Math Practice 4: Model with Mathematics (Building and District Leader Facilitation Guide)

Presenter:

Intended Use

This facilitation guide is designed for district and school leaders to use when delivering sessions on the Standards for Mathematical Practice 4: Model with Mathematics. The document can be used by district and building leaders to facilitate broader conversations on the use of local data, focusing on the broader impact of the MPs across building and district levels. Its purpose is to help broaden discussions with staff members on Math Practice 4 (MP 4) to a building and district level.

Viewing the Math Practice series can be done in any order. While viewing the series is encouraged in groups, it can also be done individually. To get the full benefit of the professional development series, educators should engage in the tasks and participate in local discussions on Mathematical Practice. Therefore, viewing the professional learning series in small groups is encouraged over individuals watching it in isolation.

Reproducing the Facilitation Guide

During Facilitation: Discussion Questions

Pause the recording at the times indicated in the recording and have discussions in smaller groups, and then in the larger group.

DISCUSSION QUESTIONS

PowerPoint Slide 16: Act 1 - A Guatemalan Sinkhole Activity

- What do you notice?
- What do you wonder?

Other potential discussion questions include:

- How much material will they need to fill the sinkhole?
- How much will it cost to fill the sinkhole?
- What events cause sinkholes?
- Why did it happen here instead of somewhere else?
- What are the land compositions that cause sinkholes?

DISCUSSION QUESTIONS

PowerPoint Slide 17: Act 2 - Estimate

- What do you know?
- What information do we need?
- Create a high estimate and a low estimate for the volume of this sinkhole.

DISCUSSION QUESTION

PowerPoint Slide 18: Act 2 – Create a Mathematical Model to Describe the Situation

- Create a model to describe the situation using the measurements given.

DISCUSSION QUESTIONS

PowerPoint Slide 20: Act 3 – Next Steps

- How could you revise your model to make it better?
- What new questions do you have?

DISCUSSION QUESTIONS

PowerPoint Slide 23: Kindergarten-Grade 2 Task

- Which shape does not belong in the group? Why?
- What makes each shape special or unique?

DISCUSSION QUESTIONS

PowerPoint Slide 24: Kindergarten-Grade 2 Tasks

- Include a model in your answer
    - Model the math in an expression such as 3 + 1 or 27 – 15.
    - 11 horses are in a field. 6 horses are black. The rest are brown. How many horses are brown?
    - Kelly was in line to buy lemonade. There were 3 people in front of her in the line. There were 2 people behind her in the line. How many people were waiting in line to buy lemonade?
- Use a model to answer a question (Reflect upon how the models will look different in each context)
    - Marcus has 3 apples. He picks 2 more apples. How many apples does Marcus have now?
    - Three apples are lying on the ground. Some more apples fell from the tree to the ground. There are now 5 apples lying on the ground. How many apples just fell from the tree?
    - Some apples were in a basket. Three more apples were added to the basket. There are five apples in the basket. How many apples were in the basket before?

DISCUSSION QUESTIONS

PowerPoint Slide 26: Grades 3-5 Tasks

- A school bus holds 36 students. If an entire school building has 1,128 students going on a field trip together, how many school buses are needed?
- How do you know? Explain your reasoning.

DISCUSSION QUESTIONS

PowerPoint Slide 27: Grades 3-5 Tasks

- Include a model in your answer
  - Model the math in an expression such as $3\frac{1}{4}$, 1230 + 570, $1 - \frac{1}{3}$, or 3.4 + 5.07.
  - Jack and Jill shared a pizza. Jack ate $\frac{1}{3}$ of the pizza. Jill ate $\frac{1}{2}$ of the pizza. How much of the pizza was left?
- Use a model to answer a question (Reflect upon how the models will look different in each context)
  - There are 3 boxes with 6 toys in each box. How many toys are there?
  - 18 toys are packed equally into 3 boxes. How many toys are in each box?
  - 18 toys are packed 6 to a box. How many boxes are needed?

DISCUSSION QUESTIONS

PowerPoint Slide 30: Grades 6-8 Tasks

- Patient 0 stands up, showing that they are infected and transmits the disease by tapping one person. The person who gets tapped stands and taps one other person until the whole class is tapped and is standing. Record the number of people tapped (infected) after 10 rounds of tapping.
- Create a model (graph, equation, diagram, table, etc.) of a one-tap situation. Does your model show each round of tapping? How many new people are infected? The total number of people?

DISCUSSION QUESTIONS

PowerPoint Slide 33: Grades 9-12 Tasks

- Patient 0 stands up, showing that they are infected and transmits the disease by tapping two other people. The people who get tapped stand and tap two other people until the whole class is tapped and is standing. Record the number of people tapped (infected) after 10 rounds of tapping.
- Create a model of a two-tap situation. Does your model show each round of tapping? What is the number of new people who are infected? The total number of people?

DISCUSSION QUESTIONS

PowerPoint Slide 34

- How can we ensure that Math Practice 4 is consistently implemented across all classrooms in our district?
- What strategies can we use to support teachers in modeling with mathematics at the building and district levels?

DISCUSSION QUESTIONS

PowerPoint Slide 48

- What are the specific learning needs of our students across the building and district levels?
- How can we address these needs to ensure that students regularly demonstrate their understanding of Math Practice 4 in the classroom?

DISCUSSION QUESTIONS

PowerPoint Slide 58

- What local data do we currently collect that can help us understand the implementation of Math Practice 4?
- How can we use this data to improve our instructional practices and student outcomes?

DISCUSSION QUESTIONS

Feedback on Additional Supports

- What additional supports do our teachers and students need to effectively implement Math Practice 4?
- How can building and district leaders provide these supports?

Engagement Activities

The following are optional activities for district and school leaders to use as part of their facilitation session(s) to further engage their audience.

Real-World Problem-Solving Activity

- Engage participants in solving real-world problems using mathematical modeling.
    - Present participants with a real-world problem that requires mathematical modeling to solve. Divide them into small groups and ask each group to create a mathematical model to solve the problem. Afterward, each group presents their models and discusses the reasoning behind their approaches.

Mathematical Model Pictionary

- Recognize different types of mathematical models students can use across the grade bands.
    - Participants write the names of different mathematical models on index cards or pieces of paper. Limit submissions to one per piece of paper or index card. Allow participants to submit multiple times. Collect the participant submissions. Identify a participant to select a card from the collected deck. Have that participant draw the mathematical model while the other participants try to guess the name of the mathematical model they are drawing.

Resource Links

- Conrad Wolfram on Computational Thinking
- Engaging in Mathematical Practice *Look Fors*
- Standards for Mathematical Practice Rubric
- Guidelines for Assessment & Instruction in Mathematical Modeling Education (GAIMME)
- Using Mathematics and Computational Thinking
- MPRES Toolkit for Teachers Conceptual Change – Using Mathematics & Computational Thinking
- Ohio Learning Standards

- Robert Kaplinsky
    - Beware of Fake Math Modeling Problems
    - Do You Need Better Spies of Analysts?
    - Sink Hole
    - What Isn't Modeling?

Conversation Notes: