Preservice Teachers Find "Math in the Museum"

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EXECUTIVE SUMMARY

Currently there is limited research as to how elementary preservice teachers learn to utilize informal learning environments to teach mathematics. However, preservice teachers need the opportunity to better understand how to facilitate mathematics learning in an informal environment so they can better understand the potential. In an effort to expose preservice teachers to the potential for mathematical learning experiences in informal sites, a course experience was organized, with a resulting project, and their perceptions were measured through a pre- and post-survey. Providing the opportunity for preservice teachers to engage in an actual field trip focused on mathematics with an associated assignment was shown to have a positive impact on their perceptions of how important this informal context can be for mathematics learning. This chapter outlines the course experience, the accompanying assignment, and the results of a perceptions survey.

INTRODUCTION

Students often have narrow views of how mathematics is applied outside of school and they usually associate mathematics around their school experiences with a focus on calculating numbers and rote memorization of facts and formulas, instead of the ways that mathematical practices can promote thinking and sense-making (Goldman & Booker, 2009, Masingila, Muthwii, & Kimani, 2011). Informal learning environments such as museums, zoos, aquariums, and planetariums, and

science centers provide unique opportunities for students to learn content in engaging and interactive ways (Kaschuk, 2014). Educators should look beyond the school curriculum to support students' informal ways of thinking through engagement in out-of-school contexts to encourage them to view mathematics as a human endeavor with applications that can support innovations to create a better world for themselves and others (D'Ambrosio & D'Ambrosio, 2013).

Anand and Dogan (2021) argue that "informal learning environments can help elementary students better prepare for long-term interest in STEM education" (p. 374). However, there is a lack of research related to how mathematics learning can be incorporated informal learning environments (Pattison et al., 2017), although this has been an area of interest for some time (Mokros, 2007). For the past decade, some researchers have shed light on the potential of informal learning experiences in mathematics, exploring visitors' experiences (Cooper, 2011; Guberman et al., 1999; Gyllenhaal, 2006), examining mathematical thinking and potential for learning through mathematical exhibits (Nemirovsky et al., 2013), and exploring connections between informal and formal learning experiences specific to mathematics (Kelton, 2021; MacDonald, 2012). In addition, some researchers have suggested ideas for developing current informal learning experiences and the design of exhibits (Cooper, 2011; Garibay et al., 2012; Kelton & Ma, 2020; Pattison et al., 2012).

Despite the perceived value of informal environments to optimize learning, many teachers are unprepared to integrate informal learning opportunities (field trips) into their school curriculum (Kaschuk, 2014; Kisiel, 2013; Morentin & Guisasola, 2014). Research asserts that teachers who lack training relative to planning field trips to informal environments may not create explicit goals for the visit, employ traditional school-based pedagogy during field trips, and are unable to connect field trip experiences to the classroom curriculum (Kisiel, 2003, 2006, 2013; Kaschuk, 2013). In addition, studies suggest that teachers vary in their sense of who is responsible for providing at-venue or post-visit experiences and are often unaware of the role that they are to take during the field trip (Kisiel, 2013; Morentin & Guisasola, 2014; Tal, Bamburger, & Morag, 2005).

In 2017, Nemirovsky et al. introduced the term "informal mathematics education" in an attempt to distinguish it from ways we typically encounter mathematics in daily life. These authors emphasized that informal mathematics education environments are intentionally designed to foster learning. Based on these ideas, they advocated for a new perspective on this field, describing it as a space where "learners become engaged in questions that matter to them, diversify their sense of what they are capable of, achieve mastery in learning through collaboration, and pursue unanticipated experimentations" (p. 970).