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SHELL EDUCATION

2nd Edition

Guided MATH

A Framework for Mathematics Instruction

Laney Sammons
Foreword by Donna Boucher

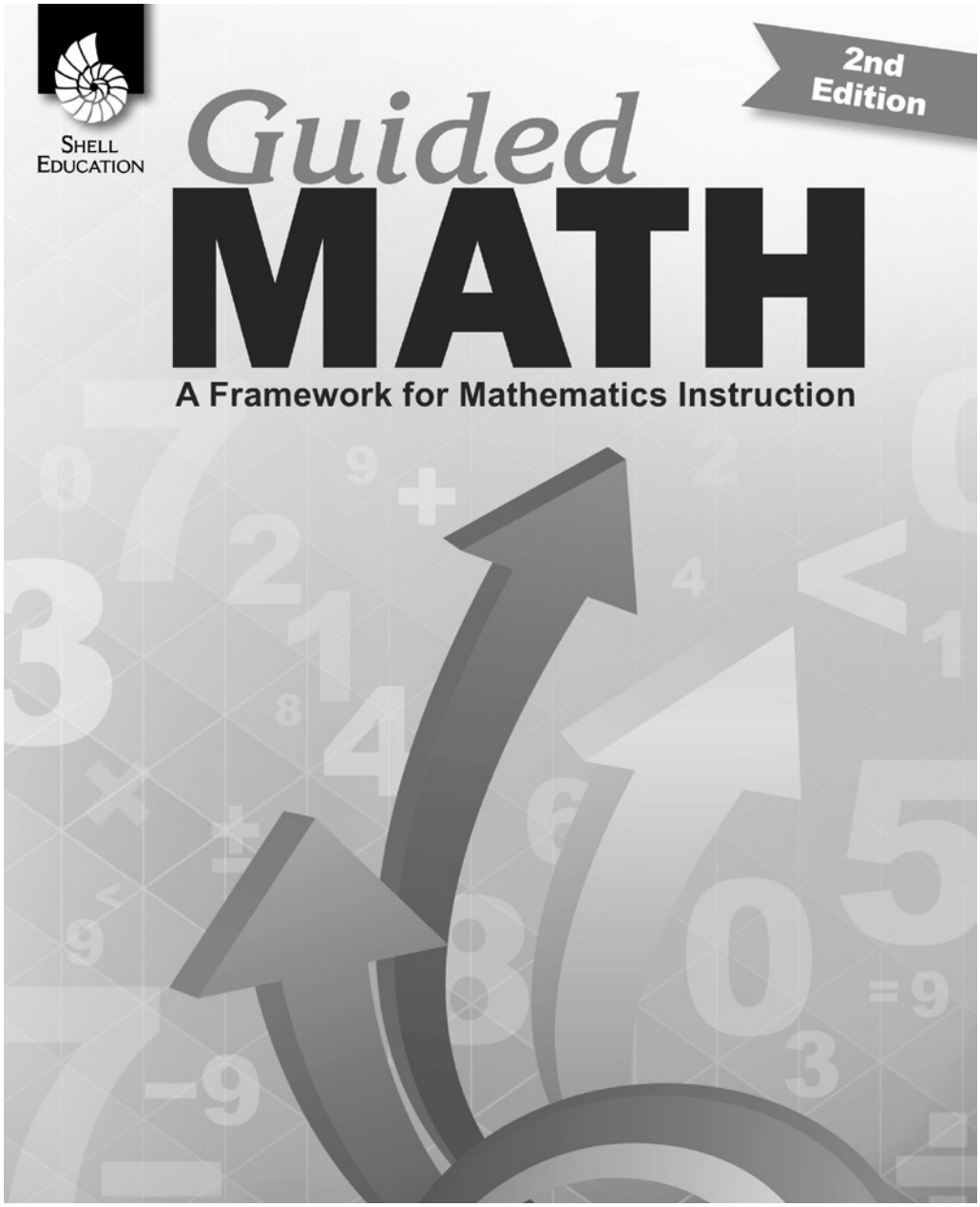

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Table of Contents

Foreword 6

Preface to the Second Edition 9

Chapter 1: Guided Math: A Framework for Mathematics Instruction 15

- Instructional Components of Guided Math 19
- Guided Math in Practice 27
- Levels of Teacher Support 29
- Scheduling Guided Math Components 34
- Review and Reflect 37

Chapter 2: Creating an Environment of Numeracy 39

- Foundational Principles of a Guided Math Classroom 41
- Building a Classroom Learning Community 44
- A Numeracy-Rich Environment 56
- Concrete-Representational-Abstract Instruction 59
- Math Word Wall and Vocabulary Displays 62
- Math Journals 67
- Graphic Organizers 70
- Class-Made Anchor Charts 72
- Tools for Measuring 73
- Math-Related Literature 75
- Connecting Math to Other Content Areas 79
- Chapter Snapshot 80
- Review and Reflect 81

Chapter 3: Guided Math Warm-Ups 83

- Math Stretches 85
- Planning Math Stretches 107
- Mathematical Current Events 109
- Math-Related Classroom Responsibilities 111
- Daily Task/Calendar Board 114
- Planning for Math Warm-Ups 123
- Review and Reflect 124
- Chapter Snapshot 125

Table of Contents *(cont.)*

Chapter 4: Whole-Class Instruction in a Guided Math Class 127
The Advantages of Whole-Class Instruction 128
The Challenges of Whole-Class Instruction 130
Choosing When to Use Whole-Class Instruction 133
Activating Strategies 134
Mathematical Connections to Literature 139
Setting the Stage for Math Workshop 142
Math Huddle Conversations 143
Practice and Review Sessions 144
Testing and Assessments 148
Mini Lessons 149
Chapter Snapshot 159
Review and Reflect 159

Chapter 5: Teaching Small-Group Lessons 161
The Advantages of Small-Group Lessons 163
The Challenges of Small-Group Lessons 167
Effective Uses of Small-Group Lessons 170
Forming Small Groups for Lessons 183
Organizing for Small-Group Lessons 189
Planning Small-Group Math Lessons 192
Preparing for Small-Group Lessons 214
Teaching an Effective Small-Group Math Lesson 218
The Value of Teacher Reflection 226
Chapter Snapshot 235
Review and Reflect 235

Chapter 6: Supporting Guided Math Workshop 237
Math Workshop in the Classroom 238
Implementing Math Workshop 240
Deciding How Much Choice Students Will Have 252
The Nuts and Bolts of Organizing Math Workshop 254
Managing Math Workshop 260
Math Workstation Tasks 265
Co-Teachers and Teaching Assistants 271
Chapter Snapshot 273
Review and Reflect 273

Table of Contents *(cont.)*

Chapter 7: Math Conferences 275
- What Are Math Conferences? 276
- The Differences between Helping and Conferring 277
- Conferring During Math Workshop 279
- The Overall Structure of a Math Conference 281
- Keeping Records of Conferences 295
- Using Conference Notes to Plan Instruction 298
- Strategies for Effective Math Conferences 299
- Chapter Snapshot 303
- Review and Reflect. 303

Chapter 8: Guided Math Assessments 305
- Rationales for Formative and Summative Assessment. 307
- Assessment and Learning in Guided Math. 309
- A Vision for Learning 309
- Establishing Criteria for Success with Checklists and Rubrics 311
- The Value of Descriptive Feedback. 317
- Involving Students in the Assessment Process. 319
- Formative Assessment 320
- Using Assessments to Inform Guided Math Groups. 322
- Chapter Snapshot 325
- Review and Reflect. 325

Chapter 9: Putting Guided Math into Practice 327
- Nurturing Student Mathematicians 328
- Creating a Guided Math Schedule. 330
- Getting Started with Guided Math 334
- The First 15 Days. 337
- Determining Student Readiness for Math Workshop. 352
- Addressing Math Workshop Problems 353
- Teacher Collaboration for Guided Math Implementation . . . 355
- Chapter Snapshot 359
- Review and Reflect. 359

Appendixes 360
- Appendix A: Math Conferences. 360
- Appendix B: Problem Solving 363

References Cited 366

Index 374

Chapter 1

Guided Math: A Framework for Mathematics Instruction

Think back to your school days. Picture your math classes. What do you remember? Many of us recall instructions to get out our math books and open to a specified page. The teacher explains the lesson using the chalkboard or overhead projector. One or two students may be called on to solve problems at the board as the rest of the students practice at their desks. Some of us may remember using manipulatives in our early grades but probably not beyond second grade. Then finally, the teacher assigns problems from the book for classwork and homework. These assignments are later turned in, checked, and graded. Periodically, quizzes are given to check understanding. At the end of the chapter, a test is given. The teacher then moves on to the next chapter.

Was this method successful? For many of us, the answer is yes. The teacher-centered approach provided the instruction we needed. We applied this instruction to problems to be completed, and our understanding increased. If it didn't, we comforted ourselves with the knowledge that some people just don't have mathematical minds. We decided to make the most of our other skills. Many of us simply opted out of math classes as soon as we could. All too often, this was considered good enough. Students either "got it" or they didn't. Their grades indicated how well they "got it." Unfortunately, too many of us didn't "get it."

Mathematical literacy has been, and continues to be, a serious problem in the United States (U.S. Department of Education 2008). In 2007, research indicated that 78 percent of adults could not explain how to compute the interest paid on a loan, 71 percent could not calculate miles per gallon on a trip, and 58 percent could not calculate a 10 percent tip for a lunch bill (Phillips 2007). According to the U.S. Department of Education's National Mathematics Advisory Panel, "there are persistent disparities in mathematics achievement related to race and income—disparities that are not only devastating for the individuals and families but also project poorly for the nation's future, given the youthfulness and high growth rates of the largest minority populations" (2008, 12).

Recent results from the National Assessment of Educational Progress (NAEP) show that only 40 percent of fourth grade students rated as proficient or advanced in 2017, while 20 percent ranked in the lowest level, below basic. The scores for eighth grade students are similar with 34 percent scoring as proficient or advanced and 30 percent scoring in the lowest performance level (National Center for Education Statistics 2004). Additionally, according to the 2015 results of the Programme for International Student Assessment, the United States placed 38 out of 71 countries in math. This ranking is behind countries such as Estonia, Vietnam, and Latvia, and below the average of the 35 members of the Organization of Economic Cooperation and Development that sponsors the test (Pew Research Center 2017).

We must change our mathematics instruction because too many of our students are falling behind. Unfortunately, many teachers are still using the traditional, whole-class instructional method in classrooms. Some teachers recognize the need for change from traditional instructional methods and are making those changes. However, the teacher-centered, large-group instruction model of teaching is still prominent in mathematics classrooms across the nation.

Because of the limitations of this method of instruction, students are often presented with the message that there is a particular way in which mathematics must be done—that there is only one right answer

and only one right way to find that answer. The emphasis is on learning a set procedure rather than on conceptual understanding. In his book *The Math Instinct*, Keith Devlin states, "The problem many people have with school arithmetic is that they never get to the meaning stage; it remains forever an abstract game of formal symbols" (2005, 248). As Arthur Hyde (2006) points out, by fourth or fifth grade, students seem to have lost the problem-solving skills they had when they began kindergarten. Lack of conceptual understanding handicaps many students as they face more difficult math challenges in the upper grades.

Rather than inspiring students to understand and make sense of math, current instructional methods too frequently focus on memorization and formalized procedures. This focus on memorization squelches the natural curiosity learners have about mathematics. To improve the quality of mathematics education, Jo Boaler urges educators to equip their students with a mathematical mindset so that they "approach math with the desire to understand it and to think about it, and with the confidence that they can make sense of it" (2016, 34). But unless traditional instructional methods change, teachers will continue to struggle to teach mathematics as a "flexible conceptual subject that is all about thinking and sense-making" (35).

Furthermore, the traditional methods for teaching math offer few options for effectively addressing the diverse learning needs of students. As Jennifer Taylor-Cox so aptly describes: "We aim for the middle and pray for ricochet. We hope the knowledge we impart to the center will bounce around until everyone gets it" (2008, 1). Students who don't "get it" fall further and further behind as teachers struggle to find the time to help them. Teachers are frustrated trying to meet the needs of those students while continuing to challenge others who master the concepts quickly. Some students complain of being bored while others fail miserably in understanding the content being taught. It is easy for teachers to feel caught in the middle of a tug-of-war game when trying to balance the needs of all learners. With the ever-increasing diversity of students in classrooms today, it has become evident that students' mathematical success hinges on teachers' ability to differentiate instruction so that all learners are both supported and challenged as they work to master the required curricular standards (Sammons 2013).

The frustrations felt by educators are only increased by the demands for accountability enacted by state and federal governments. School systems are struggling to eliminate the gaps in achievement between minority and majority students, between special education and general education students, and between students receiving free and reduced lunches and the rest of the student population. It is no longer acceptable to have a portion of our students underachieve in mathematics. Disappointingly, after several years of gaps in the scores of these groups slowly narrowing (according to NAEP assessments), the 2017 results show no further narrowing of these gaps, and they even show slight increases in the gaps since the 2015 assessments (Nation's Report Card n.d.).

Driven by these pressures and their own professional desires to provide quality mathematical education, teachers continue to search for effective means to teach their students and for ways to adapt instructional methods to accommodate all learners. Making this task even more complicated is the fact that students who are slower learners for one concept in mathematics may very well be accelerated learners with other concepts.

As states have upped the ante with the adoption of more demanding math standards based on the standards developed by the National Council of Teachers of Mathematics (2000) and the Common Core State Standards (Common Core State Standards Initiative 2015), teachers have discovered that methods they have used successfully in the past are no longer effective. The demands of the more rigorous curriculum standards call for new ways of teaching.

As I grappled with these frustrations in my own classroom, I gradually developed a model that offers all students opportunities to develop their mathematical skills at increasingly challenging levels of difficulty with the ultimate goal of helping them gain the ability to function independently in the world of mathematics. I learned the importance of establishing and maintaining a classroom framework that is organized to support numeracy, just as teachers have done for literacy for many years.

Instructional Components of Guided Math

These are the instructional components of the framework: