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FORMATIVE ASSESSMENT IN PRACTICE

TEACHER VIGNETTES FROM THREE DISTRICTS

Written in collaboration with the Michael & Susan Dell Foundation

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS 3
OVERVIEW 4
FORMATIVE ASSESSMENT CYCLE AND EXAMPLES 6
ANNOTATED TEACHER VIGNETTE 13
CONCLUDING THOUGHTS 17
APPENDIX 18

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OVERVIEW

Every day in their classrooms, teachers face a perpetual question—how to know if what they are doing as a teacher is working for students. They use a host of formative assessment strategies to find out what students know: questioning, self-assessments, exit tickets, whiteboard checks and many others. To better understand the variety of styles and the complexity of formative assessment, this document describes a cyclical process of formative assessment implementation complemented by real classroom examples that serve as illustrations of formative assessment in action.

This document serves as a companion piece to the *Formative Assessment in the Classroom: Findings from Three Districts* report prepared by Education First and written in collaboration with the Michael & Susan Dell Foundation. The report provides analysis and recommendations related to the foundation's Teacher Formative Assessment Practice Study.

About the Study

The Michael & Susan Dell Foundation has a long history of making investments to support effective data use in education. The overall purpose of the study was to help the foundation better understand formative assessment and support teachers in implementing formative assessment in their classrooms on a routine basis by answering these questions:

- To what extent do teachers engage in true formative assessment practice?
- How do teachers alter instruction based on formative data?
- How do teachers manage the logistics of individualizing and differentiating instruction?
- To what extent do technology tools aid teachers in collecting, analyzing and/or acting upon formative data?
- What kind of support do districts and schools provide for formative assessment?
- What barriers exist to classroom instruction that is routinely adjusted based on formative data?

To generate deeper understanding of effective formative assessment strategies in practice, Education First conducted research in three urban school districts—Austin Independent School District (Austin), Denver Public Schools (Denver) and Metropolitan Nashville Public Schools (Nashville). The foundation identified these districts as having taken steps to implement formative assessment practices in classrooms with intentional support at the school and district levels. The structures each district has put into place to support formative assessment vary. All three districts agreed to participate in the study as a way of collecting data about formative assessment use and to gather information about what specific efforts are required to support and grow such practices.

From March through December 2015, Education First researchers collected data in each district using a variety of qualitative and quantitative methods: interviewing district and school administrators; administering district-wide surveys of teachers on their formative assessment practices; conducting classroom observations of teachers to see firsthand their formative assessment practice (observations included pre- and post-observation interviews); and collecting relevant artifacts and materials (see Appendix B of the research report for a full description of our methodology).

The examples and vignette highlighted in this piece are based on data from:

- **Classroom observations**: We observed selected teachers for one full class period, lasting from 45-90 minutes and took field notes during the observation. We used these and other collected documents

(e.g., lesson plans, handouts) to complete a Formative Assessment Classroom Observation Protocol at the end of each observation.[1] We also captured an audio recording of each classroom observation.

- **Pre- and post-observation interviews**: We interviewed selected teachers twice—prior to the observed lesson to learn about their background and get context for the lesson, and afterwards to get teachers' reflections of what actually happened during the observed lesson. Whenever possible, we led pre-observation interviews on-site prior to each classroom observation on the day of the lesson, and conducted post-interviews no later than the day following the observation.[2]

Although we changed the names of the teachers referenced in this document to protect their identities, actual observed teacher practice is the basis for the examples and the annotated vignette.

This document is divided into two parts: a description of each element in the formative assessment cycle and a full annotated vignette. In the first section, we describe the formative assessment cycle and use real-life examples to illustrate each element. The annotated vignette depicts a full class period, and provides a more holistic view of the cycle in practice. Though formative assessment practices vary across classrooms and from lesson to lesson, the end goal is the same—gathering, analyzing and acting on student data for the purpose of adjusting instruction and improving student learning and achievement – and ideally, real-time, minute-by-minute, within the same class period. The appendix includes a consolidated table synthesizing the steps of the cycle and a chart describing some of the most commonly used formative assessment processes and practices in classrooms.

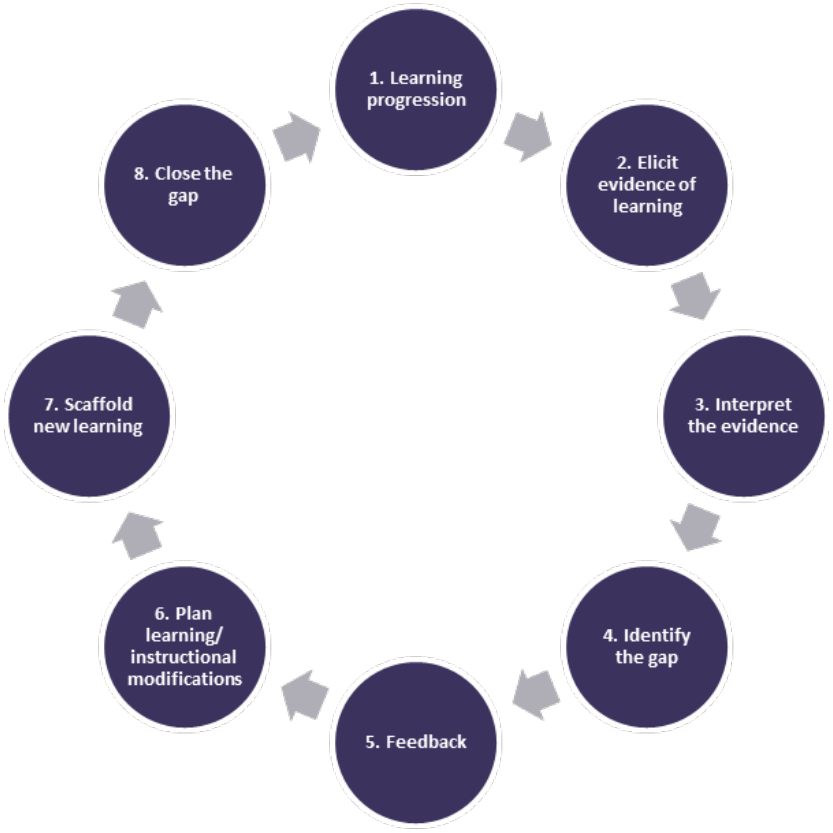
[1] The Formative Assessment Classroom Observation Protocol (FACOP) is comprised of five domains focused on best practice in formative assessment: learning intentions and criteria for success, engineering effective classroom discussions (questioning), engineering effective classroom discussions (collaboration), learning tasks (implemented), and feedback on instruction. Each domain was made up of four to five specific components that were assessed and rated on a 1-4 point scale (1=Beginning, 2=Developing, 3=Effective, 4=Exemplary).

[2] The pre-observation interview protocol consisted of 13 questions collecting information tied to the learning goals for the lesson, sequencing of the lesson with regard to prior and future planning, focus on planned strategies (including technology use), and previous professional training in formative assessment. The post-observation interview protocol included 11 reflective questions, asking educators to share their thoughts on various aspects of the enacted formative assessment from the lesson, plans for future instruction, challenges to formative assessment and resources for implementing formative assessment.

FORMATIVE ASSESSMENT CYCLE AND EXAMPLES

Formative assessment is an ongoing process that provides feedback, during the course of instruction, to teachers and students to close the gap between current learning and a desired goal. Figure 1 shows an example of a typical cyclical process teachers use in classrooms for formative assessment.[3] Though there are other formative assessment process examples available, they all have the same core elements – collect information about student learning, analyze that information, and respond to that information. And at the end of the day, it's about teachers establishing ongoing feedback loops with their students so they can adjust instruction and help their students move to where they need to be. We selected this particular formative assessment cycle because of its research-based components, developed by the National Center for Research on Evaluation, Standards and Student Testing (CRESST) and WestEd.

Figure 1: Formative Assessment Cycle



We have shown formative assessment as a cycle here, to highlight the ongoing and iterative nature of the process. This cycle is a framework for continuous improvement by collecting and responding to student data. And in real classrooms, formative assessment may not include all of these elements or follow the exact order listed in Figure 1 for any number of reasons—adjusted pacing of the lesson due to particular student needs, student misunderstandings, etc. What formative assessment practice looks like will vary from classroom to classroom and lesson to lesson. Though each element of the cycle supports effective formative assessment; it's the formative assessment practice – not each element of the cycle per se – that is most

[3] Data Use for Improving Learning, "Formative Assessment: Cycle," accessed April 21, 2015, http://datause.cse.ucla.edu/fa_cycle.php?node=7.

important. And based on our research, the reality is that implementing the full formative assessment cycle, as described here, for every class period or single-day lesson is hard work.

In this section, we describe each element of the formative assessment cycle and provide examples of these elements from real classrooms and current practicing teachers.[4] For additional examples for each element of the cycle, refer to the labeled callout boxes in the full annotated teacher vignette in the next section.

1 Learning Progression

Teachers identify learning goals for a lesson or sequence of lessons and determine criteria for the successful accomplishment of these goals. This purposeful sequencing of expectations is a "learning progression." Teachers share goals and success criteria with students. Success criteria guide learning while students engage in learning tasks.

11th and 12th Grade AP Environmental Science

Ms. Phillips starts today's lesson with warm up questions about energy transfers (material covered in a previous lesson). Once the class finishes discussing the answers, she is ready for her students to learn how matter and energy flow through an environment. Today's lesson is part of a multi-week unit about ecosystems and is the foundation for students to dive deeper into each system.

Ms. Phillips begins by explaining the lesson goals to her 11th and 12th grade AP science students: "Over the next two days, you will start exploring how matter flows between different sources within an ecosystem. There are five different types of ecosystems that we will examine. Today, you will be assigned to one system and will learn about it through the text and small group discussion. Tomorrow, you and your group will develop a poster that explains this system to the class."

Ms. Phillips continues by clearly detailing the criteria for success, which is also reinforced in the PowerPoint projected on the screen in the front of the room and a detailed rubric handout. "Your group poster should include a definition, a visual and real-life example to demonstrate that system. You'll have two minutes to present your poster to the class. I am looking for accuracy, creativity and presentation to audience." Ms. Phillips provides the group assignments and asks students to move to their groups and begin researching the assigned ecosystem. She knows that students will likely have clarifying questions about the criteria for success and circulates to each group as students begin working.

2 Elicit Evidence of Learning

Teachers use a variety of strategies during the course of instruction to elicit evidence of how student learning is progressing toward instructional goals. These strategies can be planned or can be implemented spontaneously during the lesson. Strategies for eliciting evidence include such activities as questioning, observations of student work, monitoring instructional tasks (e.g., representations, explanations, performance, problem-solving), mid-lesson checks (e.g., thumbs up/down, ABCD cards, white boards, traffic lights), exit cards, notes to the teacher and/or quizzes.

7th Grade Social Studies

Students in Ms. Knowles' seventh grade social studies class have spent the last month examining ancient Roman times. Today, the class has spent time reviewing content from the unit in both whole group and

[4] Examples were edited to clearly highlight the connection to specific formative assessment cycle elements.

small group settings. At the end of the period, Ms. Knowles' students complete a 3-2-1 exit ticket[5]– three important facts they learned; two important vocabulary words they learned related to the lesson and their meaning; and one question they still have. Ms. Knowles uses this type of exit ticket at the end of each unit review, so students know the routine. They each take out a piece of loose leaf paper and fold it into thirds so they can record responses to each question. This systematic collection of evidence helps her keep a pulse on each student's progress

As the bell rings, each student hands the exit ticket to Ms. Knowles. She plans to review the three (important facts) and the two (vocabulary words) in each exit ticket to check individual students' learning and to identify learning trends across her class. She uses the one (student questions) to adjust tomorrow's lesson and provide targeted support to specific students.

10th Grade Chemistry[6]

For the past week, Ms. Darren's 10th grade chemistry students have explored different atomic theories – what they are, how they evolved and how they led to an understanding of modern atomic structure. During today's lesson, Ms. Darren introduces a new atomic theory developed by British physicist, J.J. Thomson. Through a series of experiments investigating the electric discharge in a high-vacuum cathode-ray tube, Thomson noticed that the rays were being deflected and discovered that atoms were made up, in part, of electrons (subatomic particles with negative electric charges).

After explaining J.J. Thomson's atomic theory to the class and illustrating the cathode-ray tube experiment on the whiteboard, Ms. Darren facilitates a whole group discussion to attempt to get an initial sense of students' understanding of the new concept and to clarify any misconceptions they may have. However, only a handful of students are actively engaged and responding to her questions. Ms. Darren decides to do a mid-lesson check for understanding. She gives students six minutes to draft a summary of J.J. Thomson's theory, asking them to include both text and illustrative descriptions. Ms. Darren wants to see what each student knows about the theory so she can determine if she should move on to the next part of the lesson.

As students begin turning in their summaries and illustrations, Ms. Darren can assess gaps in students' understanding. Based on her real-time review of their work, she realizes that she needs to spend more time discussing how the deflection of the rays were associated with the negative charges emitted by electrons during the second half of the lesson before moving on to the next atomic theory, since several students struggled with accurately explaining and/or depicting this concept in their summaries.

3 Interpret the Evidence

Teachers examine the evidence against the success criteria to determine the status of student learning. With this information, teachers assess what the students understand, what their misconceptions are, what knowledge they do or do not have, and what skills they are or are not acquiring. Students also use this information to understand their progress toward learning goals.

High School Band

Every day students in Mr. Paul's high school band class practice and perform musical selections. Today, the class is rehearsing a piece called "America," in preparation for an upcoming concert. The class is focusing on articulation—the symbols that denote how notes are to be played and the techniques musicians use to

[5] Exit cards or "tickets" are written student responses to brief questions posed at the end of a class or learning activity or at the end of a day. Teachers use exit tickets in a variety of formats and situations.

[6] Some examples overlap with and include references to other steps in the cycle. This particular example highlights actions from steps 2 and steps 3 and 4, which are described below.

produce them. He asks the band to examine the first four measures of the song and to look for a symbol that denotes a particular style of articulation. After a pause, he tells each band member to turn to a neighbor and identify the symbol and what it means. He steps up through the middle of the band so that he can hear responses. From nearly every partner he hears the right answer: "dot" and "staccato." He thinks to himself, "The band clearly can read the music. Now I need to see if they can play it."

Mr. Paul often calls on particular sections of the band—such as woodwinds or brass—to play a portion of whatever piece they are rehearsing. Today, he's planned to ask specific sections of the band to play the first four measures of the song they are rehearsing today. He starts with brass—the trumpets, trombones, French horns and tubas—because he knows it is particularly difficult for brass to play staccato. He waves his baton and they play the four measures. Mr. Paul contemplates what he has heard. "One more time, he says, waving the baton once more, his ear trained on the trumpets. The brass section plays the four measures again. He thinks to himself, "The trombones, French horns and the tubas have it down. The trumpets just aren't stopping each sound quickly enough." He knows now that when he breaks the band into sections later during the lesson, he may need to work with the trumpets on techniques that produce staccato sounds.

6th Grade Science[7]

For this science unit, Ms. Larkin's sixth grade students have been learning about weather tools. During today's class, she has her students organized in small groups and rotating to different activity centers to review and practice what they've learned so far. Ms. Larkin is stationed at one of the centers where she works on emphasizing key concepts the whole class has already covered but in a small group setting. She questions students directly to assess their level of understanding, as well as reviews and provides real-time feedback on their written work.

As she's working with her second small group and listening to students' responses, Ms. Larkin is beginning to see a pattern of misunderstanding about a couple of key weather concepts. Multiple students have mixed up the definitions of the terms "convection" and "radiation." Based on this evidence, Ms. Larkin knows she will need to design another lesson to reteach this content. It's important that the whole class can differentiate between these key terms.

4 Identify the Gap

Teachers identify the gaps between students' current learning status and the goals of current instruction. By self-monitoring, students use the success criteria to identify gaps in their own learning.

3rd Grade Math

Third grade students are working with partners on number comparison. Each set of partners has two sets of numbers that they must compare using symbols and vocabulary for "greater than" and "less than." After students complete the comparison at their desks, Ms. Diaz asks them to join her on the rug and share their work. She uses this approach to collect evidence from all students, so that she can assess whether there are any gaps. Ms. Diaz asks each pair come to the front of the rug and present their two numbers, their symbols and answers. The first pair explains, "743 is less than 912." Ms. Diaz questions, "How did you know?" One student in the pair explains that the first number, seven, is less than nine. The pair then describes the next comparison. "645 is greater than 5,100 because six is greater than five." This isn't the only pair that makes this same mistake.

[7] This example includes actions from steps 3 and 4.

After several more pairs share their work, Ms. Diaz can tell that several of her students are still struggling to consistently identify the difference between "greater than" and "less than" when they compare numbers with different place values. She knows that they must go back and practice the foundational concept of place value before coming back to number comparison.

5 Feedback

Teachers provide descriptive feedback to the students about the status of their learning in relation to the success criteria and give cues to the students about what they can do to progress and close the gaps. Students get feedback about their own learning by self-monitoring and give feedback to each other.

6th Grade Social Studies

During individual work time in his sixth grade social studies class, Mr. Williams walks around the classroom to check on student progress. Students are responding to a prompt about different perspectives within Native American societies. As he circulates the room, Mr. Williams prompts a few students to provide more evidence in their responses. He encourages students to self-monitor, referring to examples of exemplary responses posted on the side wall. The exemplary responses serve as reminder that all responses should include direct evidence from the text.

After students shift from their desks to the rug, Mr. Williams facilitates a whole-class discussion to engage students in extended feedback loops. During one exchange about resources, he asks a series of rapid-fire questions: "Why were saplings so important? Why did they need to bend to make frames for their houses? Why did they bend it? Why not straight? Let's look at this more carefully. Talk with a partner about what saplings looked like and why they were so important to this society." Though this exchange took place with the whole group, targeted questioning elicited individual responses from four students. Mr. Williams quickly gathered evidence and gave real-time feedback through his line of questioning and follow-up. He also provided space for all students to discuss their thinking in pairs, which allowed him to take a quick pulse check of the class' understanding. During the next 15 minutes, Mr. Williams repeats this cycle of questioning and discussion four times, eventually asking at least one targeted question to every student in the class.

6 Plan Learning/Instructional Modifications

To address learning gaps identified by formative assessment, teachers modify subsequent instruction to meet students' learning needs. They select learning experiences that place an appropriate demand on students and lead to closing the gap between where students are and where they need to be. By self-monitoring, students also adjust their learning strategies so that they can move forward.

9th Grade Algebra

Students are working on problem solving in Mr. Shah's high school Algebra class. Seated in groups of four, students record their responses on individual hand-held whiteboards, which gives him the information he needs about current student mastery. As students complete the second problem, Mr. Shah says, "I see a common mistake. There are a lot of positive answers and the answer should be negative." Students with positive answers immediately go back and check their work. Some students ask a group member for help and adjust their answers. Mr. Shah validates the correct responses and moves on to the next problem. Students show their responses on the whiteboards and Mr. Shah points to the number line. "If we are here, at nine, which way will we go to *subtract* negative nine? After looking up at the number line, over half of the student still struggle to provide a correct response. Mr. Shah determines that instead of moving forward with the next problem, he will have student groups practice a set of foundational problems using the individually laminated number lines he keeps in the back of the room.

After the lesson, Mr. Shah reflects on his process for using this data to make adjustments during the lesson. "The data [from student whiteboards] influenced the questioning that I focused on within any given example. When students made an error, I would pose questions that would drive groups to talk it out and revise their own errors within their teams. When I saw that most of the class was stuck on subtraction of a negative number, I decided to adjust my lesson and focus on more explicit practice with the number line itself." Mr. Shah's mid-class modification allowed students to make adjustments to their problem solving strategies and deepen their own learning.

7

Scaffold New Learning

Instructional supports help students move easily from one idea to the next and rapidly close learning gaps. Teachers (or peers) scaffold new learning by focusing lessons on smaller segments of skills and knowledge. By scaffolding new learning, teachers are able to better determine exactly where students need help, where they succeed and which supports are most effective.

2nd Grade Reading

A second grade class transitions from the rug to desks and tables around the room. The class has just finished a mini-lesson on "summarizing," and will now practice reading and language skills in small groups and centers. For this rotation, Ms. London has purposefully grouped her students to ensure she can provide appropriate scaffolding when needed.

Ms. London begins her second small group lesson by beginning with a review of the definition of "summarizing." As students read the text, she purposefully pauses to ask students to remind her what a summary is and to provide her with a brief summary of what they read. She continues to reinforce the definition throughout the small group lesson by asking each group member to repeat the definition after they read.

Once the center rotation is complete, Ms. London reflects on students' progress. "When my second group joined me at the kidney table, I asked them to define "summary." The group mostly talked about the summary example that I gave during the mini-lesson. They couldn't really define what "summary" meant. That let me know that they needed a bit more support." By breaking down the specific skill into smaller components, Ms. London is able to target instruction where her students need it most.

5th Grade Math

For the past week, Ms. Arthur's fifth grade students have been learning about expressions. Today, she's working with a small group of students to translate words into algebraic expressions.

Ms. Arthur typically scaffolds her math instruction by increasing the level of difficulty in students' practice problems as the lesson progresses. After working with students on two basic translation problems, Ms. Arthur pushes her small group to try a multi-step problem. The word problem reads, "Nine more than a number F decrease by ten." Most students hesitate and begin writing slowly, so Ms. Arthur decides to model and walk them through this first multi-step problem and break it down for them step-by-step.

Ms. Arthur starts by saying, "Sometimes we read something and we don't know what it says. What do good readers do? Good readers, when they don't understand, they go back and re-read. For the first one, we are going to start with 'nine more than.' We are going to underline the words 'nine more than.' If I am translating this into numbers and symbols, what am I going to write?" Students write 9+. Ms. Arthur affirms the students' written responses and continues working through each part of the problem in a similar fashion moving onto 'a number F' and then 'decrease by ten.' She says, "I am taking the problem one part at a time.

If you are confused, you can take one part at a time." By breaking down the steps to problem solve, Ms. Arthur's can identify which steps are most challenging for students and where they need more support.

8

Close the Gap

Teachers and students close the gaps identified through formative assessment and set new goals and criteria for success. The assessment cycle is a continuous process in the classroom.

4th Grade Writing

A fourth grade writing teacher delivers a two-day lesson about parts of speech (nouns, verbs and adjectives) within subjects and predicates. As Ms. Yoon reflects on the lesson, she describes how she used different elements within the formative assessment cycle to close the gap. "On the first day of the lesson, I did a quick check of my students learning through an exit ticket. I realized that there were misconceptions about subjects and predicates that I needed to discuss with students. I adjusted the next day's lesson to include a different approach to identifying subjects and predicates. I did more re-teaching and scaffolding than I had planned to do, but the additional instruction supported students to meet the lesson goal." Even though Ms. Yoon had to make unplanned adjustments to her lessons, she closed the gap with her students and they are ready to move on to identifying prepositions within a sentence.

ANNOTATED TEACHER VIGNETTE

What does formative assessment look like in real life? How do teachers integrate real-time assessment with their daily instruction? The following vignette details one teacher's actual classroom over a full class period and provides a holistic view of the cycle in practice. Annotations throughout the vignette make explicit connections to the steps in the formative assessment cycle. This example illustrates that in reality, teachers do not necessarily follow the cycle in a step-by-step manner. Instruction shifts based on constant data collection, interpretation and subsequent adjustments and scaffolding. This vignette highlights two fundamentals of formative assessment implementation: 1) The formative assessment cycle is a fluid and constant process that is based on "in-the-moment" data collection and 2) Teachers have to balance planning and "on-the-fly adjustments" to best identify and act upon the gaps in student learning.

Assessing Student Learning: 10th Grade Algebra II

Before the bell rings, students slowly trickle into Mr. McGeary's first period, 10th grade class and put their backpacks and purses down at their desks. Students immediately head to their regular space at one of the thirty-five, four-foot whiteboards tacked up throughout the room. They look toward the front of class at the projector screen for instructions and begin solving the day's three "rewind" problems. The students know the usual class routines and expectations, and Mr. McGeary knows how he'll use the students' responses to these warm-up practice problems. He is always careful to include at least two problems related to the content from the previous class period in the "rewind" to assess whether his students have the skills they need for the day's lesson.

2. Elicit evidence of learning

Mr. McGeary begins the class by eliciting evidence of learning via daily warm-up problems, which he calls the "rewind."

1. Learning progression

Mr. McGeary knows the learning progressions associated with high school math courses. For this topic, Mr. McGeary considered the learning goals for a sequence of lessons related to equations with multiple variables using a variety of strategies (e.g., substitution, elimination).

Although Mr. McGeary covered part of today's topic with his students last year in Algebra I Honors and he spent the week helping them brush up on algebraic methods for solving systems of equations, he wants to see whether his students have a solid enough foundation to solve equations with two variables. If students demonstrate mastery on this skill they will proceed to the next level of rigor, which is today's objective—*students will solve systems of equations with three variables by using elimination as the primary strategy*.

After allowing students a few minutes to work on the "rewind" problems, Mr. McGeary closes the door and starts circulating with his clipboard and in rapid succession, gives every student individualized feedback on their work:

> *"Give yourself a check for #1. Looks good.*
> *That's the y value, don't forget to find the x variable.*
> *Give yourself a check.*
> *I don't agree with your setup for this problem. Revisit how you got that number. Rethink the y value.*
> *First two look great, now try the series."*

5. Feedback

Mr. McGeary provides descriptive feedback to each student about their status on the "rewind" problems. For students with incorrect answers, he gives them cues about what they can do to revise and rethink.

In circulating around the class and observing student work for the "rewind" problems, Mr. McGeary quickly examines the evidence of learning and determines the status of each student's understanding.

During the next five minutes, Mr. McGeary moves rapidly from student to student. Students that are not checking in with him are working individually or talking with a partner about their problem design and solution. Though not all students finish solving the third problem, Mr. McGeary asks students to return to their seats. These consistent checks for understanding allow Mr. McGeary to gauge that his students are ready to proceed with today's lesson.

To connect today's lesson to the previous lesson, Mr. McGeary asks the class to remind him of what they learned yesterday. Students call out "three variables" and "systems of equations with three variables." Next, Mr. McGeary prompts his students to discuss with their classmates how many different ways they can make systems of equations ready for elimination. The students eagerly begin discussing various solution paths in triads. After waiting a minute, Mr. McGeary calls on students from different groups to share their responses. He follows up by asking targeted questions and pressing for clarification to make sure the students understand what they saying and doing.

> *"What variable would need to be eliminated? Multiply by negative? Whole thing by 4? What will that let you eliminate? What do you see?"*

After a brief full-class discussion of students' approach to problem-solving, Mr. McGeary introduces the next set of problems on the board. Students begin to tackle the problems, and he encourages them to discuss multiple solution paths.

> *"You've identified the four easiest ways to solve..." (Shows next problem on the board.) "Now what do we do? We need to get more creative. Talk with your team. What else can do we do to solve this?"*

After students wrestle with this set of problems, Mr. McGeary displays another set of equations on the board. Students begin to solve individually and discuss solution paths with their small groups. Mr. McGeary circulates to hear different groups' discussions and determines that students are making a common mistake. He interrupts the small groups and asks to class to focus on him for instruction:

Mr. McGeary uses both instructional tasks (problem-solving) and questioning to elicit evidence of students' evolving understanding of solving systems of equations with multiple variables.

Interpreting the evidence provided students' written and verbal responses, Mr. McGeary is able to identify where students are struggling within the lesson.

"This was the most common mistake I saw earlier today in the rewind and I'm seeing it again—not solving for the next variable. You have to find the y. Don't stop until you have an answer for each variable."

Based on the students' work and class discussions, Mr. McGeary has a better sense of where the gaps are in students' understanding. He decides to have students do another round of individual practice on the wall whiteboards.

Though Mr. McGeary had planned for his students to do a couple of practice problems, he hadn't planned for them to do quite as many individual practice problems today before moving to group work. However, he modified his plans to give students the opportunity to practice in the areas where he saw them being challenged the most.

> *"We are going to do one batch of board work so we can practice and I can see where you still need help. Your rewind showed me you know how to solve systems. It's the set-up we need to work on. So let's practice more on the set-up. Discuss with the team what you're going to set-up for elimination. You don't need to solve it, focus on the set-up."*

Mr. McGeary has the students move back to the wall whiteboards to begin showing their work. This daily classroom practice, allows the teacher to see student misconceptions immediately and provide feedback to them in real-time.

Based on the formative data he collected throughout the class period, Mr. McGeary is able to pinpoint what additional support his students need as he works to revise and set new goals and criteria for success for tomorrow's lesson.

Mr. McGeary walks around reviewing each student's answers and provides a variety of verbal feedback. He affirms students' correct answers and encourages others to collaborate with their neighbors to understand how they solved the problem. He probes students for information to better assess misunderstandings they still may have. During today's seven-minute practice time, Mr. McGeary makes sure to check in with every student.

Students return to their desks and open Chromebooks[8] to record "the daily breakdown," which is another routine built into Mr. McGeary's classroom that allows him to quickly collect student data. Mr. McGeary knows this next problem is challenging and, after reminding everyone to open the Google Form, assures his students he will support them through to the solution.

> *"We're going to start with a quick problem, before diving into a more rigorous one. You're going to see a word problem. This one is a little more difficult, so I wanted to preview it before throwing you into it. You guys are going to work through this in your team. Write down your team members, define your variable, write down your system and solve with your team. We'll be able to see everyone's answers in the Google Spreadsheet."*

Mr. McGeary works to give students the necessary instructional support so they can incrementally internalize the new learning. Students can see each other's work, which acts as scaffolding so they can assess discuss their own learning strategies within their group. There is also support available from the teacher and the exemplar problem shown on the board.

[8] Chromebooks are small, lightweight laptops designed to be used while connected to the internet.

Mr. McGeary continues to elicit evidence of learning to see how his students' are making progress toward the day's learning goals. This time, he uses problem-solving in small groups and groups' responses in their Google form as their exit tickets.

This final problem is the students' exit ticket, which Mr. McGeary will review as students record their responses. Student groups begin discussing how to approach the problem and Mr. McGeary checks in with each group to reiterate the directions and assess their progress. Groups use the Chromebook to submit their answers to the exit ticket in a Google Form that will show student responses projected on the front screen. Students are able to compare their own responses and rationale to others through this process. Some students notice that their responses differ from other groups. This prompts students to review their own problem-solving strategies and assess their own learning. It also allows Mr. McGeary to see that some groups are making a common mistake. He discusses the mistake he sees with the class, and tells them that the students will work on again during the next class period.

Mr. McGeary is able to quickly review and determine student progress. He's also able to address students' misconceptions in real time. Students are also able keep track of their progress toward the learning goals.

Mr. McGeary continues to give students real-time feedback on each set of practice problems they do. Additionally, he encourages his students to self-monitor their learning by checking in with a classmate to compare answers.

As the bell rings and students pack up their belongings, Mr. McGeary knows the class met the objective of solving a system with three variables using basic elimination. His students did not get to the level of rigor he wanted—where students can solve a system of three equations that have three variables each. Based on the data Mr. McGeary gathered throughout today's lesson, he knows exactly where he'll pick up in the lesson tomorrow. He will adjust his instruction to scaffold the problems and walk students through the process of properly setting up the first two equations for elimination. This will support students in solving the more rigorous third equation correctly and close the gap in his students' understanding.

CONCLUDING THOUGHTS

Formative assessment involves the implementation of data-collection strategies and data-informed actions throughout a lesson. This approach, taken as a collective set of steps or process, helps teachers know whether students are progressing towards mastery of a learning goal or if students need more support. Simply put, formative assessment is what effective teaching is all about. Implementation of the full formative assessment cycle for every class period or single-day lesson is hard work. Yet there are teachers who are implementing portions of the cycle, or a full cycle, regularly and effectively.

Our study of formative assessment in three districts revealed that teachers turned to their peers as a primary support for their regular formative assessment practice. We encourage teachers to reach out and collaborate with their peers to discuss and share ideas about how to incorporate different forms of formative assessment into their lessons. We also encourage teachers to explore how technology (e.g., online tools, software) can help them to swiftly collect data from students, and more easily assess student knowledge, enhancing their formative assessment practices.

Our full study report outlines the kinds of supports teachers need to effectively implement formative assessment within regular instruction. School and district leaders have a role play in providing tools and training on formative assessment strategies, providing access to formative assessment technology and creating structures for teachers to collaborate with their peers as they work to incorporate formative assessment on a regular basis and improve their instructional practice.

APPENDIX

Formative Assessment Cycle

1. Learning Progression	Teachers identify learning goals for a lesson or sequence of lessons and determine criteria for the successful accomplishment of these goals. This purposeful sequencing of expectations is a "learning progression." Teachers share goals and success criteria with students. Success criteria guide learning while students engage in learning tasks.
2. Elicit Evidence of Learning	Teachers use a variety of strategies during the course of instruction to elicit evidence of how student learning is progressing toward instructional goals. These strategies can be planned or can be implemented spontaneously during the lesson. Strategies for eliciting evidence include such activities as questioning, observations of student work, monitoring instructional tasks (e.g., representations, explanations, performance, problem-solving), mid-lesson checks (e.g., thumbs up/down, ABCD cards, white boards, traffic lights), exit cards, notes to the teacher and/or quizzes.
3. Interpret the Evidence	Teachers examine the evidence against the success criteria to determine the status of student learning. With this information, teachers assess what the students understand, what their misconceptions are, what knowledge they do or do not have, and what skills they are or are not acquiring. Students also use this information to understand their progress toward learning goals.
4. Identify the Gap	Teachers identify the gaps between students' current learning status and the goals of current instruction. By self-monitoring, students use the success criteria to identify gaps in their own learning.
5. Feedback	Teachers provide descriptive feedback to the students about the status of their learning in relation to the success criteria and give cues to the students about what they can do to progress and close the gaps. Students get feedback about their own learning by self-monitoring and give feedback to each other.
6. Plan Learning/ Instructional Modifications	To address learning gaps identified by formative assessment, teachers modify subsequent instruction to meet students' learning needs. They select learning experiences that place an appropriate demand on students and lead to closing the gap between where students are and where they need to be. By self-monitoring, students also adjust their learning strategies so that they can move forward.
7. Scaffold New Learning	Instructional supports help students move easily from one idea to the next and rapidly close learning gaps. Teachers (or peers) scaffold new learning by focusing lessons on smaller segments of skills and knowledge. By scaffolding new learning, teachers are able to better determine exactly where students need help, where they succeed and which supports are most effective.
8. Close the Gap	Teachers and students close the gaps identified through formative assessment and set new goals and criteria for success. The assessment cycle is a continuous process in the classroom.

Source: Data Use for Improving Learning, "Formative Assessment: Cycle," accessed April 21, 2015, http://datause.cse.ucla.edu/fa_cycle.php?node=7.

Formative Assessment Processes and Practices

Letter-card	A teacher provides all students with a selected-response prompt and set of cards with letters (e.g., A-D for multiple choice or T and F for true/false). Students hold up the letter that represents their response to the prompt. This technique is designed for use only with selected-response items.
Whiteboard	Similar to letter-card technique but for use with constructed-response items, students write a short answer to a prompt on a whiteboard and hold it up for the teacher and class to see.
Exit slips/tickets	Exit cards are written student responses to questions posed at the end of a class or learning activity or at the end of a day.
Item sampling	A teacher administers a portion of an assessment's items to a portion of the students in order to estimate all students' mastery of the content. For example, a teacher might divide a 30-item quiz into six five-item quizzes and randomly administer them to students
Warm-ups (bell work)	When teachers use bell work to start a lesson, students have the opportunity to show what they know about a topic with a particular focus. It might be a pre-assessment for what's coming today or tomorrow. Or it might be a quick review of something that was a challenge from the day before or else a check-in on what happened last week.
Checks-for-understanding (CFUs)	Through a menu of activities (e.g., No-Hands-Up techniques or All-Student Response systems), students have the opportunity to check their own understanding of a topic during instruction. They may be able to compare their responses with their peers, hear the reasoning behind a peer's response and/or make adjustments to their own thinking.
Clickers (Student Response Systems)	Clickers can be used to pose questions to students and collect their answers for the purpose of providing real-time information about student learning to both the instructor and the students. Students can use this feedback to monitor their own learning, and instructors can use it to change how they manage class "on the fly" in response to student learning needs.
Mini-presentations	When student have to prepare to "teach" something, the content takes on new meaning to them. They have to clarify their own understanding before they can then act as instructional resources for their peers.
Peer review	This might be as simple as a checklist for an assignment where one student reviews another's work to make sure all the components are included, and then collaborates to help fill in any gaps or make a component stronger. Or it might be more complex, where students are self-assessing and then have a peer assess and provide dialogue about where there are similarities and differences and how the work relates to success criteria.
Self-assessments	A process in which students collect information about their own learning, analyze what it reveals about their progress toward the intended learning goals and plan the next steps in their learning. *Example of a scale some use for self-assessment:* 1 = Totally confused 2 = Shaky on this 3 = I think I get this 4 = Got it. Let's move on
Quiz	Quizzes assess students for factual information, concepts and discrete skills. There is usually a single best answer. Some quiz examples are: multiple choice, true/false, short answer, paper and pencil, matching and extended response.
Web or concept maps	Any of several forms of graphical organizers which allow learners to perceive relationships between concepts through diagramming key words representing those concepts.
Smartboards	The SMART Board and SMART Notebook collaborative learning software are tools that can be used for whole class, small group and individual learning. For example, The SMART Response VE is a cloud-based software that enables students to respond to planned and spontaneous questions and take quizzes using any of their favorite Internet-enabled devices, from anywhere.