

# PART I

## GETTING STARTED



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# MODULE 0

## WHY FORMATIVE ASSESSMENT? ISSUES AND OPPORTUNITIES

"I never really thought much about assessment other than the tests I would create and use or the end-of-year standardized required tests we used."

—KINDERGARTEN TEACHER

"When I first heard about assessment, I just figured they were talking about our end-of-year state-required tests."

—FIFTH-GRADE TEACHER

"Why didn't I learn about formative assessment in my teacher preparation program?"

—FIRST-YEAR MIDDLE SCHOOL TEACHER

"I just thought I could search online and buy whatever formative assessment I needed for math."

—HIGH SCHOOL TEACHER

## FROM THE CLASSROOM

*I admit to beginning my teaching career absolutely clueless with regard to any sort of “plan” about my use of and involvement with assessments. When it came time for me to do an end-of-topic test, I ran to my teacher colleagues and asked for help. Ever so helpful, they gave me tests they had created. I used them. Oh my. Did I know if such tests were formative or summative assessments? No! Did I consider what my students had done in our classroom and whether these “hand me down” tests were appropriate for what my students had learned and what I had taught? No! Without a doubt, I had a lot to learn.*

*I like to think—in fact, I know—I have come a long way. I know about the impact and importance of targeted summative assessments and classroom-based formative assessment. I can’t imagine planning a lesson without thinking about observations, interviews, Show Me, hinge questions, and exit tasks to guide and monitor my teaching as well as provide me with incremental profiles of my students and their mathematics learning.*

### Purpose

An important everyday consideration of your planning and teaching is assessment. You control some of this! Classroom-based formative assessment monitors student progress, and also impacts your planning and instruction. That’s on you, and it’s what the Formative 5 is all about. However, summative assessment will also influence your teaching. Some of the summative assessments you may implement or analyze may be required by your school, school district, or state. Determining the influence of such external assessments on your teaching is important. As your planning and teaching intersect with both formative and summative assessment, the feedback you provide to your students, they provide to you, and students provide to each other identifies the instructional start line within a lesson or within the planning process.

### Module Goals

As you read and complete activities within this module, you will:

- ✓ Understand the important role of assessment not only in measuring student progress, but also in monitoring and informing instruction.
- ✓ Differentiate between formative and summative assessment and reflect on the impact of each on your planning, instruction, and monitoring of student progress.
- ✓ Consider and reflect on your use of formative assessment as assessing to *inform*, with particular consideration of the five key strategies noted by Wiliam and Thompson (2008).

- ✓ Reflect on how regular, everyday use of classroom-based formative assessment informs your planning and instruction.
- ✓ Recognize the important connection between your assessments and the feedback you give to your students as well as the opportunities you will provide for students to provide feedback to you and to each other.

## STUDENT LEARNING, TEACHING, ASSESSMENT, AND YOU: MAKING CONNECTIONS

Assessment of student learning is the responsibility of every school district, every school, and every teacher. Understanding and being able to use assessment to assist in teacher planning and instruction is an important element of a teacher's preparation and ongoing success in the classroom. Such assessment literacy includes being able to create, select, and effectively use classroom assessments and being able to select and effectively interpret and use results from external summative assessments.

Part of defining *your* assessment literacy means having the background and understanding to:

- Identify, select or create, and, of course, use assessments.
- Diagnose specific student instructional needs.
- Look for opportunities to focus on feedback: your feedback to students, their feedback to you, and student-to-student feedback.

This is essentially what this book is all about—classroom-based formative assessment. Important issues related to analyzing and evaluating the evidence generated by summative assessment, including externally developed and required summative assessments (e.g., annual state assessments), is really important, too, but that's another book for another time. Our focus will be on assessment as it relates, every day, to the classroom—*your* classroom.

Consider this module as the beginning of a journey that will start with an overview of particular issues and challenges related to assessment and then move to address, more directly, the classroom-based formative assessment techniques that are the focus of this book, and that you will use every day.



## Video—Thinking About Assessment



### Video 0.1

<http://bit.ly/3ERts4N>

To read a QR code, you must have a smartphone or tablet with a camera. We recommend that you download a QR code reader app that is made specifically for your phone or tablet brand.

Michele, Kristen, and Rebecca discuss their understanding and use of formative and summative assessment. Skip Fennell describes the intent of summative assessment and how formative assessment is connected to teacher planning and instruction, emphasizing the importance of ongoing connections between planning, instruction, and assessment.

**Think about and discuss** how closely your definitions and practice of formative and summative assessment align with or differ from how these ideas are discussed in the video. How closely is formative assessment connected to your teaching?

## FORMATIVE, SUMMATIVE: IT'S ALL TESTING, RIGHT?

“I actually never knew that my end-of-year and end-of-marking-period benchmark tests in mathematics were summative assessments. Thinking about how I can use both formative and summative assessments has been an eye-opening experience for me, *and* I’m in my fifth year of teaching!”

—FOURTH-GRADE TEACHER

Assessment at the PreK–12 level has long been an assumed responsibility of the classroom teacher. You assess to determine and monitor student progress, to compare students, to guide and influence instruction, and to evaluate (e.g., evaluating a curricular program or instructional technique). Think about each of these purposes. When are you assessing to determine and monitor student progress? To compare students? To influence instruction? To evaluate? And, importantly, how much instructional time are you and your school district devoting to assessment? How are you using the assessment results—both assessments that you create and use and those that are external, typically summative assessments that you are responsible for administering (e.g., school district, state, or other mandated assessments)? Some argue, appropriately, that external summative tests are taking way too much time away from teaching and learning. For example, in *Testing More, Teaching Less* (Nelson, 2013), it was revealed that in one school district studied, students spent up to fifty-five hours per year taking tests. (That’s about two full weeks of the school year.) One of the school districts studied had twelve different district and external summative assessments that accounted for forty-seven separate administrations of these assessments over the course of one instructional year.

# MODULE 0 WHY FORMATIVE ASSESSMENT?

## INSIGHT

*Formative assessment includes all activities that provide information to be used as feedback to modify teaching and learning.*

For the classroom teacher, day-to-day involvement with assessment should be in the consideration and use of classroom-based formative assessments, while acknowledging the role and potential of summative assessment. Let's start this by considering, and defining, both formative and summative assessment.

**Formative assessment** has been discussed and seemingly defined and redefined for more than fifty years. Scriven (1967) and Bloom (1969) were early advocates of the power of formative evaluation to improve instruction. Based on their review of hundreds of studies, of which 250 were directly relevant to formative assessment, Black and Wiliam (1998) defined formative assessment “as encompassing all those activities undertaken by teachers and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged” (p. 7). The Council of Chief State School Officers (2018) defines formative assessment as “a planned, ongoing process used by all students and teachers during learning and teaching to elicit and use evidence of student learning to improve student understanding of intended disciplinary learning outcomes and support students to become self-directed learners” (p. 2). From our perspective, the focus of the Formative 5 is on the everyday use of classroom-based formative assessments to monitor, probe, and provide feedback designed to impact student learning and your planning and teaching.



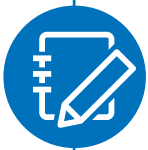
## What About You? Formative Assessment

Complete the following table and share your responses with a colleague.

How do you use formative assessment in mathematics?	When do you use formative assessment in mathematics?	How does your use of formative assessment influence your mathematics teaching?

**Summative assessments** are typically used to assess student learning at the conclusion of an experience. Such assessments could be a unit assessment, an assessment required by your school district, or the more high-stakes and high-profile end-of-year state assessments you may be required to administer. Many summative assessments are externally created—that is, prepared by others. Summative assessments are typically used to compare. Such comparisons could be student-to-student or class-to-class, or the extent to which results address pre-determined standards or expectations.

Summative assessments are regularly used to identify score-based differences among individual students or among groups of students. These comparisons often lead to classifications of student scores on a student-by-student basis or on a group-by-group basis, using norms or defined levels of performance (e.g., *advanced*, *proficient*, *developing*, *not yet met*). It should be noted that summative assessment results or even performance on particular items of a summative assessment can also be used formatively when grade-level teams analyze results and use them to guide instructional goals and classroom activities. The Every Student Succeeds Act (2015) requires that all students complete a state-determined summative assessment in mathematics in Grades 3–8 and once at the high school level. However, states have flexibility in how and when they administer the tests (e.g., a single annual assessment can be broken down into a series of smaller tests). There’s also an emphasis, beyond state-required assessments, on finding different kinds of summative tests that more accurately measure what students are learning. But most importantly, “if mathematics teachers are not drawn into discussions and decision-making about the use of summative assessments and their genuine influence on instruction, one wonders how we can continue to justify their overuse” (Fennell, 2020, p. 674).



## What About You? Summative Assessment

Complete the following table and share your responses with a colleague.

What summative assessments are used at your grade level (elementary and middle school) or within courses you teach (middle/high school)?	When are they administered?	How are the results interpreted and used to influence your mathematics teaching and student learning?

### INSIGHT

To summarize the differences between formative and summative assessment, many characterize summative assessments as **assessments of learning** and formative assessments as **assessments for learning**.

This book addresses a specific need regarding formative assessment, which is to identify and provide specific suggestions for how to use particular classroom-based formative assessment techniques on a regular—daily—basis. Our book is not about high-stakes summative assessments and the perceived, by many, overuse of such assessments. What we offer is designed to connect planning, teaching, and assessment in *your* classroom every day.



## Time Out

### The Importance of Assessment: What About You?

#### Let's Reflect

1. Does your school or school district have policies related to assessments and their use? If so, briefly describe the policies.

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2. Are there opportunities for you to share formative assessments with members of your grade-level or departmental teaching team or with other school district colleagues? If so, what might you advise others regarding the sharing and related discussions of such assessments?

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3. If there was one thing you could advise your school district's mathematics office about the use of assessments, formative and summative, what would that be?

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## FORMATIVE ASSESSMENT: ASSESSING TO INFORM

“I never really ‘got’ formative assessment. It just seemed to be like ‘try this’ and ‘try that.’ So many things to consider. Then I had this professor, and he used the painter’s palette analogy. Small number of paints to choose from, which could be mixed and applied using various techniques and used daily. Got it. Worked for me! And now I use these classroom-based formative assessment techniques every day.”

—MATH SPECIALIST/INSTRUCTIONAL LEADER

Black and Wiliam (2009) noted that assessment becomes formative “to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction” (p. 9). As stated previously, we know that formative assessment has been defined, redefined, researched, and discussed for decades. *Education Week* (“Understanding Formative Assessment,” 2015) noted that formative assessment is both widely used and poorly understood! Some argue that the phrase *formative assessment* is open to too many interpretations. Stiggins (2005) and others actually prefer the phrase *assessment for learning*. Our position is that formative assessment is an integral component of what you do every day—planning and teaching—and that it involves a carefully defined and vetted set of assessment techniques specifically designed to *inform* instruction. Classroom-based formative assessment must engage students. How your students experience mathematics, which includes engagement in the assessment process, impacts the ways they identify themselves as knowers and doers of mathematics (National Council of Teachers of Mathematics [NCTM], 2018). As noted in *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014),

*Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning. (p. 10)*

As a teacher, you are involved every single day in planning and teaching and then repeating that process. Assessment is integral to both planning and teaching. Linda Darling-Hammond (1994) noted that “in order for assessment to support student learning, it must include teachers in all stages of the process and be embedded in curriculum and teaching activities” (p. 25).

Directly connecting assessment to planning and teaching within each lesson provides both the foundation and consistency in approach to truly influence teaching and learning. So, for instance, as you plan, consider not only mathematics content (e.g., place value) but also how the Standards for Mathematical Practice (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) or mathematical processes (NCTM, 2000) will be integrally involved within a lesson. Linking assessment to planning *informs* both teaching and learning (*form* within *inform* is italicized to bring attention to

### INSIGHT

*Directly connecting assessment to planning and teaching within each lesson can truly influence teaching and learning.*

the central role of classroom-based formative assessment as it *informs* teaching and learning).

William and Thompson (2008) suggest that the effective use of assessment for learning consists of five key strategies:

**1. Clarifying and sharing learning intentions and criteria for success with learners:**

**MATH  
TASK**

*Jada cut 4 pieces of string, and each piece was 2 feet long. She placed the string pieces end-to-end. She thought she had more than 10 feet of string. Was she right? Can you show me how you decided if Jada was right or wrong?*

The focus here is on unpacking the intended learning goals of a lesson and then determining the mathematical tasks and related activities that will lead to the expected learning. The example of the problem involving Jada provides a beginning task in multiplying whole numbers. The Show Me response requested (this formative assessment technique is the focus of Module 3) should demonstrate a level of understanding related to the mathematical intent of the lesson.

**2. Engineering effective classroom discussions, questions, and learning tasks that elicit evidence of students' learning:**

**MATH  
TASK**

*Using a drawing of rectangular or circular regions, show me three ways to represent fractions equivalent to  $\frac{3}{4}$ .*

*If we doubled the length of each side of a square, what would happen to the area of the square? What would happen if we tripled the length of each side of the square?*

This assessment strategy considers how you will develop classroom activities that not only engage students in doing mathematics but provide evidence of student progress toward intended mathematical goals. The emphasis here is on the importance of taking the time to plan each lesson with a consideration for what you will assess and how you will assess the progress of your students. Think about what you would look for assessment-wise for each of the preceding examples. Careful planning—including attention to questioning, particularly the lesson's hinge question (more on that later)—and engineering the discussion of learning tasks address assessment *for* learning rather than *of* learning.

**3. Providing feedback that moves learners forward:**

**MATH  
TASK**

*“Great job! All five answers are correct.”*

*“You solved the first three correctly. Look at problems 4 and 5 and see if you can find your mistake, and then show me how you would do these problems differently.”*

You provide feedback to your students each day. However, the most important thing about feedback is what students do with it. If your feedback prompted students to try a different solution strategy and they did so, then the feedback was helpful. Perhaps your feedback just affirms a student's response like the "Great job!" example. Whether or not specific feedback to your students "works" is really something that you can control. The more you observe your students as they engage in learning mathematics, the more you will get to know them and provide personalized feedback when they need it. In the example of doubling and tripling each side of a square, you may want to linger with the student so that the response can be quickly reviewed, and additional feedback provided as needed. See the next section of this module, which details how assessment and feedback are connected and linked to your planning and teaching.

#### 4. Activating students as owners of their own learning:

##### MATH TASK

*"I like that pattern. Can you provide the next five numbers in the pattern and, as you do that, tell me why you have included them?"*

*"Show me how you know that the multiples and factors of a number are different."*

Using formative assessment to monitor teaching and learning is not a one-way, teacher-to-student trip. The intent is to engage students in learning mathematics, which includes students taking an active role as they monitor and guide their own learning. One intent of formative assessment is to help students, all students, take an active role in and ownership of their learning. Such inclusive ownership and self-assessment opportunities will impact the pace of particular lessons and also have you consider particular formative assessment techniques. Your use of Observations, Interviews, Show Me, Hinge Questions, and Exit Tasks, the classroom-based formative assessment techniques presented in this book, will include the consideration of students as respondents, active learners, and fully engaged self- and peer assessors.

#### 5. Activating students as instructional resources for one another:

##### MATH TASK

**Teacher:** *Discuss and solve the next problem with your partner and be prepared to share the solution with the class.*

**Cal:** *When I looked at how Juan solved the problem, I really liked what he did. Next time I might try thinking about percent his way—rather than finding what you pay if it's 30 percent off, which is a two-step problem, thinking about the problem as 70 percent on (just subtracting 30 percent off mentally) turns it into just a one-step solution. I like that.*

Paired learning and small-group learning activities are instructional strategies you have most likely used throughout your teaching career. The formative assessment potential of peer review is in developing responsible collaboration among

## MODULE 0 WHY FORMATIVE ASSESSMENT?

### INSIGHT

*One intent of formative assessment is to help students, all students, take an active role in and ownership of their learning.*

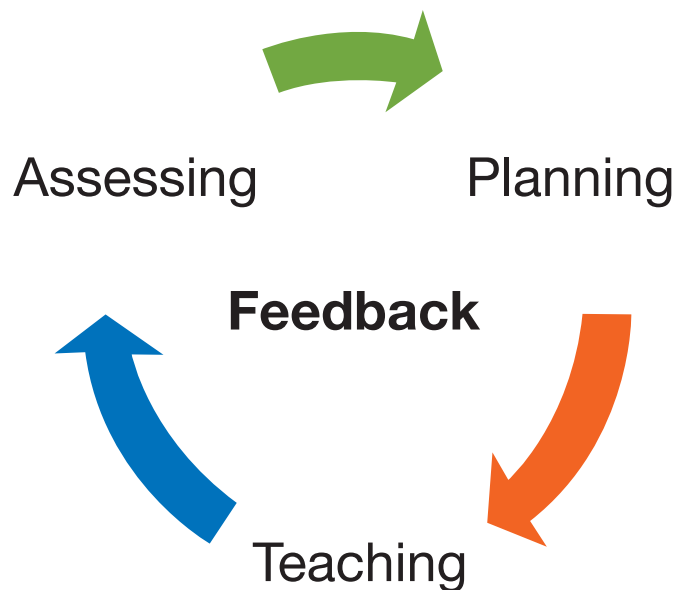
students. The result is that students learn from each other. Perhaps more importantly, students are often more willing to receive and accept feedback from a peer than an authority figure (e.g., teacher or parent/guardian) even when such student-to-student feedback is generally concisely presented and often very direct (e.g., “Why would you do it that way?” or “No way—that answer is not even close”).

What we know about formative assessment is that student achievement can be improved when teachers regularly use it both within and between lessons. Our approach to classroom based formative assessment has been to focus on what Wiliam and Thompson (2008) have defined as short-cycle formative assessment—day by day and minute by minute. Our experience has been that such assessment is integral to and within every lesson, with the potential to impact students between lessons as well. While we recognize the importance of all the key strategies just discussed, our approach particularly emphasizes and promotes the following two strategies:

- Engineering effective classroom discussions, questions, and learning tasks that elicit evidence of students’ learning
- Providing feedback that moves learners forward

## FOCUSING ON FEEDBACK

As you anticipate how your students will respond to a learning activity you are planning, you’ll also need to think about the classroom-based formative assessments you will implement to monitor your students’ progress. But wait. Planning, teaching, and using assessment to inform instruction without also providing, receiving, or facilitating feedback denies the importance of supporting student engagement. Feedback is not just connected to planning, teaching, and assessment; it’s what defines the next steps learning-wise for your students and planning-wise for you. It is cyclical. Without this cycle, the learning–teaching continuity you so desire is lost.



### INSIGHT

*Consider the relationships that you have built with your students and how these relationships inform the feedback that you provide. How do your students respond? What kinds of feedback best support your students?*

Feedback is nuanced and must include attention to four attributes: (1) timeliness, (2) type, (3) purpose, and (4) *who* is receiving the feedback. The kinds of feedback teachers convey and seek—as well as how and when that feedback is delivered—can motivate students to work harder or, tragically, shut them down. When teachers know their students' mathematical, social, and emotional needs and find ways to cultivate positive relationships with those students, they can provide timely, explicit feedback that propels their students to work hard to seek mathematical understanding.

Our perception about the kinds of feedback we provide, and the timing of that feedback, may differ a bit from reality. Teachers can learn a lot about their feedback by conducting a feedback audit.



## What About You? Feedback Audit

Ask a fellow teacher to observe you using the following chart and record only the feedback that occurs during the lesson. You could also simply audio-record a lesson or a portion of your lesson and then record the feedback.

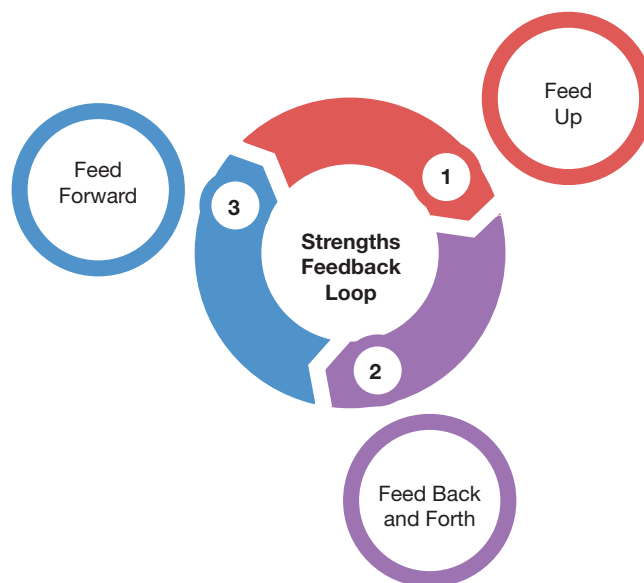
Teacher-to-Student Feedback (Note the feedback and student the feedback is provided to)	Student-to-Teacher Feedback (Note the feedback and student who provided the feedback)	Student-to-Student Feedback (Note the feedback and students who provided the feedback)

As you review the feedback from your feedback audit, what do you notice?

- Does the feedback align with your perception? Why or why not?
- What is the overall quality of the feedback?
- Are there particular students who seem to receive more or less feedback?

Kobett and Karp (2020) propose the Feedback Loop model presented in Figure 0.1 (adapted from Hattie & Timperley, 2007), which illustrates the ordering and connections between determining and understanding expectations (*Feed Up*), receiving and responding to the responses and products of instruction (*Feed Back*), and next step actions you and your students will consider (*Feed Forward*). Kobett and Karp recognize the absolute necessity of planning and instruction that uses student strengths as the instructional starting line.

FIGURE 0.1 • Strengths-Based Feedback Loop Model



Source: Kobett & Karp (2020, p. 152).

Hattie and Timperley (2007) propose that feedback addresses three important questions you or one or more of your students may ask:

- **Where am I going?** (What's the intent, or the goals, of the learning activity?) *Feed Up* is about your students' understanding of the intent or goals of a learning activity. When your planning anticipates how you will assess students within the proposed learning activity, student understanding of what's expected learning-wise is more likely to occur.

WHAT "FEED UP" FEEDBACK LOOKS LIKE	WHAT "FEED UP" FEEDBACK SOUNDS LIKE
<b>Teachers:</b> <ul style="list-style-type: none"> <li>• Refer to the goals for the lesson.</li> <li>• Remind students of what they have learned.</li> <li>• Show students how prior solution pathways have paved the way for new learning.</li> </ul>	<b>Teachers say:</b> <p>"Yesterday, we learned about _____. This new learning will help you today because _____."</p> <p>"You have been working in groups to solve problems together. Working collaboratively helps you to hear the mathematical reasoning of your peers. Today, I'd like you to ask your partners to share their ideas and compare their ideas to your own."</p>

- **How am I doing?** (What progress is being made?) *Feed Back (and Forth)* is an indicator of your students' progress regarding a specific learning task. This may be your feedback to a student or class or feedback from a student, a group, or the class to you.

WHAT “FEED BACK AND FORTH” FEEDBACK LOOKS LIKE	WHAT “FEED BACK AND FORTH” FEEDBACK SOUNDS LIKE
<b>Teachers:</b> <ul style="list-style-type: none"> <li>Explicitly attend to students’ mathematical understanding by affirming what students are doing, asking questions, and observing student responses.</li> <li>Ask students to show what they are doing or perhaps how to extend a response or solve a related problem.</li> </ul>	<b>Teachers say:</b> <p>“The drawings you have created really show your thinking and the different solution pathways you tried!”</p> <p>“In your groups, share your solutions to the problem. Ask questions to learn more about how your partners solved the problem. Each of you should share your understanding of each other’s solution strategy for the class problem.”</p> <b>Students say:</b> <p>“I like that we could solve the problem in different ways. Using a drawing helps me get started.”</p>

- **What’s next?** (What are the next steps, instructionally, as I/we focus on making progress?) *Feed Forward* addresses next steps, perhaps within the lesson—and, of course, in the planning, teaching, and assessment process—for the next day. This is the direct link to your use of classroom-based formative assessment—your Formative 5 feedback connection. Use of one or more of the soon-to-be-presented Formative 5 classroom-based formative assessment techniques and responses to the *Feed Up* and *Feed Back (and Forth)* questions defines *Feed Forward*.

WHAT “FEED FORWARD” FEEDBACK LOOKS LIKE	WHAT “FEED FORWARD” FEEDBACK SOUNDS LIKE
<b>Teachers:</b> <ul style="list-style-type: none"> <li>Extend student thinking by asking students to consider a new strategy.</li> <li>Advance student understanding by prompting students to think in new ways about the mathematics content they are learning.</li> <li>Use observation and interviews to design and adjust their lessons.</li> </ul>	<b>Teachers say:</b> <p>“What might be another method you can try to solve this problem? Which of those methods do you like best? Why?”</p> <p>“What would happen if we changed the number(s)? Would that make a difference? Why or why not?”</p> <p>“What might be a rule or formula that could work for other problems like this one?”</p> <b>Students say:</b> <p>“I tried two solution pathways and decided that _____ is the best because _____.”</p> <p>“I am wondering if this method will work for other problems.”</p> <p>“This problem reminds me of other problems we have solved because _____.”</p>

Let’s consider your use of feedback. Sadly, when we discuss teaching and learning, assessment and feedback are often talked about later, often as an after-thought, as if assessment and feedback are not integral components of planning



and teaching. A point that this book will make many times is the day-to-day connection between your planning, your teaching, the formative assessment techniques used to monitor student progress, and their direct connection to feedback—instructional goals understood by your students (*Feed Up*), how and when you will provide feedback to students during the day’s mathematics lesson (*Feed Back and Forth*), and how your assessments and feedback will define your instructional next steps (*Feed Forward*), which could be in the moment within a lesson, as well as the starting point for your planning of the next day’s mathematics lesson.

As noted, feedback is multidirectional and includes providing opportunities to encourage and receive student-to-teacher feedback relative to an assigned task or perhaps to a Show Me prompt (Module 3), as well as planning for opportunities for students, as they truly engage in the mathematics they are learning, to provide student-to-student feedback. We also recognize that the feedback provided or received actually launches the next lesson you will prepare, teach, and assess, confirming, once again, that assessing while you teach is what you do!

However, as you consider the feedback you provide, seek, or encourage your students to provide for each other, a most important consideration will be the actual focus of your feedback as it relates to student learning. Feedback is much more than a “great job” or “I like your graph” kind of comment, and feedback should not be implied as suggestions for just doing more or doing better. Also keep in mind that feedback is often thought of as teachers making statements about students, not about the impact and influence of their teaching (Timperley & Wiseman, 2002), thus diluting the impact and benefit of truly connecting assessment and feedback. The everyday use of and related student responses and feedback to formative assessment techniques are intended to guide and *inform* your everyday planning and instruction. Consider the activity that follows. Sort the feedback provided and respond to questions 1–3.



### Focusing on Feedback: Activity

Sort the feedback statements for the following task.

Create a word problem for  $\frac{1}{2} \div 4 = \frac{1}{8}$ , representing the solution using a visual model.

A.

“Great job on your math drawing!”

B.

“As I look at the problem you wrote—‘Mabel has  $\frac{1}{2}$  brownie and wants to share it with 4 friends. How much brownie will each friend get?’—and your model, which shows 4 brownies divided in  $\frac{1}{2}$ , I am wondering if they match.”

C.

“I see that many of you have written one word problem. Can you write another word problem and use a different model to solve it?”



D. “Please review your solution—it doesn’t make sense.”	E. “I love how creative your math story is!”	F. “Your word problem—‘Mary Alice is serving ice cream to her friends, but she only has 4 cups. How many $\frac{1}{2}$ -cup servings can she serve?’—is an interesting problem to showcase division of a whole number by a fraction. What model do you think will be most helpful to show your classmates?”
G. “I noticed you used a region model to represent your word problem. Would a number line also work?”	H. “I am noticing that some of you used number lines and others used region models to show the division. Find someone who used a different model than you used and compare your word problems.”	I. “I see that you have written a multiplication of fractions word problem. Take a look at this again.”

1. How did you sort the feedback?
2. What did you notice about the feedback?
3. Which of the teacher-to-student feedback comments provided opportunities for students to adapt, revise, and/or advance their thinking?

While it seems natural to encourage students by making declarative statements about what is observed (Great job! Fabulous work! Nice model!), student thinking—and, often, working—stops. Providing explicit teacher-to-student feedback about what you observe during a task is a powerful way to reflect back to students how their learning demonstrates understanding.

## CONSIDER THIS: MATHEMATICAL UNDERSTANDING AND FEEDBACK

Decisions about how we determine, interpret, record, and discuss student understanding are centered on the big idea that mathematical understandings are developmental. Important mathematical concepts and related procedures are developed over time and include many opportunities for students to grapple with the concepts or procedures being developed. Research has demonstrated that students must be able to make “connections between the new concept and at least two existing concepts” already understood (Yang et al., 2021). Recognizing that

mathematical understanding is complex, we must carefully consider as we regularly engage in classroom-based formative assessment techniques both the ways we communicate what we assess and how we interpret students' mathematical understanding. Teachers frequently describe student understandings as misconceptions, implying that the student is wrong. But "from a child's perspective, it is a reasonable and viable response or conception based on their experiences in different contexts or in their daily life activities" (Fujii, 2020, p. 625). Student understanding that is resistant to change and persistent is often described as a misconception (Stacey, 2005). We recognize that all student mathematical understandings or conceptions range the full spectrum from small computational errors, to initial or partial conceptions, to fully developed conceptual understanding. But student understandings are just that—what students understand at any given time on any given day. Watson and Barton (2011) describe student conceptions as "developmental pathways" as students build greater mathematical understanding, adding to and revising previous understandings as they encounter new mathematical topics. Consider, for example, the mathematical conception that young students develop that "multiplying makes things bigger" and "dividing makes things smaller" as a mathematical idea that is developed through early experiences with multiplication and division of whole numbers and an example of early, naïve, or partial conceptions. Teacher use of language and use of "rules that expire"—something we tell students because it works right now, but later will no longer be true (Karp et al., 2014)—can heavily influence this kind of student conception.

A teacher's perception of student understanding greatly influences the feedback they will provide and the instructional decisions they will make. Student understanding that is early, or partial, requires a particular kind of feedback that provides the student with continued opportunities to grow in their understanding, while students with alternate conceptions might need to consider counterexamples to confront their mathematical ideas. Therefore, next we briefly describe student understanding and provide examples of related feedback.

**Conception:** Student understanding—whatever that might be at this point in time about the mathematics that they are learning. Feedback will likely collect more information from the student.

Examples of Feedback:

- Can you tell me more about your idea?
- Will that solution pathway work for another problem? Why or why not?
- I see that you are doing \_\_\_\_\_. That is a good idea because \_\_\_\_\_.
- What might happen if \_\_\_\_\_?
- Does your solution pathway make sense to you? Why or why not?
- Has your thinking changed about \_\_\_\_\_? Why or why not?

**Mistakes:** Typically, small errors.

Examples of Feedback:

- Does your answer make sense? Why or why not?
- I wonder if you could take a look at what you did again and see if you get the same solution.
- Could you and \_\_\_\_\_ compare your solutions?

**Early, Naïve, or Partial Conception:** Beginning or tentative understanding. Students may show inconsistent understanding. It is there one day, but not every day. This is normal and common in the learning process, as students grapple with their understanding.

Examples of Feedback:

- Tell me more about your mathematical idea.
- I wonder, if we tried this same method/strategy again, if we would get the same or a similar solution.
- Let's keep working on this idea you are developing with a new task.

**Alternative Conception:** Understanding that is built on prior ideas that worked before but don't work now. Or students applying an understanding that they have about another mathematical idea to a new mathematical idea.

Examples of Feedback:

- Tell me more about your solution.
- [Show students an example of the problem solved incorrectly (not their own work).] Is \_\_\_\_\_'s solution correct? Why or why not?
- [Pose two solved samples.] Which one makes the most sense? Why?
- I'd like you to pair up with \_\_\_\_\_ and compare your ideas.

## CLASSROOM-BASED FORMATIVE ASSESSMENT: WHY IS THIS IMPORTANT? YOU DO HAVE THE TIME TO DO THIS!

"It took me years to realize that assessment, particularly what I do involving classroom assessment, isn't some stand-alone 'other thing' I am supposed to be doing as required by my school's principal or supervisor. Hello, why didn't anyone tell me?!"

—FOURTH-GRADE TEACHER

"Formative assessment? I just thought it was something I was required to do."

—KINDERGARTEN TEACHER

“I knew about formative assessment; it has just taken me a while to connect it to my classroom teaching and my planning.”

—HIGH SCHOOL MATHEMATICS DEPARTMENT CHAIR

When you create, select, administer, and then evaluate the results of *any* assessment, formative or summative, you estimate the value of the responses and use that to determine what your students know. Important stuff. Probably by November of any given instructional year, maybe earlier, you have a sense of what each student in your mathematics classroom knows and is able to do. But the reality is, much of what you do assessment-wise is, or should be, directly related to what you teach—every single day. That’s how we envision formative assessment. As noted earlier, the focus of this book is classroom-based formative assessment—the use of particular assessment techniques that you can and should use each day to not only validate and build on prior assessments, but also guide your planning and teaching. Why?

Consider NCTM’s (2014) *Principles to Actions*:

An excellent mathematics program ensures that assessment is an integral part of instruction, provides evidence of proficiency with important mathematics content and practices, includes a variety of strategies and data sources, and informs feedback to students, instructional decisions and program improvement. (p. 89)

The point here is that assessment must be an everyday component of what you do as you plan and teach. Assessing while you teach—it’s what you do. You plan and teach, and as you teach a lesson, any lesson, you can—and should—use particular assessment techniques to monitor student progress within the lesson, as well as assessing the impact of the lesson itself.

In our early work with formative assessment, we recognized—and mathematics specialists and teachers told us—that there were so many suggestions and ideas related to formative assessment that understanding and using them was never well understood. And, in some cases, all the hype regarding formative assessment put the specialists and teachers on overload. This got our attention. We have spent time distilling and validating, through classroom use, a small set of classroom-based formative assessment techniques that teachers have used successfully on a regular basis. We like to think of these classroom-based formative assessment techniques metaphorically as a palette of five “colors” that you can use as you paint your own classroom canvas, sometimes mixing the colors to find the best way to formatively assess and guide teaching and learning on a daily basis. Later in this module, and much more specifically and in depth in the modules that follow, we will discuss the five techniques, which we call the Formative 5—Observations, Interviews, Show Me, Hinge Questions, and Exit Tasks.

Let’s think about how formative assessment links to your own daily and even long-term instructional planning. As you plan, you consider the mathematical focus of a lesson. An important prerequisite to such planning is your own

understanding of the mathematical content and pedagogical knowledge related to your grade level and beyond. We fully recognize that it takes time for you to understand the learning trajectories of the mathematics content topics for which you are responsible, as well as how to interpret and address them in your classroom. For example, for a lesson at the fourth-grade level related to equivalent fractions, some of your students may be able to move quickly into lesson extensions involving comparing and ordering fractions, while others may have difficulty representing common equivalent fractions. As you know, such an achievement range within a single mathematics topic is not uncommon. However, your ability to plan based on knowledge of your students and their mathematical needs is important. This certainly includes particular tasks you may select and design to match your lesson's mathematical focus and, importantly, how you will assess student performance and the overall impact and effectiveness of your lesson. In short, as you plan, you should anticipate what you expect your students to accomplish. So, yes, what and how you will assess is part of both planning and teaching. Your teaching will reflect the formative assessment techniques you have planned to use to monitor student progress and the lesson's overall effectiveness. The following questions may help guide your planning and teaching as connected to your use of formative assessment:

- What tasks and questions will be used to engage students in the lesson?
- How will learning trajectories of the mathematics content focus of the lesson be considered to ensure the developmental appropriateness and student prerequisite background for this lesson?
- How will you communicate student learning expectations for this lesson?
- When and how will students receive feedback for their contributions during the lesson? And, how and when will students provide feedback to you?
- What responsibilities do your students have for assessing each other's learning in this lesson?
- How will formative assessment be used to monitor student progress in this lesson?
- Will students be assessed individually, in groups, or both individually and within a group?
- How will formative assessment be used to determine the effectiveness of the lesson?

Now it's time to consider the specific classroom-based formative assessment techniques that you can use in your classroom.

**INSIGHT**  
*Assessing while  
you teach—it's  
what you do.*

## FORMATIVE ASSESSMENT IN YOUR CLASSROOM: THE CLASSROOM IS YOUR CANVAS!



Source: iStock.com/Turac Novruzova

“I never thought much about using formative assessment every day and had no idea how it connected with my planning and teaching. So glad we decided to use observation, interviews, Show Me, hinge questions, and exit tasks regularly. I get it now, and my kids have actually come to expect the hinge question and exit tasks.”

—THIRD-GRADE TEACHER

As noted earlier, this book presents five classroom-based formative assessment techniques, the Formative 5, which you can use every day. Using the metaphor of an artist’s palette of five colors, the assessment techniques can be ordered and mixed based on your planning and instructional needs. The modules that follow will present, discuss, and provide tools for using the Formative 5 techniques—Observations, Interviews, Show Me, Hinge Questions, and Exit Tasks—in your classroom. This palette of formative assessment techniques has been gleaned from the seemingly endless suggestions provided for classroom consideration and use and has been carefully defined and tested in classrooms. A brief summary of each of the Formative 5 techniques is provided as follows.

### Observations

You observe your students every day—throughout the day. While this technique may be the most informal classroom-based formative assessment, its use is of particular importance to you as you monitor a lesson. As you use observation as a classroom-based formative assessment technique, the following questions, which will be discussed in depth in Module 1, will be helpful as you plan for the use of this technique.

#### INSIGHT

*The palette of formative assessment techniques can be ordered and mixed based on your planning and instructional needs.*

1. What will you expect to observe?
2. How will you know “it” if you see it?
3. What particular strengths or challenges might you observe?
4. How will you record and provide feedback of what you observe?

A major intent of the Observations module (Module 1) is to provide the background and support tools that should assist you in using observation as a formative assessment technique to guide and *inform* your planning and teaching and monitor student progress.

## Interviews

An interview extends an observation. The Interviews and Observations techniques are almost always connected. An interview provides the obvious follow-up to an observation a teacher might make when implementing a lesson. An interview also allows the teacher to spend a few valuable minutes digging deeper with an individual student or perhaps a small group of students. The goal of the interview is to get a glimpse of what a student is thinking. A full discussion of the Interviews technique, including helpful interview tools, is provided in Module 2. The following questions, also presented in Module 2, should help guide your use of this technique.

1. What would make you decide to work with a student one-on-one or with a small group of students?
2. What interview questions might you ask? How might the questions be different for particular students?
3. What responses will you anticipate from students? (Consider understandings *and* possible challenges.)
4. What follow-up interview questions might you ask, and how would such questions be connected to the feedback you might provide to the student or group of students?

The Interviews module will provide you with the background and tools appropriate to conduct, analyze, and use interviews to both monitor student progress and guide your planning and teaching.

## Show Me

Show Me is a performance-based response by a student and, like an interview, extends an observation. Show Me occurs when a student, a pair of students, a small group, or perhaps the entire class is asked to show how something works, how a problem was solved, how a particular manipulative material or related representation was used, and so on. Teachers and mathematics leaders who have used the Show Me technique have noted that it validated information gathered from an observation and/or interview and often provided the first step in redirecting student responses. The following questions have proven to be helpful when anticipating use of the Show Me technique.



1. How is your Show Me different from an observation and interview?
2. What will you use as a prompt for a Show Me request for this lesson?
3. What might you want a student or students to show and say as they describe their Show Me response?
4. Recognizing that a student response to a Show Me prompt is student-to-teacher feedback, when would you provide teacher-to-student feedback to a Show Me response?

Module 3, the Show Me module, provides a full discussion and includes related tools useful for presenting and using the Show Me technique. The Observations, Interviews, and Show Me techniques are all quite connected. You will use each of them every day, with the Observations typically, but not always, helping to define the specifics of the Interviews and Show Me opportunities.

## Hinge Questions

The hinge question (William, 2011) provides a check for understanding/proficiency at a “hinge point” in a lesson. The hinge question is a question that you plan for and use to elicit responses indicating your next step planning-wise and instructionally, with particular implications for the next day’s lesson. Responses to the hinge question directly *inform* both planning and instruction.

Creating the hinge question is an important part of the planning of the day’s lesson. Our experience has been that teachers need to take the time to create a question that truly assesses a major focus of the day’s lesson. We often consider the hinge question as the lesson’s “deal-breaker” since responses help you to determine your next steps instructionally, perhaps within the lesson you are teaching. We have also found it helpful to actually try out hinge questions with colleagues within a grade-level or departmental professional learning community. Such trial opportunities also provide teachers with occasions to consider varied hinge question formats. Most importantly, your ability to engineer the use of the hinge question is critical. Considering how you will engage students, assess responses, provide feedback, and decide instructional next steps attests to both the value and importance of the hinge question. Suggestions for the use and types of hinge questions are presented in Module 4. This will be a particularly important module for you.

## Exit Tasks

The NCTM’s (2014) *Principles to Actions* emphasizes the importance of using tasks to elicit student learning and then using the resulting analysis to inform instruction. We consider exit tasks as end-of-lesson formative assessments. We deliberately define such assessments as exit tasks given our experience with the seemingly increasingly popular use of exit tickets or exit slips. The exit task is designed to provide a capstone problem/task that captures the major focus of the mathematics lesson for that day or perhaps the past several days. The use of such problem-based tasks is quite different from the exit tickets or exit slips we have reviewed that tend to address particular mathematical procedures or provide



opportunities for students to rate their level of understanding on the mathematics topic of the day. The exit task is actually a product, providing actual work samples for you to review and use for future planning. As for the hinge question, planning time will be needed to develop the exit task, and such task development is enhanced when school, department, or grade-level teacher learning communities work together in their creation, use, and revision. Questions to consider in exit task development include, but are not limited to, the following:

1. Does the exit task capture the mathematics content expectations of your lesson?
2. Given the grade level or mathematics course, classroom norms, and students' prior experience working with challenging mathematical tasks, will this exit task engage all of your students?
3. Should the exit task be completed by individual students, student pairs, or small groups?
4. When will you be able to review exit task responses and use the responses to guide your planning as well as provide feedback to your students?

The Exit Task module (Module 5) includes multiple examples of exit tasks and tools guiding their use. Given the performance and product nature of the exit task, it is not likely that you will use the exit task each day. Our experience has been that teachers use exit tasks two or three days per week and that the student responses guide not only daily but longer-term planning.

## CONSIDER THIS: FORMATIVE ASSESSMENT AND GRADING

The focus of this book is the understanding and use of classroom-based formative assessment, with the intent to inform your practice by guiding your planning and teaching every day and by providing a constantly updated profile of individual student and class progress in learning mathematics. Should you grade responses to any of the Formative 5 techniques? While our quick response is no, that's not the intent of the response. Grades symbolically represent what you are constantly updating every minute of every classroom day—student progress. Consider the following: Would you individually grade what you observe, the interview responses of a student, or feedback to a Show Me response, hinge question, or exit task? We think not. Our position about grading student responses to any of the Formative 5 techniques you will learn about and use has been framed by our concern that grading when students are initially learning a particular concept or topic is not informed grading. At this point, learning is developing and emerging as students are observed or interviewed, respond to a Show Me request, answer a hinge question, and even work through an exit task. Evaluating students as they are just learning about, exploring, and engaging with new concepts does not give a complete picture of their understanding and may contribute to student anxiety or even fear or a reluctance to perform. Additionally, grading a formative response to any of the techniques presented in the next five modules sends a message to

students that they are expected to immediately “get” particular concepts/skills/understandings.

We do know that some teachers with whom we have worked have found a workable way to grade exit tasks. Some have even graded Show Me responses. Interestingly, both techniques typically provide a performance-based written response. The decision to grade student responses to an exit task or any other formative assessment is yours, but the determination, framing, and use of the Formative 5 is more about embedding assessment with your planning and teaching to seamlessly address student progress and, for the reasons already noted, was never considered a formal grading opportunity.

## SUMMING UP

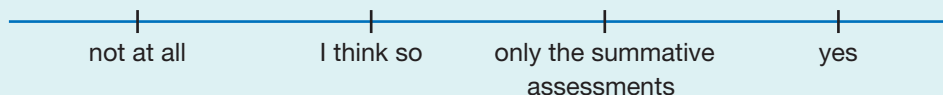
Consider the title of this module: *Why Formative Assessment? Issues and Opportunities*. Even without thinking about it, you assess student progress all day long, every day. You observe, you talk to your students about what they are learning, you ask students to show you what they are doing, you ask questions, you provide feedback, and so much more. The module started by discussing the importance of assessment, and we recognize that such understanding is the foundation to truly recognizing the importance, value, and use of both formative and summative assessment and how, in particular, formative assessment can and must guide and monitor your teaching every single day. That’s what this module and the following modules are all about—understanding the opportunities related to classroom-based formative assessment and considering how you can make a difference as you connect your planning and teaching to particular classroom-based formative assessment techniques—the Formative 5. This palette of formative assessment techniques—Observations, Interviews, Show Me, Hinge Questions, and Exit Tasks—was presented briefly in this introductory module, and will be thoroughly discussed and analyzed, with lots of tools supporting its use, in subsequent modules. The Formative 5 techniques represent our response to addressing issues and opportunities related to formative assessment. Let’s get started.



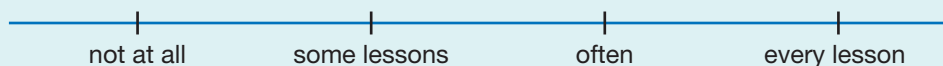
## Your Turn

**Rate, Read, Reflect!** Consider the following questions. Complete and then discuss your responses with your grade-level (elementary, middle school) or department (high school) teaching team or with teams across multiple grade levels.

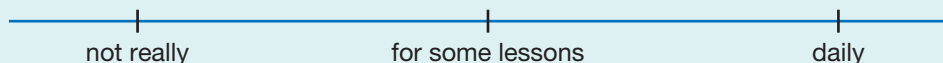
1. Your school or school district's policies related to formative and summative assessment are known and understood by most teachers.



2. How often do you actually plan for your use of formative assessment and the related feedback to your students?



3. When you plan a lesson, do you anticipate what you will assess and when and how you will provide feedback to your students?



4. How does (or perhaps should) the use of formative assessment influence your instructional planning?
5. How much time do you spend each day assessing student progress in mathematics?
6. How much time do you spend each month and during the entire school year assessing your students? Make sure to include the summative assessments you administer as well as your use of formative assessments.
7. In your own words, describe the differences between formative and summative assessments.
8. What formative assessment techniques are you currently using?
9. How do you provide feedback to your students with regard to the assessments that you use? What opportunities are provided for students to provide feedback to you and for students to provide feedback to each other regarding their mathematics learning?

(Continued)

*(Continued)*

10. What concerns you the most about the imbalance, particularly as emphasized in reporting to parents/guardians and in the media, between formative and summative assessments?
11. Professional Connection: Consider reading *Using Formative Assessment Effectively* by NCTM president Trena Wilkerson (2022), available from <https://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/Trena-Wilkerson/Using-Formative-Assessment-Effectively/>, then discuss the following:
  - a. Wilkerson discusses “short cycle” assessments (William, 2018) and how they help teachers respond in real time to the learning needs of students. What is it that helps teachers get to the point where they can literally adjust a lesson while teaching, and how does assessment provide the “tipping point” for such adjustments?
  - b. Consider the following statement within the president’s message: “Too often students are marginalized through ineffective, inequitable assessment practices, including formative assessments. We must ensure that our formative assessment practices are inclusive of all students, and in particular students who are often marginalized, such as students of color, LGBTQ+ students, those from low-income families, multilingual students, and students with disabilities” (Wilkerson, 2022). Would this statement represent the inclusive nature of assessments, both formative and summative, in your school and school district? Discuss your response with others.