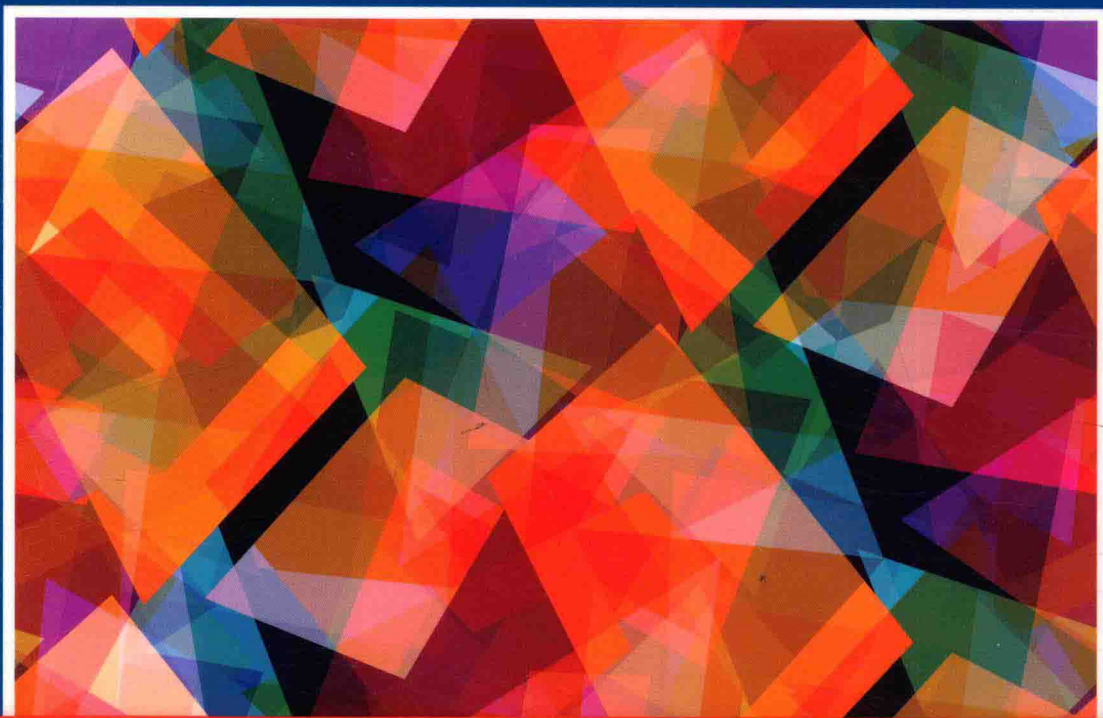


MATH

Know-How



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

图书馆

THOMASENIA LOTT ADAMS ◆ JOANNE LaFRAMENTA

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A SAGE Company
2455 Teller Road
Thousand Oaks, California 91320
(800) 233-9936
www.corwin.com

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55 City Road
London EC1Y 1SP
United Kingdom

SAGE Publications India Pvt. Ltd.
B 1/1 Mohan Cooperative Industrial Area
Mathura Road, New Delhi 110 044
India

SAGE Publications Asia-Pacific Pte. Ltd.
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#10-04 Samsung Hub
Singapore 049483

Acquisitions Editor: Robin Najar
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Typesetter: C&M Digitals (P) Ltd.
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Cover Designer: Karine Hovsepian

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Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Adams, Thomasenia Lott, author.

Math know-how: Answers to your most persistent teaching issues, Grades 3-5/Thomasenia Lott Adams, Joanne LaFrumenta.

pages cm

Includes bibliographical references and index.

ISBN 978-1-4522-8263-3 (alk. paper)

1. Mathematics—Study and teaching (Middle school)—Standards. I. LaFrumenta, Joanne, author. II. Title.

QA11.2.A315 2014

510.71'2—dc23

2013027238

This book is printed on acid-free paper.



SFI label applies to text stock

13 14 15 16 17 10 9 8 7 6 5 4 3 2 1

Math

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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.

Acknowledgments

We are indeed grateful for the opportunity to collect our thoughts and experiences, reflect on them, and share them with everyone concerned with the teaching and learning of mathematics. Individually, we each express our gratitude and acknowledge those who contribute unconditionally to success in every area of our lives.

Thomasenia Lott Adams

I owe all that I am, and all that I am able to do—with the intellect, abilities, and gifts that I have—to God. Speaking of gifts, the greatest gifts in my life are my husband, Larry, and sons, Blake, Philip, and Kurt, my “heart children,” Georges and Diana, my mother, Tennie Ruth Lott, and my siblings, Larry, Rhoda, Alie Ruth, Jacqueline, Jerridene, and Malcolm. I am also grateful that every week I get to rest my mind, body, and soul in the hands of my pastors at the Showers of Blessings Harvest Center, Apostle Willie and Prophetess Linda King. Finally, I am grateful for mathematics—for a long time it escaped me—but because of a good teacher during my first year of college, Willie Briggs, I gained mathematical power. To all who think you can’t, you can!

Joanne LaFramenta

This is the occasion to recognize those who have given me the opportunities to love mathematics and to share that love. I acknowledge the support and education I received from my colleagues, especially Gail Standiford, during my years of public school teaching. Thank you for sharing all your good ideas with me and letting me share mine. To all the students I taught, please remember that this book would not be possible without your important participation in the described activities.

Because of the mentorship of my coauthor, who accepted me as a colleague after years of being her student, my authorship became possible. Thanks to my family—Scott, my husband, for his support; my children, Charmi and her husband John, Shreve and wife Candice, who believed I could succeed; and my grandsons Henry, Levy, and River, who illuminate my purpose and dream that mathematics can be accessible to all children. Finally, and most importantly, I acknowledge the power of God who has showered me with these gifts.

Specifically, we would like to acknowledge the assistance of Helen Saltzgiver for contributing to our letters from the teachers, and the aid of Autumn Nowlin for her contribution to our diagnostic assessments. These are two of the many teachers who have stimulated our imaginations and freely shared their enthusiasm for teaching. We hope that this book offers ideas and encouragement to all who teach mathematics in Grade 3 to Grade 5.

PUBLISHER'S ACKNOWLEDGMENTS

Corwin wishes to acknowledge the following peer reviewers for their editorial insight and guidance.

Edward C. Nolan, Supervisor, Mathematics, Pre-K to 12
Montgomery Public Schools
Rockville, MD

Stefan Mayer, Teacher of Mathematics & Technology
Carmel Middle School
Carmel, CA

Andrea Miller, Math Coordinator, Math & Science Collaborative
Allegheny Intermediate Unit
Homestead, PA

Barbara D. Fox, Former Math Coach
West Medford, MA

Amanda McKee, Mathematics Instructor at Florence School District #5
Vice President of the South Carolina Council of Teachers
Johnsonville, SC

Dr. Monica Uphoff, Math Education Consultant
Corinth, TX

Daniel Kikuji Rubenstein, Executive Director
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Nancy Chesley, Elementary Mathematics, Science, and Literary Specialist
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National Science Foundation. Dr. Adams has a commendable list of publications and conference presentations and is a senior author of the elementary mathematics textbook series titled *Go Math!*, published by Houghton Mifflin Harcourt. She is also author on several publications of the National Council of Teachers of Mathematics (NCTM) and *Solutions Tree*.

Service posts to her credit include editor of the Mathematical Roots Department in *Mathematics Teaching in the Middle School* and coeditor of the Investigations Department of *Teaching Children Mathematics*, both published by NCTM. Dr. Adams has also served as board member of the Association of Mathematics Teacher Educators, board member of the School Science and Mathematics Association, and past president of the Florida Association of Mathematics Teacher Educators.

Dr. Adams is a previous recipient of the Mary L. Collins Teacher Educator of the Year Award for the Florida Association of Teacher Educators. She has participated in major efforts to improve teaching and learning of mathematics, including coauthor of K–12 mathematics professional development programs, serving as a mathematics coach across grades K–12, and leader for the mathematics and science job-embedded professional development and graduate degree program for middle and high school teachers. She is also an accomplished mentor of mathematics education doctoral students.

Dr. Adams received a bachelor of science in mathematics from South Carolina State College, a master of education and doctor of philosophy in Instruction and Curriculum from UF in 1990 and 1993, respectively.



Joanne LaFramenta is a retired middle school mathematics teacher with a master's degree in teaching from the University of Chicago. She taught in public schools for more than thirty years in elementary, middle, and high school as well as at the community college and university levels. Her career as a teacher of middle school mathematics began in 1985 in California as the state began an ambitious program of reform, an effort to improve both mathematics teaching and learning. She is a National Board Certified Teacher of Early Adolescence/Mathematics. She graduated from the University of Florida in the summer of 2011, with a degree of doctor of philosophy in Curriculum and Instruction, emphasis in mathematics education. She now serves as a research associate and adjunct instructor at the University of Florida.

Contents

Preface	ix
Acknowledgments	xiii
About the Authors	xv
Chapter 1: Common Core State Standards for Mathematics: Mathematics Content and Mathematical Practices	1
Creating the Common Core State Standards for Mathematics	2
Theoretical Basis of the Common Core State Standards for Mathematics	7
Structure of the Common Core State Standards for Mathematics	10
Two Brief Notes	13
Summary	17
Questions and Tasks for Reflection	18
Chapter 2: Making Mathematics Teaching Decisions	19
Learning: The Primary Purpose of School and the Primary Goal of Teaching	19
The Nature of Learning	20
Formative Assessment: Discovering the Prior Knowledge	24
Types of Formative Assessment Practices	25
Making the Decisions of Teaching	38
Summary	39
Questions and Tasks for Reflection	40
Chapter 3: Using the Pacing Guide Effectively	41
Pacing Guides for Mathematics Instruction	42
Role of the Mathematics Pacing Guide	48
How Do Mathematics Standards Influence the Pacing Guide?	50
Pacing and Mastery	51
Summary	54
Questions and Tasks for Reflection	54

Chapter 4: Approach to Planning Mathematics Instruction	57
Perspective: Mathematics Content	58
Perspective: Models of Instruction	66
4-A Way to Mathematical Success	69
Overarching Instructional Strategies	73
Summary	76
Questions and Tasks for Reflection	76
Chapter 5: Facilitating Differentiated Instruction	79
Introduction to Differentiated Instruction	80
Specific Points About Differentiated Instruction	86
Summary	93
Questions and Tasks for Reflection	93
Chapter 6: Teaching and Learning Mathematics With Manipulatives	95
Young Students Learn Best When Mathematics Is Linked to a Real-World Context	96
Selection of Manipulatives	97
Use of Manipulatives	105
Tools in the Practice Standards	111
Summary	112
Questions and Tasks for Reflection	113
Chapter 7: Appropriate Use of Technology	115
Technology in the Classrooms	116
Technology for the Learner	117
Effective Implementation in the Classroom	124
Evaluating the Use of the Technology	124
Technology for the Teacher	125
Summary	127
Questions and Tasks for Reflection	127
Chapter 8: Reflecting on the Teaching Practice of Mathematics	129
What Is Reflection on Teaching?	129
Connecting Anticipations and Results	130
Measuring the Outcomes	137
The Formal Reflection Process	139
Summary	140
Questions and Tasks for Reflection	141

Chapter 9: Understanding the Learner	143
The Expectations From the Common Core State Standards Initiative (CCSSI)	144
The Special Case of Gloria Jean Merriex	144
Culturally Responsive Teaching	146
Summary	151
Questions and Tasks for Reflection	152
Chapter 10: Mathematics Assessment 101	153
Introduction	153
Summative Assessment	154
Authentic Assessment	159
Summary	164
Questions and Tasks for Reflection	165
Chapter 11: Conclusion	167
All Eyes on Mathematics Education	167
Appendix: Resources for Teachers	173
References	177
Index	183

1

Common Core State Standards for Mathematics

Mathematics Content and Mathematical Practices

Dear professor:

I've been teaching for fifteen years, and I'm pretty busy. The days at school with the children consume all my attention, and then after school I have to plan for the next day. I'm pretty tired by the time I get home (and I also have school-age children), but I'm a professional and I try to keep abreast of the new happenings in education. Now all the talk is about the Common Core standards. I'm sure there is information about the Common Core on the Internet, but they haven't given us much information at school, just saying that we need to get ready and we need to get students ready, because it is coming and it will be different. Someone told me that almost all the states will be using Common Core and that our teachers won't be ready to teach it. Some gloomily predict that vast numbers of our students will fail the new assessments. All this talk is really frustrating, and frankly, frightening. What is actually going on? Why are we changing standards now? I am not the oldest member of the staff here, but I know that this is not the first time that the administration has tried to "reform" our curriculum. It seems as if just about the time we finally learn how to teach a mathematics curriculum, somebody changes it. Are these changes different? What will I have to do now as a teacher? Can we expect this reform to last? I wish someone would help me understand what I should know and do about the Common Core.

*Sincerely,
A fourth-grade teacher*

Quantitative data and technology were the driving forces behind the global economy in which we are now interacting, which makes mathematics a critical element in both national and international undertakings. Hence mathematics education is a field vibrant with new and paradigm-changing adventures required to support these driving forces. The most recent adventure in the field of mathematics education involves the unveiling of the Common Core State Standards (CCSS) for Grades K–12. The CCSS includes content for language arts and mathematics. We refer to the Common Core State Standards for mathematics as CCSSM. The mission of the CCSS is to

. . . provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy (National Governors Association Center for Best Practices (NGA) & Council of Chief State School Officers (CCSSO), 2010, p. 93).

In this chapter, we address many important and relevant questions: Why do we need the CCSSM? What supported the development of the CCSSM? And how does the CCSSM differ from already existing standards related to the teaching and learning of mathematics? Knowing the answers to these questions equips you to address inquiries from peers, school administrators, parents, and even students. We also recommend that you begin to collect your own additional questions and any questions posed from others so that as you answer these questions, you become more informed about the CCSSM. Table 1.1 is a CCSSM Information Log provided to record questions in order to facilitate building your knowledge of the CCSSM.

CREATING THE COMMON CORE STATE STANDARDS FOR MATHEMATICS

The CCSSM developed quickly, but the antecedents have been in existence for many years. Likewise, concern about the educational issues necessitating adoption of these standards has been the focus of policy makers and educators for several decades. Working together, political and educational leaders joined to develop the CCSSM.