

## Chapter 18

# Integrating Mathematics and Science Methods Classes With an Afterschool STEM Club

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### ABSTRACT

*This chapter describes a model of integrating an elementary mathematics methods course with an afterschool club in order to support pre-service teachers' development of a teaching practice. The goal of the model was to help pre-service teachers integrate theory and practice as well as begin to notice particular elements of a classroom and lesson. Details of the model, the course, and how the partnership with the elementary school was formed are shared. In addition, results from analyzing pre-service teachers' journal responses indicate most teachers focused on classroom management initially; however, writing shifted to focus on students' mathematical ideas and the purpose of play. Learnings with respect to teacher education as well as ideas for future research are discussed.*

### INTRODUCTION

As pre-service teachers (PSTs) train for their careers, especially in the fields of mathematics and science, they have often not experienced learning mathematics and science in the ways that are promoted in their education program. In addition, PSTs often experience a mismatch between their field experience classrooms and the pedagogies encouraged in university courses (Grossman, Compton, Igra, Ronfeldt, Shahan, & Williamson, 2009; Shulman, 1986; Sowder, 2007). This mismatch can create a distinct separation of action and theory that Feiman-Nemser and Buchmann (1985) argue PSTs need help in making connections between action and theory. Ebby (2000) shared an example of how this dissonance has potential to be a learning experience. This, combined with typical teacher development trajectories, where beginning teachers tend to focus on themselves and concerns over their abilities to maintain control in the classroom, to meet the expectations of the school community, and to adequately master the content and shift to be more focused on students (Mewborn, 1999; Star, Lynch & Perova, 2011; Star & Strickland, 2008; van

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Es & Sherin, 2002), supports the need for teacher education programs to create more opportunities for PSTs to experience the teaching and learning of mathematics and science, especially.

This chapter will share one type of informal field experience model for addressing the marriage of theory (from methods classes) and practice (from work with elementary students in an afterschool STEM club) in a way that supports undergraduate, elementary PST development. This chapter uses the construct of teacher noticing to examine the development of elementary PSTs over the course of a semester who were enrolled in both a mathematics and science methods course utilizing this model. In addition, details about the semester, including the methods course and afterschool STEM club, will be shared. The objective of this chapter is for other teacher educators to learn ways in which they can modify their programs to better merge theoretical and practical experiences for PSTs, support PST noticing, as well as pose ideas for further research.

## **BACKGROUND**

The idea of using an after school venue for supporting field experiences is not entirely unique. Particularly in science education, researchers have explored informal settings and how they support PST development (e.g. Anderson, Lawson, Mayer-Smith, 2006; Chesebrough, 1994; Ferry, 1995; Jung & Tonso, 2006). Literature on these types of informal experiences merged with teacher education programs will be discussed followed by two ways to consider teacher development. These two ways are grounded in the premise of the informal field experience model shared here: merging theory and practice as well as teacher noticing. Thus, approaching teacher development through considering what PSTs experience through university coursework in terms of how closely and authentically the activities mimic actual teacher practice connects with the merge of theory and practice. Teacher development can also be approached through the construct of teacher noticing. The definition of noticing and the connection between noticing and development, particularly in the mathematics education field, is addressed.

### **Informal Field Experiences**

Science, and to a lesser extent mathematics, teacher educators have studied the use of informal field experiences with PSTs (e.g. Katz, Randy McGinnis, Riedinger, Marbach-Ad, & Dai, 2013; Cartwright, 2012), particularly family science nights (e.g. Harlow, 2012; McCollough & Ramirez, 2010; McDonald, 1997). Through participation in family science nights PSTs tend to shift thinking to be more positive about science and the prospect of teaching science. Additional benefits vary based on the structure but most PSTs realize the power of assessing student's prior knowledge and recognize the intelligence of students and parents, particularly from diverse backgrounds (Harlow, 2012; McCollough & Ramirez, 2010; McDonald, 1997). In McDonald's study, the PSTs helped facilitate activities by working with children and parents in small groups where the directions and whole group discussions were led by faculty and paid undergraduate student workers. The results demonstrated PSTs held positive attitudes towards science and teaching science after the experience, even without the planning and leading of the activities. Harlow's and McCollough and Ramirez's studies reported family science nights that were planned and led by PSTs. The results of these two studies show the positive impact of these experiences on the PSTs' efficacies as teachers. The PSTs were successful in engaging elementary students in science and

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