

Math

Know-How

Math Know-How

Answers to Your Most Persistent
Teaching Issues, Grades 3–5

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Preface

Together, we have been mathematics educators for more than four decades. We have taught children, students, teachers, and administrators. We have provided professional development, conducted research, written curriculum, and shared our knowledge of mathematics and mathematics education at both national and international conferences. Although we have each worked in different educational contexts and at different levels of education, the concerns and problems that teachers have are remarkably consistent. This book is a response to those questions we have heard while working in the field.

We write this book from the positive position that teachers have the goal of teaching students to understand mathematics. We assume that teachers' questions about teaching mathematics stem from this basic objective and are supported by teachers' desires to make it possible for each and every student to be a confident and competent learner of mathematics. Teachers wonder how to facilitate this process in an educational system that is frequently changing and is sometimes bewildering. This book is a response to their questions and concerns. Here we address some of these questions with our best answers drawn from research, practice, and professional judgment. We offer these answers to you as you seek to deal with the challenges of facilitating effective mathematics instruction.

TOPICS OF THE CHAPTERS

Each chapter follows a similar organization. We open with a letter from a teacher or a vignette from a classroom that presents questions or issues regarding the topic of the chapter. The narrative of the chapter focuses on instructional practices that provide answers to the questions, drawn from contemporary research of best practices for instruction in mathematics classrooms. We offer practical applications of these practices and provide examples a teacher can quickly put into place in their classroom. We conclude each chapter with a section encouraging reflection on one's own

practice, fully aware that advice is easier to give than to receive. We encourage the reader to share this book with a colleague, consider the approaches we suggest, and create other opportunities to respond to the questions as you carry about the duties of teaching mathematics.

Chapter 1 sets the stage for mathematics education against the backdrop of standards-based instruction. Today, across the United States, the standards of mathematics content are directed by the Common Core State Standards for Mathematics (CCSSM) which have been adopted by forty-five states, three territories, the District of Columbia, Puerto Rico, and Guam (<http://www.nctm.org/standards/default.aspx?id=58>).

These standards will influence the mathematics that is taught. Teachers wonder what impact the adoption of these standards will have on the requirements that they have to meet within their classroom. They want to know how to interpret the standards for the grade they teach. They want to know what's different about the CCSSM when compared to previous curriculum standards. They want to know more about the philosophy and the scope and sequence of the mathematics curriculum. They ask about content and what's important, what should be emphasized or why certain content is no longer emphasized as in the past. Answers to these questions have context in the CCSSM.

Tightly woven into the CCSSM content standards are eight Mathematical Practices. These are the practices of mathematicians, the *how* of doing mathematics. The Mathematical Practices postulate that to truly understand mathematics, students must also *do* mathematics by using mathematical processes, such as solving problems, making connections, and justifying their reasoning. During prior reform efforts, these practices were strongly suggested, but now the CCSS mandates that more structured mathematical practices should be embedded in students' mathematics learning experiences. For many teachers, this mandate offers a particular challenge and demands significant change in their instructional practices. Teachers want to know how to facilitate and encourage the mathematical practices, particularly across various content. Teachers want to know how to assess students' growth in the mathematical practices. This book offers support for tackling the challenge by sharing ways to incorporate the mathematical practices into instruction. Teachers want to know how to interpret the mathematical practices and how they relate to each other.

It has been widely published that teachers are making decisions every minute of their teaching day (Lampert & Ball, 1998). In Chapter 2, we present examples of decisions that come to mind, such as when to use individual or group learning, how to teach for conceptual understanding, what activities to include in instruction, how to address students' misunderstanding, what questions to ask, and how to respond to each student's

statement. In addition, there are multiple decisions to make during the planning process. Teachers examine the data about what the students know and understand, and they choose the instructional tasks and activities to address both misunderstanding and lack of understanding. Textbooks, curricula, and standards draw boundaries and exert pressure on teachers' decision-making processes. They want to know when and when not to use manipulatives, how to teach content in different ways (particularly for reteaching) and when to let students work on mathematics together. We offer the teachers guidelines to help them negotiate the range of choices provided for them in this process.

Chapter 3 addresses the tension teachers experience between time constraints and teaching for mastery. Do they teach a concept over and over, until it is mastered? If they do that, will they have sufficient time to teach all the standards expected for the grade level they teach? The current climate created by high-stakes standardized testing based on state standards is intensified by curriculum pacing guides. These guides are designed to assist the teacher in the planning process and encourage uniformity across contexts, such as classrooms within a school, or schools within a district. The guidelines offer a structure of dates and timelines created to insure student readiness for benchmark and summative examinations. Teachers often feel caught between the timeline for completion of a topic and their concern that the students are not yet ready to be examined on that concept. Managing pacing and mastery is the focus of this chapter. We offer guidance about incorporating "reteaching" into "teaching," and filling gaps in student knowledge bases. We offer teachers advice about what to do when they fall behind a pacing guide in order to help them fit their curriculum into the time that is becoming more limited as the school year continues.

Some of the structural elements of instruction in mathematics classrooms are discussed in the fourth chapter. Foremost are the content areas of mathematics, which are described in detail here with suggestions for implementation. Ideas for models of instruction, such as project-based instruction and problem-based instruction are offered to guide the framework for your class. This chapter draws attention to the overarching instructional strategies of multiple intelligences, testing, parental or family involvement, and professional development. A valuable contribution from Marilyn Burns, "Do something that counts every day," completes the chapter.

Specific classroom topics are delineated in Chapters 5, 6, and 7. We offer multiple suggestions for instructional tasks that help teachers differentiate instruction and meet the needs of each individual, even as we advance their understanding of mathematics in Chapter 5. Manipulatives, tools specific to mathematics, are the subject of Chapter 6, where we

describe the types of realia and offer examples of situations for appropriate use of those tools. In Chapter 7, we examine many of the helpful purposes that are served by technology. Additionally, we point out important questions a teacher should ask—and answer—as the technology becomes part of instruction.

Effective learning, and effective teaching, more readily happens when reflection is part of the cycle. Most professionals wonder, after the lesson concludes, if it went well or if it could have been improved. In Chapter 8, we offer guidelines for engaging in the inquiry of one's own practice. These suggestions streamline the informal self-assessment into a structure that facilitates improvement of instruction based on the data from student work.

Students in mathematics classrooms today bring with them a range of background experience that influences how they understand mathematics. Their home language, ethnic and social background, and individual strengths and talents all have a bearing on student learning. In Chapter 9, we offer information from our research and experience about Culturally Responsive Teaching, a cluster of attitudes and practices shown to be successful strategies for raising students' mathematics achievement. Learning is an individual endeavor and teaching must reach the student as an individual. This chapter shows how that might occur.

Just as in schools where there is a test at the end of the year, our final chapter about effective practices discusses assessment. Here we focus on evaluative assessment, that time when the teacher determines the extent of student learning and pronounces a professional judgment about its depth and breadth. Multiple means for gauging that learning are presented in this chapter. As we fill in the report cards, we offer suggestions for navigating the districtwide assessments while remaining true to our professional judgment about the knowledge and understanding of individual learners.

Finally, we bring our book about effective mathematics practices, drawn together in response to questions and concerns we heard in the field, to its conclusion in Chapter 11. Our purpose is to increase your awareness of many successful strategies for teaching mathematics, to help you ask the necessary questions that evaluate your own practice, to trust your professional judgment, and to confidently share your stories with your colleagues.