and address environmental issues, researchers and practitioners need more robust and inspiring teaching methods in science, technology, engineering and mathematics (STEM). Professional development (PD) targeting Common Core State Standards in science or mathematics prepare middle and secondary teachers to use effective approaches for increasing content knowledge and skill proficiencies in students. However, teacher training to integrate one or more STEM subjects across the targeted field is an underutilized approach to PD.

Discussions about the compatibility of integrating environmental education, mathematics, and science have ensued for decades (e.g. Lorson et al., 1993). Nonetheless, advancements in and the accessibility of technological and engineering processes have enhanced STEM integration efforts, and in some programs, the curriculum draws upon an environmental education context. Unfortunately, approaches to integrative teaching are not yet commonplace in pre-service and in-service teachers' training. This is mainly due to the early and exploratory research phases of describing effective teaching methods, identifying forms of integration, integrated curriculum development, and developing student outcome measures. There are, however, early adapting teacher educators and teachers who desire opportunities to pioneer integrative STEM teaching and learning. Educators do this so that more can be known about how interdisciplinary knowledge for teaching in their fields develops and to discern what skills and knowledge for interdisciplinary teaching contribute to student success. PD opportunities that introduce teachers to ways of teaching their subject through integration with other STEM topics and principles

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