

AGENDA

Teaching Math through Problem Solving

OVERVIEW

This course provides teachers with a firsthand experience of learning mathematics through problem solving. Through this experience, participants are introduced to approaches and strategies to help students build new mathematical knowledge and use a range of problem-solving strategies. Throughout the course, teachers experience and learn how to provide a classroom environment that encourages students to explore, take risks, and share their thinking.

OUTCOMES

- Characterize problem-solving experiences that require mathematical reasoning and communication of that reasoning
- Understand how the Common Core impacts teaching, curriculum, and learning in mathematics
- Implement instructional strategies that align to the Standards for Mathematical Practice
- Use strategies to help all students deepen and communicate their mathematical reasoning
- Experience a variety of classroom organizations: whole-class, small-group, and individual learning

WELCOME, OVERVIEW, AND GOALS

The introduction to the day presents session goals and logistical information pertinent to the day.

ENGAGING IN LOGICAL THINKING

The first three Mathematical Practices in the Common Core require students to make sense of problems, to reason abstractly and quantitatively, and to construct viable arguments and critique the reasoning of others. During this session, participants reflect on their own reasoning processes as they engage in logical-reasoning tasks. They consider how their students use similar processes while working on developmentally appropriate problems.

DEVELOPING SPATIAL REASONING

This activity gives participants the opportunity to reflect on how children's spatial-reasoning abilities develop with explicit attention to rotational and mirror symmetry. Participants are also given the chance to examine the structure of lessons that support students' thinking, reasoning, and problem solving. As they engage in the mathematical content, participants examine the use of Mathematical Practices #1: *Make sense of problems and persevere in solving them* and #6: *Attend to precision*.

UNDERSTANDING HOW STUDENTS LEARN

The Common Core for Mathematical Content presents a balanced combination of procedure and understanding. This session focuses on a view of learning in which people construct their own understanding of abstract mathematical concepts and relationships through interactions with concrete materials. After estimating how many scoops of rice a jar can hold, participants consider how access to new knowledge and the ability to discuss their ideas with others influence their mathematical reasoning.

LUNCH

PUTTING ARITHMETIC IN PERSPECTIVE

This session looks at arithmetic in a different way and puts it into a perspective that may be new for participants. Participants read an article about the three legs of arithmetic instruction, and then engage in several activities that illustrate the importance of each.

COMPUTING FLEXIBLY AND ACCURATELY

The Common Core call for students to flexibly and accurately compute with whole numbers. Additionally, the Mathematical Practices expect students to make conjectures, construct viable arguments to prove or disprove them and critique the reasoning of others. In this session, participants engage in The Game of Pig that supports these expectations.

CONNECTING OPERATIONS AND ALGEBRAIC THINKING

The final segment of the day helps participants bring meaning to Mathematical Practices #4: Model with mathematics and #7: Look for and make use of structure. In addition, this session provides a final opportunity to connect the important ideas of communication, the role of the teacher, the use of collaborative groups, and the structure of problem-solving lessons that have been the focus of the day's experiences.

REVIEW, CLOSING, AND REFLECTIONS

Participants take time to reflect on the experiences of the day and ways that these experiences will positively impact their classroom instruction.

MATH SOLUTIONS GUIDING PRINCIPLES

Drawing upon academic work and our own classroom-grounded research and experience, Math Solutions has identified the following four instructional needs as absolutely essential to improving instruction and student outcomes:

- Robust Content Knowledge
- Understanding of How Students Learn
- Insight into Individual Learners through Formative Assessment
- Effective Instructional Strategies

These four instructional needs drive the design of all Math Solutions courses, consulting and coaching. We consider them our guiding principles and strive to ensure that all educators:

- Know the math they need to teach—know it deeply and flexibly enough to understand various solution paths and students' reasoning.
- Understand the conditions necessary for learning, what they need to provide, and what students must make sense of for themselves.
- Recognize each student's strengths and weaknesses, content knowledge, reasoning strategies, and misconceptions.
- Have the expertise to make math accessible for all students, to ask questions that reveal and build understanding, and help students make sense of and solve problems.