

Who's Asking: Inquiry and Discourse in Math

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Essential Question(s)

- How do we promote inquiry and discourse in the math classroom?

Summary

In this professional learning session, participants experience and analyze instructional strategies that promote inquiry and mathematical discourse. Through modeled activities and structured reflection, participants examine how these various instructional strategies support student engagement, reasoning, and fluency in mathematical concepts, and identify concrete ways to apply these strategies in a future mathematics lesson.

Learning Goals

Attachments

- Notes and Reflections—Who's Asking.docx
- Notes and Reflections—Who's Asking.pdf
- Presentation Slides—Who's Asking.pptx

Materials

- Presentation Slides (attached)
- Notes and Reflections handout (attached; one per participant; print two-sided)
- Highlighters
- Poster board
- Markers
- Pens and/or pencils

10 minutes

Engage

Use the attached **Presentation Slides** to guide the session. Display **slide 2** as participants are entering the room. Ask them to think about their answer to the question on the slide and to have a response ready when the session begins.

Once participants are seated, display **slide 3** and introduce the presenters. Show **slides 4–5** and go over the essential question and learning objectives of the session.

Show **slide 6** and ask participants to raise their hands when you call the number they chose. Call out each number on the slide. Note which numbers, if any, do not receive votes.

Facilitator's Note: Additional Questions

If a number did not receive any votes, consider asking participants if they can give a reason as to why that number could be the one that doesn't belong.

Move to **slide 7** and introduce the Not Like the Others instructional strategy. Explain to participants that the versatility of this strategy exists in that there can be one correct answer, or there can be many correct answers, depending on the needs of the group for challenge or confidence. The growth and learning come from the explanations students give. Share that if there is no correct answer, the teacher may choose to inform students of this ahead of time, or keep it as a surprise until after student answers have been given.

Elicit responses to the following questions present on the slide:

- How does this strategy develop vocabulary?
- How does this strategy lower barriers to participation?

Distribute one copy of the **Notes and Reflections** handout to each participant and encourage participants to jot down notes on how they could use this strategy in their own classroom.

10 minutes

Explore

Show **slide 8**. Give participants 30–45 seconds to answer the question in their heads.

Ask for volunteers to explain how they solved the problem. Consider having a co-presenter write their processes on a whiteboard, poster paper, or digital whiteboard (like the space provided on **slide 9**). Have at least two or three participants share strategies for solving the problem and lead a discussion about the similarities and differences in the strategies. If possible, show how two participants took different approaches and still arrived at the same correct answer.

Display **slide 10** and repeat the process. Have participants solve the question in their heads, then invite participants to share out their responses along with their strategies for solving the problem. Draw any parallels that may help connect different methods.

Show **slide 11** and introduce the Strategy Harvest instructional strategy. Explain that this strategy can be used to create activities with a low participation barrier, so students can engage with the material even if they do not have extensive mathematical knowledge. Share that problems using this strategy can be at any difficulty level so that all students can participate. Ask participants to share out responses to the following questions on the slide:

- How does this strategy strengthen metacognitive skills?
- How does this strategy increase student confidence?

Encourage participants to consider their responses to the questions and have them record ideas of how they could use this strategy in their classrooms using the Notes and Reflections handout.

10 minutes

Explain

Show **slide 12** have participants read and consider the quote from Eugène Ionesco. Explain that students learn more when they ask questions as opposed to when teachers ask most of the questions. Share that questions make way for curiosity, discussion, and deeper learning.

Show **slide 13** and discuss the K20 Center's theory of Authenticity and the Components of Authenticity. Consider sharing the *What is Authenticity?* infographic with participants. Offer a brief overview of the four Components of Authenticity: Student-Centered Learning, Construction of Knowledge, Real-World Connections, and Inquiry-Based Learning. End on Inquiry-Based Learning to transition into the next activity.

Display **slide 14** and elaborate on Inquiry-Based Learning. Ask participants to discuss the statement on the slide about research with their table group for approximately 1–2 minutes. Call on a few tables to share out what they discussed.

Ask participants to look at the back side of their Notes and Reflections handout and display **slide 15**. Explain that this is a list of student and teacher actions that occur in a classroom where discourse and inquiry are encouraged. Have participants spend approximately 3 minutes highlighting actions that already take place in their classrooms in one color and highlighting actions they want to improve in their classroom in another color. Have them share their highlighted actions with their tables.

Move to **slide 16** and highlight the differences between inquiry and discourse. Share that inquiry is about curiosity, asking questions, and searching for answers. Share that inquiry should be done with discourse and input from other perspectives, so that students do not find answers that hold little meaning or value. Tell participants that discourse involves collaborative conversation about a topic. Share that discourse should be done alongside inquiry with a driving question and focus, so that it does not devolve into a meaningless conversation.

Show **slide 17** and briefly review the Common Core *Standards for Mathematical Practice*. Invite volunteers to share how these actions and practices are supported in inquiry-based or discourse-based learning.

10 minutes

Extend

Transition to **slide 18** and introduce the Question Formulation Technique (QFT) instructional strategy. Give each table a one piece of poster board and markers. Share that participants should generate as many questions as possible about the problem that will appear on the following slide. Share the rules for creating questions that are also present on the slide

- Ask as many questions as you can without stopping to discuss, judge, or answer questions.
- Write down every question exactly as it is stated. Change any statement into a question.

Present participants with the prompt on **slide 19**. Give participants three minutes to create questions related to the prompt. Have them record all of their questions on the poster board at their table.

Display **slide 20**. Give groups three minutes to identify one closed-ended question from their poster and change it to an open-ended question, and to identify their top three questions.

If time permits, invite groups to share out their top questions.

Show **slide 21** and elaborate on the Question Formulation Technique instructional strategy. Emphasize that a main intention of this strategy is to list all possible questions and further refine them into better questions, not to censor questions. Invite participants to share out responses to the following questions:

- How does this strategy build curiosity?
- How does this strategy clarify thinking and focus?

Encourage participants to think about how they might use this strategy in their own classrooms.

5 minutes

Evaluate

Bring the session to a close and display **slide 22**. Remind participants of the three instructional strategies demonstrated in the session. Allow participants approximately five minutes (or other length of time depending on needs) to complete the chart and two reflection questions on the Notes and Reflections handout:

- How can an increase in inquiry and discourse help my students?
- What is one strategy I can integrate into my content within the next two weeks to encourage inquiry and discourse with my students?

Research Rationale

Authentic learning—exploring meaningful concepts, their relationships, and real-world context—is inherent to disciplined inquiry and complex understanding. Rule (2006) noted that rich problems adhere to principles such as "personal meaningfulness to students; construction, refinement, or extension of a model; self-evaluation; documentation of mathematical thinking; useful prototype for other structurally similar problems; and generalization to a broader range of situations."

Unsurprisingly, these traits are similar to the traits of good essential questions. There are a number of academic benefits for students and teachers that can be easily accomplished by budgeting time and space in the classroom for students to have conversations. When student conversation is an integrated part of the learning, students get practice working with one another, being accountable to others, listening, sharing their ideas in ways that others can understand, and working together to make decisions (Gillies, 2016; Resnick, Michaels, & Connor, 2010; Gibbs, 2006).

Learning that results from student conversations increases student motivation, self-esteem, and problem-solving outcomes. Giving students a space to speak also gives teachers insight into how students are organizing their thoughts, and these conversations can serve as formative assessments of what students are learning during the course of a lesson.

Resources

- Common Core State Standards Initiative. (2010). *Standards for mathematical practice.* https://www.thecorestandards.org/Math/Practice/
- Gibbs, J. (2006). *Reaching all by creating Tribes learning communities: A new way of learning and being together.* CenterSource Systems.
- Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education, 41*(3). http://dx.doi.org/10.14221/ajte.2016v41n3.3
- K20 Center. (n.d.). Not like the others. Strategies. https://learn.k20center.ou.edu/strategy/77
- K20 Center. (n.d.). Question formulation technique. Strategies. https://learn.k20center.ou.edu/strategy/5188
- K20 Center. (n.d.). Strategy harvest. Strategies. https://learn.k20center.ou.edu/strategy/135
- Resnick, L. B., Michaels, S., & O'Connor, M. C. (2010). How (well-structured) talk builds the mind. In D. D. Preiss & R. J. Sternberg (Eds.), *Innovations in educational psychology: Perspectives on learning, teaching, and human development* (p. 163–194). Springer Publishing Company.
- Rule, A. C. (2006). The components of authentic learning. *Journal of Authentic Learning, 3*(1), 1–10. https://soar.suny.edu/entities/publication/44ccd885-1ccf-46bd-8da2-6fd4889eff16