Chapter 5
Common Core Standards for Mathematical Practice and TPACK:
An Integrated Approach to Instruction

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ABSTRACT

This chapter seeks to answer the guiding question: How does the TPACK (Technological Pedagogical Content Knowledge) framework influence how technology can support the implementation of the Common Core Standards for Mathematical Practice? The authors provide an overview of the Standards for Mathematical Practice and an application of the TPACK framework to the Common Core State Standards for Mathematics. Classroom scenarios describe how teachers can use the TPACK framework to integrate technology into the Standards for Mathematical Practice from kindergarten to eighth grade. The authors conclude with implications for professional developers, teacher educators, and administrators as they work to develop teachers' TPACK and prepare teachers for implementing the Common Core State Standards for Mathematics.

INTRODUCTION

Mathematics teachers across the nation are charged with implementing the Common Core State Standards for Mathematics (CCSSM), which comprise the Standards for Mathematical Content and the Standards for Mathematical Practice. Many teachers, schools, and districts are taking advantage of professional development offerings focused on the grade level content standards. However, many teachers have noticed a lack of support and resources for integrating the Standards for Mathematical Practice, which were designed to be taught across all grade level standards from Kindergarten through twelfth grade. Along with changes in mathematics curriculum and teaching

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practices, teachers are expected to integrate more technology into their classrooms to meet the needs of today's learners and prepare students for college and careers in the 21st century. Technology integration is a complex task that requires not only knowledge about technological tools but also training and support in how to use them appropriately.

This chapter describes one vision for technology integration within the CCSSM, introducing the TPACK (technological pedagogical content knowledge) framework (Mishra & Koehler, 2006) as a tool to support technology integration and effective teaching of the Standards for Mathematical Practice. The goal of this chapter is to provide a framework for integrating technology into the teaching and learning of mathematics as specified by the Standards for Mathematical Practice. To this end, this chapter includes a brief description of the Standards for Mathematical Practice, a thorough analysis of how the CCSSM can be situated within the TPACK framework and classroom scenarios to guide educators in integrating technology within the Standards for Mathematical Practice. It is our hope that this chapter will serve as a resource for teachers, administrators, professional developers, and teacher educators striving to increase effective use of technology in teaching and learning about mathematics.

BACKGROUND

Integrating technology into the curriculum has been a recent shift occurring in the past ten years (Niess, 2005). Although staff developers, and therefore teachers, have tended to focus on technology itself rather than on how it can be used in the classroom, we agree with Mishra and Koehler (2006) that simply "knowing how to use technology is not the same as knowing how to teach with it" (p. 1033). Technology integration is complex, requiring teachers to possess not only technological knowledge and skills but also an awareness of how to facilitate learning with technology. According to the National Council for Teachers of Mathematics (NCTM), technology has the potential to empower mathematics teachers and students. However, there is very little mention of technology in the Common Core State Standards for Mathematics. NCTM commented on the newly-released standards:

Unless technology is woven throughout these standards, the credibility of any claim that they will better prepare students in the 21st century is diminished. Moreover, without ties to technology, many of these standards read like school expectations from the last century rather than expectations intended to equip students for a mathematical future in the 21st century (National Council for Teachers of Mathematics, 2010, n.d.).

The TPACK framework can provide the missing support that teachers need to effectively integrate technology within the Common Core State Standards for Mathematics. Technological pedagogical and content knowledge (TPACK) is a framework for technology integration developed by Mishra and Koehler (2006), extending Shulman's work on pedagogical content knowledge. Shulman (1986) defined pedagogical content knowledge as the blending of content and pedagogy into an understanding of how to organize and represent subject matter to enhance the learning of it. The TPACK framework adds a third dimension–technology–to the knowledge needed for effective instruction. TPACK is the foundation of good teaching with technology that requires teachers to understand not only their content knowledge and effective pedagogical strategies but also how technology can be utilized to strengthen teaching and improve student learning (Mishra & Koehler, 2006). While technological knowledge has typically been viewed as a separate set of skills isolated from knowledge of content and pedagogy, the TPACK model emphasizes the