

BetterLesson Professional Learning Webinar

Introduction to the 5 Practices for Orchestrating Productive Mathematics Discussions



Setting Goals & Selecting Tasks Ohio Department of Education & Workforce January 17th 3:30-4:30pm Padraic O'Donnell & Megan Nagel

Welcome!



Welcome!

Share in the chat:

- Where are you joining us from today?
- What is your current role?
- How many snow days have you had this year?



Aligned & Tailored for Ohio ESC Partnership



Aligned

Our partnership is specifically designed to amplify the impact of other state-wide infrastructure and initiatives, specifically:

Materials Matter

BetterLesson[®]

- HQIM-related work streams with EdReports & Instruction Partners
- Ohio Standards for Mathematical Practice



Tailored

Our BL team has worked with leadership from the ESC of Central Ohio, OESCA, and the Department of Education & Workforce to tailor our professional learning experiences to our Ohio partners.





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Your Hosts



Padraic O'Donnell Instructional Coach



Megan Nagel Instructional Coach



Lisa Fik Instructional Coach (Tech Support)

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Department of Education & Workforce

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Our Webinar Series: The 5 Practices for Orchestrating Productive Mathematics Discussions



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Anticipating & Monitoring



Selecting & Sequencing



Connecting Student Ideas to Learning Goals





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Let's Check In!

How familiar are you with the 5 Practices?



I've never heard of it or I've heard a little bit



I'm aware of it, but need more explanation



I know what the 5 Practices are



I try to use the 5 Practices in my lessons



I can teach the 5 Practices to others!





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5 Practices and Meaningful Discourse



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Meaningful Mathematical Discourse

Thinking about your classroom and students...

- How would you define discourse?
- What makes that discourse "meaningful"?

Share your thoughts in the chat!



Mathematical Discourse Defined

"...ways of representing, thinking, talking, agreeing, and

disagreeing; the way ideas are exchanged and what the ideas

entail; and as being shaped by the task in which student engage

as well as by the nature of the learning environment. "

National Council of Teachers of Mathematics

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Goals and Realities for Math Teaching and Learning

- Cognitively demanding, engaging tasks
- Students as authors of ideas
- Deep learning of key mathematical concepts

- Maintaining cognitive demand is challenging
- Responding in real-time to student thinking is demanding
- Student autonomy and learning goals require balance

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Supporting Effective Teaching with the 5 Practices



5 Practices for Orchestrating Productive Mathematics Discussions





Professional Learning Reimagined

Our Series: The 5 Practices for Orchestrating Productive Mathematics Discussions



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Goal

Explore tools and strategies that lay the foundation for productive discourse

DEFINE	EXPLORE	BUILD	TRY, MEASURE, LEARN
5 Practices and Meaningful Discourse	Laying the Groundwork with Practice 0: Setting Goals & Selecting Tasks	Understanding with resources for Practice 0	+
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Explore

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Practice 0: Setting Goals & Selecting Tasks



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Practice 0: Setting Goals and Selecting Tasks

Lays the groundwork for the five practices

Productive discussions based in clear goals and high cognitive tasks

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Setting Goals for Instruction

Variety of ways to set goals/Explicit goals for planning

What's the difference between these 3 goals? Why does it matter?

- **Goal A:** Students will learn the Pythagorean Theorem
- **Goal B:** Students will be able to (SWBAT) use the Pythagorean theorem to solve a series of missing value problems.
- **Goal C:** Students will recognize that the area of the square built on the hypotenuse of a right triangle is equal to the sum of the areas of the squares built on the legs and will conjecture that c² = a² + b²





Performance vs Learning Goals

Performance goals:

outcome-oriented and focus on achievement

- Specific result(s) over time
- Achievement does not always equal deep learning
- Long term Standards

Learning goals: process-oriented and focus on learning process.

- Enhance a task and how a task should be completed.
- Create space for learning and revising thinking
- Short term

Unpacking standards, curriculum



Explicit Learning Goals

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"Without explicit learning goals, it is difficult to know what counts as evidence of students' learning, how students' learning can be linked to particular instructional activities, and how to revise instruction to facilitate students' learning more effectively. Formulating clear, explicit learning goals sets the stage for everything else."

Preparing Teachers to Learn from Teaching, Hiebert



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Writing Learning Goals

What possible learning goals could come from these standards?

- Learning goals focus on math relationships
- Consider connections students must make in order to get to this point.
- Don't be afraid to get narrow.

2.NBT.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

8.EE.1 Understand, explain, and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

F.BF.1 Write a function that describes a relationship between two quantities

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Writing Learning Goals (Examples)

2.NBT.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

8.EE.1 Understand, explain, and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Use the relative position on a number line to compare two three-digit numbers.

Use the value of each place value digit to compare two three-digit numbers.

Generalize exponent rules for nonzero bases, including bases other than 10.

Use exponent rules to identify (in writing) equivalent exponential expressions, and explain (orally) the reasoning.

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Writing Learning Goals (Examples)

F.BF.1 Write a function that describes a relationship between two quantities

Find the inverse of a linear function given in function notation.

Write a linear function and an inverse function to model data and solve problems.

Identify a transformation needed to fit a function to data and represent the new function with an equation.

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Selecting Quality Math Tasks

What are the characteristics of quality math tasks?





Matching a task to a goal

- High-level tasks provide opportunities for thinking and reasoning
 - Procedures with connections
 - Doing mathematics
- Task selection should align to goals and connect to prior knowledge and experience
- Can come from a curriculum or can be modified to high cognitive demand



Considerations for Selecting Math Tasks



Alignment and Relevance

Connects to learning goals, student experiences and interests

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Connections to Prior Knowledge Builds conceptual understanding and connections to prior knowledge

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Reasoning and Problem Solving Includes appropriate levels of cognitive demand to be intellectually engaging



Flexibility

Flexibility in strategy and solutions, along with the ability to differentiate and improve accessibility

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Selecting Quality Math Tasks



What type of thinking are students engaging in with these tasks? How does that impact discussions?

Online reading & math for K-5	© www.k5learning.com	Γ		Printable Math Worksheets @ www.mathworksheets4kids.com	
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Value of Quality Math Tasks

"Quality tasks provide opportunities for students to think deeply about mathematics, to make connections among mathematical ideas, and to develop a robust understanding of important mathematical concepts...By selecting quality tasks, teachers provide students with the opportunity to engage in mathematical practices such as problem solving, reasoning, communicating, and making connections"

Implementing Standard-Based Mathematics Instruction



Emily is training for a marathon. She runs at a constant speed and completes 5 laps around the park in 40 minutes. What is Emily's average speed in laps per minute?







A school carnival ticket booth posts the following sign:



TICKET BOOTH 1 ticket for \$0.50 12 tickets for \$5.00 25 tickets for \$10.00 50 tickets for \$25.00 120 tickets for \$50.00 HAVE FUN!

Which amount of tickets offer the best deal? Explain.

How would you suggest the students running the ticket booth modify the list

of prices?

Rate Match-Up

- 1. Work with a partner. Shuffle the cards and spread them out face down.
- 2. One person turns one card over. Both players find the unit rate and race to find the matching card. If someone makes a mistake, they have to give their card to the other player.
- 3. Continue until there are no cards left.

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A recipe calls for 2 cups of flour for every 3 cups of sugar. How much flour is needed if you have 6 cups of sugar?

50 miles per hour

Levels of Cognitive Demand

Developed based on the kind and level of thinking to solve the problem.







Higher Level Cognitive Demand



- Active inquiry and exploration
- Encourage use of procedures connected to concepts or understanding.
- Focus on reasoning and problem solving
- Low-floor, high ceilings, wide walls
- Tap in to the standards of mathematics practice



A school carnival ticket booth posts the following sign:

- No suggested path
- Problem can be represented in multiple ways.
- Unspecified sequence of steps
- Flexibility in responses

TICKET BOOTH 1 ticket for \$0.50 12 tickets for \$5.00 25 tickets for \$10.00 50 tickets for \$25.00 120 tickets for \$50.00 HAVE FUN!

Which amount of tickets offer the best deal? Explain. How would you suggest the students running the ticket booth modify the list of prices?



Lower Level Cognitive Demand



- Procedures, formulas, and algorithms without linking to meaning
- Memorization and recall of facts
- Limited use of mathematical practices



Emily is training for a marathon. She runs at a constant speed and completes 5 laps around the park in 40 minutes. What is Emily's average speed in laps per minute?

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 Procedure is strongly implied

- Focused on a single right answer
- No connections to steps or meaning
- Little flexibility in how to do the problem

Rate Match-Up

- 1. Work with a partner. Shuffle the cards and spread them out face down.
- 2. One person turns one card over. Both players find the unit rate and race to find the matching card. If someone makes a mistake, they have to give their card to the other player.
- 3. Continue until there are no cards left.

- Little cognitive demand for success
- Emphasizes speed
- No connections to meaning
- Single procedure likely followed for each.



Selecting Lower-Level Demand Tasks



Share your thoughts:

- When would you select a task with lower cognitive demand?
- **How** would you use tasks focused on memorization and applying procedures?



Selecting Lower-level Demand Tasks

Accurate, efficient strategies come *from* conceptual understanding and solving problems. Low demand tasks promote retrieval of information and efficiency.



Low demand tasks should:

- Align with the learning target
- Build on and emerge from problem solving experiences
- Reinforce skills students have mastered



Low demand tasks should NOT:

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- Dominate instructional time
- Preempt a task that promotes reasoning



Tasks and Learning Goals

Learning Goal: Students will recognize how operations in an equation determine how they will solve the equation.

How does this task connect to the learning goal?



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Make Use of Structure

Think about what these equations mean, and find their solutions. Write a sentence explaining how you know your solution is correct.

a. x + 6 = 10b. 1000 - y = 400c. 100 = m + 99d. 0.99 = 1 - te. 3a = 300f. $\frac{1}{2}p = 8$ g. 10 = 0.1wh. 1 = 50b

Synthesis

- Practice 0: 2 steps prior to the 5 Practices that lay the groundwork for planning for student learning
 - **Step 1**: Learning goals are the incremental steps towards a greater outcome
 - **Step 2:** High-level tasks create reasoning and thinking opportunities for students to achieve learning goals



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How can we make this work actionable?



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Let's Explore: Strategy Choice Board

Choose any of the sections below and explore the related BL resources & strategies.

Learn More About High-Level Math Tasks Mathematical Task Analysis Guide

Evaluate and Modify Existing Math Tasks

BetterLesson Strategy Preview the 5 Practices

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Q & A

What questions do you have about our conversation today?





We value your feedback!

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Your input is important to us, please take a moment to complete our survey using the link in the chat. Please include your name and email for credit.





Thank you!





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