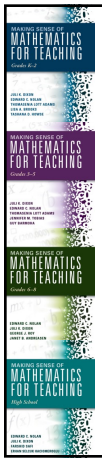


Building a Productive Climate for Effective Questioning

Edward C. Nolan
ednolan@dnamath.com

http://www.dnamath.com/presentations/

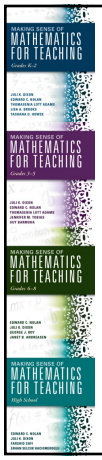
© 2026 Ed Nolan



Session Goals

- Share strategies for student engagement.
- Discuss how to use questioning to engage students in learning.
- Link teaching outcomes to positive visions of learning.

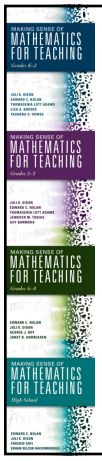
© 2026 Ed Nolan



Student Engagement

- What do our students look for in their mathematics class?
- What do we look for in our mathematics classes?
- How do we engage students in our lessons?

© 2026 Ed Nolan



Focus on Questioning

"In a general sense, **teachers' questions** control students' learning because they **focus students' attention on specific features** of the concepts that they explore in class. Moreover, these questions **establish and validate students' perceptions** about what is important to know to succeed in mathematics class."

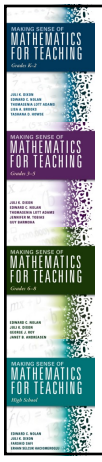
- Azita Manouchehri & Douglas A. Lapp

© 2026 Ed Nolan

Role of Questioning

Questioning can provide teachers a structure for **helping students through hints and clues as well as probing student responses** to understand their thinking (van den Kieboom et al., 2014).

Teacher questions need to build on one another, allowing **students** "**to identify thinking** processes, **to see the connections** between ideas and **to build new understanding** as they work their way to a **solution that makes sense to them**" (Ontario Ministry of Education, 2011).

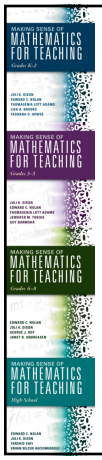


Plan with the TQE Process in Mind



- **Tasks** connect to learning goals and help identify student errors.
- **Questions** elicit mathematical understandings and common errors.
- **Evidence** drives scaffolding and guides extensions.

© 2026 Ed Nolan

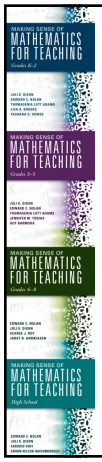


Focus on Questioning

Learning Target:

Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$.

© 2026 Ed Nolan

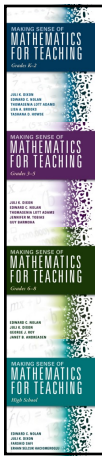


Focus on Questioning

Solve the following task.

Think about how you might support students to engage with this task during instruction.

© 2026 Ed Nolan



Focus on Questioning

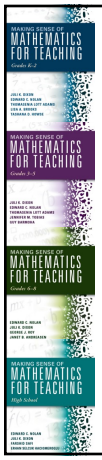
PROBLEM

Consider this equation:

$$x^2 - 4x = 5$$

How can thinking of this as $f(x) = g(x)$ and sketching each function help to determine the number of solutions to this equation?

© 2026 Ed Nolan

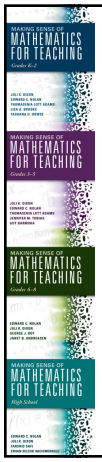


Focus on Questioning

What are some strategies to determine the solution?

What errors might students make?

© 2026 Ed Nolan



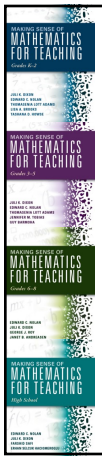
Plan with the TQE Process in Mind



Questions

- Identify opportunities for students to do the sense making and think of questions to encourage this.
- Anticipate students' potential errors. Prepare questions to be posed during instruction and anticipate students' responses.

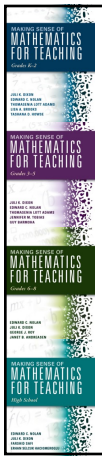
© 2026 Ed Nolan



Anticipating Questions

Teachers anticipate what may happen in the lesson, creating a "**hypothetical learning trajectory**" (Simon, 1995, p. 135) for the lesson. Effective planning can provide high-cognitive-level questions that are be difficult to create while teaching. This is why planning is so important to effective questioning (Nolan, Dixon, Roy, & Andreasen, 2016).

© 2026 Ed Nolan

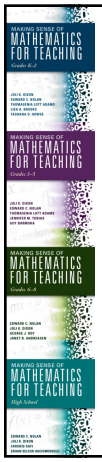


Focus on Questioning

What questions are asked in the video?

What is the "impact" of each of these questions?

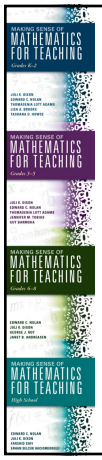
© 2026 Ed Nolan



Creating an Image

- How do the questions you plan define your classroom environment?
- How do your planned questions impact the questions you ask while teaching?

© 2026 Ed Nolan



Dig into the Dialogue

Examine the transcript to explore questions used to support this task during instruction.

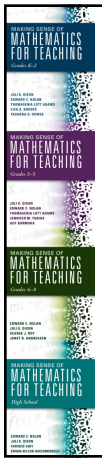
How did the questions elicit different types of responses?

© 2026 Ed Nolan

Enacting Questions

Teachers need to be able to **ask questions guided not only by the task at hand, but in consideration of students' present abilities, as well as those they need to develop in the future** (Thompson & Zeuli, 1999).

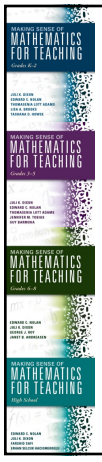
Lessons should **provide opportunities for students to use their own reasoning** in performing mathematical tasks (Lobato, Hohensee, Rhodehamel, & Diamond, 2012).



How did the use of questions rate?

The teacher's role in following up on students' responses supports students to engage in mathematical discourse.

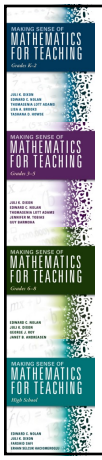
© 2026 Ed Nolan



Focusing on Student Thinking

1. Plan multiple question-and response pathways
2. Ask open-ended questions
3. Listen actively to student answers
4. Act to privilege student thinking
5. Reflect on how the lesson engages students

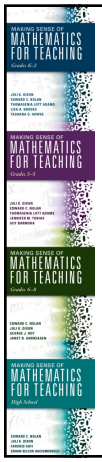
© 2026 Ed Nolan



Discourse Norms

- Provide explanations and justifications with solutions.
- Make sense of others' solutions.
- Communicate when you don't understand or don't agree.

© 2026 Ed Nolan

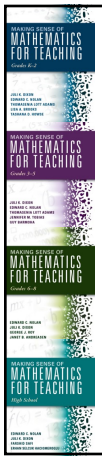


Grounding our Work

To ensure that students have the opportunity to engage in high-level thinking, teachers must regularly select and implement tasks that promote reasoning and problem solving.

(National Council of Teachers of Mathematics, 2014, p. 17)

© 2026 Ed Nolan

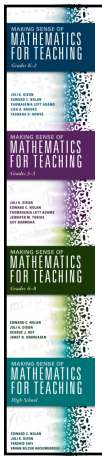


The importance of task implementation

In research on the use of cognitively challenging tasks, the greatest impact on students' learning occurred in classrooms where teachers consistently maintained the demand of the task during implementation.

(Cai et al., 2011; Grouws et al., 2013)

© 2026 Ed Nolan

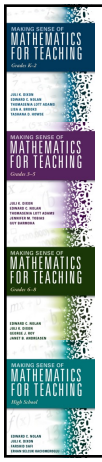


And as a Summary…

How does this apply to our work?

What are the takeaways that you can use?

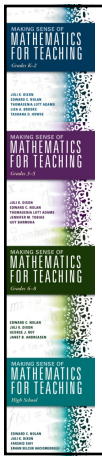
© 2026 Ed Nolan



Creating an Image

- How do the questions you plan define your classroom environment?
- How do your planned questions impact the questions you ask while teaching?

© 2026 Ed Nolan



The Process in Action

Ambitious teaching (Lampert et al., 2013) requires teachers to not only use the preconceived ideas developed in their lesson plans but also **to incorporate in-the-moment decisions to integrate the focus both on the learning goal and the thinking of the students**.

© 2026 Ed Nolan