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An Introduction to Formative Assessment Classroom Techniques (FACTs)

WHAT DOES A FORMATIVE ASSESSMENT–CENTERED CLASSROOM LOOK LIKE?

In a primary classroom, students are having a "math talk" to decide which figures are triangles. After using a *Card Sort* strategy to group picture cards as "triangles" and "not triangles," the teacher encourages the students to develop a list of characteristics that could be used to decide whether a figure is a triangle. As students share their ideas and come to an agreement, the teacher records the characteristic and draws an example and nonexample to further illustrate the idea. She then gives students an opportunity to regroup their cards, using the defining characteristics developed as a class. As the students discuss the results of their sorting process, she listens for and encourages students to use the listed characteristics to justify their choices. Throughout the discussion, the class works together to revise the triangle characteristics already listed and to add additional characteristics that were not included in the initial discussion.

In an intermediate classroom, the teacher uses a *Justified List Probe* to uncover students' explanations of how to determine equivalent and non-equivalent sums and differences of various two-digit numbers (for example, is 23 + 42 equal to 42 + 23? Is 23 + 42 equal to 22 + 43? Is 42 – 23 equal to 23 – 42? Is 42 – 23 equal to 43 – 22? Using the *Sticky Bars* strategy to anonymously display students' ideas, the teacher and the class can see that many students believe that both sums and differences are equivalent regardless of the order of the numbers. Knowing that this is a common misunderstanding cited in the research literature and seeing that the data from her own class mirrors that misunderstanding, the teacher designs a lesson that involves the students in using manipulatives to model the addition and subtraction of various two-digit numbers. After students experience modeling the operations, they revisit their original ideas and have an opportunity to revise them. The next day, students are given the task of defining the commutative property of addition. They work in small groups with *Whiteboards* to demonstrate the commutative property for addition and explain why there is no commutative property for subtraction. At the end of the lesson, students use *I Used to Think . . . But Now I Know . . .* to reflect on their original thinking about whether the sums and differences were or were not equivalent.

In a middle school classroom, the students use a *P-E-O Probe* to predict the number line location of the results of a number of multiple multiplication and division problems. Using the *Human Scatter Graph* technique, the teacher quickly sees that students differ in their responses and their confidence in their answers regarding whether multiplication always makes bigger and division always makes smaller. Knowing that this would be a difficult idea to change, the teacher provides students with various visual representations of multiplication and division with whole numbers, decimals, fractions, and integers using an interactive technology-based program. For multiple problems, students observe the modeling of the operation and discuss the pattern of results with various number types. After the demonstration and class discussion, the students use *Thinking Logs* to reflect on their new ideas regarding the effects of multiplication and division.

In a high school geometry class, small groups of students are using a collection of *Examples and Nonexamples* to discuss and reconcile their different ideas about whether the information provided about a figure is sufficient to determine whether that figure is a parallelogram. With the goal of consensus, students within each group justify their choice, trying to persuade others who disagree. As the groups work to produce justifications that will be shared with the whole class, the teacher circulates among the group, probing further and encouraging argumentation. Students write a *Two-Minute Paper* at the end of class to share their thinking with the teacher and describe the information needed to determine whether a figure is a parallelogram. The teacher uses this information to prepare for the next day's lesson on conditions of parallelograms.

What do all of these classroom snapshots have in common? Each of these examples embeds formative assessment techniques into instruction for a specific teaching and learning purpose. Often it is hard to tell whether a particular technique or strategy serves an instructional, assessment, or learning purpose because they are so intertwined. Students are learning while at the same time the teacher is gathering valuable information about their thinking that will inform instruction and provide opportunities for students to surface, examine, and reflect on their learning.

Each of these snapshots gives a brief glimpse into the different techniques teachers can use in their lessons to promote student thinking, uncover students' ideas, and use information about how their students are progressing conceptually to improve their instruction. The teaching strategies in these snapshots are just a few of the 75 formative assessment classroom techniques (FACTs) described in Chapter 4 that, along with the background on formative assessment described in Chapters 1 through 3, will help you understand and effectively use these techniques. While you may be tempted to skip ahead and go directly to Chapter 4 to find FACTs you can use in your classroom, you are encouraged to read all of the chapters in this book. The image and implementation of formative assessment in your classroom will be sharper and more deliberately focused if you have a firm knowledge base about the purposes and uses of formative assessment, including clearly articulated learning goals, before you select a FACT.

WHY USE FACTS?

Every day, mathematics teachers are asking questions, listening carefully to students as they explain their thinking, observing students as they work in groups, examining students' writing and representations, and orchestrating classroom discourse that promotes the public sharing of ideas. These purposeful, planned, and often-spontaneous teacher-to-student, student-to-teacher, and student-to-student oral and written interactions involve a variety of assessment techniques. These techniques are used to engage students in thinking deeply about their ideas in mathematics, uncover the thinking students bring to their learning that can be used as starting points to build upon during instruction, and help teachers determine how well individual students and the class are progressing toward developing mathematical understanding.

> "Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning. It thus differs from assessment designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence" (Hodgen & Wiliam, 2006).

The 75 mathematics FACTs described in this book are inextricably linked to assessment, instruction, and learning. The interconnected nature of formative assessment clearly differentiates the types of assessments we call assessments *for* learning from assessments *of* learning—the summative assessments used to measure and document student achievement. Figure 1.1 describes the different types and purposes of assessment in the mathematics classroom.

Figure 1.1 Types and Purposes of Assessment

Diagnostic: To identify preconceptions, errors, types of reasoning, and learning difficulties.

Formative: To inform instruction and provide feedback to students on their learning.

Summative: To measure and document the extent to which students have achieved a learning target.

Source: Keeley (2008), p. 4. Used with permission.

Note: Diagnostic assessment becomes formative when the assessment data are used to inform teaching and learning.

Each FACT described in Chapter 4 is a type of question or activity that helps provide teachers and students with information about their factual, conceptual, and procedural understandings in mathematics. These formative assessment techniques inform teaching by allowing the teacher to continuously gather information on student thinking and learning in order to make data-informed decisions to plan for or adjust instructional activities, monitor the pace of instruction, identify misconceptions and common errors that can be barriers as well as springboards for learning, and spend more time on concepts and procedures that students struggle with. Formative assessment is also used to provide feedback to students, engaging them in the assessment of their own or their peers' thinking. In addition to informing instruction and providing feedback, many of the formative assessment techniques included in this book initiate the use of metacognitive skills and promote deeper student thinking.

> "When data are used by teachers to make decisions about next steps for a student or group of students, to plan instruction, and to improve their own practice, they help *inform* as well as *form* practice; this is *formative assessment.* When data are collected at certain planned intervals, and are used to show what students have achieved to date, they provide a *summary* of progress and are *summative assessment*" (Carlson, Humphrey, & Reinhardt, 2003, p. 4).

The FACTs described in this book are designed to be easily embedded into classroom instruction. They are primarily used to assess *before* and *throughout* the learning process, rather than at the endpoint of instruction, except when used for purposes of reflection. Their main purpose is to improve student learning and opportunities to learn by gathering data that are then intentionally used to carefully design instruction that takes into account students' ideas and ways of thinking. They generally do not involve grading in the way that marking papers and assigning grades do; those types of grading tend to cast judgment on students' knowledge and skills and set up competition among students, conveying the unintentional message to the learner that "I am not good at mathematics" or "I'm better in mathematics than my classmates." They are generally not used for the summative purpose of documentation and accountability—measuring and reporting student achievement. The versatility of the techniques described in this book accommodates a range of learning styles and can be used to differentiate instruction and assessment for individuals and groups of students. FACTs can be used to spark students' interest, bring ideas to the surface, initiate mathematical explorations, and encourage classroom discourse—all assessment strategies that promote learning rather than measure and report learning. A rich repertoire of FACTs enables learners to interact with assessment in multiple ways—through writing, drawing, speaking, listening, physically moving, and designing and carrying out mathematical explorations. Figure 1.2 lists a variety of purposes for which FACTs can be used in the mathematics classroom.

Figure 1.2 Twenty Purposes for Using FACTs

- Activate thinking and engage students in learning
- Make students' ideas explicit to themselves and the teacher
- Challenge students' existing ideas and encourage intellectual curiosity
- Encourage continuous reflection on teaching and learning
- Help students consider alternative viewpoints
- Provide a stimulus for discussion and mathematical argumentation
- Help students recognize when they have learned or not learned something
- Encourage students to ask better questions and provide thoughtful responses
- Provide starting points for mathematical inquiry
- Aid formal concept development and transfer
- Determine whether students can apply mathematics ideas to new situations
- Differentiate instruction for individuals or groups of students
- Promote the use of academic language in mathematics learning
- Evaluate the effectiveness of a lesson
- Help students develop self-assessment and peer assessment skills
- Give and use feedback (student to student, teacher to student, and student to teacher)
- Encourage social construction of ideas in mathematics
- Inform immediate or later adjustments to instruction
- Encourage and include participation of all learners
- Increase comfort and confidence in making one's own ideas public

Source: Keeley (2008), p. 6. Used with permission.

Regardless of geographic area, type of school, degree of diversity of the student population, or the grade level taught, every teacher shares the same goal. That goal is to provide the highest quality instruction that will ensure that all students have opportunities to learn the concepts, procedures, and skills that will help them become mathematically literate students and adults. Formative assessment provides ongoing opportunities for teachers to elicit students' prior knowledge; to identify the ideas they struggle with, accommodate, or develop as they engage in the process of learning; and to determine the extent to which students are moving toward or have reached mathematical understanding at an appropriate developmental level. FACTs help teachers continuously examine how students' ideas about concepts and procedures form and change over time as well as how students respond to particular teaching approaches. This information is constantly used to adjust instruction and refocus learning to support each student's intellectual growth in mathematics.

HOW DOES RESEARCH SUPPORT THE USE OF FACTS?

The seminal research report from the National Research Council, *How People Learn: Brain, Mind, Experience, and School* (Bransford, Brown, & Cocking, 1999), followed by the practitioner version, *How Students Learn Mathematics in the Classroom* (Donovan & Bransford, 2005), have significantly contributed to our understanding of how students learn mathematics. This understanding has implications for what content is taught, how the mathematics is taught, how learning is assessed, and how to promote deeper understanding in mathematics. Three core principles from *How People Learn* underscore the value of using FACTs in the mathematics classroom.

> **Principle 1:** If their [students'] initial understanding is not engaged, they may fail to grasp new concepts and information presented in the classroom, or they may learn them for purposes of a test but revert to their preconceptions (Bransford et al., 1999, p. 14).

This principle supports the use of FACTs as a way to elicit the prior ideas students bring to the classroom, making their thinking visible to themselves, their peers, and the teacher. By knowing in advance the ideas students have already formed in their minds, teachers can design targeted instruction and create conditions for learning that take into account and build on students' preconceived ideas. Students' own ideas and the instructional opportunities that use them as springboards provide the starting point from which concepts and procedures in mathematics can be developed. As students engage in learning experiences designed to help them develop mathematical understanding, teachers keep their fingers on the pulse of students' learning, determine when instruction is effective in helping students revise or refine their ideas, and make midcourse corrections as needed.

> **Principle 2:** To develop competence in an area of inquiry, students must (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework, and (c) organize knowledge in ways that facilitate retrieval and application (Bransford et al., 1999, p. 16).

This principle points out the importance of factual knowledge but cautions that knowledge of a large set of disconnected facts is not sufficient to support conceptual understanding. Several of the FACTs described in Chapter 4 not only provide strategies for teachers to assess students' knowledge of facts and understanding of concepts but actually promote thinking that supports understanding. This thinking and the feedback students receive during the learning process help support the development of a conceptual framework of ideas. Teachers use the information on students' thinking to design opportunities that will help students develop from novice learners into deeper, conceptual learners who can draw upon and retrieve information from their framework. As concept development is monitored, reinforced, and solidified, formative assessment techniques are also used to determine how well students can transfer their new knowledge and skills from one context to another.

> **Principle 3:** A "metacognitive" approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them (Bransford et al., 1999, p. 18).

John Flavel, a Stanford University psychologist, coined the term *metacognition* in the late 1970s to name the process of thinking about one's own thinking and learning. Since then, cognitive science has focused considerable attention on this phenomenon (Walsh & Sattes, 2005). Several FACTs described in this book promote the use of metacognitive strategies for self-regulation of learning. These strategies help students monitor their own learning by helping them predict outcomes, explain ideas to themselves, note areas where they have difficulty understanding mathematical concepts, activate prior knowledge and background information, and recognize experiences that help or hinder their learning. White and Frederiksen (1998) suggest that metacognitive strategies not be taught generically but rather be embedded into the subject matter that students are learning. The FACTs that support metacognition are designed to be seamlessly embedded into the mathematics learning experiences that target students' ideas and thinking in mathematics. They provide opportunities for students to have an internal dialogue that mentally verbalizes their thinking, which can then be shared with others.

Evidence from the research studies described in *How People Learn* (Bransford et al., 1999) indicates that when these three principles are incorporated into instruction, assessment, and learning, student achievement improves. This research is further supported by the metastudy described in *Assessment for Learning* (Black, Harrison, Lee, Marshall, & Wiliam, 2003) that makes a strong case, supported by a significant effect size in the study, for the use of formative assessment to improve learning, particularly to raise the achievement levels of students who have typically been described as low attainers.

CLASSROOM ENVIRONMENTS THAT SUPPORT FORMATIVE ASSESSMENT

In addition to contributing to our understanding of how students learn mathematics, *How People Learn* (Bransford et al., 1999) has also changed our view of how classroom environments should be designed in order to support teaching and learning. These characteristics relate directly to classroom climates and cultures where the use of FACTs is an integral part of teaching and learning. These environments include the following:

Learner-Centered Environments. In learner-centered environments, careful attention is paid to the knowledge, beliefs, attitudes, and skills students bring to the classroom (Bransford et al., 1999, p. 23). In a learner-centered classroom, teachers use FACTs before and throughout instruction, pay careful attention to the progress of each student, and know at all times where their students are in their thinking and learning. All ideas, whether they are right or wrong, are valued in a learner-centered environment. Learners come to value their ideas, knowing that their existing conceptions that surface through the use of FACTs provide the beginning of a pathway to new understandings.

Knowledge-Centered Environment. In a knowledge-centered environment, teachers know what the goals for learning are, the key concepts and ideas that make up the goals, the prerequisites upon which prior and later understandings are built, the types of experiences that support conceptual learning, and the assessments that will provide information about student learning. In addition, these goals, key concepts and ideas, and prerequisite learnings can be made explicit to students so they can monitor their progress toward achieving understanding (Bransford et al., 1999, p. 24). The knowledge-centered environment uses FACTs to understand students' thinking in order to provide the necessary depth of experience students need to develop conceptual understanding. It looks beyond student engagement and how well students enjoy their mathematics activities. There are important differences between mathematics activities that are "fun" and those that encourage learning with understanding. FACTs support a knowledge-centered environment by promoting and monitoring learning with understanding.

"An important feature of the assessment-centered classroom is assessment that supports learning by providing students with opportunities to revise and improve their thinking" (Donovan & Bransford, 2005, p. 16).

Assessment-Centered Environment. Assessment-centered environments provide opportunities for students to surface, examine, and revise their thinking (Bransford et al., 1999, p. 24). The ongoing use of FACTs makes students' thinking visible to both teachers and students and provides students with opportunities to revise and improve their thinking and monitor their own learning progress. In a formative assessment–centered environment, teachers identify problem learning areas to focus on. They encourage students to examine how their ideas have changed over the course of a unit of study. Having an opportunity to examine their own ideas and share how and why they have changed is a powerful moment that connects the student to the teaching and learning process.

Community-Centered Environment. A community-centered environment is a place where students learn from each other and continually strive to improve their learning. It is a place where social norms are valued in the search for understanding and both teachers and students believe that everyone can learn (Bransford et al., 1999, p. 25). Within this environment, FACTs are used to promote intellectual camaraderie around discussing and learning mathematics. A mathematics community–centered environment that uses FACTs encourages the following:

- Public sharing of all ideas and problem-solving strategies, not just the "right answers"
- Safety in academic risk taking
- Revision of ideas and problem-solving strategies and reflection
- Questioning and clarification of explanations
- Discussions with peers and use of norms for argumentation
- Group and individual feedback on teaching and learning

A classroom with these four overlapping environments is a place where students and teachers both feel part of an intellectual learning community that is continuously improving opportunities to teach and learn. It is a place where students and teachers thrive. It is a place where the connections between assessment, teaching, and learning are inseparable.

CONNECTING TEACHING AND LEARNING

Teaching without learning can happen in mathematics classrooms. Too often, students learn procedural steps and can produce a correct solution without understanding the important conceptual underpinnings of the process. Without conceptual understanding, students are not able to use their knowledge flexibly, cannot apply the procedure or skill within a new context, and are unable to justify and check the appropriateness of a solution.

"Learning can and often does take place without the benefit of teaching—and sometimes even in spite of it—but there is no such thing as effective teaching in the absence of learning" (Angelo & Cross, 1993, p. 3).

Even our brightest students sometimes "learn" mathematics for the purpose of passing a test but then quickly revert back to their misconceptions and common errors. Gaps often exist between what was taught and what students actually learned. Frequently these gaps do not show up until after students have been summatively assessed through end-of-unit, district, or state assessments. At this point, it is often too late to go back and modify lessons, particularly when assessments given months and even years later point out gaps in student learning.

To stop this inefficient cycle of backfilling the gaps, teachers need better ways of determining where their students are in their thinking and understanding prior to and throughout the instructional process. Students need to be actively involved in the assessment process, so that they are learning through assessment as well as providing useful feedback to the teacher and other students. Good formative assessment practices raise the quality of classroom instruction and promote deeper conceptual learning. Formative assessment ultimately empowers both the teacher and the student to make the best possible decisions regarding teaching and learning.

Linking assessment, instruction, and learning does not merely involve adding some new techniques to teachers' repertoire of strategies. The purposeful use of FACTs, on a continuous basis, provides much more; it organizes the entire classroom around learning and ways teachers can provide more effective learning experiences based on how their own students think and learn. Formative assessment can be used formally or informally, but it is always purposeful. Teachers can take actions based on the information gained from the use of FACTS immediately, the next day, or over the course of a unit; or ideas for action can be shared with and used by teachers who will have the same students the next year.

"Formative assessment isn't just about strategies to ascertain current knowledge—formative happens after the finding out has taken place. It's about furthering student learning during the learning process" (Clarke, 2005, p. 1).

If information about student learning is collected but not used as data or feedback that leads to action to improve teaching or learning, then it is not formative. It becomes information for information's sake. For example, using a FACT to find out if students have misconceptions similar to the commonly held ideas noted in the mathematics research literature is interesting and important in and of itself. However, just knowing that students have these ideas does not make this a formative assessment activity. It is not merely the collecting of this information, but the making of decisions as a result of careful examination of the data, that makes the activity formative assessment and connects teaching to learning.

MAKING THE SHIFT TO A FORMATIVE ASSESSMENT–CENTERED CLASSROOM

Formative assessment requires a fundamental shift in our beliefs about the role of a teacher. In a formative assessment–centered classroom, teachers interact more frequently and effectively with students on a day-to-day basis, promoting their learning (Black & Harrison, 2004). This interaction requires the teacher to step back from the traditional role of information provider and corrector of misconceptions and errors in order to listen to and encourage a range of ideas and problem-solving strategies among students. The teacher takes all ideas and strategies seriously, whether they are right or wrong, while helping students talk them through and encouraging them to consider the evidence that supports or challenges their thinking. During such interactions, the teacher is continuously thinking about how to shape instruction to meet the learning needs of students and build a bridge between their initial ideas and the mathematics understandings we want all students to successfully achieve.

> "Even though teachers routinely gather assessment information through homework, quizzes, and tests, from the students' perspective, this type of information is often collected too late to affect their learning. It is very difficult to 'de-program' students who are used to turning in homework, quizzes, and tests, getting grades back, and considering it 'over and done with'" (Angelo & Cross, 1993, p. 7).

The teacher also plays a pivotal role in connecting assessment to students' opportunities to identify and understand the role of a mathematically literate citizen.

> Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen. (Organisation for Economic Cooperation and Development, 2003)

Providing opportunities to discuss, construct and to organize thinking about the principles, properties, and uses of mathematics in solving relevant problems helps students understand the importance of the discipline beyond the school setting.

Traditionally, mathematics teachers were considered the providers of content that students then learned—teachers teach content and, as a result, students learn. The role of the teacher in a formative assessment–centered classroom is more of a facilitator and monitor of conceptual and procedural learning. The teacher's role expands to helping students use strategies to understand how well they are learning. As a result, students become more conscious of the learning process itself and take greater responsibility for their own learning.

> "The role of the learner is not to passively receive information, but to actively participate in the construction of new meaning" (Shapiro, 1994, p. 8).

In a formative assessment–centered classroom, students learn to play an active role in the process of learning. They learn that their role is not only to actively engage in their own learning but to support the learning of others as well. They come to realize that learning has to be done *by* them; it cannot be done *for* them. They learn to use various FACTs that help them take charge of their own learning and assess where they stand in relation to identified learning goals. When they know what the learning target is, they use metacognitive skills along with peer and self-assessment strategies that enable them to steer their own learning in the right direction so they can take responsibility for it (Black & Harrison, 2004).

Standards and learning goals have a significant impact on what teachers teach and students learn. Developing content knowledge that includes important mathematics facts, concepts, procedures, and problem-solving abilities is at the heart of mathematics teaching and learning. As a result, teaching, assessing, and learning must take place with a clear target in mind. Standards should not become a checklist of content to be taught and assessed. Rather, they inform thinking about content as an interconnected cluster of learning goals that develop over time. By clarifying the specific ideas and skills described in the standards and articulated as learning goals, teachers are in a better position to uncover the gap between students' existing knowledge or skill and the knowledge or skill described in the learning goal. As a result, they are better able to monitor that gap as it closes (Black et al., 2003). While a particular FACT may determine the approach that teachers take to uncover students' ideas and modify instruction accordingly, the fundamental ideas and skills students need to learn remain the same. The focus of teaching and learning is on meeting goal-oriented learning needs rather than delivering a set of curricula at an established pace or teaching a favorite activity that does little to promote conceptual understanding.

Identifying and targeting learning goals is not the sole purview of the teacher. In a formative assessment–centered classroom, teachers share learning goals with students. This may involve breaking them down into the key ideas and procedures students will learn. Awareness of the goals for learning helps students see the bigger picture of learning and make connections to what they already know about mathematics concepts and procedures.

> "Through communication, ideas become objects of reflection, refinement, discussion, and amendment. The communication process also helps build meaning and permanence for ideas and makes them public" (National Council of Teachers of Mathematics, 2000, p. 60).

Another major shift that happens in a formative assessment–centered classroom is the recognition of the importance of acknowledging students' ideas. Traditional instruction involves the passing on of information from the teacher or the instructional materials, with little thought given to building on students' existing conceptions. Students form many of their ideas in mathematics by generalizing and adapting concepts and procedures learned in a different mathematical context. Often the adapted concept or procedures are no longer applicable within the new context, possibly contributing to a misunderstanding. These misunderstandings are referred to in a variety of ways, including misconceptions, overgeneralizations, conceptual misunderstandings, or common errors. In this book, they will be referred to generically as *misconceptions,* although the term does not necessarily imply that the idea is completely incorrect. In some cases, misconceptions include partially formed correct ideas, but they are not yet put together in a way that is mathematically correct. The nature of these misconceptions is described as follows (Mestre, 2000):

> They interfere with learning when students use them to interpret new experiences.
>
> Students are emotionally and intellectually attached to their misconceptions because they have actively constructed them.
>
> Students give up their misconceptions only with great reluctance.
>
> Repeating a lesson or making it clearer will not help students who base their reasoning on strongly held misconceptions.
>
> Students who overcome a misconception after ordinary instruction often return to it only a short time later.

A constructivist approach to teaching and learning posits that students' existing ideas make a difference to their future learning, so effective teaching needs to take these existing ideas into account. Research indicates that misconceptions held by students persist into adulthood if they are left unconfronted and unchallenged (Carre, 1993). However, this does not simply imply that misconceptions are a bad thing and must be confronted on the spot as "wrong ideas." Rather than immediately correcting misconceptions when they surface, teachers should gather information that may reveal how misconceptions can be used as starting points for instruction. Starting with students' ideas and monitoring their progress as they are guided through learning that helps them recognize when their ideas no longer work for them and need to be modified or changed is the essence of an idea-focused, formative assessment classroom that promotes conceptual change.

As you gain a deeper understanding of the purposes and uses of formative assessment, you may find yourself reshaping techniques or developing new ones. You might find some techniques work better than others, depending on the mathematics idea being assessed or the nature of the learners in your classroom. Many of the FACTs described in Chapter 4 may be new to you; others may be ones you use routinely. Regardless of how you use the FACTs or your familiarity with them, one important implication for the mathematics classroom stands out—formative assessment provides an effective way for teachers to create classrooms that reflect current research on learning and provide greater opportunities for all students to achieve deeper levels of learning.