Preface

THIS BOOK EVOLVED from a similar volume at the prekindergarten through grade 8 level published last year (Small, 2009b). That resource was built on a long-term research study that looked at how students in the elementary years develop in their mathematical understanding. The research resulted, in part, in the creation of developmental maps that show the stages students move through in each of the strands of mathematics articulated by the National Council of Teachers of Mathematics (Small, 2005a, 2005b, 2006, 2007).

Having those maps led to the obvious question: What are they good for?

Clearly, a map of student development is most valuable if it can help teachers adjust instruction to meet the needs of students in their classes who are at different levels of development. With that in mind, we have created a number of professional development courses and many presentations wherein we shared with teachers two strategies that are relatively easy to implement and that allow them to make such curriculum adjustments. These strategies are open questions and parallel tasks.

Many teachers who have participated in these professional development sessions have reported that they found the approaches very useful and very manageable in the classroom environment, whether at the elementary or the secondary level. With their encouragement, and at their suggestion, we have written this book to provide even more models for how the strategies can be used.

ORGANIZATION OF THE BOOK

An introductory chapter describes the rationale for differentiating math instruction and explains the two principal strategies that are employed throughout the book: open questions and parallel tasks. Five content chapters then illustrate application of these strategies, followed by a final summary chapter, an appendix containing a template for teachers wishing to develop their own materials, a glossary, a bibliography, and an index.

Chapters 2–6 focus on the five content strands enunciated in the *Principles and Standards for School Mathematics* of the National Council of Teachers of Mathematics (NCTM):

- Algebra
- Number and Operations
- Geometry
- Measurement
- Data Analysis and Probability (NCTM, 2000)

The content strands are not developed sequentially, and Chapters 2–6 can be approached in any order.

Mathematical concepts are addressed in a framework of big ideas, which have been developed by marrying the NCTM process standards of problem solving, reasoning and proof, communicating, connecting, and representing (NCTM, 2000) with the NCTM content standards for the five content strands listed above. Big ideas are statements of fundamental principles and are broadly applicable to multiple grade bands and different developmental levels of understanding.

Within each of the content chapters, the suggested differentiating questions and tasks are divided according to middle and secondary grade bands set out in the NCTM (2000) standards:

- Grades 6–8
- Grades 9–12

The Appendix features a template worksheet that will assist teachers in developing their own materials in support of differentiated instruction through use of open questions and parallel tasks. An example of application of the worksheet appears in Chapter 1. The Glossary defines technical terms used throughout. Each word that appears in the Glossary is shown in boldface type at its first occurrence in the text, and each Glossary entry is annotated with the chapter and page number of the term's first occurrence.

The Bibliography highlights three types of resources: those that are referenced in other parts of the text, those that speak to the issues of teaching to big ideas and differentiating instruction, as well as a number of excellent sources for activities that can be used as is or used as a starting point for creating open questions and parallel tasks.

The Index focuses on educational concepts—standards, student development, teaching methods and principles, and such—as opposed to mathematical concepts. To facilitate user access to the mathematical topics covered, an Index of Big Ideas is provided, listing all big ideas covered in the content chapters.

A number of topics will be met in several strands. Using the Index and Glossary, together, will help the reader find where questions related to these topics can be found. For example, there are questions about parallelism in both the Measurement and the Geometry chapters, questions about factoring in both the Number and Operations and the Algebra chapters, and questions about similarity in both the Measurement and the Geometry chapters.

ORGANIZATION OF THE CONTENT CHAPTERS

Chapters 2–6 address the five NCTM content strands, providing examples of open questions and parallel tasks—organized around big ideas—for the grades 6–8 and 9–12 grade bands.

Each chapter begins with a listing of the goals of the NCTM standard for the particular content strand, followed by a brief description of how student understanding of the content develops across grade levels from grades 6 through 12. For each grade band, concepts students will learn and apply are described, demonstrating how basic concepts form the foundation for more complex concepts as understanding develops. The content standards are approached through exploration of big ideas, which are listed at the beginning of each chapter.

The bulk of each chapter is composed of a series of illustrations of application of the two differentiation strategies that are the focus of this book: open questions and parallel tasks. Each of these strategies is discussed for each of the two grade bands. Within each grade band section, content is organized by big idea, often with several illustrations for each big idea. Readers may choose to focus on the grade band in which they teach, or they may choose to study both of the grade bands to get a better sense of how understanding of the content develops in students.

For many of the questions and tasks described, important follow-up questions that can be used in the classroom are listed. In many cases, variations of activities or follow-up questions are provided to allow for even more flexibility in differentiating instruction. In addition, the rationale for each activity is presented as background that will make it easier for teachers to develop their own related activities.

Numerous Teaching Tips are included in each chapter. These sometimes relate to a specific activity, but often they are general strategies that can apply to any situation in which a teacher is attempting to differentiate instruction in math.

At the end of each chapter, concluding remarks include a few suggestions for developing additional open questions and parallel tasks by using the template provided in the Appendix.

AS THE AUTHORS, it is our hope that teachers will embrace the two core strategies—open questions and parallel tasks—that are explained and demonstrated in this book, and find them, as we have, to be helpful to the many children who come into classrooms with highly differentiated mathematical preparation, skill, and confidence. Seeing a child who has been struggling in mathematics start to feel successful is an important goal in our teaching. We have seen the use of the strategies described in this volume make that happen over and over again.