A Fresh Look at Formative Assessment in Mathematics Teaching
Contents

Foreword
Margaret Heritage .......................................................... v

Preface
Edward A. Silver and Valerie L. Mills .................................................. vii

Section 1
Focusing on Formative Assessment:
What, Why, and How? ......................................................... 1

Chapter 1
Our Evolving Understanding of Formative Assessment and the Challenges of Widespread
Implementation, by Valerie L. Mills, Marilyn E. Strutchens and Marjorie Petit ........... 3

Chapter 2
Why Focus on Formative Assessment in Relation to Mathematics Instructional Frameworks,
Tools, and Approaches? by Edward A. Silver, Megan Burton and Wanda Audric 11

Section 2
Frameworks, Tools, and Approaches to Improve
Mathematics Teaching and Learning ........................................... 19

Chapter 3
Using Classroom Discourse as a Tool for Formative Assessment,
by Michelle Cirillo and Jennifer M. Langer-Osuna ............................ 21

Chapter 4
Cognitively Guided Instruction and Formative Assessment,
by Linda Levi and Rebecca Ambrose ........................................... 41

Chapter 5
Distinguishing Features of Culturally Responsive Pedagogy Related to Formative Assessment
in Mathematics Instruction, by Thomasenia Lott Adams and Emily P. Bonner ....... 61

Chapter 6
Using Learning Trajectories to Elicit, Interpret, and Respond to Student Thinking,
by Caroline B. Ebby and Marjorie Petit ........................................... 81
A Fresh Look at Formative Assessment in Mathematics Teaching

Chapter 7
The Mathematical Tasks Framework and Formative Assessment,
  by Michael Steele and Margaret S. Smith ............................... 103

Chapter 8
Using Formative Assessment to Guide the Effective Implementation of
  Response-to-Intervention (RTI), by Beth Kobett and Karen Karp ............ 127

Section 3
Using the Power of Formative Assessment .................................. 145

Chapter 9
Focusing on Formative Assessment to Improve Mathematics Teaching and Learning,
  by Megan Burton and Wanda Audriect ................................. 147

Chapter 10
Formative Assessment and Equitable Mathematics Classrooms: Probing the Intersection,
  by Marilyn E. Strutchens and Edward A. Silver ........................ 157

Chapter 11
A Vision for Professional Learning Design that Repositions and Reinforces
  Formative Assessment, by Valerie L. Mills and Marjorie Petit .............. 171

Chapter 12
Putting it All Together and Moving Forward: Concluding Thoughts,
  by Valerie L. Mills and Edward A. Silver ............................... 179

Purchase a print or digital copy of the following titles before
October 1, 2020 and use Campaign Code SOCJUS to receive
25% off the list price:

A Fresh Look at Formative Assessment in Mathematics Teaching

Motivation Matters and Interest Counts: Fostering Engagement in Mathematics

Annual Perspectives in Mathematics Education: Rehumanizing Mathematics for Black, Indigenous and Latinx students
In recent years, many conceptions of educational equity have been proposed and considered. Some focus on achievement disparities, others on differential access to human and material resources, and others on systemic linkages to issues of race, language, culture, socioeconomic status or gender. Yet, at the core of these disparate views, we find a deep concern for the nature and the quality of the experience that schools and teachers offer students as opportunities to learn. In this regard, we find the writings of Pauline Lipman and colleagues (Lipman, 2002, 2004; Lipman & Gutstein, 2000) to be particularly compelling. For example, consider Lipman’s assertion—

All students need an education that is intellectually rich and rigorous, and that instills a sense of personal, cultural, and social agency—an education that helps students to think critically about the inequalities enveloping our lives while it prepares them for a wide range of academic and vocational choices . . . a commitment to educate all students requires the deployment of significant material and intellectual resources. (Lipman 2002, p. 411)

Applying this view of educational equity to school mathematics, we argue that equity can be realized in the mathematics classroom if and when teachers ensure that every student has regular opportunities to (1) encounter challenging mathematics tasks that call for reasoning and sense making; (2) learn worthwhile mathematics within contexts that are relevant and meaningful, and that reveal how mathematics can be used as a tool to examine and challenge inequality and injustice; and (3) develop proficiency in working collaboratively with peers to solve challenging problems along with a strong sense of personal agency and identity as a competent and confident doer of mathematics.

In the remainder of this chapter, we elaborate these core notions of educational equity in mathematics classrooms. We conclude by discussing some of the ways we see formative assessment practices being inextricably bound up in this vision of equitable mathematics classroom instruction. Along the way, we draw connections to the instructional approaches discussed in chapters 3–8 of this volume.
Unpacking Components of Equity in Mathematics Classrooms

Encounter Mathematics Tasks Calling for Reasoning and Sense Making

In an equitable classroom, a teacher should ensure that every student has opportunities to encounter mathematics tasks that call for reasoning about and making sense of mathematics and applying mathematical knowledge to solve complex problems. Reasoning is the process of drawing conclusions on the basis of evidence or stated assumptions (National Council of Teachers of Mathematics [NCTM] 2009, p. 4). Mathematical reasoning can range from informal explanations and justifications to formal deductions or inductive observations (NCTM, 2009, p. 4). Sense making is “developing understanding of a situation, context, or concept by connecting it with existing knowledge” (NCTM, 2009, p. 4). Reasoning and sense making often happen simultaneously.

The mathematics education community’s interest in promoting reasoning and sense making in mathematics classrooms as a regular feature of instruction has deep roots in mathematics education (e.g., Fawcett, 1938; Pólya, 1945), but the level of interest has varied over time. After intense attention in the 1970s, community interest waned somewhat in the 1980s (Lester, 1994; Schoenfeld, 2007). Renewed attention was stimulated when NCTM published its standards for school mathematics programs (NCTM, 1989, 2000). One component of the Standards became known as “Process Standards,” which complemented the more familiar Content Standards (i.e., mathematics topics to be taught and learned) and included the mathematical processes of problem solving, reasoning and proof, connections, communication, and representation.

Interest in developing students’ proficiency with mathematical reasoning, problem solving, and sense making has continued with the advent of the Common Core State Standards for Mathematics (National Governor’s Association [NGA] and the Council of Chief State School Officers [CCSSO] 2010), which include a set of Standards for Mathematical Practice that are similar in many ways to the earlier NCTM Process Standards. Among the standards for mathematical practice are the following: develop the ability to make sense of problems and persevere in solving them, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, look for and make use of structure, and look for and express regularity in repeated reasoning (NGA & CCSSO, 2010).

Any effort to promote reasoning and sense making as a regular feature of mathematics classroom instruction must attend to the central role that mathematics instructional tasks play in daily lessons in providing opportunities for students to learn mathematics. For example, the Professional Standards for Teaching Mathematics (NCTM, 1991) claimed that students’ learning of worthwhile mathematics depends to a great extent on teachers using “mathematical tasks that engage students’ interests and intellect” (p. 1). Such tasks, when implemented well in the classroom, can help develop students’ understanding, maintain their curiosity, and invite them to communicate with others about mathematical ideas. Unfortunately, research on instructional practice has found both that such teaching does not occur regularly in U.S. mathematics classrooms (Porter, 1989; Stake & Easley, 1978; Stigler & Hiebert, 1999; Stodolsky, 1988), even when teachers display what they regard as their best practice (Silver, Mesa, Morris, Star, & Benken, 2009).

Mathematics tasks that encourage or require students to engage in reasoning and sense making are often called cognitively complex (Stein, Smith, Henningsen, & Silver, 2000). Promoting the successful use of such tasks in mathematics classrooms is challenging for teachers (Stein, Grover, & Henningsen, 1996), but research has demonstrated that the regular use of cognitively
demanding tasks in ways that maintain high levels of cognitive demand can lead to increased student understanding and the development of problem solving and reasoning (Stein & Lane, 1997) and greater overall student achievement (Hiebert et al., 2005). It is these ideas that lie at the heart of the MTF, which is discussed extensively in chapter 7 (Smith & Steele), and the “five practices” (Smith & Stein, 2011), which are discussed in chapter 3 (Cirillo & Langer-Osuna). Interestingly, those instructional improvement suggestions emerged from the QUASAR project (Silver, Smith, & Nelson, 1995; Silver & Stein, 1996), an initiative driven by a commitment to promote educational equity in mathematics classrooms in schools serving low income communities that some scholars have argued “broadened the imagination of the field for national reform for marginalized children” (Gholson & Wilkes, 2017, p. 237).

Examples of cognitively demanding mathematics tasks appear often in chapters 3–7 in this book. Consider, for example, the task below (Task D; fig 10.1) that is discussed by Smith and Steele in chapter 7.

**Task D (Doing mathematics)**

You work for a small business that sells bicycles and tricycles. Bicycles have one seat, two pedals and two wheels. Tricycles have one seat, two pedals and three wheels.

On Monday, there are a total of 24 seats and 61 wheels in the shop. How many bicycles and how many tricycles are in the shop? Show all your work using any method you choose and explain your thinking.

Fig. 10.1. A cognitively demanding mathematics task

Smith and Steele (see chapter 7) discuss how a teacher might use Task D with students in a way that maintains the cognitive demand as students attempt to solve it. In so doing, Smith and Steele demonstrate how a teacher can help students to reason and make sense of mathematics and how a teacher may support productive struggle and increase students’ confidence in their ability to solve such problems.

Levi and Ambrose (see chapter 4) illustrate that even very young children can be appropriately and productively engaged with tasks that call for them to reason about and make sense of mathematics problems. Cognitively Guided Instruction (CGI) is a problem-based approach to promote mathematics learning in the primary grades.

CGI is based on the premise that teachers can make productive use of research findings regarding how children think about problem situations and use mathematical ideas to make sense of the problems (Carpenter et al., 1996).

Research with young children has shown that—even before receiving formal instruction on basic addition, subtraction, multiplication, or division—children are able to solve many situational problems by modeling, counting, or inventing solutions that are not tied to traditional arithmetic computation. Knowing this corpus of research on children’s reasoning and sense making invites teachers to think differently about how to design and enact their classroom lessons.

Levi and Ambrose (see chapter 4) describe the work of Ms. Harris, a second-grade teacher, as she plans her instruction, sets goals for individual students, selects an appropriate problem to engage her students and help them reach her instructional goals, orchestrates student-to-student discourse to move students to higher levels of thinking, and reflects on her lesson during and
after the lesson. The authors use Ms. Harris to illustrate hallmarks of CGI encouraging teachers to—

- author their own problems based not only on their students’ mathematical development but also on their interests and activities;
- assess students by closely observing and listening during individual interactions with children;
- convey high expectations for children by prompting them to attempt more sophisticated strategies when the time is right; and
- facilitate collaborative learning.

The vignette of Ms. Harris’s teaching, along with many other examples of teaching provided in chapters 3–7, vividly illustrates the critical importance of basing mathematics lessons on cognitively demanding tasks that invite students to engage in reasoning and sense making.

It is also worth noting, in relation to formative assessment, that the use of cognitively demanding tasks in the mathematics classroom can create opportunities for students to make their mathematical thinking visible to themselves, other students, and the teacher. In this way, students allow teachers to gather evidence of their understanding that can guide instructional decision making.

Learn Mathematics in Contexts That Are Relevant and Meaningful

Closely related to the notion that cognitively demanding tasks are essential to mathematics classroom instruction, and consistent with a longstanding interest in helping students understand the application of mathematics to solve important problems, there has been a renewed interest in application contexts spurred by the CCSS emphasis on the mathematical practice of modeling. In addition, and with particular relevance to our vision of equity in mathematics classrooms, is the notion that relevant problem contexts can be found in the examination of social inequality, local community issues, or students’ cultural backgrounds, and interests. The intention of this work is to help students to see that mathematics is used and developed by all people and to help motivate students to learn mathematics.

A number of scholars and educators have noted either the potential value of linking classroom instructional activity to students’ culture and interests or the difficulties that arise when students do not see school mathematics as connected in any way to their lives. Though there are many seemingly different perspectives taken on this issue—such as culture and cognition (e.g., Saxe, 1991), inclusive mathematics (e.g., Strutchens, 1995, 2002), culturally responsive pedagogy (e.g., Ladson-Billings, 1995; Leonard, 2008; Bonner & Adams, 2012; Rubel & Chu, 2012; Tate, 1995; Wager, 2012), funds of knowledge (e.g., González, Andrade, Civil, & Moll 2001; Civil, 2008), social justice (e.g., Gutstein, 2003, 2012) and ethnomathematics (e.g., D’Ambrosio, 1985, 2001; Furuto, 2014)—there is large-scale agreement on the likely value of making explicit connections to students’ lived experience for their engagement with and learning of mathematics in school. In this section, we discuss a few of these ideas as they pertain to our vision of equity in the mathematics classroom.

As Adams and Bonner discuss (see chapter 5) culturally responsive pedagogy incorporates tasks and situations that link explicitly to students lived experiences or topics that allow students to develop a sense of personal agency with respect to learning and using mathematics. Ford (2005) describes a culturally responsive classroom as one where—

Copyright © 2020 by The National Council of Teachers of Mathematics, Inc. www.nctm.org. All rights reserved. This material may not be copied or distributed electronically or in any other format without written permission from NCTM.
1. Diversity is recognized and honored—a color-blind and culture-blind philosophy is avoided;
2. Cultural mismatches are minimal, not only among students, but also between teachers and students;
3. Teachers take the time to get to know students for the unique individuals they are—students feel physically and emotionally safe to be themselves;
4. Formal and informal, standardized and non-standardized assessments are fair and equitable;
5. Materials are culturally relevant and meaningful—students’ backgrounds and experiences are central to teaching and learning;
6. Lesson plans and activities are infused with multicultural content that is respectful; and
7. Teachers display cultural sensitivity and competence (p. 30).

Adams and Bonner (see chapter 5) assert that culturally responsive pedagogy requires that teachers know their students in ways that support them to facilitate their students having meaningful interactions with mathematics through tasks and other learning experiences that are authentic. In chapter 5, Adams and Bonner describe how Ms. Pace used culturally relevant pedagogy.

See figure 10.2 for an excerpt from the vignette.

It is a typical day in Ms. Pace’s class. Her sixth grade students are sitting in groups of three to four students working on a warm-up in preparation for a mathematics lesson. When the students have completed the warm-up, Ms. Pace says, “Recently, I have asked you to think about problems that we see in your community, and how we might be able to use mathematics to solve them. In your groups, I want you to write down two such problems and share them with the class.”

After two minutes, student groups take turns discussing what they are seeing in their community. There is a lot of discussion around City Park located just one block from the school. The students really enjoy playing there, but would like to build a short fence around the playground area because of the high number of unleashed dogs in the area. After some initial discussion about this, the teacher launches the following task:

You are a city planner, and you want to know how much it will cost to build a short fence around the playground area at City Park. What information do you need to solve this problem? What is a good estimate of the cost of building a fence?

Fig. 10.2. A task used in a culturally responsive mathematics lesson

Through this vignette, Adams and Bonner illustrate how a teacher can use a cognitively demanding mathematics task in conjunction with culturally responsive pedagogy to orchestrate student engagement with and discourse about worthwhile mathematics, as students work in groups to solve the problem and then share solution strategies with their classmates.

In addition to the use of mathematics tasks that connect to students’ lives, our vision of equitable mathematics classrooms also suggested the possibility that tasks could create opportunities for students to see how mathematics might be used as a tool to examine and challenge inequality and injustice. This idea is closely related to culturally responsive pedagogy and is often referred
to as teaching for social justice. According to Gutstein (2007) teaching mathematics for social
justice builds on students’ culture and experiences and engages students in using mathematics to
think about, and act on, the world, especially in relation to inequity and injustice.

Teaching for social justice entails engaging students in critical mathematics through a peda-
gogy of questioning, incorporating students’ life experiences directly into the curriculum, helping
students to develop sociopolitical consciousness, facilitating student’s development of mathemat-
cal power (NCTM, 2000), using problems that motivate students to study and use mathematics,
and cultivating students’ sense of personal, cultural and social agency (Gutstein, 2006, 2012).

Gutstein (2006) described a lesson that he taught to middle school students entitled “Driving
While Black or Brown.” Students were given the following information to ponder:

This is a sample of Illinois data based on police reports from 1987–1997. In an area of about 1,000,000
motorists, approximately 28,000 were Latinos/as.

Over a certain period of time, state police made 14,750 discretionary traffic stops (e.g., if a driver changes
lanes without signaling, or drives 1 to 5 mph over the speed limit, police may stop her or him but do not
have to). Of these stops 3,100 were of Latino/a drivers.

Fig. 10.3. A task used in mathematics for social justice lesson

Students were asked to determine whether racial profiling occurred through developing a mathe-
matical simulation of the event. They were also asked to reflect on their findings and the lesson in
general. During a lesson such as this, the teacher monitors students’ mathematical processes, as
well as their thinking about the social justice issue. This type of lesson affords students with the
opportunity to determine how just an occurrence in society is through the use of mathematics in
multiple ways. They can use theoretical and experimental probability to determine if the discre-
tionary stops were influenced by a person’s race. During the lesson, the teacher raises questions
to the students, and the students respond to the teacher and to each other based on their mathe-
matical findings and their beliefs about the situation. In this lesson, a social justice issue provided
a context within which one or more cognitively demanding mathematics tasks were embedded.
As students engaged with this situation and associated tasks, the teacher could both assess their
mathematical reasoning and sense making and cultivate in students a disposition to use mathe-
matics as a tool to address complex socio-political issues. Moreover, we think it likely that stu-
dents would want to hold themselves accountable to a higher standard of argumentation on such
issues because they know that the issues are likely to be controversial and evidence is likely to be
viewed skeptically. A teacher could certainly make a compelling case to students for the need to
produce a clear, concise, mathematically sound argument in order to have a chance of persuading
and convincing skeptics.

Learn Collaboratively and Develop Mathematical Agency and Identity

The ideas discussed in relation to the first two principles of equitable mathematics classrooms
have already highlighted the importance of cognitively demanding tasks as a basis for students to
develop a positive mathematical identity—as mathematical thinkers who solve challenging prob-
lems, reason about relationships, and make sense of ideas. Experience with cognitively demand-
ing tasks can also assist students in developing a sense of personal, cultural, and social agency


in relation to their lived experience and to sociopolitical challenges they and their families may face in their communities. In addition to the use of tasks that can build a strong sense of agency, there are instructional practices that can also play an important role. Among the most important of these is the use of collaborative work to support individual student growth and to promote discourse among students about mathematical ideas.

The notions of agency, autonomy and identity are intertwined, but all refer at least in part to: beliefs about oneself as a mathematics learner and doer of mathematics, one’s perceptions of how others perceive him or her as a mathematics learner, one’s beliefs about the nature of mathematics and mathematical activity, and one’s self-perception as a potential participant in mathematical activity (Solomon, 2009; Aguirre, Mayfield-Ingram, & Martin, 2013). In equitable mathematics classrooms, teachers and students not only capitalize on the knowledge and strengths that students bring with them to affirm them as learners, but also provide opportunity for every student to develop a sense of personal agency and confidence as a doer of mathematics.

The development of individual identity, agency and autonomy can often be supported through collaborative classroom work. Working with peer support, students not only learn to work productively with others but also to make visible ways that they can contribute to the learning and success of their peers. Critically important to the development of agency, identity and autonomy is the role of classroom discourse as discussed by Cirillo and Langer-Osuna (see chapter 3), especially in classrooms where collaborative learning is also used to support individuals as they solve cognitively demanding mathematics tasks and to encourage student-to-student discourse and discussion.

Teachers often use collaborative learning or cooperative group work to teach at a high academic level in diverse classrooms. In such settings, cognitively demanding tasks, including open-ended, interdependent group tasks, can be assigned, and the classrooms are organized to maximize student interaction. One pioneering version of this approach to support mathematics learning in classrooms with diverse student populations is called complex instruction (Cohen et al., 1994). One important feature of complex instruction is that teachers pay particular attention to unequal participation of students, and they employ strategies to address such status problems (Cohen, Lotan, Scarloss, & Arellano, 1999). Status perception is closely linked to how competent a student feels about himself or herself, as well as the extent to which a student is perceived as competent by his or her classroom peers (Horn, 2012). The use of cognitively demanding tasks and collaborative group work is intended to convey a sense of challenge and accomplishment, within a setting that supports each student to contribute to completing the task, and conveys the value of each student’s contribution to success.

Boaler (2006) used relational equity to refer to what occurs when students learn both to appreciate the contributions of students from different cultural groups, social classes, genders, and attainment levels and to develop positive intellectual relations. Boaler (2006) has argued that students can develop these relationships through a collaborative problem-solving approach in which students work together and learn to appreciate the variety of insights, methods, and perspectives that different students can generate when solving problems together. Relational equity can develop both through experience with culturally relevant or historical situations and also through the collaborative solution of worthwhile mathematical tasks. To illustrate this point further, consider figure 10.4, which shows a mathematics task and some student comments about their experience in solving it collaboratively (Boaler, 2011).
Determine how the pattern is growing, represent this as an algebraic rule and a t-table. Also show the 100th case in the sequence, having been given the first three cases.

**Students’ reactions to solving the problem together**

I think it helps, because it helps with learning to get out of your comfort zone, ‘cause whenever you learn, you’re not always going to learn the exact way, so to be able to learn different types of ways, if someone interprets something the way they do, and then you look at it and you’re like: “oh, look at this,” and you see it *their* ways, you never know later on when you might have to change your interpretation or something. So it allows you to come out of like your comfort zone. (Ayana, Y4)

You got everyone’s perspective on it, ‘cause like when you’re debating it, a rule or a method you get someone else’s perspective of what they think instead of just going off your own thoughts. That’s why it was good with like a lot of people. I liked it too. Most people opened up their ideas. (Tanita & Carol, Railside, Y4). (Boaler, 2011, p. 5–9)

In complex instruction, such as CGI, the teacher is key to insuring that all students have an opportunity to participate and contribute, that multiple voices are heard in the classroom and that all students are respected and valued for their contributions to the collective reasoning and sense making about mathematics. In this regard, the role of classroom discourse and discussion, as discussed by Cirillo and Langer-Osuna (see chapter 3) is critically important. As the student quotes above suggest, it is through classroom discourse and discussion that students become aware of their own contributions, as well as those of peers, and the perceptions of value that peers convey when a student contributes to a group effort to solve a challenging problem. In addition, of course, the student-to-student discourse allows teachers to access evidence of students’ reasoning and sense making. This information then informs not only teachers’ short-term decisions about if and how to assist a student or collaborative group in their quest to solve a problem but also longer-term planning of future lessons or decisions about whether to reteach a topic about which students appear to be uncertain. The use of evidence of student thinking to make such instructional decisions is the heart of formative assessment. Moreover, collaborative experiences in the classroom can facilitate peer assessment and self-assessment, which in turn support the development of agency and identity.
Linking Instruction, Formative Assessment, and Equity

The vision of equitable mathematics classrooms discussed in this chapter suggests the importance of a problem-based approach to mathematics instruction. Students work individually and collaboratively on cognitively demanding mathematics tasks, which are often connected in important ways to students’ lives. Teachers monitor student work on the tasks, probing students’ reasoning and sense making and eliciting evidence of students’ mathematical thinking and learning. Teachers then use the evidence of students’ thinking to plan and enact next steps that will increase students’ understanding of and proficiency with worthwhile mathematical concepts and skills. Students are treated as agents of their own mathematical activity and are also seen as intellectual resources for each other.

This characterization aligns well not only with our vision of equitable mathematics classrooms but also with Leahy et al.’s (2005) five strategies for effectively implementing formative assessment. Table 10.1 summarizes the core components of our proposed vision of the equitable mathematics classroom, the key features of classroom practice highlighted in our earlier discussion as being consistent with our vision and Leahy et al.’s (2005) five strategies.

<table>
<thead>
<tr>
<th>Equity in Mathematics Classrooms</th>
<th>Features of Equitable Mathematics Classrooms</th>
<th>Leahy et al.’s Five Formative Assessment Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Encounter challenging mathematics tasks that call for reasoning and sense making:</strong></td>
<td><strong>Lessons use cognitively demanding mathematics tasks.</strong></td>
<td><strong>Clarifying and sharing learning intentions and criteria for success.</strong></td>
</tr>
<tr>
<td><strong>Learn worthwhile mathematics within contexts that are relevant and meaningful, and that reveal how mathematics can be used as a tool to examine and challenge inequality and injustice:</strong></td>
<td><strong>Teachers monitor and probe student thinking about the mathematics or issue addressed in the problem, or both.</strong></td>
<td><strong>Engineering effective classroom discussions, questions, and learning tasks.</strong></td>
</tr>
<tr>
<td><strong>Develop proficiency in working collaboratively with peers to solve challenging problems along with a strong sense of personal agency and identity as a competent and confident doer of mathematics.</strong></td>
<td><strong>Teachers use this evidence of student thinking to make short- and long-term instructional decisions to support student learning.</strong></td>
<td><strong>Providing feedback that moves learners forward.</strong></td>
</tr>
<tr>
<td><strong>Students are seen as agentic and as intellectual resources for each other.</strong></td>
<td><strong>Students are seen as agentic and as intellectual resources for each other.</strong></td>
<td><strong>Activating students as the owners of their own learning.</strong></td>
</tr>
<tr>
<td><strong>Activating students as instructional resources for one another.</strong></td>
<td><strong>Activating students as instructional resources for one another.</strong></td>
<td><strong>Activating students as instructional resources for one another.</strong></td>
</tr>
</tbody>
</table>

In our presentation in this chapter, we have tried to underscore several points made in other chapters in this book:

1. The centrality of using cognitively demanding tasks that are linked to worthwhile mathematical ideas that correspond to a teacher’s curricular goals;
2. The key role of classroom discourse to promote students’ learning and identity formation;
3. The importance of gathering evidence of student thinking, reasoning and sense making to gauge student progress and to inform teachers’ instructional decision making; and

4. The value of multiple methods of supporting all students to learn important mathematical concepts and skills, including collaborative group work and scaffolded, individually tailored learning opportunities.

However, our intent was not simply to summarize these key points; rather we sought to emphasize the ways in which these instructional ideas are central to efforts to promote equitable mathematics classrooms.

We would assert that formative assessment is not only effective in promoting students’ mathematics achievement in general but also essential to promoting our vision of the equitable mathematics classroom. In this regard, the ideas expressed by A. Wade Boykin (2014) resonate with us:

Educational assessments should be coupled with a schooling purpose that emphasizes more human capacity building rather than sorting and selecting. The thrust here is that it is a societal good to foster extensive, high-level knowledge, skills, and abilities in intellectual, technical, and civic participation domains, for successive cohorts of the American population. And in turn, assessments should function principally to help actualize such human capital production. (p. 499)

The impact on student learning of the intentional and systematic use of formative assessment to improve student learning has been well documented. For example, an oft-cited study by Ehrenberg et al. (2001) estimated that the impact of formative assessment on student achievement was four to five times greater than the impact of reducing class size. Furthermore, Black and Wiliam (1998) reported that “improved [student-involved] formative assessment helps low achievers more than other students and so reduces the range of achievement while raising achievement overall” (p. 141).

Formative assessment is not just a nice thing to do if one has time, it is an essential component of our professional obligation to promote excellence and equity in mathematics education.

References


A Fresh Look at Formative Assessment in Mathematics Teaching


