

# Preface

The three books in the *Reasoning and Sense Making in the Mathematics Classroom* series 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. All student names have been changed to protect their privacy.)

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 third book, targeting grades 6–8, we focus on fractions, algebraic reasoning, statistics and probability, and decomposing and composing geometric shapes.

In Chapter 1, Michael Battista discusses the nature of reasoning and sense making in grades 6–8 and why they are critically important in the development of mathematical thinking. He illustrates the nature of children's mathematical reasoning with examples of middle school students attempting to make sense of the concepts of fractions and geometric properties of shapes.

In Chapter 2, Kathleen Cramer discusses how reasoning about ratios and proportional relationships involves a deep understanding of the multiplicative relationships embedded in the comparisons of two quantities. She also discusses how students' reasoning about these ideas develops and how instruction can support it.

In Chapter 3, Ana Stephens and Eric Knuth focus on what it means to call algebra a “style of mathematical thinking” and what this looks like in the middle grades. They illustrate how students can and should view algebra as a reasoning and sense-making activity, not as an isolated set of concepts to be learned by rote and quickly forgotten.

In Chapter 4, Jane Watson discusses how reasoning and sense making are inextricably linked in statistics and probability. She uses discussion and examples to illustrate pedagogical practices that recognize and address students' development of statistical understanding, including some of the misunderstandings that students display along the way.

In Chapter 5, Michael Battista examines how students make sense of and reason about the general topic of decomposing shapes. He discusses the mental processes underlying this reasoning in the context of area, surface area, and volume; a learning progression for the development of this reasoning; and teaching that promotes and supports this reasoning.

For your convenience in following how chapter discussions are connected to practices and standards cited within the text, two appendixes 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 by visiting NCTM's More4U website ([nctm.org/more4u](http://nctm.org/more4u)). The access code can be found on the title page of this book.