

Chapter 7

Empowering Preservice Teachers Through Alternative STEM Teaching Experiences

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ABSTRACT

Science, technology, engineering, and mathematics education (STEM) is a focus in many schools and businesses. Therefore, it is critical teachers are prepared to implement effective STEM lessons in their classrooms, and that research explores ways to prepare teachers for this important field. This chapter describes the experience of 24 preservice teachers that planned and implemented a three-week summer elementary STEM classroom experience for approximately 150 students in Grades 3 to 5. Preservice teachers' reflections and perceptions from of this experience are captured from multiple lenses at four points of the experience using the portraiture method of inquiry. Then these portraits are analyzed for themes that provide insight into the perceptions and effectiveness of the experience.

INTRODUCTION

Preparing students to effectively problem solve, utilize technology, communicate, and collaborate is an essential part of education (Powell, Cleveland, Thompson, & Forde, 2012). Science, Technology, Engineering, and Mathematics (STEM) are important fields that utilize these skills mentioned. To prepare students, teachers need experiences and support ineffective strategies to help students succeed in these skills. Collaborative learning (Arbaugh, 2013; Faulkner & Cain, 2013), opportunity for direct application (Ball, Wilson, Higgins, & McCoach, 2010; McGee, Wang, & Polly, 2013), and ongoing support and coaching (Jao, 2013) are all critical pieces in preparing teachers and preservice teachers (PSTs) to implement new ideas or strategies. However, finding effective STEM classrooms and opportunities for PSTs to apply what they learn about STEM classrooms in real situations can be challenging. Peer placement research consistently describes favorable results for PSTs learning stating peers often invest more time in the professional development of each other (Baker & Milner, 2006; Bullough et al., 2002, 2003; Gardiner & Robinson, 2009, 2010; Goodnough et al., 2009; Nokes et al., 2008; Smith, 2002).

This chapter explores one model that allows PSTs to collaborate, directly apply knowledge of teaching in a STEM environment, and to receive support and coaching throughout the experience. This experience focused on providing elementary students with STEM experiences that encourage students to problem solve, utilize technology, communicate, and collaborate while meeting state content standards. Using the experiences of 24 PSTs that planned and implemented a three-week summer elementary STEM classroom experience for approximately 150 students in grades three through five, it seeks to share their reflections and perspectives from multiple lenses at three points of the experience using the portraiture method of inquiry. During the summer STEM experience, there were a total of 48 PSTs involved in the STEM Camp experience, but only 24 were currently enrolled in mathematics, science, and reading methods coursework. The remaining 24 PSTs that were engaged in STEM Camp were currently enrolled in social studies and language arts methods coursework. Our findings seek to highlight the benefits of alternative field experience to encourage innovative practice from PSTs that will strengthen their ability to meet the needs of their future students in this technological era.

NEED FOR MEANINGFUL STEM FIELD PLACEMENTS

PSTs' thoughts about teaching and learning are shaped by many years of experiences as a student before they ever enter teacher preparation programs (Shoffner, 2008). They often have experienced years of passive, lecture driven science and mathematics during their K-12 education. They then enter college and take science and mathematics in their core courses which is taught similar to their K-12 courses. PSTs then enter their methods courses with a vision of themselves as science and mathematics teachers that is closely related to their experiences as science and mathematics learners (Abell & Bryan, 1997; Beck & Kosnik, 2002; Shoffner, 2008). They then have the expectations to teach the same as they were taught. Therefore it is important for field experiences to provide opportunities for reform-based science and mathematics teaching practices. When elementary age students solve problems through the engineering design process, they are exploring the engineering field, but in the past, often teachers didn't recognize this important process, or they neglected to ensure that students understood the role of engineers (Cun-

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