Chapter 12
Connecting STEM Rich Learning Environments With Environmental Education

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ABSTRACT

The objective of this chapter is to provide an overview of research in the convergence of environmental education and science, technology, engineering, and mathematics (E-STEM) education models through a values-based framework for nature. An argument for the interconnectedness of environmental education and STEM programs is presented. A further argument presented that nature-based learning environments engage children in E-STEM. Lastly, an exploration of research suggests how various pedagogical practices incorporate and facilitate the E-STEM paradigm to prepare young children for 21st century workforce that can solve large, complex problems in an information and service-based economy.

INTRODUCTION

Due to a rapidly changing human landscape, dialogue among politicians, educators, and other experts identify science, technology, engineering, and mathematics (STEM) and environmental education fields as one of the best solutions to solving the world's critical issues. The advancement of E-STEM—the integration of environmental education into STEM (science, technology, engineering, and math)—connects children to a broad array of cognitive skills, abilities, and attitudes (Barr, Cross, & Dunbar, 2014; Bonnett, 2006; Capra, 2013; Eilks, 2015; Partnership for 21st Century Learning; 2007; Spinola, 2015; Stone, 2010; UNESCO, 2005; Warner & Elser, 2015). This field of study provides a vehicle that prepares children to be lifelong learners that know how to make a difference in this world.

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A growing body of research suggest the E-STEM educational paradigm is an expansive field of study with variations on methodical approaches. E-STEM education does not happen in isolation (Bonnett, 2006; Capra, 2013; Eilks, 2015; Spinola, 2015; Stone, 2010; Warner & Elser, 2015). Thus, the pragmatic suggestions of previous research seem to indicate that a connection occurs between environmental education (EE), STEM, and students' beliefs about the natural world. Hence, several questions beg answers. First, is there a convergence between environmental education and STEM? Second, do nature-based learning environments provide a method for engaging children in E-STEM? Lastly, how do various pedagogical practices facilitate connections between nature-based learning environments and E-STEM? This literature review examines the synergies between environmental education and STEM learning environments.

BACKGROUND

To understand the present relevance of E-STEM, the education paradigm of environmental education and the collective subjects in the acronym STEM requires examination. Historically, the constructs of STEM date back to the western expansion of the United States, arguably global modernization in the late 1700s early 1800s, with the design of railroads, bridges, and roads. The production of revolutionary technologies during the Industrial Revolution along with ways to improve the agrarian educational system furthered the study of STEM-related subjects. However, several historical events, The Second World War and the space race with Russia, during the 1940-1950s provided a genuine need for technologies and pushed conventional science, mathematics, engineering, and technology education to the forefront of societal wisdom (Stevenson, 2014; Oslter 2012). In the early 1990s, the National Science Foundation (n.d.) formally coined the STEM acronym.

As the last several decades proceed, a perpetual cycle of STEM frenzy continually arises as policymakers and others continually recapitulate the impending worker shortfall in the STEM field (Stevenson, 2014). To add to this cycle, an explosion of the technology fields has led to an urgent focus in interdisciplinary education to support the needs of a global workforce in technologies (Barcelona, 2014). In order to bolster the United States' performance in the global economy, an impetus for educational reform emerged in US policies in the way of STEM educational reform. Thus, the No Child Left Behind (NCLB) law—which grew out of alarm that the American education system was no longer globally competitive—afforded state funding for STEM education (Klein, 2015); while further reauthorization of NCLB gave genuine attention to the infrastructure and pedagogy of STEM education. The current Every Student Succeeds Act allocates increased federal funding for programs and initiatives to support STEM education (NGSS, 2018).

In retrospect, the ideology of humans' relationship with nature—all living and non-living things occurring within the natural world not made by humans, which includes all forms of flora and fauna—harkens back to ancient time. From the philosophies of Aristotle to Confucianism and Taoism, through Gestalt, up to the present-day study of ecology, present an inclusive, holistic, systems approach of humans' interrelationship with nature.

During the past half-century, the environmental movement's capacity for profound growth and development increased as scientists, environmental leaders, and individuals became concerned about the ruin and devastation of the natural environment and thus sought ways to improve humans' adverse effects to the planet. In the early 1970s, two conferences were held—the International Union for Conservation of Nature (IUCN) and United Nations Conference on the Human Environment—expressly to address the