

## Chapter 20

# Evolution of a Course for Special Education Teachers on Integrating Technology into Math and Science

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### ABSTRACT

*This chapter describes a two-year development of a graduate pedagogy course for pre-service special education teachers to integrate technology into teaching mathematics and science. The Technological Pedagogical Content Knowledge (TPACK) framework was used for the course design. The chapter discusses the modifications made to the course from semester to semester based on the analysis of lesson plan TPACK scores and information drawn from pre-service teachers' written feedback. The challenge was to determine an optimal balance between theory and practice and between guided and independent learning that leads to higher TPACK gains. Data analysis showed that in a semester when the instructor provided extensive instructional support coupled with a large amount of work required of the pre-service teachers, they achieved the highest TPACK level; however, this design resulted in unreasonable workload. Reducing the amount of work to a reasonable level produced lower TPACK; nevertheless, the gain in TPACK was still significant.*

### INTRODUCTION

Teacher preparation programs have long recognized that teachers need to teach effectively with educational technologies. This study describes the evolution of a required graduate course for pre-service special education teachers to integrate technology into teaching mathematics and science

to students with special needs. The primary goal of the course was the development of pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) in mathematics and science in special education classrooms. Thus, TPACK was used as the conceptual framework for the course design. In the last decade, the TPACK framework has significantly influenced teacher

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education professionals. As a result, it has led to re-thinking and re-designing general education teacher preparation programs nationally and internationally (Burns, 2007; Chai, Koh, & Tsai, 2010; Lambert & Gong, 2010; Niess, 2005, 2007; Shoffner, 2007). However, little research exists on TPACK for special education teacher education. Marino, Sameshima, and Beecher (2009) developed an enhanced TPACK model for special education that added assistive technology as a means to promote inclusive educational practice for pre-service teachers. Benton-Borghi (2013) proposed to view the TPACK framework through the lens of Universally Designed Learning (UDL) in order to ensure that teacher educators are using one merged framework to prepare both general and special education teachers to teach every student. Lyublinskaya and Tournaki (2013) examined TPACK developments of pre-service special education teachers by assessing TPACK of pre-service teachers' lesson plans that were developed as a part of a graduate course for teaching mathematics and science to students with special needs. These efforts may be the first attempts to integrate the TPACK framework into special education teacher preparation.

The graduate program in childhood special education examined in this study requires the completion of a course that focuses on integrating technology into teaching mathematics and science in special education and inclusive classrooms. A preliminary study conducted over four semesters indicated that the completion of this course is associated with significant gains in pre-service special education teachers' TPACK in mathematics and science (Lyublinskaya & Tournaki, in press; Tournaki & Lyublinskaya, 2014). This chapter describes a two-year iterative process of the course evolution, providing detailed quantitative analysis for each semester. The chapter highlights the modifications made to the course from semester to semester based on the information drawn from the analysis of data collected from eight sections of the course, offered in four consecu-

tive semesters. As the course instructor and the researcher, I describe the challenges experienced during this process, such as balancing theory and practice, keeping the depth of knowledge while exposing students to the breadth of the field, and maintaining high expectations while keeping the workload reasonable for both pre-service teachers and the instructor. Implications for special education teacher preparation programs are discussed.

## **BACKGROUND**

This section provides review of relevant literature. The first part focuses on the research about technology in teacher education in general. The second part introduces TPACK framework and its role in the design of programs and courses in teacher preparation programs. Finally, the last section introduces few studies that focus on TPACK in the context of preparation of special education teachers.

### **Technology in Teacher Education**

The need for a technology infrastructure in teacher education programs that enables pre-service teachers to develop attitudes, values and competencies for making technology a tool for teaching has been recognized for over 20 years (Laffey, Musser, & Wdman, 1998). In 1995, the Office of Technology Assessment (OTA, 1995) in its report on technology in teacher education noted significant limitations: 1) faculty do not model the technology, 2) students learn about technology, not with it, 3) field experiences are not designed to model the use of technology, and 4) technology is isolated from the main curriculum and pedagogy of teacher education. Twenty years later, we are still facing the same challenges. Many pre-service teachers graduating from today's schools of education are not adequately prepared to teach with technology in the classroom. Therefore, they use it infrequently or only for information transmission rather than

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