

All of these beliefs point the way to what coaches can do to help teachers teach most effectively.

## WHAT IS A MATHEMATICS COACH?

The term *coach* is part of our everyday vocabulary, but what do educators mean when they use it? Most people think of sports coaches first and then realize that there are many kinds of coaches. Music coaches train individuals to play various musical instruments. Voice coaches work with singers, public speakers, and vocal performers. Acting coaches work with actors.

In schools, just as sports coaches work with teams and individual athletes, there are other coaches who work with students to improve their academic skills, for example, for the University Interscholastic League competitions that cross many areas of school life, from writing to business to using calculators. The idea of employing coaches to enhance skills is accepted in our society and our schools (West & Staub, 2003).

But this is the critical point: People form mental images of what a coach is, and these images influence their thoughts and actions. To gain a clear understanding of what a mathematics coach is and does, it is helpful to build a definition in stages:

1. Defining *mathematics coach* for purposes of this book.
2. Identifying the responsibilities of mathematics coaches.
3. Identifying characteristics of successful mathematics coaches.
4. Dispelling negative images.

By working through these stages, readers will be able to develop a mental filter so that they can focus on the critical components of successful mathematics coaching.

### STAGE 1: DEFINING MATHEMATICS COACH

Simply stated, *a mathematics coach is an individual who is well versed in mathematics content and pedagogy and who works directly with classroom teachers to improve student learning of mathematics.*

This definition describes the knowledge base required for effective mathematics coaching. The coach is

- well versed in mathematics content and
- well versed in pedagogy.

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# 2 Bridging From the Present to the Future

In Chapter 1 we identified characteristics and responsibilities that support a definition of *mathematics coach* as “an individual who is well versed in mathematics content and pedagogy and who works directly with classroom teachers to improve student learning of mathematics.” In this chapter we examine some of the specific problems that mathematics coaches may encounter and what they can do to solve them. If certain problems are “the present,” then what vision should define “the future” in which those problems are solved?

## GOALS, PROCEDURES, AND SHARED VISION

A starting point will be to expand the understanding of the mathematics coach’s role and responsibilities. Teachers and administrators with whom the coach will work need to understand what the coach seeks to do and why. Three points are key:

- The definition of *mathematics coach* should be understood by all parties.
- The responsibilities of the coach need to be identified and commonly agreed on.
- The characteristics needed to be a successful coach should be known and addressed.

These understandings cannot be achieved in a single conversation but will be gained through continual contact and communication over time.

that is a teachable moment. Immediate feedback or interaction increases teachers' confidence in a coach's competence.

## COACHING SCENARIOS

Building rapport with teachers is a complex undertaking. It is achieved over a period of time, not through a single event but a connected series of events. Some of these events may be brief, while others may occur in steps or stages. Following are three scenarios that will be helpful in further understanding how coaches build rapport. Questions are provided throughout so that you may reflect on the steps of each scenario.

### SCENARIO 1: THE RESISTANT MIDDLE-LEVEL TEACHER

Following is the situation:

A veteran seventh-grade teacher told a newly hired coach that mathematics coaching services were not wanted and definitely not needed. This middle school teacher of 25 years further indicated that her retirement was soon approaching; therefore, changes in instruction would not occur. This teacher ultimately refused to attend any "useless" professional development sessions.

First, the questions: What should the coach do? Which of the previously listed steps could the coach take in this situation? How can the coach build rapport with a teacher who truthfully says that she does not believe in mathematics coaching? How can the coach establish a positive relationship with a teacher who will be asked to change how she teaches in order to teach in ways congruent with desired teaching practice? How can the coach reach a teacher who does not see ongoing professional learning as a teacher's responsibility to ensure student success?

#### Coaching Considerations

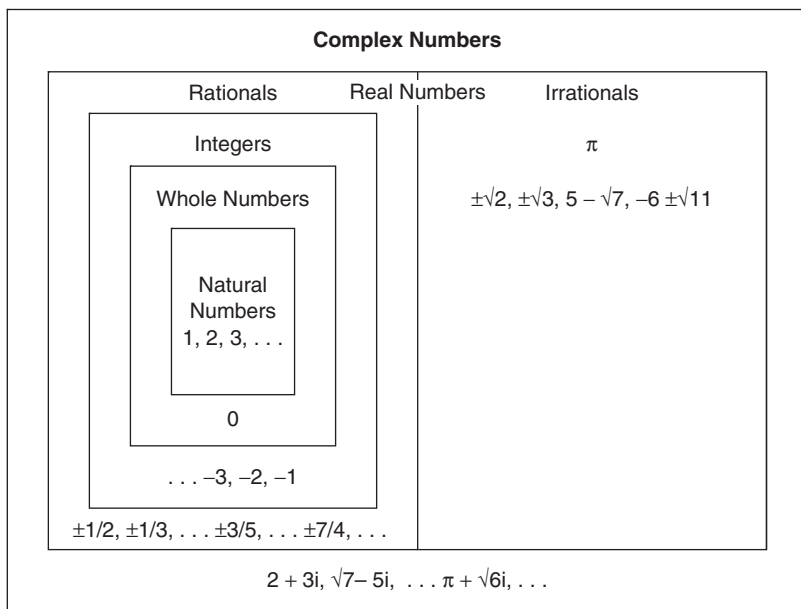
Some perceptions may be helpful to consider. For example, the resistant teacher's behavior may be the result of insecurity or simply fear of change. To be observed by a mathematics coach who might uncover what is really happening in the classroom might be stressful for this (or any) teacher. She may see the mathematics coach as coming into her classroom to change everything all at once, which would be frightening. She also may see the

Figure 7.1 provides an example of how a problem might be approached consistent with these two lists of characteristics.

**Figure 7.1** Sample Approach to Visible Thinking: Properties of Numbers

As students progress through a K–12 mathematics curriculum, they encounter a variety of numbers and operations on these numbers. Properties are added along the way to create mathematical systems that have particular structures, some similar and some different. For example, the Natural Numbers under addition have no additive identity, whereas the Whole Numbers under addition do have an additive identity. Not until they take Algebra II in high school, or possibly Algebra I, will students work with Complex Numbers. The point to be made using the Euler diagram below, where examples of numbers in each set are shown, is that students and teachers need to see the big picture of mathematics; however, mathematics coaches may need to provide that picture.

Starting in the elementary grades, students solve simple equations such as  $n + 3 = 5$ . The solution,  $n = 2$ , is initially a Natural or Whole Number. Before long, equations such as  $n + 5 = 2$  are introduced, where the solution,  $n = -3$ , is a negative Integer. Soon equations are introduced where the solution is a fraction (Rational Number), such as  $4n + 3 = 2$ , where  $n = -1/4$ . Late in Algebra I, or certainly in Algebra II, students solve quadratic equations, where solutions sometimes come from the Irrational Numbers, such as  $x^2 + 1 = 3$ , where  $x = \pm 2$ , and then equations such as  $x^2 = -4$ , where  $x = \pm 2i$ , and  $x$  is a Complex Number.



By fifth or sixth grade, students have used numbers from several number systems. Around this time in their learning, students should become familiar with the idea that additional systems exist and will be introduced in the coming years.

**Teaching:** Mathematics coaches ensure that every student has access to inclusive instructional strategies that encourage and promote student participation. Regardless of their assigned teachers, students are given opportunities to learn appropriate content. Teachers understand the degree of influence they exert on students and the effect they have on learning.

**Learning:** Mathematics coaches ensure that students are given opportunities to explore, think, reason, and solve challenging problems that show mathematics to be reasonable and applicable. Students know what mathematics they are expected to learn and are provided data to support their progress in learning it. Students are given multiple ways and opportunities to learn recommended content by working independently, with partners, in small groups, and in whole-group settings.

**Assessment:** Mathematics coaches ensure that students have opportunities to justify and strengthen their own understanding of mathematical concepts. Students see the developmental nature of mathematics, understand the organizational methods used for introducing concepts, and know their progress in learning required concepts. Assessments are more than just a grade to be recorded. Assessments assist students in reflecting on their learning and in self-correcting misconceptions.

**Technology:** Mathematics coaches ensure equal access to mathematical tools, such as calculators, computers, and data-collecting and processing devices. Technology is not used merely to perform calculations but as a vital tool to explore complex mathematical situations.

Mathematics classrooms must be (or become) places where teacher practices “focus on sense-making, self-assessment, and reflection on what worked and what needs improving” (NRC, 2000, p. 12). Teachers need to recognize and comprehend students’ preexisting understandings before they can push students into new areas of mathematics (Cushman, 2003; NRC, 2000). Trend data can be used to point the way toward progress in all of these areas.

## INDICATORS OF SUCCESS

Most trend data are not different from data already being collected. But trend data are charted differently. Mathematics coaches should not collect data from teachers for trends if such data are already being collected in some other way.