Formative Assessment in the Mathematics Classroom

Lindsey Link, Michell Eike
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Time Frame 3 hours

Essential Question(s)

What is formative assessment and what does it look like in a mathematics classroom?

Summary

This professional development session is the mathematics content-specific day of the Formative Assessment Institute. In this session, participants will learn what formative assessment looks like in a mathematics classroom and will create formative assessments to take back to their classrooms.

Learning Goals

- Use and design tasks that will help make students' thinking explicit
- Identify specific strategies that will elicit mathematical thinking in students and inform ongoing instruction

Attachments

- Math Assessment Strategies—Formative Assessment in the Mathematics Classroom.pptx
- Note Catcher—Formative Assessment in the Mathematics Classroom.docx
- Note Catcher—Formative Assessment in the Mathematics Classroom.pdf
- OK Mathematical Actions and Processes—Formative Assessment in the Mathematics Classroom.pdf
- Presentation Slides—Formative Assessment in the Mathematics Classroom.pptx

Materials

- Presentation Slides (attached)
- Note Catcher handout (attached; one per participant; print front only)
- OK Mathematical Actions and Processes document (attached; one per participant; print front only)
- Math Assessment Strategies slide deck (attached; place in shared folder)
- Writing utensils
- Paper
- Participant devices with internet access

15 minutes

Engage

Presenter's Note: Session Preparation

During the Extend portion of this professional development session, participants are asked to use the attached **Math Assessment Strategies** slide deck to create their own formative assessments. Before beginning this session, be sure to complete the following tasks to prepare the Math Assessment Strategies slide deck for participants' use:

1. After Day 1 of the Formative Assessment Institute, insert a picture of the collaborative list from the Day 1 session on *slide 5* (which is titled "Day 1: Purposes of Formative Assessment") for participants to use as a quick reference.
2. Duplicate each of the master slides (*slides 6–7*) to ensure there are more slide templates than participants. *Slide 6* is the master slide for Extend Activity 1, and *slide 7* is the master slide for Extend Activity 3. Then, place the Math Assessment Strategies slide deck in Google Drive or in another type of shared folder. At the beginning of the Extend portion, you will provide participants with a link to the shared slide deck.

Welcome participants and briefly introduce yourself. Using the attached **Presentation Slides**, display **slide 4** and welcome participants to the content-specific day of the institute: Formative Assessment in the Mathematics Classroom.

Display **slide 5** and share the session's essential question: *What is formative assessment and what does it look like in a mathematics classroom?* Then, go to **slide 6** and share the session's learning objectives:

- Use and design tasks that will help make students' thinking explicit.
- Identify specific strategies that will elicit mathematical thinking in students and inform ongoing instruction.

Go to **slide 7** and give each participant a copy of the attached **Note Catcher** handout. Ask participants to take a moment to decide if they think the three samples of student work all follow the order of operations. Then, have participants turn to their elbow partners and discuss their reasoning. After a few minutes of discussion, ask for volunteers to share with the whole group.

30 minutes

Explore

Presenter's Note: Grouping Preparation

During this portion, participants go to the Instructional Strategies page on the K20 LEARN website. It is important to note that, if the option to show 12 results per page is selected (by default), there are 16 pages of strategies. Depending on the size of your group, consider the suggestions below to prevent participants from all looking at the same 12 strategies on the first page.

- Divide the group into quarters; the four groups do not need to be equal in size. For example, you could group participants based on how they naturally sat at four different tables. Then, ask the first group to pick strategies from pages 1–4, the second group to pick from pages 5–8, the third group to pick from pages 9–12, and the fourth group to pick from pages 13–16.
- For a smaller group, consider assigning page numbers to individual participants.

Display **slide 8** and have participants use their devices to go to the Instructional Strategies page on the K20 LEARN website: https://learn.k20center.ou.edu/strategies. Ask them to pick one strategy from their assigned page(s) that they could use as an assessment strategy.

Presenter's Note: Guiding the Activity

Participants are not expected to have all the details of strategy implementation at this time. They just need to have a general idea of how and why they might use their chosen strategy. For example, a participant might select the 30-Second Expert strategy for students to demonstrate their knowledge at the end of a unit as a review activity. Consider giving participants this example to help clarify the expectations for this activity.

Once participants have selected an assessment strategy, introduce them to the Yes, Because strategy. Ask one participant to share the strategy they chose with a brief explanation of their reasoning, and then ask a second participant to elaborate, contribute, or affirm the first participant's reasoning by responding with the phrase, "Yes, because…". The second participant should then share their own strategy selection with reasoning, and a third participant should respond with "Yes, because…" and so on.

Remind participants to use the Note Catcher handout to take notes on how they might use the Yes, Because… strategy in their own classrooms. If time allows—and if it was not already shared by a participant during the activity—ask for volunteers to share with the whole group their ideas for using this strategy in a mathematics classroom.

After the discussion, give participants a break.

25 minutes

Explain

As participants return from their break, display **slide 9**. Ask participants to think of a time when they found success in using a formative assessment and to talk with an elbow partner about how they define "success." While they discuss, give each participant a copy of the attached **OK Mathematical Actions and Processes** document.

Once participants have discussed with their partners, transition and talk through **slides 10–11**. On **slide 10**, walk participants through the considerations for selecting assessment strategies. On **slide 11**, show participants the State Department of Education's *Mathematical Actions and Processes* (*MAPs*).

Go to **slide 12** and ask participants to talk with an elbow partner about the following questions:

- What are some ways we can assess mathematical actions and processes?
- What are some ways we can help students develop those actions and processes?

Once participants have discussed with their partners, ask for volunteers to share their ideas with the whole group.

Go to **slide 13** and read the quote aloud. Give participants a quiet moment to think about the quote. If time allows, ask volunteers to share their thoughts about the quote.

90 minutes

Extend

Presenter's Note: Activity Preparation

During this portion of the session, participants are asked to create their own formative assessments based on the strategies introduced here. The purpose is for participants to collaborate and create formative assessments they can use in their own classrooms.

At this point, revisit the **Math Assessment Strategies** slide deck; make sure it has been prepared according to the instructions at the beginning of this session. It should be placed in Google Drive or in another type of shared folder. Get ready to provide participants with a link to the shared slide deck.

If you have a large group of mathematics teachers, ask participants to get in groups based on the specific course they mainly teach: Algebra 1, Geometry, and Algebra 2 and above, or PLC groups.

Activity 1: Not Like the Others

Participants read a description of the strategy and its potential purposes. Then, they assume the role of students and work through a specific example. Finally, each participant uses the Not Like the Others strategy to create their own formative assessment.

Show and talk through **slides 14–15**. Then, go to **slide 16** and ask participants to follow the directions on the slide as if they were students. Ask them to record their thinking on a piece of paper or on the back of the Note Catcher handout.

Sample Responses

- Participants may select graph A because it is the only graph that has a negative y-intercept.
- Participants may select graph B because it is the only graph that goes through the origin. Alternatively, participants may select graph B because it is the only graph with a positive slope less than 1 or with a slope that is not very steep.
- Participants may select graph C because it is the only graph that has both a positive slope and a positive y-intercept.
- Participants may select graph D because it is the only graph that has a negative slope.

Provide participants with the link to the attached **Math Assessment Strategies** slide deck. As you continue through the Presentation Slides, display **slide 17** and ask participants to create their own formative assessments using the Not Like the Others strategy.

Once participants are in the Math Assessment Strategies slide deck, ask each participant to go to a different slide to type their formative assessment idea for Activity 1. Remind participants to reference their anchor chart from the Day 1 session as they work.

At the top of each participant's slide, remind them to include a specific lesson objective and the course they teach. Ask participants to either describe or insert the images they would present to students. Additionally, have participants explain where in the lesson they would use this assessment and why they would use this assessment.

If time allows, ask for volunteers to share their ideas with the whole group. Remind participants they can use this slide deck as a resource when they go back to their classrooms.

To conclude Activity 1, go to **slide 18** and share some of K20's math lessons that use the Not Like the Others strategy. The showcased lessons consist of a Geometry lesson, "A Perfect Match," and an Algebra 2 lesson, "My Imaginary Friend, Part 1."

Activity 2: Strategy Probe

Participants read a description of the strategy and its potential purposes. Then, they assume the role of students and work through a specific example.

Show and talk through **slides 19–20**. Then, go to **slide 21** and ask participants to follow the directions on the slide as if they were students. Ask them to record their thinking on a piece of paper or on the back of the Note Catcher handout.

Display **slide 22**. Again, ask participants to follow the directions on the slide as if they were students. Give them a moment to decide which method is most similar to theirs, then go to **slide 23**. Ask participants to analyze the methods that they did not select, then go to **slide 24**. Have participants discuss all methods with their group members.

After a few minutes of discussion, go to **slide 25** and ask if anyone used a method that was not shown. If so, ask them to share it with the whole group.

Inform participants that this activity also helps students develop a deep and flexible conceptual understanding—which is one of the *MAPs*. Also, remind participants to use their Note Catchers to take notes on how they might use the Strategy Probe technique in their own classrooms.

At this point, give participants a break.

Activity 3: Quick Checks

Participants read a description of the strategy and its potential purposes. Then, they assume the role of students and work through a specific example. Finally, each participant uses a Quick Check strategy to create their own formative assessment.

Show and talk through **slides 26–27**. Then, go to **slide 28** and ask participants to share examples of how they imagine their students might respond to this Bell Ringer prompt at the beginning of a lesson.

Remind participants that asking students to respond to broad questions like "What do you know about…?" is a procedure that needs to be taught and developed within a classroom. For example, a student who gives a one-word or very short response needs to be encouraged to create an exhaustive list of things they know. Getting students to think in this way will take some training, time, and practice, so be sure to keep this in mind.

To introduce participants to other Quick Check strategies, transition and talk through **slides 29–32**. As you show each slide one by one, remind participants to use the Note Catcher handout to take notes on how they might use these Quick Check strategies in their own classrooms, either during or at the end of their lessons.

After explaining each strategy, go to **slide 33** and ask participants to create their own formative assessments using a Quick Check strategy. Participants should return to the Math Assessment Strategies slide deck and each go to a different slide to type their formative assessment idea for Activity 3. Remind participants to reference their anchor chart from the Day 1 session as they work.

At the top of each participant's slide, remind them to include a specific lesson objective and the course they teach. Ask participants to either describe or insert the images they would present to students. Additionally, have participants explain where in the lesson they would use this assessment and why they would use this assessment.

If time allows, ask for volunteers to share their ideas with the whole group. Remind participants they can use this slide deck as a resource when they go back to their classrooms.

To conclude Activity 3, transition through **slides 34–36** and share some of K20's math lessons that use Quick Check strategies. On **slide 34**, the Fist to Five strategy is showcased in an Algebra 2 lesson: "My Imaginary Friend, Part 2."

On **slide 35**, the 3-2-1 strategy is showcased in two Geometry lessons: "If at First You're Not the Same, Try Triangles! (Part 1)" and "What Does That Look Like?"

On **slide 36**, the Muddiest Point strategy is showcased in two Algebra 1 lessons: "Shiver Me Functions!" and "Journey of the Isolated Variable, Part 3."

Activity 4: My Favorite Mistake

Participants read a description of the strategy and its potential purposes. Then, they assume the role of students and work through a specific example.

Show and talk through **slides 37–38**. Then, transition through **slides 39–40** to demonstrate the My Favorite Mistake strategy to participants.

Set the stage with **slide 39**. You have asked the class to solve the equation: $7(x+1) = 4x - 8(x-6)$. The class already has solved the equation, and you (acting as the teacher) have selected your favorite mistake, which is shown on the right.

Go to **slide 40** and ask participants to assume the role of students. Ask the group (acting as the class) what was done well by the student who worked out the problem on the slide. After several responses, ask the group to find the mistake.

Sample Responses

The fictional student did some of the math correctly—in fact, they made only one mistake. The work that was done correctly includes distributing on both sides, adding 8x to both sides, subtracting 4x from both sides, and dividing both sides by 11.

Once participants have completed the activity, remind them to use their Note Catchers to take notes on how they might use the My Favorite Mistake strategy in their own classrooms.

15 minutes

Evaluate

Display **slide 41**. Have participants use the What? So What? Now What? strategy to reflect on what they have learned from the institute, why formative assessment is important, and what they plan to do with this information. Ask participants to record their responses on their Note Catchers and consider how they might use this strategy in their own classrooms.

To conclude the session, go to **slide 42** and share some of K20's math lessons that use the What? So What? Now What? strategy. The showcased lessons consist of a Geometry lesson, "Trig-O-Nom-E-Tree," and an Algebra 2 lesson, "Expanding Binomials, Expanding Your Mind (Part 1)."

Research Rationale

Analyzing the current skill level of students in a classroom at any given time and determining the best course of action to ensure they all meet the target learning goals can be a challenge, even for seasoned teachers. The idea of using formative assessment to meet students' individual needs is not new. In fact, researchers as far back as Benjamin Bloom have shown that one-to-one tutoring is the most effective form of instruction because of the tutor's ability to pinpoint misconceptions and provide immediate feedback and correctives (William, 2011). Despite continued research that shows formative assessment can enhance student success, many teachers struggle to use the full array of formative assessment practices available. The question then becomes: What can teachers do to effectively improve and enhance their use of formative assessment in the classroom environment?

Resources

- Keeley, P., & Tobey, C. R. (2011). Mathematics Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning. Thousand Oaks, CA: Corwin, SAGE.
- K20 Center. (n.d.). 3-2-1. Strategies. https://learn.k20center.ou.edu/strategy/117
- K20 Center. (n.d.). Bell Ringers and Exit Tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Fist to Five. Strategies. https://learn.k20center.ou.edu/strategy/68
- K20 Center. (n.d.). Muddiest Point. Strategies. https://learn.k20center.ou.edu/strategy/109
- K20 Center. (n.d.). My Favorite Mistake. Strategies. https://learn.k20center.ou.edu/strategy/115
- K20 Center. (n.d.). Not Like the Others. Strategies. https://learn.k20center.ou.edu/strategy/77
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- Oklahoma State Department of Education. (2016). Oklahoma Academic Standards for Mathematics [PDF]. The State of Oklahoma. https://sde.ok.gov/sites/ok.gov.sde/files/OAS-Math-Final%20Version_3.pdf
- William, D. (2011). What is assessment for learning? Studies in Educational Evaluation, 37(1), 3-14. doi:https://doi.org/10.1016/j.stueduc.2011.03.001