Chapter 12
Teaching and Learning the Common Core State Standards in Mathematics with Web 2.0 Tools

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ABSTRACT

With the initial implementation of the Common Core State Standards in Mathematics (CCSSM) currently under way across much of the United States and the continuing evolution and expansion of educational technology, it is imperative that teachers not only understand the new Common Core content expectations but also know how to incorporate the Common Core Standards for Mathematical Practice using technological tools. As teacher educators of pre-service and in-service K-12 teachers, the authors have developed and utilized a variety of methods to introduce the CCSSM and technology tools to our students. Among these methods are a heavy emphasis on mathematical problem solving and the use of Web 2.0 tools, both by us and our students, to illustrate mathematical concepts, promote exploration, and assess understanding. Asking pre-service and in-service teachers to produce their own CCSSM-aligned Web 2.0 creations is an effective way to teach the new standards while introducing them to the latest technological tools. With technology becoming ever more vital in the teaching and learning of mathematics, it is essential that teachers develop expertise in promoting the CCSSM with the latest technological tools.

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ORGANIZATION BACKGROUND

The authors teach at the Atlanta, Georgia (USA) campus of Mercer University. Their students are primarily preservice and inservice teachers in Master of Arts in Teaching (MAT) and Master of Education (M.Ed.) degree programs. The methods and ideas presented in this chapter have been implemented in the authors' own classrooms.

SETTING THE STAGE

Released in 2010 by the Common Core Sate Standards Initiative (CCSSI), the CCSSM have been adopted by the majority of states and are expected to be fully implemented by 2014 (Wu, 2011). As such, teacher education programs must provide training in the new standards immediately, especially in the states that have already adopted the standards. Otherwise, new mathematics teachers will enter the profession with little to no exposure or understanding of the standards that they will be expected to teach.

Similarly, new teachers are expected to be proficient with educational technology and incorporate these tools into their teaching. Because technology has been shown to increase student achievement in mathematics (International Society for Technology in Education [ISTE], 2008), it holds an important role in mathematics education. The National Council of Teachers of Mathematics (NCTM, 2000) has put forth the Technology Principle which states: "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p. 24). Similarly, the Apple Classrooms of Tomorrow – Today ($ACOT^2$) model emphasizes the ubiquitous use of technology (Apple, 2008), while ISTE (2008) states that "technology must be incorporated into the daily learning schedule" (p. 7). Such conditions must be met "in order to positively affect student achievement and to enhance 21st century skills" (ISTE, 2008, p. 7).

Although the CCSSM content standards do not explicitly mention educational technology requirements (Porter, McMaken, Hwang, & Yang, 2011), the Common Core Standards for Mathematical Practice do include technology. Students are expected to be able to use technological tools properly when doing mathematics. For example, the standard "CCSS.Math.Practice.MP5: Use appropriate tools strategically" requires students to be "able to use technological tools to explore and deepen their understanding of concepts" (CCSSI, 2012a, para. 6). Similarly, CCSSI also states the following:

Strategic use of technology is expected in all work. This may include employing technological tools to assist students in forming and testing conjectures, creating graphs and data displays and determining and assessing lines of fit for data. Geometric constructions may also be performed using geometric software as well as classical tools and technology may aid three-dimensional visualization. Testing with and without technological tools is recommended. (CCSSI, n.d.b, p. 3)

The end goal is to develop students who can "use technology mindfully to work with the mathematics" (CCSSI, 2012a, para. 11). Thus, preservice and inservice mathematics teachers must be proficient in technology in order to assist students in their learning.

Based on this information, it is clear that effective teachers must have three different types of knowledge: content, pedagogical, and technological. These three components form the Technological Pedagogical Content Knowledge (TPACK) framework as described by Koehler and Mishra (2009). To properly train preservice and inservice teachers of mathematics, these three components must be addressed in teacher education programs.