
Preface

The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly.

—Ausubel, Novak, & Hanesian, 1978

ABOUT THIS BOOK

In 2008 the book *Science Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning* was copublished by Corwin and the National Science Teachers Association (NSTA). The book quickly became a best seller, widely used by teachers, university preservice instructors, and professional learning communities. Science teachers shared the book with other teachers in their schools, including mathematics teachers. While mathematics teachers modified the strategies to fit their subject, many of them expressed the desire to have a parallel book for mathematics educators, using similar strategies from the science version but including examples for mathematics as well as some strategies specific to mathematics. Well, we heard you! This book is designed for mathematics educators, and as with the science formative assessment book that preceded it, many of the strategies in this book can be shared across all content areas.

Like the science version, this book addresses the need to balance opportunity to learn, which includes assessment *for* learning (Black, Harrison, Lee, Marshall, & Wiliam, 2003), with assessment *of* learning. Optimal opportunities to learn exist when mathematics teachers are aware of the variety of different ideas and strategies students are likely to bring to their learning; see the connections between students' thinking, problem-solving skills, and the specific ideas included in standards; and provide learning experiences that build a bridge between their students' thinking and mathematical understanding. What is effective for one purpose—external accountability—may not effectively serve the purpose of informing instructional planning

and decision making in the classroom, which is ultimately what affects student learning. A rich repertoire of formative assessment techniques provides the ongoing feedback and stimulus for deep thinking that a high-stakes test once or twice a year cannot provide in time to inform instruction and affect learning.

Teachers are the most important link in the chain that connects assessment, instruction, and learning. The need for a varied repertoire of purposeful techniques that weave mathematics assessment throughout instruction and learning is what led to this book. We hope you can turn the insights and ideas gleaned from this book into practical actions that will transform teaching and learning in your classroom.

Purpose and Need

There is a substantial body of research that indicates formative assessment can significantly improve student learning. Yet this same research shows that the features of formative assessment that affect student achievement are, sadly, missing from many classrooms (Black, Harrison, Lee, Marshall, & Wiliam, 2003). The purpose of this book is to provide teachers with guidance, suggestions, and techniques for using formative assessment to improve teaching and learning in the mathematics classroom. A wide variety of assessment books and resources available to mathematics educators provide the theoretical rationale for formative assessment and its implications for teaching and learning. This book expands on the current literature by identifying and describing content-specific practical techniques teachers can use to build a rich repertoire of formative assessment strategies for the mathematics classroom.

The acronym FACT is used to label the 75 techniques included in this book. FACT stands for Formative Assessment Classroom Technique. Through the varied use of FACTs, explicitly intended to gather information about or promote students' thinking and learning, teachers can focus on what works best for learning and design or modify lessons to fit the needs of the students.

Audience

The primary audience for this book is K–12 mathematics teachers. However, many of the strategies described can be used in other disciplines such as science, social studies, language arts, fine arts, health, and foreign language; these other uses, as well as those for other content areas not listed here, are noted in each of the FACT descriptions. University faculty may also find the FACTs useful in teaching college students or preparing preservice teachers to use formative assessment. Professional developers can use several of the FACTs to design and monitor learning experiences for adult learners, including teachers. Many Professional Learning

Communities (PLCs) are using this book to study formative assessment and to build their capacity to use effective formative strategies to improve student learning.

Organization

The organization of this book follows the same organization as the science version (Keeley, 2008). Where appropriate, we kept the same information so that the two books would parallel each other and could be used together in science and mathematics PLCs or by teams of science and mathematics teachers. Chapter 1 provides an introduction to formative assessment in the mathematics classroom. It describes the inextricable link between assessment, instruction, and learning. It describes what a FACT is and the cognitive research that supports the use of FACTs. It describes the learning environments that support assessment, instruction, and learning. It examines the relationship between teaching and learning and describes new roles and implications for a formative assessment-centered classroom.

Chapter 2 focuses on the use of FACTs to integrate assessment, instruction, and learning. It examines the connection between assessment and instruction and describes a learning cycle model in mathematics called the Mathematics Assessment, Instruction, and Learning (MAIL) cycle, which integrates assessment with instruction and learning and provides a framework for using FACTs. This cycle parallels the SAIL (Science Assessment, Instruction, and Learning) cycle. It describes how formative assessment promotes learning in the mathematics classroom, including the role of metacognition, self-assessment, and reflection. It provides suggestions for strengthening the link between assessment, instruction, and learning.

Chapter 3 addresses considerations for selecting, planning for, and implementing mathematics formative assessment. It also provides suggestions for ways to use this book with PLCs. It includes a matrix for matching FACTs with their main purposes for use in teaching and learning as well as secondary purposes.

Chapter 4 is the heart of the book. It includes a collection of 75 FACTs. Many of the same FACTs are included in the science version of this book, and several new ones, specific to mathematics, have been added. The FACTs are arranged in alphabetical order so that teachers can locate them by name (we found we could not arrange them by use since many of the uses overlapped). They are also numbered on the matrix in Figure 3.5. Each FACT uses a common format that provides a description, how it promotes student learning, how it informs instruction, considerations for design and administration, modifications that can be made to a FACT for different types of students or purposes, caveats for using a particular technique, general attributes, and uses in other disciplines besides science. Each FACT includes an example that shows or describes how the FACT

is used in mathematics. Space is provided after each FACT to record your notes on how it worked in your classroom and any modifications or suggestions for further use.

The Appendix contains an annotated list of the resources referred to in Chapter 4, as well as additional resources useful for expanding your knowledge of formative assessment, building a repertoire of strategies, and accessing ready-made probes. In addition, several websites are provided that focus on formative assessment.