Chapter 37
TPACK Pathways that Facilitate CCSS Implementation for Secondary Mathematics Teacher Candidates

Nathan Borchelt
Western Carolina University, USA

Kathy Jaqua
Western Carolina University, USA

Axelle Faughn
Western Carolina University, USA

Kate Best
Western Carolina University, USA

ABSTRACT

Implementation of the Common Core State Standards in Mathematics has provided teacher educators a great opportunity to reexamine whether teacher preparation programs adequately provide the experiences to develop the base of knowledge and 21st century skills necessary to be effective teachers. The Mathematics TPACK Framework provides a roadmap for a series of pathways to integrate three knowledge components that are essential in teacher development: content knowledge, pedagogical knowledge, and technological knowledge. In this chapter, the authors examine how a teacher preparation program has evolved to integrate meaningful uses of digital technologies in content and pedagogy that are relevant to the teaching and learning of mathematics through the lens of implementing the Common Core State Standards.

INTRODUCTION

When examining the components of a teacher preparation program, one of the most pressing implications for practice is a need for meaningful experiences for teacher candidates similar to those provided through in-service professional development. Teacher candidates must be prepared to establish learning environments that emphasize 21st century skills.

People in the 21st century live in a technology and media-suffused environment, marked by various characteristics, including: 1) access to

DOI: 10.4018/978-1-4666-7363-2.ch037

an abundance of information, 2) rapid changes in technology tools, and 3) the ability to collaborate and make individual contributions on an unprecedented scale. To be effective in the 21st century, citizens and workers must be able to exhibit a range of functional and critical thinking skills related to information, media, and technology (Partnership for 21st Century Skills, Information, Media, and Technology Skills, 2011).

To that effect, technology should be an integral part of teacher candidates' experiences learning mathematics, or else they may not value the benefits of technology integration. They must also understand what the Common Core State Standards in Mathematics say about students' experiences with digital technologies in order to meet professional standards used to evaluate teachers.

Technology is valuable in leveraging and enhancing classroom experiences for students which promote mathematical reasoning and sense making (Dick & Hollebrands, 2011). In this chapter, we examine how a teacher preparation program has evolved to integrate meaningful uses of digital technologies in content and pedagogy which are relevant to the teaching and learning of mathematics. The Mathematics Technological Pedagogical and Content Knowledge (TPACK) Framework (Mishra & Koehler, 2006; Koehler & Mishra, 2008; 2009; Association of Mathematics Teacher Educators (AMTE), 2009) provides a roadmap for a series of pathways to integrate three knowledge components, which are essential in teacher development: content knowledge, pedagogical knowledge, and technological knowledge. We argue the necessity of moving teacher candidates through these pathways to help them promote in their students the types of mathematical practices described in the Common Core documents (Common Core State Standards Initiative (CCSSI), 2010).

BACKGROUND

Program Description

Our undergraduate pre-service mathematics education program includes extensive work both in mathematics and in education. Because of the comprehensive nature of our program, each of our teacher candidate graduates receives two degrees– a Bachelor of Science in Education, Mathematics and a Bachelor of Science, Mathematics. As part of this program teacher candidates complete 15 hours of education and mathematics methods courses, 42 hours of mathematics content courses, and at least 12 hours of full-time field experience. These degrees reflect the North Carolina Professional Teaching Standards (North Carolina Professional Teaching Standards Commission, 2006) and the 21st century knowledge, skills, and dispositions embedded in them.

Early classroom experience is a key component of our program. School partners are actively and continuously involved in providing multiple field experiences for our teacher candidates in the form of field observations and pre-service lesson study cycles. During internship and student teaching, school partners help evaluate teacher candidates' performance through observation protocols. As part of a prior evaluation of the program, a group of 58 teachers from local middle schools and high schools attended a presentation on our mathematics education program. Specific topics of discussion addressed what teacher candidates need to know and be able to do in the classroom upon graduation from a teacher education program. As a result of this evaluation, we designed a new course to enhance the connection of content, technology, and pedagogy. The new course, *Math 414: Introduction to Secondary Mathematics Teaching Methods*, has an emphasis on connecting technology and pedagogy. This course serves as a springboard to the second methods course,