Making Moves: FORMATIVE ASSESSMENT IN MATHEMATICS

A seventh-grade teacher finds that the notion of attention—to student and teacher thinking about student thinking—is key to orchestrating standards-based mathematical learning.

Brent Duckor,
Carrie Holmberg, and
Joanne Rossi Becker

TPOPOVA/THINKSTOCK

Research on teacher professional learning has shown that formative assessment can improve student learning more than most instructional practices (Hattie 2012). Empirical evidence indicates that thoughtfully implemented formative assessment practices improve students' learning, increase students' scores, and narrow achievement gaps between low-achieving students and others (Black and Wiliam 1998). Practiced well, formative assessment holds promise for fostering equity. Given the role that students' achievement in middle school mathematics classes can play in college-going trajectories (Balfanz 2009), articulating how formative assessment can support equity in mathematics classrooms is critically important.

But what *is* formative assessment, or FA? Does "doing FA" mean giving more quizzes, managing interim test data, or processing exit slips? Doing formative assessment in mathematics classes depends greatly on teachers' and students' use of language: producing language, taking language in, and sharpening language skills (Hakuta 2013).

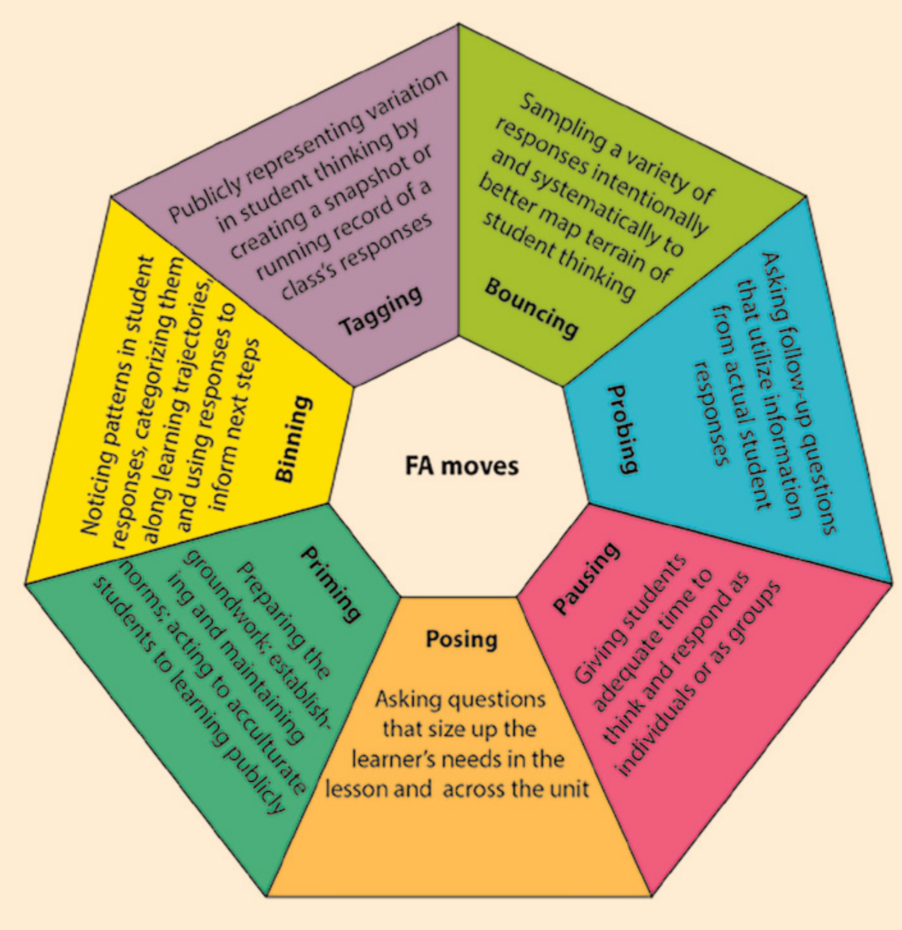
Some conceptualizations of formative assessment are more explicit than others in their focus on language use. In this article, we present our conceptualization of formative assessment; introduce FA moves of *priming, posing, pausing, probing, bouncing, tagging,* and *binning*; and illustrate the moves at play in one middle school mathematics class. Each of these moves lends itself to sustaining a focus on the development of academic language for all students, which is critical to fostering equity in mathematics learning and teaching.

REFRAMING FORMATIVE ASSESSMENT: ONE MOVE AT A TIME

FA is more than checking for understanding. Formative assessment, as we conceptualize it, helps teachers learn more about students' understandings and productively respond to those understandings (not merely "misconceptions" or "wrong" answers) during class. We think of FA as a dynamic pedagogical process between students and teachers. Doing FA means that teachers initiate, then orchestrate openings for mathematical reasoning and investigations (CCSSI 2010). A primary goal during mathematics lessons thus becomes keeping the discussion flowing and interjecting just-in-time *moves* that promote a conscious and strategic use of student thinking.

Our conceptualization of FA places a premium on feedback loops in classroom talk, the building up of repertoires of auditory and verbal skills, and providing instructional space for students to use mathematical language as they reason in real time. This definition contrasts with those who orient FA toward high-tech products and "micro" testing events. Assessing formatively should emphasize real-time instructional processes and the uses of feedback "on the fly" (Linquanti 2014).

Fig. 1 A teacher can orchestrate formative assessment (FA) moves in myriad combinations.



This moves-based conceptualization of classroom formative assessment relates to Wiliam's framework, in particular, how teachers can engineer effective classroom discussions and present tasks that elicit evidence of learning (2007, p. 1064). Like other experts in FA, we recognize the significance of classroom discourse in laying the groundwork for effective feedback, particularly in how teachers can consciously pose questions that serve various purposes and provide a "window into thinking" (p. 1069).

We extend Wiliam's FA framework by delving into the focus on "Where now? Where to? How?" from a beginner's perspective. Teachers are not born formative assessors; they are also not likely to become experts in FA moves without coaching and support over time. We have introduced a language of formative assessment as an instructional practice that focuses attention on malleable "moves" (Duckor and Holmberg, in press). Although the FA moves framework can help uncover student thinking about multiplicative structures or proportional reasoning, for example, it also serves as an accessible lexicon for those *learning to become* classroom formative assessors.

These seven FA moves create opportunities for *all* students to interact productively and persistently with higher-order thinking (see **fig. 1**). In combination with deep mathematical content knowledge, FA moves can help teachers make sense of what students know, make connections between ideas, and facilitate the process of learning in more transparent, visible ways (Heritage 2007).

Traditional formative assessment in mathematics classrooms include do nows, polling technologies, and quizzes. FA, however, is more than a mini-assessment event or high-tech tool for grading. We have seen preservice and in-service teachers demonstrate that making FA moves is also about orchestrating and eliciting student understanding through speaking and listening routines that uncover prior knowledge and misconceptions. By consciously enacting multiple combinations of moves—over time and with practice—teachers get better at doing FA.

Teaching must balance lesson planning with improvising. People do not often think of such improvised moves as re-posing a question, scaffolding a probe, or re-introducing think time in response to students' verbal and nonverbal action (or in-action!) as assessment tools. Yet that is how we conceptualize FA moves.

Bottom line: FA is more than parroting a guided inquiry technique or calling for "thumbs up, thumbs down." It requires pedagogical strategies for re-engaging mathematics students who say, "I don't know" or just shrug when they inevitably get stuck.

Table 1 These formative assessment moves were enacted in a middle school mathematics classroom.

FA Move	How Might the Move Look and Sound When Enacted?
Priming	"That's a great question! Why don't we ask that of everybody? That'll help." Priming Out: "I'm so glad you asked that question because it seemed like maybe some other people had the same question."
Posing	"Anyone notice any common boxes?" "Which box would you recommend?" "Why would the $3 \times 2 \times 4$ box have less surface area than the $6 \times 4 \times 1$ box?"
Pausing	First, Sevan poses a question to the whole class. Then, in very slow motion, he pantomimes a student raising a hand, moving his hand ever so slowly up from his waist to above his shoulder. The nonverbal message is that "We take our time to raise our hands. I am protecting individual student think time right now." Sevan brings his hand to his chin and crinkles his brow in concentration, striking a pose reminiscent of Rodin's "The Thinker." He does not call on anyone to speak.
Probing	"If you couldn't show me, how would you describe the box?" "What changed as you changed your arrangements?" "Based on what you saw around the room, would you stick with that?"
Bouncing	"Take 60 seconds. Talk with your team." [*Bounce* to all] [To one particular group who built a smallest box that was different from the other groups' smallest boxes] "Do you guys think that the one you saw the most of was actually the smallest box?" [*Bounce* to group] "Kamal, in your team, which arrangement had the *most* surface area?" [*Bounce* to individual] "Anyone have anything to add to that?" [*Bounce* to all]
Tagging	"So, let's come to an agreement as a group. When I talk about material, let's say that material means cardboard." [*Tags* by writing "material = cardboard" on whiteboard]
Binning	"Are $4 \times 2 \times 3$ and $2 \times 3 \times 4$ two different boxes?" [Sevan *bins* students' responses as "correct" or "incorrect" without disclosing to students, then asks class] "Who agrees?" "Who thinks there is a bigger box?"

ILLUSTRATING MOVES: SEVAN'S SEVENTH-GRADE MATH CLASS

No matter the topic or grade, the general aims of making FA moves are similar. *Bouncing* moves aim to offer opportunities to sample, take note, and make sense of a wide range of student responses. *Probing* moves aim to catalyze thinking in the student or students being probed and to make thinking more visible to students and teacher alike. *Tagging* moves aim to make student thinking public for others to see, explore, and develop. But a move or combination of moves will look and sound different, depending on classroom context.

"Sevan," a middle school mathematics teacher in Northern California, learned how fluid, flexible, and ubiquitous the seven moves are while working with a team of four teachers in an FA-driven lesson study project over a semester. **Table 1** shows how Sevan enacted FA moves with his seventh graders during a lesson on minimizing surface area of rectangular prisms.

Although all students benefit from paying attention to language development (Zwiers 2013), Sevan's suburban classroom comprised a diverse range of learners needing an explicit focus on fostering language. Of twenty-four students, three were enrolled in classes to support their English language development. Eight spoke Spanish, Mandarin, Korean, or Hebrew; many were schooled abroad where exposure to English varied significantly. Several of Sevan's designated and undesignated English language learners participated in a "reading enhancement class" designed for students without Individualized Education, or 504, plans. As Sevan noted during the lesson study, his students' enthusiasm and skill sets regarding mathematics varied as much as their language and literacy histories in this culturally and economically diverse school.

Each move reflects Sevan's appreciation for students' levels of mathematical understanding as "progressions," not merely pacing challenges to be overcome.

From Launching to Discussing and Summarizing

As this lesson example (see **table 1**) illustrates, FA moves can be used in combination to productively handle student sticking points or cul-de-sacs that a teacher does not anticipate in advance of the lesson. Sevan used FA moves to uncover the extent of, and then address, a language-related sticking point that several of his students were having during a module on surface area of rectangular prisms.

Sevan wanted students to notice patterns associated with minimizing surface area of rectangular prisms. When different rectangular prisms, all with the same volume, have different lengths, widths, and heights, what happens to the surface area? Specifically, what could students discover about minimizing the surface area of rectangular prisms?

Sevan contextualized their instructional task by asking, "How can math help us be more green?" They visited http://rethinkrecycling.com and read four paragraphs about companies' needs to "Minimize the Number and Amount of Materials Used in Packaging." Sevan checked his students for understanding by asking, "What do you suppose the connection is between this article and the math that we've been doing?"

He then invited everyone to imagine that they worked for ATC Toy Company and that they were to help the company evaluate their packaging needs. He gave teams of two and three students twenty-four 1 in. × 1 in. × 1 in. interlocking cubes, directing students to find all the ways that the cubes could be arranged into different boxes. They were also to chart their data. Sevan then projected the information in **figure 2**.

After allowing students fifteen minutes to build arrangements and chart data, Sevan distributed the handout in **figure 3**.

Fig. 2 Sevan asked students to imagine that they worked for a toy company as they tackled the instructional task, which he projected on a whiteboard.

Packaging Blocks

ATC Toy Company is planning to market a set of children's alphabet blocks. Each block is a cube with 1-inch edges, so each block has a volume of 1 cubic inch.

Find all the ways that 24 cubes can be arranged into a box (mathematically speaking, a rectangular prism). Record the dimensions (length, width, and height), volume, and surface area of the prism.

Length (units)	Width (units)	Height (units)	Volume (cubic units)	Surface Area (square units)

Fig. 3 After students had worked on the task for fifteen minutes, Sevan distributed this handout to prepare students for a whole-class discussion.

Classwork: Packaging Blocks Follow-Up Questions

1. Which of your arrangements requires the box made with the least materials? Which requires the box made with the most material?

2. Which arrangements would you recommend to ATC Toy Company? Why? Why do you think the company makes 24 alphabet blocks rather than 26? (Think mathematically.)

Sevan projected question 1, directing students to answer all the questions on the handout and build the arrangement requiring the fewest materials. He drew a box around "least materials," writing "Build me" nearby. Before he released students, Ornetta raised her hand. Although she spoke English fluently and some of her education outside the United States had been in English, this was Ornetta's first year attending U.S. schools. She was neither shy nor exceptionally outgoing. According to Sevan, her mathematical struggles were "pretty typical," she "did not try to put on a front that she knew more than she knew," and she "worked hard."

Acknowledging Ornetta's mathematical nature and her raised hand, Sevan asked, "A question? Not a 'whole-class' question, but a 'me-and-you' question?" Ornetta's one-on-one "private" question to Sevan was this: "Didn't all of our boxes have the same amount of material?"

Sevan's *priming* of routines for engaging student questions was well established in his classroom. Priming students for an FA-driven classroom culture—something as subtle and important as permission and support for engaging in whole-class, small-group, or one-on-one questions—is not well documented in the literature. But it is essential to the linguistically heterogeneous, culturally and economically diverse classrooms in the United States.

Fig. 4 "Materials = Cardboard —> Surface Area" episode. The teacher uses FA moves in combination to support students in connecting language to mathematical concepts.

Teacher: [*Priming,* saying to both Ornetta and the entire class] That's a great question! Why don't we ask that of everybody? That'll help. [*Bouncing* Ornetta's one-on-one question out to the entire class, *posing* it to everyone] This team asks, "Didn't all of our boxes have the same amount of material?"

[*Pause* 3+ seconds]

Brianne: Yeah. [Teacher *bins* this response as an incorrect response/misconception.]

Nadia: They all had 24 blocks.

Teacher: They all had 24 blocks. [*Posing*] Did anything change as you changed your arrangements?

Matteo: No. [Teacher *bins* this as incorrect response/misconception.]

[*Pause* almost 3 seconds]

Teacher: [*Probing*] What changed as you changed your arrangements? [*Bouncing* to Abby] Abby, what changed?

Abby: The surface area.

Teacher: [*Posing* to all] The surface area changed. So, when we think of surface area changing, what materials might we associate with the surface area of a box?

[*Pause* of 11 seconds]

Teacher: [*Bouncing* to Jack] Hey Jack, if you had to guess, what material would you associate with the surface area of a box?

Jack: The walls.

Teacher: The walls. [*Probing*] Jack, what are the walls of the box made out of?

Jack: Cardboard.

Teacher: Cardboard. So let's come to an agreement as a group. When I talk about material, let's say that material means cardboard. [*Tagging* by writing "material = cardboard" on whiteboard.] Right? Material means cardboard. And when we're talking about the cardboard of a box, the mathematical concept that we're focused on is…

Several students: Surface area. [*Tagging* by writing " —> surface area"]

Teacher: [*Priming out*, supporting FA class culture] Ornetta, I'm so glad you asked that question because it seemed like maybe some other people had the same question.

Unpacking Student Misunderstandings: One Move at a Time

Figure 4 is a transcript of Sevan's response to Ornetta's question, coded with FA moves. It illustrates Sevan's using the moves to discover academic language and conceptual challenges that students were having concerning volume, surface area, and the word *materials,* and how Sevan addressed these issues as a class before releasing students for teamwork.

Sevan used FA moves to widen access to the curriculum. He took up Ornetta's "me-and-you" question, about the boxes having the same amount of material; *primed* the class for it; *bounced* her question to the entire class; *posed* further questions to everyone; *probed*, *paused*, and *tagged* the class responses on the SMART Board™; and then *primed* again by explicitly reinforcing the importance of Ornetta's question. Each move reflects Sevan's appreciation for students' levels of mathematical understanding as "progressions," not merely pacing challenges to be overcome.

Making Sense of the "Quiet Liana" Episode

Not all interactions proceed so fruitfully. In the same videotaped lesson during the "discuss and summarize" phase (Smith and Stein 2011), Sevan called on Liana, who is "quiet" and "unlikely to volunteer."

Sevan had just finished *tagging*, writing, "2 × 3 × 4" and "4 × 2 × 3," on the SMART Board. *Priming* first, he said, "OK, I have a question for everyone. I'd love to hear some new voices." Sevan *posed*, "Are these two different boxes?" Liana shook her head no. Sevan, wanting Liana's engagement, *bounced* the spotlight to Liana and *probed*, "Why is it not a different box?" (This can be a dangerous move if norms of trust and respect are not in place.)

Sevan *probed*, "You're not sure how to describe it? Just a gut feeling you know it's true?" More silence. (In many classrooms, "eager beavers" would now jump in to supply the "correct" answer.) Sevan moved the spotlight off Liana by *bouncing* a question to all, *re-posing*, "Can anyone tell me why it's not a different box?" (He used call and response, although often he uses equity cards.) Albert raised his hand. Immediately, Sevan called on him to get "the answer."

In the FA lesson study group, we reflected on how the sixth-grade and seventh-grade mathematics classrooms might offer additional opportunities to re-engage students like Liana who may falter when in the spotlight. Sevan agreed to work on *priming* students for sharing.

MAKING LEARNING VISIBLE: SEVAN'S REFLECTIONS ON FA MOVES

Effective formative assessment—in contrast to interim testing or "data-driven" decision-making strategies—meets students with conceptually difficult material *during* class, anticipating learning challenges as a productive *process* in building more powerful understandings (Shepard 2009). FA moves can serve as a conceptual and practical tool for improvisation and sense making, especially as teachers are building schema (i.e., building bins to evaluate "stuck," "confused," "incorrect" responses) about "what to do next." Adaptation on the fly and real-time feedback to students rely on moves that make students' thinking visible.

If Sevan had anticipated the challenges that students would have connecting *materials* and *cardboard* to the concept of *surface area*, he would have launched the lesson differently. Reflecting on his video with his colleagues, Sevan gained generalizable knowledge about how conceptual confusions about language and math touch all students. Although Ornetta's status as a nonnative speaker of English might suggest that only designated English learners need academic language support, Sevan was adamant that there are no shortcuts to learning what experts call the "register," so-called tier II and III phrases, words, and expressions (Beck, McKeown, and Kucan 2002). For Sevan, FA moves help all students who have language-related challenges, confusions, and sticking points learn mathematics.

Bouncing Asks Us to Widen the Sample and Share the Spotlight

Before being introduced to FA moves, Sevan prioritized "hearing from everyone." Yet he did not call his sampling of student responses *bouncing*. Sevan's first focus on *bouncing* meant increasing attention to when, how, and who benefited from *bouncing*. How often did students turn and talk, to prepare for sharing their thoughts with the class? Did Sevan invite students who were "unlikely to volunteer" to speak during these whole-class discussions? How?

By the last professional development session, Seven had shifted how he carried out his *bouncing*. Rather than standing at the front and *bouncing* by directing the "attention spotlight," Sevan focused on sampling by *bouncing* himself around and listening for "nuggets" while students were working.

While circulating, Sevan felt that the quality of his "listening in" was better. Students were more at ease, too, and were willing to reveal thinking and take risks. Some were "reluctant to admit not knowing" and shared partial understandings. *Probing* that would have fallen flat in whole-class situations worked better one on one. While circulating, Sevan would support such students, *priming*, saying, "Later I'm going to ask you to contribute what we just talked about." Sevan's combinations of FA moves created new feedback loops (Sadler 1989) that led to a better real-time analysis of his students' thinking. It also gave him more time to recognize partial understandings, to *probe* and *bin* more effectively later in the lesson. He also found

We reflected on how the sixth-grade and seventh-grade mathematical classrooms might offer additional opportunites to re-engage students who may falter in the spotlight.

that when students' contributions are valued in class discourse, their confidence in their mathematical competence increases (Darragh 2013).

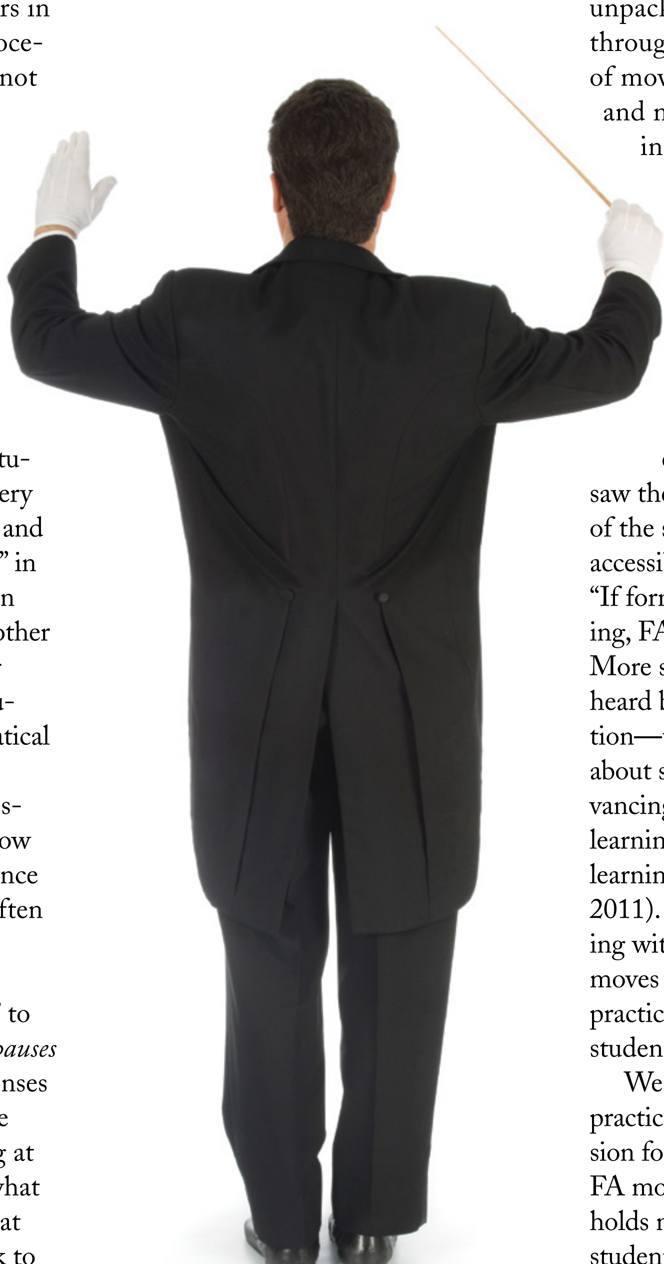
Using Tagging to Improve Binning Strategies

As Sevan implemented FA moves during the semester, he became more interested in students discovering weaknesses in the logic of their "first-draft answers." Sevan *tagged* by writing on the board a range of four to five answers to a probability problem; he then *binned* those answers in his mind ("partially correct," "procedural error," "careless mistake"), not sharing his *binning* strategies with students but using them to gauge the class's level of understanding.

Once a range of responses was represented, Sevan *probed* students, digging into why they agreed or disagreed with a *tagged* response. During this deliberate process of public mathematical reasoning, Sevan's students felt the power of self-discovery as they explained their "solutions" and as Sevan watched them "fall apart" in a safe classroom space. Rather than being shown by the teacher or another student what went wrong, *tagging* norms and practices supported students' insights into their mathematical reasoning processes.

During the FA video-based lesson study, Sevan became aware how particular classroom habits influence instruction. He noticed that he often *poses* "yes-no" or "agree-disagree" questions, listening for particular responses, *binning* them "correct" to move the lesson forward. Sevan *pauses* frequently, and *tags* student responses occasionally on the board. But, he reported, "The challenge of being at the front and really listening to what students are actually saying is great enough; I find myself falling back to the habit of narrowing and working for a predetermined response."

A fifth-year teacher working on his master's degree, Sevan expressed respect for the teaching experience needed to build repertoires of student responses to problems, beyond the "easy to anticipate" ones. He noted the importance of choosing tasks that consistently elicit varied solution strategies. Planning lessons requires that teachers do the problem as many ways as they can and consider moves that they would use in orchestrating a productive mathematical discussion with that solution method.



JGROUP/THINKSTOCK

REFRAMING FORMATIVE ASSESSMENT

NCTM (2014) recommends that teachers collaborate in teams to drive reflective discussions about student learning. We add the use of an FA moves-based lens to sharpen and sustain the focus on mathematics instruction in these discussions of what's working and what needs unpacking. We have discovered, through video analysis and coding of moves in language arts, science, and mathematics lessons, that instructional decision making and reflection improve when teachers become more strategic in their own responses to students' responses (Duckor 2014; Lovell, Duckor, and Holmberg 2015).

The middle school mathematics teachers in this study saw the language, concepts, and use of the seven FA moves as practical, accessible, and concrete. Sevan told us, "If formative assessment equals listening, FA moves help you listen further. More student voices are heard and heard better." The notion of attention—to student and teacher thinking about student thinking—is key to advancing standards-based mathematical learning and next generation science learning in the classroom (Coffey et al. 2011). Planning, enacting, and reflecting with a common language of FA moves in safe, collegial communities of practice hold great potential for raising student achievement in mathematics.

We hope these illustrations of practice catalyze more teachers to envision formative assessment through an FA moves-based lens. This approach holds more promise—for teachers and students—than focusing on teachers' assessment literacy, with its deficit overtones, or focusing on interim assessments, which tend to emphasize curriculum products and score data. We further hope that as teachers begin seeing FA in a new light that they continue to amplify the voices and values of quieter students, particularly those English language learners in middle school math classrooms who too often have been rushed past in the race to the top.

"If formative assessment equals listening, FA moves help you listen further. More student voices are heard and heard better."

REFERENCES

Balfanz, Robert. 2009. "Putting Middle Grades Students on the Graduation Path." *Policy and Practice Brief.* Westerville, OH: National Middle School Association. http://www.amle.org/portals/0/pdf/articles/Policy_Brief_Balfanz.pdf

Beck, Isabel L., Margaret G. McKeown, and Linda Kucan. 2002. *Bringing Words to Life: Robust Vocabulary Development.* New York: Guilford.

Black, Paul, and Dylan Wiliam. 1998. "Inside the Black Box: Raising Standards through Classroom Assessment." *Phi Delta Kappan* 81 (2): 139–48.

Coffey, Janet E., David Hammer, Daniel M. Levin, and Terrance Grant. 2011. "The Missing Disciplinary Substance of Formative Assessment." *Journal of Research in Science Teaching* 48 (10): 1109–36.

Common Core State Standards Initiative (CCSSI). 2010. Common Core State Standards for Mathematics. Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers. http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

Darragh, Lisa. 2013. "Constructing Confidence and Identities of Belonging in Mathematics at the Transition to Secondary School." *Research in Mathematics Education* 15 (3) : 215–29.

Duckor, Brent. 2014. "Formative Assessment in Seven Good Moves." *Educational Leadership* 71 (6): 28–32.

Duckor, Brent, and Carrie Holmberg. In press. *Mastering Formative Assessment Moves: 7 High-Leverage Practices to Advance Student Learning.* Alexandria, VA: ASCD.

Hattie, John. 2012. *Visible Learning for Teachers: Maximizing Impact on Learning.* New York: Routledge.

Hakuta, Kenji. 2013. *Assessment of Content and Language in Light of the New Standards: Challenges and Opportunities for English Learners.* Princeton, NJ: The Gordon Commission on the Future of Assessment in Education. http://www.gordoncommission.org/rsc/pdf/hakuta_assessment_content_language_standards_challenges_opportunities.pdf

Heritage, Margaret. 2007. "Formative Assessment: What Teachers Need to Do and Know." *Phi Delta Kappan* 89 (October): 140–45.

Linquanti, Robert. 2014. *Supporting Formative Assessment for Deeper Learning: A Primer for Policymakers.* Washington, DC: Council of Chief State School Officers. http://www.ccsso.org/Documents/Supporting%20Formative%20Assessment%20for%20Deeper%20Learning.pdf

Lovell, Jonathan, Brent Duckor, and Carrie Holmberg. 2015. "Rewriting Our Teaching Practices in Our Own Voices." *English Journal* 104 (6): 55–60.

National Council of Teachers of Mathematics (NCTM). 2014. *Principles to Actions: Ensuring Mathematical Success for All.* Reston, VA: NCTM.

Rethink Recycling. http://www.rethinkrecycling.com

Sadler, D. Royce. 1989. "Formative Assessment and the Design of Instructional Systems." *Instructional Science* 18 (2): 119–44.

Shepard, Lorrie. 2009. "Commentary: Evaluating the Validity of Formative and Interim Assessment." *Educational Measurement: Issues and Practice* 28 (3): 32–37.

Smith, Margaret S., and Mary Kay Stein. 2011. *5 Practices for Orchestrating Productive Mathematics Discussions.* Reston, VA: National Council of Teachers of Mathematics.

Wiliam, Dylan. 2007. "Keeping Learning on Track: Classroom Assessment and the Regulation of Learning." In *Second Handbook of Research on Mathematics Teaching and Learning: A Project of the National Council of Teachers of Mathematics*, edited by Frank K. Lester Jr., pp. 1053–98. Charlotte, NC: Information Age Publishing.

Zwiers, Jeff. 2013. *Building Academic Language: Essential Practices for Content Classrooms, Grades 5–12*. Hoboken, NJ: Jossey-Bass.

Brent Duckor, brent.duckor@sjsu.edu, is an associate professor in the Department of Teacher Education and the Ed.D Program in Educational Leadership in the College of Education at San José State University in California. **Carrie Holmberg**, carrie.holmberg@sjsu.edu, is a doctoral student and a National Board Certified Teacher. **Joanne Rossi Becker**, joanne.rossibecker@sjsu.edu, is professor emerita in the Department of Mathematics and Statistics in the College of Science at San José State University.