

Preface

As teachers and educational leaders in the United States continue through the early phases of implementing the Common Core State Standards for Mathematics (CCSSM), there is a need for educators to critically examine how to best support the implementation of both the Grade Level Content Standards and the eight Standards for Mathematical Practice. When we consider the potential that educational technologies and technological supports can have on mathematics teaching and learning, it is intuitive that we must consider how to best leverage these resources to support the teaching and learning processes.

This book aims to capture a wide variety of conceptual manuscripts, empirical pieces, as well as cases about how educational technologies can support the implementation of the CCSSM. To that end, this book is a compilation of some thought-provoking chapters written by a variety of mathematics educators, educational technologists, as well as representatives from K-12 schools and educational companies.

SECTION 1

In Section 1, “Frameworks and Conceptual Orientations,” Hirsch and his colleagues provide a broad description of the potential power of the open-source suite of technologies called *Core Math Tools* and describe how they can support the mathematics teaching and learning processes in high school classrooms. In Chapter 2, Orrill and Polly present a framework about how technology and dynamic mathematical representations can support the communication of mathematical ideas in classrooms. As educational leaders focus more on how to support teachers’ implementation of the Standards for Mathematical Practice, especially ones focused on communication, such as *Construct Viable Arguments* and *Attend to Precision*, the chapter provides examples of high-level mathematical tasks and details about how representations supported students’ communication of mathematical ideas. In Chapter 3, Rutherford provides an overview of blended learning and implications for schools as resources become more digital and electronic. In Chapter 4, Taylor lays out a framework to support action research in their classroom in light of both the CCSSM and the framework Technological Pedagogical And Content Knowledge (TPACK). Taylor provides categories and possible questions for teachers to explore in order to more effectively examine their students’ learning and their own teaching.

SECTION 2

Section 2, “Content and Context,” provides a myriad of chapters that address how technology can support the teaching and learning of various concepts and learning environments. In Chapter 5, Manouchehri and colleagues provide an empirical study of how an interactive computer program over three years impacted middle school students’ learning. They found that the program led to increased student understanding, provided struggling students with an entry point to cognitively demanding tasks, feedback on their performance, as well as successfully engaging them in mathematical inquiry. In Chapter 6, Sherman provides a description and examples of how Dynamic Geometry Software (DGS) can support students’ development of geometric concepts. In Chapter 7, Ames and colleagues provide findings from a study in which they found that intensive use with Geometer’s Sketchpad to explore mathematical tasks led to an increase in students’ understanding of concepts. In Chapter 8, Schroeder and Lee describe a project in which middle grades students participated in several project-based learning tasks with Google Sketchup. They used Sketchup to complete a variety of mathematical tasks focused on modeling and manipulating 3-dimensional figures. In Chapter 9, Morge and her colleagues used a problem-based learning context and Squeak Etoys to engage learners in a variety of tasks focused on Science, Technology, Engineering, and Mathematics (STEM) concepts with a specific emphasis on mathematics and engineering.

In Chapter 10, Hensberry and her colleagues thoroughly describe the design and potential uses of the PhET interactive simulation project and how the various simulations (over 125) have been utilized to support students’ learning. In Chapter 11 Lim and Kim provide a comprehensive overview of various technologies that can support students’ work with statistics education in high schools. In Chapter 12, Greenhaus details how dynamic software, specifically Sketchpad®, Fathom®, and TinkerPlots® support the teaching and learning of the high school CCSSM.

SECTION 3

Section 3, “Cases and Vignettes,” includes classroom-based cases and vignettes. In Chapter 13, Magruder and Mohr-Schroeder describe how a virtual manipulative was utilized to support middle school teachers’ understanding of algebraic reasoning and the process of solving equations. In Chapter 14, Ivy and Franz use the TPACK framework to describe how high school students engaged in the CCSSM Standards for Mathematical Practice. In Chapter 15, Erbas and his colleagues provide a broad overview about how spreadsheets can support mathematical explorations and address the CCSSM Standards that focus on mathematical patterns and algebraic reasoning.

Chapters 16-18 include examples from elementary school classrooms. In Chapter 16, Linton and Stegall extrapolate how technology can support the implementation of the CCSSM Standards for Practice with examples from Grades Kindergarten through Grade 8. In Chapter 17 Martin and Polly share data from a study that examined how mathematics journals and writing across the curriculum supported students’ mathematical understanding in elementary school. In Chapter 18, Boland shares the impact of Pearson’s interactive whiteboard project focused on supporting teachers’ work with the *Investigations in Number, Data, and Space* curricula.

SECTION 4

Section 4, “Innovative Approaches to Teacher Education and Professional Development,” features examples about how technology is being leveraged to support teachers’ and preservice teachers’ understanding and implementation of the CCSSM. In Chapter 19, Herbst and his colleagues describe LessonSketch, a Web-based environment that allows preservice and practicing teachers to explore both the CCSSM content standards and the Standards for Mathematical Practice. In Chapter 20, Madden extrapolates how dynamic geometry software can be leveraged to create learning environments and learning experiences for preservice and inservice teachers’ understanding of the CCSSM. Chapter 21 features Kopcha and Valentine’s Web-based framework for supporting inservice teachers’ implementation of the CCSSM through a suite of various professional development materials. In Chapter 22, LeHew and Polly share how technology was utilized in a large, urban school district to support elementary school teachers’ implementation of the CCSSM. In Chapter 23, Browning and her colleagues describe a project where preservice teachers used VoiceThread to reason mathematically about mathematical tasks that they had solved and concepts that they were exploring. In Chapter 24, Borchelt and his colleagues show how their mathematics education program has been modified to include learning technologies aligned to the CCSSM. In Chapter 25, Grassetti and Brookby describe how they have used iPads with preservice teachers to develop their mathematical understanding with an explicit focus on constructing viable arguments and critiquing the reasoning of others.

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