

---

# Contents

<b>About the Authors</b>	<b>v</b>
<b>Introduction</b>	<b>1</b>
<b>1. A Glimpse at Mathematics Instruction</b>	<b>3</b>
Two Illustrations	4
Vignette 1: Algebra I—Shake Across America	4
Discussion	7
Adaptations and Extensions	10
Vignette 2: Seventh Grade—Surface Area With Polydron Shapes	10
Discussion	14
Adaptations and Extensions	15
Success in Teaching Mathematics	16
Summary	16
<b>2. Standards-Based Teaching</b>	<b>17</b>
Why Do We Need Standards for Teaching Mathematics?	18
The National Council of Teachers of Mathematics (NCTM) Principles and Standards	18
State and District Standards for Teaching Mathematics	24
The Relationship Between Standards and Standards-Based Mathematics Textbooks	25
Aligning Algebraic Reasoning With the Process Standards	26
Summary	31
<b>3. Engaging Students in Learning Mathematics</b>	<b>33</b>
What Is Engagement?	34
Engaging Learners in the Affective Domain	34
Vignette 1: Math Clubs	35
Vignette 2: Seventh Grade—Math Jeopardy	35
Glasser’s Five Basic Needs	36
Vignette 3: Increasing a Student’s Confidence in Mathematics	38
A Fresh Look at Math Clubs and Math Jeopardy	39
Affective Issues Related to Teaching and Learning Mathematics	42

Students Engaged in Learning Probability	44
Engaging Learners in the Behavioral Domain	51
Engaging Learners in the Cognitive Domain	53
Summary	56
<b>4. Engagement Strategies for Special Populations</b>	<b>57</b>
Vignette 1: Disparate Learners in Algebra I	57
The Special Needs Learner	59
The Gifted Learner	65
The English Language Learner	70
Example of Engaging Learners in a Mathematics Classroom	74
Vignette 2: Permutations, Counting, and Ice Cream Cones	74
Discussion	78
Summary	79
<b>5. Assessment</b>	<b>81</b>
Types of Assessment	82
Rubrics	88
Developing Assessments: The Use of Backward Design	89
Grading and Assessment Schemes	91
Practical Ways of Assessing Throughout the Instructional Process	92
Tailoring Assessments for Special Populations	92
Data Driven Instructional Practices	97
A Word About Standardized Tests	98
Summary	98
<b>6. Putting It All Together</b>	<b>99</b>
The Year at a Glance: Designing Your Curriculum	99
Making Connections Within Mathematics	100
Mathematical Connections Across the Grades	102
More Connections Across the Grades	105
Making Connections Across the Curriculum	106
Succeeding at Teaching Mathematics—and Loving It!	107
<b>Appendix A: Solutions to Shake Across America</b>	<b>109</b>
<b>Appendix B: Solution to the Following Problem     From the Polydron Vignette</b>	<b>111</b>
<b>Appendix C: The Dart Board Game Solution</b>	<b>113</b>
<b>Appendix D: Generalization for Original Pizza Problem</b>	<b>115</b>
<b>References</b>	<b>117</b>
<b>Index</b>	<b>121</b>

---

# Introduction

**T**hroughout our collective years as mathematics educators, we have found that new teachers are concerned about many of the same issues surrounding mathematics education. We realized that there is a critical need to ease the transition to teaching mathematics, and it goes beyond the teacher preparation programs that new teachers have completed. Our goal with this book is to supplement what new teachers of mathematics have already learned about teaching mathematics and to focus on the key elements of successful teaching.

In this book we have used a combination of research, personal experiences, and observations of other mathematics teachers. We present all the ideas that we have found to be extremely important to the developing teacher of mathematics. We have included many of the common problems and big ideas in mathematics in many vignettes sprinkled throughout the book. The vignettes were inspired by real teachers in real classrooms, and we hope they encourage thought-provoking discussion on important issues in content as well as pedagogy in mathematics lessons for Grades 6–12.

We would like you to keep in mind as you read this book that there is no one right way to approach teaching and that you are already in the process of developing your own philosophy of teaching and learning. This book is meant to be used as a tool to help you think about the important issues that can shape the kind of teacher you are meant to be. We hope that by reading this book you will get a better understanding of the strong connections inherent in mathematics as a body of knowledge and begin to see how everything you teach can be connected to other concepts or understanding.

## HOW THE BOOK IS ORGANIZED

Chapter 1: “A Glimpse at Mathematics Instruction.” This chapter provides a look at mathematics instruction in two classrooms. With two vignettes we set the stage for the rest of the book by introducing elements of successful mathematics instruction.

Chapter 2: “Standards-Based Teaching.” In this chapter we build on the elements of successful mathematics instruction from Chapter 1 by discussing standards-based teaching in mathematics. We look at the standards set forth by the National Council of Teachers of Mathematics, as well as discuss the importance of standards created at the state and district levels. We also provide examples of standards-based teaching relative to algebraic reasoning.

Chapter 3: “Engaging Students in Learning Mathematics.” In this chapter we take a look at the three interrelated components of engagement: the affective, behavioral, and cognitive. We begin with the affective component in light of Glasser’s categorization of a human being’s five basic needs: (1) survival, (2) love and belonging, (3) fun, (4) freedom, and (5) power. We describe how each of these basic needs is reflected in the classroom and how you can use knowledge of these basic needs to create an inclusive classroom environment.

Chapter 4: “Engagement Strategies for Special Populations.” This section of the book takes an in-depth view of strategies for engaging several special populations: special needs students, gifted students, and English language learners. We discuss strategies for engagement that are specific to these special populations. We then present an engaging activity involving permutations and discuss how this activity may engage special populations of students.

Chapter 5: “Assessment.” This book would be incomplete if it did not address assessment and its importance in the instructional process. We look at the purposes of assessment, and we discuss different means of assessing mathematical understanding and give examples of each. We also discuss the backward design model for assessment and present suggestions for assessing special needs students.

Chapter 6: “Putting It All Together.” In this last chapter, we discuss ways for you to incorporate the strategies in this book throughout your mathematics curriculum. We suggest ways to connect big ideas within mathematics as well as present ideas for you to connect mathematics across the grades.

Your first few years of teaching mathematics are a very exciting time. Whether you are a new teacher or simply want to take a fresh look at teaching mathematics, we hope that this book will provide you with a structure to plan and guide you through your teaching. We wish you the very best for a long and rewarding career.

of competence comes from students' perceived view of how others see them—both the teacher and their classmates. Students gain power or rank in the classroom in various ways. They can gain power in obvious ways such as by getting the highest grade on a quiz or exam. They can also gain power in simple ways such as by answering a question in class correctly or by contributing to the solution in a cooperative learning setting. When students are observed performing competently, their perceived rank in the class increases.

A word of caution: It is true that increasing students' feelings of power in your classroom should be one of your highest-level goals, and that students who are empowered in mathematics can accomplish truly amazing things, far beyond what you can probably imagine at this point. Yet in your quest to instill power in your classroom, don't make the mistake of widening the gap between the haves and the have-nots. Your brightest students, the ones who always get the As on the quizzes and tests, are not the ones you necessarily need to empower. They are likely already empowered. It is the other students, the ones who lack confidence in their abilities, that you need to turn your attention toward.

There are ways to empower these learners as well; it may just take a bit of creativity. Teachers can effectively increase a student's feelings of competence by providing encouragement. Pointing out a nice solution method to a student, whether in private or to the entire class, can go a long way toward increasing confidence in a student who is uncertain of his or her mathematical ability. Teachers can also influence the mathematical status of a student in the class. Let's consider the case of Miss Gold and her student Rich, who is struggling in her mathematics class.

---

### **VIGNETTE 3: INCREASING A STUDENT'S CONFIDENCE IN MATHEMATICS**

*Seeing that Rich was having some trouble understanding, Miss Gold asks him to come in at lunch for extra help. When he comes, she helps him solve a problem, and she lets him know that she will ask him to write his solution on the board the next day. The next day, she assigns several problems to be written and explained on the board, making sure she includes the problem she discussed with Rich the day before. Rich solves his assigned problem beautifully and seems very happy and confident of his work. Over the next few weeks, he continues to ask Miss Gold for help at lunch or after school and volunteers to put more problems on the board.*

---

The strategy used by Miss Gold allowed Rich to demonstrate his correct solution to the class without having to reveal to his peers that he had