Preface

This is the second of the three-book series *Reasoning and Sense Making in the Mathematics Classroom*. The books maintain the National Council of Teachers of Mathematics' (NCTM) focus on teaching that promotes and supports mathematical reasoning and sense making, and they emphasize implementation of the Common Core State Standards for Mathematics (CCSSM) Standards for Mathematical Practice (SMP; NGA Center and CCSSO 2010) and the Process Standards (PS) from NCTM's *Principles and Standards for School Mathematics* (*Principles and Standards*; NCTM 2000). To illustrate the nature of mathematical reasoning and sense making in prekindergarten–grade 8 and the critical role that reasoning and sense making play in learning and using mathematics, these books show—through student and classroom vignettes as well as instructional tasks—how instruction can support students in their development of reasoning and sense making. (All student and classroom dialogues in this book are either edited versions of actual student/classroom dialogue or composites of dialogue from research and classroom observation. Student names have been changed throughout.)

Throughout this book, research on student learning is used to help teachers understand, monitor, and guide the development of students' reasoning and sense making about core ideas in elementary school mathematics. Research on teaching and learning mathematics, as cited in the chapters, is the basis of all the discussions and recommendations in this book. To illuminate the connection between reasoning and mathematical content, all three books concentrate on sense making as it is implemented for specific content areas in prekindergarten–grade 8 mathematics learning. In this book, we focus on number and operations, fractions, algebraic reasoning, and decomposing and composing geometric shapes.

Michael Battista opens the book with a discussion on the nature of reasoning and sense making in grades 3–5 and why they are critically important in the development of mathematical thinking. He illustrates the nature of children's

mathematical reasoning with examples of students attempting to make sense of the division of fractions and the concept of length.

In chapter 2, Jae Meen Baek examines student strategies that exemplify conceptually sound reasoning and sense making in the context of multiplication word problems. She discusses how instruction can support students' growth in this reasoning, as well as the critical topic of properties of numbers that underlie reasoning about multiplication.

In chapter 3, Kathleen Cramer describes how students in grades 3–5 extend their understanding of number to include fractions and how they can build reasoning and sense making for fractions through explorations of different representations, such as physical materials, pictures, and story contexts.

In chapter 4, Maria Blanton discusses the nature of early algebraic reasoning and provides research-based descriptions of how children in grades 3–5 reason algebraically. She also addresses how classroom practice can support this reasoning and how mathematical content in the elementary grades can integrate algebra in appropriate ways.

In Chapter 5, Michael Battista discusses practices and processes connected to reasoning about geometric decomposition and structuring as applied to arrays of squares and cubes and to area and volume problems. He also examines a learning progression for the development of such reasoning and the instructional practices that are consistent with this learning progression.

For your convenience in following discussions of practices and standards cited within the text, two appendices consisting of abbreviated and labeled versions of the CCSSM Standards for Mathematical Practice (SMP) and the Process Standards (PS) from NCTM's *Principles and Standards* are included in the book. You can also access the appendixes, along with other resources, by visiting NCTM's More4U website (nctm.org/more4u). The access code can be found on the title page of this book.