# One

# *Preparing for a Successful Year*

*Cameron and Shelly both teach eighth-grade math and want to be sure that their middle school students are well prepared for high school math. Their district has just published new math standards, and the district testing requirements are new as well. Cameron and Shelly aren't sure about how these changes should impact their math teaching. What should they be thinking about in terms of instruction? What preparation will students need for the new assessments?*

*Max has different questions about the upcoming year. He has been teaching in a self-contained sixth-grade classroom for five years and has just been reassigned to eighth grade. He enjoys teaching math and knows the sixth-grade math curriculum well, but he hasn't taught eighth grade since his student-teaching assignment. He feels he needs to determine the year's goals and learn what topics his eighth graders should study in mathematics and when they should be taught.*

*Madison has other concerns. She's getting ready to teach sixth grade and wants to know what models the fifth-grade teachers used in their instructional program. Madison knows that reminding students about models or strategies that they learned in an earlier grade helps them connect their current learning with their prior knowledge. She also wants to meet with the math teachers in her school to discuss how topics are being built on from one year to the next.*

*As these teachers' concerns illustrate, there are many things to consider when preparing for a year of math teaching, from standards and assessment to curriculum and instruction. Looking at the overall picture can help you identify issues that are important for you to address in your instructional program.*

## 1 What's the best way to determine what math concepts and skills I need to teach for my grade level?

It's wise to have a governing idea about the year's math instruction. You need to comprehend the big picture of what students in your classes should understand and be able to do mathematically by the end of the year. This can be a bit tricky if you are a new teacher or a teacher new to a particular grade level. You may remember what it was like learning math as a student in the grade level(s) you're teaching, but what and how it was taught is likely to have changed. Take advantage of several types of resources rather than relying solely on one source for determining your teaching goals. Each will inform your thinking by offering you a different perspective.

You might start with the national standards, which provide overall guidance about the elements of a strong math program, including content standards and process standards—the "what" to teach and the "how" to teach it. Don't expect to find daily lesson plans in the national standards document, but it will provide a helpful picture in which to frame your more specific grade-level concerns. *(See Question 2 for an overview of the national standards.)*

Next, check your state standards. Many states have patterned them after the national standards. In addition, many states include the content of their standards on statewide assessments, so you'd be wise to familiarize yourself with them.

To provide more specifics, many schools and school districts have developed a set of local math standards. These are important to consult when developing an overall picture for the year. Variously called math frameworks, curriculum guides, teaching and learning standards, district benchmarks, student learning objectives, and performance standards, they provide information about what students should learn. Read these carefully. Look at the math concepts and skills in earlier and future grades to understand the context for the math you teach. It's important to know what students learned in previous years and what will be covered in the next year or years. If you look only at the standards for your grade, you may miss the big picture in planning your instruction. For example, a new sixth-grade teacher read just his district's sixth-grade math standards and was concerned when he found that integers were not addressed. Responding to this perceived lapse, he developed and taught a unit on integers for his students only to learn that integers were thoroughly covered and assessed in seventh grade. Furthermore, in teaching his unit on integers, he ran out of time to teach about probability, which *was* included on the sixth-grade state assessment.

Your school or district may not have a specific set of math standards, using instead the documents produced by your state. Ask one of your math colleagues or your

principal for information about obtaining copies of various standards documents, or check your district or state education department's Web site.

Finally, the instructional materials provided by your school or district for teaching math will include specific information about planning the year's instruction. Lessons may be described in detail, helping you think about and prepare the materials needed for each learning segment. As you become more experienced in teaching math, you'll likely supplement your curriculum materials with activities that you've learned about from a variety of sources: colleagues, workshops, teacher resources, and your own experiences.

## 2 What should I know about the national math standards?

*Principles and Standards for School Mathematics*, our current national math standards, is published by the National Council of Teachers of Mathematics (2000c). This document sets forth a vision for school mathematics that includes the following ideas:

- All students (including those traditionally underrepresented in mathematics) can learn math when they have access to high-quality math instruction.
- Our world is constantly changing and thus the need to understand and use math in everyday life is increasingly important. This includes the need to understand quantitative information and the ability to problem solve in and out of the workplace.
- Learning math today requires much more than memorization of facts and procedures. Students must be able to think, reason, and solve problems with depth and understanding.
- Students learn math when they are actively involved in sense making.

Six guiding principles—equity, curriculum, teaching, learning, assessment, and technology—are described in the first part of the document. These are followed by standards for four separate grade-level bands: pre-K–2, 3–5, 6–8, and 9–12. Each grade-level band provides specific information about ten standards (five content standards and five process standards) as well as suggestions for classroom instruction.

The content standards include:

Standard 1. Number and Operations

Standard 2. Algebra

Standard 3. Geometry

Standard 4. Measurement

Standard 5. Data Analysis and Probability

The mathematics that students must learn is defined in the five content standards, which describe "what" we teach. Note that there are overlaps among the content areas. For example, as you might guess, number appears in all of the content standards. Algebra and geometry share content with respect to patterns, functions, and spatial sense. Regardless of the instructional materials you use, the content standards should all be addressed. They give you a lens through which to think critically about your curriculum materials.

The five process standards describe the "how" of bringing the content standards to life for your students. They include:

Standard 6. Problem Solving

Standard 7. Reasoning and Proof

Standard 8. Communication

Standard 9. Connections

Standard 10. Representation

All ten standards are necessary in a comprehensive and coherent math program.

## 3 My instructional materials give me the direction I need for planning day-to-day lessons, so why is it important to consider national or state standards?

While your instructional materials give day-to-day support for teaching your students, national and state standards provide an overall picture of math teaching and learning that can inform your thinking as you make your daily instructional plans.

An analogy can help illustrate this idea. Say you're planning a garden. You might decide on specific plants to put in it and determine where in the garden each will go. But what if you get to the nursery and the specific plants you want are unavailable? You'd be better prepared if you had a broader sense of what you're trying to achieve in the garden, the kind of soil you have, the amount of sunlight it receives throughout the day, and so forth. Knowing these general characteristics of your garden plot will enable you to achieve success with the individual plants contained in it. In the same way, national and state standards can be thought of as the broad general characteristics—the garden plot—that provide a context for specific instructional materials.

When you're preparing to teach any lesson, there are many things you need to take into consideration in order for the lesson to be a success. You need to think about the

objective for the lesson, the context and materials needed, how students will be organized—in small groups? with a partner? alone?—how you'll introduce the lesson, explain your expectations, support and challenge students as they work, figure out how to deal with students who finish early, and so on. Sometimes it's so easy to get caught up in planning for these important details, you forget the larger purpose and mathematical goals of the lesson and where these ideas fit into students' overall math learning. Standards can help with that, and they are especially useful in helping you think of extensions for your lessons. If you know where the lesson is going mathematically, it's a lot easier to think about what questions and extensions are appropriate for your students.

## 4 How might I think about scheduling in all of the topics I need to teach, and matching my curriculum, major projects, and assessments to scheduling constraints?

It's helpful to map out your instructional year using your school or district calendar. This way you can take into consideration when quarters, trimesters, or semesters end, and when standardized assessments, holidays, and vacations are scheduled, all of which will help you make decisions about the order in which to include units and assessments.

The math team at one school I know gets together in late spring to plan out the next school year. Their school is on a quarter system, so they've learned that they can teach about two four-week units or chapters per quarter for a total of eight per school year. The teachers look carefully at when their school administers standardized tests, which is usually about two-thirds of the way through the school year. They conceive of the instructional year as beginning the day after standardized testing ends. They've learned that they cannot address every topic on their standardized test before it is administered in the spring, so they consider the topics taught after testing as preparation for next year's test.

The teachers place a greater emphasis on number concepts when their students are in sixth grade, but by the time students reach eighth grade, they are studying fewer number topics and more algebra topics, consistent with national recommendations.

Finally, when they plan the year, they think about unifying ideas that tie together the sixth- through eighth-grade topics, especially proportionality, which integrates many areas of middle school math, including ratio and proportion, percent, scaling, similarity, slope, linear equations, relative-frequency histograms, and probability.

A three-year plan that includes when major projects are assigned might look something like this:

| | Fifth Grade | Sixth Grade | Seventh Grade | Eighth Grade |
|---|---|---|---|---|
| **Quarter One** | | Number Theory: Primes, Multiples, Prime Factorization, etc. | Algebraic Thinking: Multiple Representations, Variables | Linear Relationships |
| | | Data & Statistics: Measures of Central Tendency (Project) | Similarity (Project) | Geometry: Pythagorean Theorem (Project) |
| **Quarter Two** | | 2D Geometry: Polygons, Angles, etc. (Project) | Proportionality & Scaling | Algebraic Thinking: Exponential Functions |
| | | Rational Numbers: Concepts & Relationships | Integers | Algebraic Thinking: Quadratics |
| **Quarter Three** | | Measurement: Area & Perimeter | Data & Statistics: Large Numbers & Sci. Notation (Project) | Algebraic Thinking: Language of Algebra, Properties |
| | | Introduction to Algebraic Thinking | Geometry: Surface Area & Volume | Geometry: Transformations (Project) |
| | | Standardized Testing | Standardized Testing | Standardized Testing |
| **Quarter Four** | Introduction to Rational Numbers | Rational Numbers: Computation & Estimation | Rational Numbers: Review & Application | Data & Statistics: Box & Whiskers, etc. |
| | Probability: Experimental | Probability: Experimental & Theoretical | Probability: Area Models, Expected Value | Probability: Combinations |

The teachers include the fifth-grade teachers when they plan, to ensure continuity. Having all the grades represented not only helps teachers to coordinate the topics taught and the order in which they are presented, but also enables them to articulate the models and strategies used in each grade level so that they are able to help students make connections from one grade and math topic to the next.