Chapter 9
Investigating Teachers' Attitudes and Behavioral Intentions for the Impending Integration of STEM Education in Primary Schools

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ABSTRACT

The aim of this study was to determine the attitude and behavior intentions of primary school teachers regarding the integration of STEM education in primary school grades, elements that will significantly affect the success of its impending implementation. A mixed methods research design was used, and the study sample consisted of 123 in-service teachers. The results of quantitative data revealed that teachers generally have positive attitude and intentions. In addition, both dependent variables (attitude and behavior intentions) showed a strong positive relationship with teachers' perception of practicality in their teaching practice. Another important factor was gender, where female teachers seem to show more positive attitude and intentions regarding the integration of STEM education in primary schools.

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INTRODUCTION

The term "STEM education" refers to teaching and learning in Science, technology, engineering, and mathematics. It typically includes educational activities across all grades and education levels in formal and informal settings (Gonzalez & Kuenzi, 2012). STEM is a significant emphasis and a top priority in global educational initiatives seeking to enhance economic prosperity. It is considered a powerful tool for students to acquire the necessary knowledge, skills, and attitude to engage as future citizens and employees in an increasingly developing technological world (McDonald, 2016).

STEM education is not just about a group of disciplines included in the acronym; on the contrary, it is considered a meta-discipline, and it is expected to be delivered to the students in an interdisciplinary and transdisciplinary manner (English, 2016). Learning is achieved through structured activities that resemble scientific laboratory research, using a problem-solving and project-based methodology. Teachers are expected to provide meaningful learning opportunities to their students and promote context, applied, and collaborative learning (Kennedy & Odell 2014).

The main advantage of STEM education is the interdisciplinary methodology used for problem-solving activities and projects. Students develop their autonomy and collaboration skills, seeking innovative solutions, while they develop their technological literacy. Moreover, by situating students at the center of the learning process, they are encouraged to engage with meaningful yet challenging problematic situations, promoting higher levels of cognitive reasoning (English, 2017). The purposeful, collaborative, practical, and meaningful hands-on experiments and STEM activities are applied according to the socio-constructivist learning approach, which encourages the "learning by doing" (Pellas et al., 2017).

Over the past decade, there has been significant interest in many developed countries integrating STEM education into their educational systems. Nevertheless, STEM programs and initiatives mainly concern the secondary level of education. DeJarnette (2012) asserts that a competent STEM workforce will be achieved only by providing all students with STEM education opportunities, well defined, and aligned throughout the K-16 grade levels. Simultaneously, the need to include STEM programs and curriculum in the primary education level has been highlighted. Many questions, whether early exposure to STEM will be beneficial and effective to young students. Research shows that positive educational impact can be achieved by providing developmentally appropriate STEM activities. Through authentic classroom experiences that reflect future professional work and duties, students can become aware of what STEM professionals do at work. By early engaging them, they can develop a positive attitude, a sense of admiration, and a tendency to explore factors that appear to be related to higher performances in Science and a preference for STEM careers later in life (DeJarnette, 2012; Kalogiannakis et al., 2018; Murphy & Mancini-Samuelson, 2012; Walker, 2012). Recent research suggests that young students, even at preschool age, have the ability to perceive scientific concepts to a greater extent than previously believed (Kalogiannakis et al., 2018). Despite most STEM educational programs taking place in secondary and higher education, students' early exposure to STEM, even in preschool grades, is considered important and effective, while it can also promote a continuous learning process in STEM disciplines, in both academic and professional sector (Dorouka et al., 2020; Kalogiannakis & Papadakis, 2020).

The goal for a continuous STEM education that takes place from an early age imposes STEM literate teachers, be well informed about the benefits of STEM education, ready and committed to preparing, engaging, and inspiring their students (Kennedy & Odell, 2014). However, STEM's socio-constructivist approach to knowledge and learning is fundamentally opposed to behavioral theory, which was dominant at the time when several in-service teachers were beginning their careers, and continues to be a current