

Math in Action: Bringing Principles to Life with Authentic Learning

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Time Frame 60–90 Minutes

Essential Question(s)

How can teachers enhance student engagement and learning?

Summary

Engage in an interactive professional learning experience that bridges NCTM's Principles to Action with the K20 Authenticity Framework. Participants will explore effective teaching practices that enhance student engagement and deepen learning by analyzing the connection between research-based strategies and authentic instruction. Through hands-on activities and collaborative discussions, participants will gain practical strategies to apply in their classrooms, ensuring meaningful and student-centered learning experiences.

Learning Goals

- Analyze the relationship between the Effective Teaching and Learning Practices and the K20 Authenticity Framework.
- Create a plan to implement best teaching practices in the classroom.

Attachments

- 3-2-1 Organizer—Math In Action.docx
- 3-2-1 Organizer—Math In Action.pdf
- Honeycomb Harvest Cards—Math In Action.docx
- Honeycomb Harvest Cards—Math In Action.pdf
- Math Interview Guide—Math In Action.docx
- Math Interview Guide—Math In Action.pdf
- Mathematics Teaching Practices Posters—Math In Action.docx
- Mathematics Teaching Practices Posters—Math In Action.pdf
- Note Catcher—Math In Action.docx
- Note Catcher—Math In Action.pdf
- Presentation Slides—Math In Action.pptx

Materials

- Presentation Slides (attached)
- Honeycomb Harvest Cards (attached; one per group)
- Math Interview Guide handout (attached; optional; one per participant
- Mathematics Teaching Practices Poster (attached; one per session)
- Note Catcher (attached; one per participant)
- 3-2-1 Organizer (attached; one per participant)

Preparation

This PD was written to be completed during a 60–90 minute meeting or a PLC meeting with limited time. If this PD is done during two 45-minute sessions—like a PLC meeting—do the Engage, Explore, Explain in one meeting, and the Extend and Evaluate in the next meeting.

Throughout the facilitation of this professional learning, use the speaker notes located in the PowerPoint slides for additional insights and information about the presentation.

Prior to facilitating the session, print out the **Mathematics Teaching Practices Posters** and hang them around the room.

The **Honeycomb Harvest Cards** handout is seven pages. Print enough copies to distribute one per pair or small group. Pages 1–6 are for the Engage phase of the lesson. Page 7 is for the Explore phase. Prior to the session, cut out the cards for pages 1–6 and use a paperclip, envelope, or zip top bag to keep them together.

Optional Activity Extension

If you have extra time, you can include the descriptive quotes (white cards) from the text to the honeycomb harvest and ask the participants to match the practice, definition, and quote (3 cards) together. If you are doing this, edit slide 3 to include a third sub-bullet point under definition that says, “Quote (Italics)” and include the “Quote” as a third matching criterion in the second bullet point.

Cut the cards on page 7 and group them separately from the other two. These will be used during the Explore phase when the work from the Engage is is tied in with the components of authenticity.

15 minutes

Engage

Use the attached **Activity Slides** to guide participants through the session. Start with **slide 3** and invite participants to engage in the Honeycomb Harvest instructional strategy. Pass out the **Honeycomb Harvest Cards** to pairs or small groups. Have participants match NCTM's Effective Teaching and Learning Practices (blue cards) with their corresponding definition (grey cards).

Once participants are finished, show **slide 4** and facilitate a brief discussion using the following prompts:

- What practices do you see most often in your own instruction?
- Which feels more challenging to implement?

After the discussion, remind participants not to move their cards because they will come back to them. Move to **slide 5,** and briefly, read aloud the essential question on this slide: "How can teachers enhance student engagement and learning?" Move to **slide 6** and discuss the objectives on the slide. Let participants know what they can expect from the session.

Optional Slide

For emphasis, unhide **slide 7** to show that these Teaching and Learning Practices are not standalone but most effective when embedded in authentic learning experiences.

10 minutes

Explore

Transition to **slide 8** and introduce the second layer of the Honeycomb Harvest by passing out the Authenticity Component cards — the green ones from the Honeycomb Harvest Cards handout. Ask the participants to now connect the components of authenticity to the Teaching and Learning Practices. If a component can align with multiple practices, move the cards in a way that allows the component to touch as many of those practices as possible, effectively turning the table into a mind map. Encourage groups to discuss their reasoning as they work together to build their Honeycomb Harvest. Prompt them to use evidence from their teaching experience or their understanding of the Practices of Authenticity.

While groups are working, circulate and listen for productive talk. Transition to **slide 9** and facilitate a brief discussion inviting groups to share their honeycombs, the reasoning behind their decisions and the following questions:

- "How do these components of authenticity show up in your classroom when you use these practices?"
- "Where do you see overlap or tension between a practice and an authenticity component?"

Emphasize that authenticity is multifaceted. Acknowledge that the connections between practice and components are interpreted differently and that is ok. It's the intention and justification that matters. There is no one single path fitting all contexts.

Optional Slides

If time allows, unhide **slide 10–11** and invite 1–2 groups to briefly share how they connected the authenticity components with the practices. Use the unhidden slides to model how a group could have connected authenticity to the practices.

10 minutes

Explain

Use **slide 12** and introduce the *Authentic Learning and Teaching* chart. Invite participants to read and reflect on the components and actions listed in the chart. Emphasize that this chart summarizes the specific actions of teachers and students in a classroom when Authenticity is present. After participants have had a minute to look at the chart, facilitate a brief discussion using the following prompts:

- What characteristics in the Teaching and Learning Practices chart are *familiar*?
- What characteristics are *new* or *surprising*?

Transition to **slide 13** and play the 90 second video on Authenticity to introduce Authenticity and its meaning and purpose. Emphasize how K20 has coined the term Authenticity to summarize what education research has proven to be best practices for teaching and learning and that the resources they will explore later aim to help educators accomplish those best practices in their classrooms.

Next, use **slide 14** to talk about the purpose for and creation of the Principles to Actions by NCTM. Emphasize that the Principles to Actions were created by NCTM to give educators guidance on *how* to best make math content standards meaningful and successful. NCTM's goal for ***Principles to Actions*** was to help educators bring math standards to life through effective teaching practices, policies and school-wide decisions.

Emphasize that while the K20 center and NCTM independently set out to improve education and classroom practices, their research into best practices resulted in many of the same findings and overlapping research —point to the mind map that the participants constructed earlier in the professional learning and briefly point out 1–2 examples of Components (green cards) and practices (blue cards) that appear very similar through their definitions.

Use **slides 15–16** to establish the connection between Teaching and Learning Practices and Authenticity, and their purpose in the math classroom. Using slide 15, explain that Authenticity is the overarching "framework" that guides a teacher's teaching philosophy. The Effective Teaching and Learning Practices are the practices that are implemented in the classroom that promote those authentic components, and the instructional strategies are the day-to-day ways we go about implementing those practices in a meaningful, engaging classroom.

Using slide 16, ask the question: "How can this model shape how we plan our math instruction?" After a few responses, emphasize that a way this model can shape planning math instruction is through the intentionality and shift in thinking when planning lessons. In Authenticity the goal is to first focus on which authentic component can be improved in the classroom such as "increasing student centered learning" or "better inquiry based learning" for example, then use that to drive the teaching of the standard through more student collaboration or productive discourse. This kind of planning leads to increased student engagement.

Display **slides 17–19** to show a sample scenario to walk through with the group. Starting with a K20 Authenticity component that will then inform what teaching and learning practice could be developed and which instructional strategies could support the development of these skills.

- **Authenticity Component**: Student-Centered Learning
- **Practice**: Elicit and Use Evidence of Student Thinking
- **Strategy:** Math Interview

Optional Activity

If time allows, pass out the attached **Math Interview Handout** for the participants to review and discuss how this strategy supports the practices and how those practices foster student-centered learning.

Facilitator's Note: Pacing

If this PD is done during a 45 minute meeting, stop here and start with the Extend in the next meeting.

20 minutes

Extend

Move to **slide 20**, pass out the **Note Catcher** handout, and introduce the Gallery Walk instructional strategy to the participant. Explain that around the room are **Mathematics Teaching Practices Posters**, which have one of the Effective Teaching and Learning Practices from *Principles to Actions*, and each poster lists specific instructional strategies that align with that practice.

Point out the Note Catcher to the participants and let them know that their goal is to identify at least one strategy for each authenticity component. For each strategy they choose, record its name and the practice poster it came from. Instruct participants to take their Authenticity Teaching and Learning chart with them to the posters to remind them of the components if they need that support.

Set a 10-minute timer and allow participants to walk freely between posters to explore the instructional strategies and take notes on their paper.

After the timer has ended, have participants return to their tables. Transition to **slide 21**, and ask groups to quickly respond to the following prompt: “Share one or two strategies you chose and explain how you see them supporting authentic learning in your classroom.”

5 minutes

Evaluate

Once groups have had enough time to share, move to **slide 22** and introduce the 3-2-1 instructional strategy. Pass out the **3-2-1 Organizer** handout to each participant. Give participants a couple of minutes to individually answer the prompts on their page. Encourage participants to be specific and reference strategies from the gallery walk, discussions, or their own experience.

If time allows, invite participants to share one of their commitments with a partner or their table. Transition to **slide 23** and wrap up the professional learning with the sources slide.

Research Rationale

Authentic learning and teaching empower educators to “infuse learning with purpose and meaning so that students develop the skills necessary to fully engage with the world at large” (K20 Ideals, 2023). This approach serves as a guiding lens for all educational practices, emphasizing real-world connections, inquiry-based learning, student-centered approaches, and the active construction of knowledge. These components align closely with the NCTM’s mathematical teaching practices, which offer focused pathways for effective classroom instruction. Each practice reinforces one or more elements of authenticity, providing a clear framework for implementing high-leverage strategies that promote deep mathematical understanding (NCTM *Principles to Actions*, 2014). However, without opportunities to connect theory to practice, both teachers and students may become frustrated and disengaged. This professional development resource addresses that gap by offering instructional strategies that help students bridge prior knowledge with new concepts through the use of texts, hands-on activities, and peer collaboration.

Resources

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