

## Preface

### HOW THIS BOOK FITS WITH THE OTHER BOOKS IN THIS SERIES

In the last decade, a great many books have been published on formative assessment. These books, usually intended for a general audience, address the importance of formative assessment, the research that supports it, how it is used formally and informally, and they also include examples. Most of these books provide only a few mathematics examples and are seldom authored by mathematics or STEM specialists. When mathematics examples are included, they rarely contain conceptual examples of mathematics that reflect current mathematical thinking.

In 2008, the first edition of *Science Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning* was published (Keeley, 2008). Finally, science teachers had a formative assessment resource they could use that was science specific and authored by an experienced and well-respected leader in science education. In 2011, the mathematics version of the science book, *Mathematics Formative Assessment- 75 Practical Strategies for Linking Assessment, Instruction, and Learning* was published with co-author and mathematics specialist, Cheryl Rose-Tobey.

Instead of a one-size fits all generic approach across all subject areas, Mathematics Formative Assessment was designed to specifically address formative assessment considerations in mathematics and include examples that reflect the nature of mathematics teaching and learning. The first mathematics book provided 75 formative assessment classroom techniques, referred to by the acronym FACTs, which mathematics educators could use to elicit common, research-based misconceptions, misunderstandings, and common errors as well as feedback on student learning throughout a cycle of instruction. These FACTs promote thinking and mirror practices used by scientists and mathematicians to make sense of the natural and numerical world.

As assessments for learning, they ultimately help teachers build a bridge between where students are to where they need to be in their mathematical

understanding. These 75 FACTs have been used by thousands of K–12 teachers, university faculty, and professional developers, in the U.S. and internationally, to both inform and transform teaching and learning in mathematics.

A second science volume, *Science Formative Assessment: 50 More Practical Strategies for Linking Assessment, Instruction, and Learning*, authored by Page Keeley, was published in 2015. Many of the same FACTs that are included in the second volume of science FACTs are included in this new mathematics Volume 2 version. FACTs that were science-specific were replaced with mathematics-specific FACTs, as well as some new FACTs that can be used across disciplines. Twenty five new FACTs were added, and 25 FACTs from the science volume 2 were repeated with mathematics examples. Not counting the overlap in strategies, these four books in science and mathematics provide educators with a total collection of 162 FACTs. Now, mathematics teachers have an extensive collection of 125 mathematics FACTs and for teachers who teach multiple disciplines, there is now a combined collection of 162 FACTs that can be used across subjects.

## **PURPOSE AND NEED**

Why so many formative assessment strategies teachers can use to inform their teaching and promote learning? Good teachers have a repertoire of purposeful and effective strategies they use to move students' learning forward, while at the same time, understanding where their students are in their thinking at any point during a cycle of instruction. They do not use the same strategies over and over until students tire of them. Having a rich and robust repertoire of purposeful strategies brings variety to instruction and motivates and engages learners.

Having a full toolbox of strategies (FACTs) to pull from is not enough. Teachers need to know how, when, and for what purpose to use a FACT. They need to know what stage in an instructional cycle a FACT is best used. Should it be used for elicitation or to check whether students have grasped and can apply the concept or practice? Is it helpful in bringing misconceptions to the surface? Teachers need to know in what format the FACT should be used. Should it be used

individually at first, and then in a small-group format? Which FACTs work well in a whole-class discussion format? Teachers need to connect the FACT to a learning goal and think about how students will get feedback to know how they are moving toward the intended outcome of a lesson.

The description of each FACT provides information on how the FACT promotes learning, how it informs instruction, how it should be implemented, connections to standards, modifications for different types of learners, and caveats to be aware of when using the FACT. This information is specific to each FACT and will help teachers use the strategy effectively. However, it is important to take the time to gain a broader understanding of mathematics formative assessment in general, and how it inextricably links instruction, assessment, and learning. For this reason, I strongly suggest you read Chapters 1–3 in *Mathematics Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning* (Keeley and Tobey, 2011) as a companion to this book, as this important information is not repeated in this volume.

## **AUDIENCE**

The primary audience for this book is K–12 teachers who teach mathematics and pre-service teachers preparing to teach mathematics; however, many of the formative assessment techniques described in this book can be used in other disciplines besides mathematics. College instructors can also use the techniques in this book. Professional developers, instructional coaches, mentors, and anyone who works with teachers can benefit from using the formative assessment classroom techniques to design, facilitate, and monitor adult learning.

## **ORGANIZATION**

Chapter 1 opens with a classroom snapshot and describes the important link between assessment and learning. It describes the big idea of formative assessment and breaks it down into five key strategies. The chapter further elaborates on two major ways to use the formative assessment techniques in mathematics—as an elicitation strategy and to support productive mathematics

talk. It concludes with considerations for next steps and provides a table of all 163 FACTs in the four books in this series.

Chapter 2 describes the link to content and practices that are in most states' mathematics standards. Table 2.1 lists the grade-level examples included in Chapter 3 that illustrate how a FACT is used and the concept and key mathematical idea targeted by the example. Table 2.2 shows how mathematical practices are linked to the 50 FACTs in Chapter 3.

Chapter 3 is the heart of the book. It includes a collection of 50 FACTs. The FACTs are arranged in alphabetical order so they can be easily located by name. Each section uses a common format, with a brief description of the FACT, how the FACT promotes student learning, how it informs instruction, how to develop and use the FACT, a content specific example of using the FACT in mathematics, general attributes, links to Mathematics Standards, modifications for different types of learners, caveats to be aware of, uses in other disciplines besides mathematics, and a brief example of how it is used in another discipline. Space is provided at the end of each section for you to record notes on how you used the FACT and considerations for further use.

There is also an Appendix with an annotated list of resources that can be used with the FACTs, as well as resources to extend your learning.