

# Chapter 7

## Documenting a Developing Vision of Teaching Mathematics with Technology

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### ABSTRACT

*This chapter reports on a study of 39 Preservice Mathematics Teachers (PSMTs) enrolled in a course on mathematical problem solving with technology. Qualitative data were collected with the purpose of examining the extent to which the course was supporting the development of a vision of teaching with technology amongst secondary preservice mathematics teachers. Two findings are discussed. First, PSMTs developed a vision aligned with the vision provided by the National Council of Teachers of Mathematics Technology Principle. Second, PSMTs drew heavily on instructional experiences gained in the course to illustrate that emergent vision. The voices in this study challenge key assumptions that may be prevalent in current practice in the preparation of PSMTs.*

### INTRODUCTION

Recommendations for the technological preparation of preservice mathematics teachers (PSMTs) come from many different professional organizations. The National Council of Teachers of Mathematics (NCTM, 2003) recommends that teacher preparation programs “strive to instill dispositions of openness to experimentation with ever-evolving technological tools and their pervasive impact on mathematics education” (p. 2). Subsequently, NCTM (2014) has referred to technological tools as *essential* and recommends that mathematical and technological tools be integrated “to help students learn and make sense of mathematical ideas, reason mathematically, and communicate their mathematical thinking” (p.78). The Association of Mathematics Teacher Educators (2006) states, “mathematics teacher preparation programs must insure all mathematics teachers and teacher candidates have opportunities to acquire the knowledge and experiences needed to incorporate technology in the teaching and learning of mathematics” (p. 2).

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The International Society for Technology in Education (2008) expects that teachers be able to design and develop digital age learning experiences and assessments, model digital age work and learning, and “exhibit leadership by demonstrating a vision of technology infusion” (p. 2).

A picture of what it means to prepare teachers to teach with technology is emerging in the field, centered around providing PSMTs with opportunities to actively engage with technology as mathematics learners and to design technology-enhanced instructional materials (Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, 2013). However, ensuring that our PSMTs develop a rich understanding of the benefits of incorporating technology into instruction is not a simple matter of exposure. Olive and Leatham (2000) have documented that using technology as a tool for learning mathematics is not enough to ensure PSMTs will use technology as a teaching and learning tool in their own classrooms. They refer to teachers’ dispositions, suggesting that PSMTs need sustained interactions with technology coupled with positive pedagogical experiences. Grandgenett (2008) adds that willingness to experiment is a key facet of disposition. Niess (2011) argues that any experiences that might influence decisions about when and why to incorporate technology in instruction should be grounded in mathematical content.

We have begun to develop our own theory of what it means to enact these principles in the development of preservice secondary mathematics teachers and to honor the rich connections between technology, mathematics, and teaching in the context of personal conceptions and beliefs. This chapter reports on a study of 39 PSMTs enrolled in two sections of a course, Mathematical Problem Solving with Technology. In this course, PSMTs are expected to revisit their own learning of secondary mathematics and investigate mathematical concepts by way of problem solving with various technological tools. The course is taught as a hands-on course conducted in a one-to-one computer setting. The PSMTs in our course spend a majority of class time engaged in small group or partnership activities. We follow most activity with a whole-class discussion of the mathematical, pedagogical and technological principles they encounter along the way.

As a means to inform our own practice, we engaged in a qualitative, descriptive study to uncover the shifting landscape of our PSMTs professional beliefs and conceptions of technology as a tool to learn mathematics. At the heart of the study was a desire to know what PSMTs believed about the role technology could play in mathematics instruction. We also wanted to understand how those beliefs may be influenced by curricular elements and opportunities to learn. As a means to access those beliefs and look at how they might shift as a result of our course, we chose to focus on helping PSMTs express those beliefs in terms of their *vision of teaching with technology*. We set about to explore two research questions:

1. What is the *vision of teaching with technology* held by PSMTs prior to and at the conclusion of a semester of concentrated experiences utilizing technology for mathematical problem solving?
2. What personal experiences do PSMTs use to illustrate or justify their beliefs regarding technology in the classroom and how do these experiences influence their *vision of teaching with technology*?

## **BACKGROUND**

The goal of this section is to provide a description of what it means to have a *vision of teaching with technology*. First we provide some background and context from the current literature on beliefs about technology. We conclude by drawing on theory about the development of PSMTs beliefs to hypothesize about how to cultivate a *vision of teaching with technology* by making belief systems explicit through inquiry and self-reflection.

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