Math Solutions
FOUNDED BY MARILYN BURNS

GO MATH!

Math Solutions Professional Learning Aligned with *Go Math!*

AGENDA

Mathematical Processes Three Day Series™

This three-day series focuses on effective teaching and learning required to meet the increased rigor of state standards and current assessments. We align what educators already know with what they need to learn about developing the habits of mind their students need for success with mathematics. Participants will leave each course with instructional skills and strategies they can use in their classrooms immediately.

The National Council of Teachers of Mathematics (NCTM) recommends that teachers use tasks that:

- Invite exploration of important mathematical concepts
- Allow students the opportunity to solidify and extend knowledge
- Encourage students to make connections and develop a coherent framework for mathematical ideas
- Call for problem formulation, problem solving, and mathematical reasoning
- Provide more than one solution path
- Promote the development of all students' disposition to do math

Course/Day One: Making Sense of Math—Reasoning and Discourse
Course/Day Two: Mathematical Thinking—Representation and Procedural Fluency
Course/Day Three: Problem Solving—Developing Disposition, Competence, and Confidence

FORMAT

This series is offered as a three-day institute or as individual courses over time.

SERIES OUTCOMES

- Strengthen participants' math content and pedagogical knowledge in order to understand various solution paths and students' reasoning
- Understand how students learn in order to make instructional decisions about tasks to complete and questions to pose
- Cultivate new instructional strategies that promote thinking, reasoning, and sense-making

Day One: MAKING SENSE OF MATH—REASONING AND DISCOURSE

Among the highest priorities of state standards is for students to build a deep understanding of mathematics and use that understanding to reason about problems, make sense of new learning, and communicate their thinking to others.

This full-day course is designed to introduce participants to the essential habits of mathematical thinkers, with particular emphasis on the role of reasoning and discourse. During this course, participants engage in and examine the kinds of tasks that help students communicate about and make sense of important mathematical ideas, and discuss the implications for planning and teaching with *GO Math!*.

Day One: Outcomes

- Use strategies to help all students deepen and communicate their mathematical reasoning during *GO Math!* lessons
- Identify the difference between social conventions of mathematics and mathematical knowledge that students need to make sense of for themselves
- Select tasks and use classroom discussions in *GO Math!* lessons to develop students' mathematical habits of mind and to assess understanding

OPENING—WELCOME, LOGISTICS, AND EXPERIENCES

This introduction includes the course goals, an overview of the course, and pertinent logistical information. In addition, time is provided for the group to build a community for learning.

LOGICAL REASONING AND CLASSROOM DISCOURSE

Current state standards require students to make sense of problems, reason abstractly and quantitatively, and communicate their reasoning to others. During this session, participants focus on strategies to engage students in discussions to communicate their reasoning during Math Talk. Participants learn about and practice using Talk Moves and then consider their influence in developing students reasoning skills and deepening their understanding during *GO Math!* lessons.

HOW STUDENTS LEARN

When mathematical knowledge is based in logic, it requires students to interact with the knowledge in ways that help them uncover its meaning for themselves. In this session, participants develop an understanding of the standard formula for determining the circumference of a circle. Through this experience, they reflect on the conditions needed for students to develop understanding of mathematical ideas.

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COMPARING MATHEMATICAL TASKS

The tasks teachers provide are the foundation for mathematics instruction that supports thinking, reasoning, and problem solving. Learning occurs when teachers choose mathematical tasks that challenge students just enough to help them develop new skills by building on those that have already been established. In this session, participants engage in; reflect on; and compare and contrast two tasks. They identify characteristics of tasks that build upon students' understanding and support their abilities

to represent and communicate that understanding to others. Knowing these characteristics impacts instructional planning with *GO Math!.*

TRANSFORMING TASKS

The focused progression of current state standards allows teachers time to uncover important mathematics, not just cover the content. This shift requires that teachers plan for instruction that develops student conceptual understanding and skills. During this session, participants engage in a process to support the enhancement of student learning when planning *GO Math!* lessons.

REFLECTION AND CLOSING

Teachers need a vision of the type of work students need to be engaged in to be mathematically successful. During this session, participants reflect on the experiences of the day and plan what they will do differently in their *GO Math!* classrooms as a result of their new or deepened understanding.

Day Two: MATHEMATICAL THINKING—REPRESENTATION AND PROCEDURAL FLUENCY

Current state standards call for students to develop knowledge of computational procedures along with knowledge of when and how to use them appropriately. The goal is for students to become skillful in performing computational procedures flexibly, accurately, efficiently, and with understanding.

This full-day course provides teachers with a deeper understanding of procedural fluency beyond merely the ability to memorize procedures and apply them with little understanding. In addition, teachers will learn strategies to support students in representing ideas visually, symbolically, and verbally, as well as strategies for helping students make connections between these different representations as they encounter them in *GO Math!*.

Day Two: OUTCOMES

- Expand understanding of procedural fluency to include carrying out procedures flexibly, accurately, and appropriately
- Connect multiple representations for the purpose of helping all students better understand underlying mathematical ideas
- Consider students' use of tools and representations for the purpose of assessing student understanding

OPENING—WELCOME, LOGISTICS, AND EXPERIENCES

This introduction includes the learning outcomes, an overview of the mathematical practices addressed during the day, and pertinent logistical information.

WHAT IS PROCEDURAL FLUENCY?

Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. In this session,

participants reflect on what "flexibly" and "efficiently" mean as they engage in mental math and estimation tasks. Using their own experiences, participants consider how to use developmentally appropriate problems in *GO Math!* to support students' development of flexibility and efficiency.

USING TOOLS TO DEVELOP UNDERSTANDING

Mathematical tools are used for three main purposes: to provide a convenient and permanent record of mathematical activity; to provide a way of communicating with others; and for thinking. This session focuses on three kinds of tools: language, materials, and symbols. In this session, participants gain more experience with the properties and relationships of figures through the use of tools and discussion of the relevant geometric concepts. They focus on the role of teacher questioning in directing students' work with various tools in ways that support developing understanding of important mathematics in *GO Math!*.

LUNCH

CONNECTING MULTIPLE REPRESENTATIONS

In this portion of the day, participants explore multiple representations of a mathematics problem and discuss the role of representations in communicating mathematical approaches, arguments, and understandings to oneself and to others. As participants experience how different representations highlight different aspects of the concept, they recognize that when *GO Math!* instruction includes the use of representations that are familiar to students—relevant situations, manipulatives, pictures, spoken language, graphs, or equations—students make connections among these representations and build deeper understanding of the underlying mathematics.

REFLECTION AND CLOSING

Teachers need opportunities to translate professional learning experiences to practical classroom application. During this session, participants reflect on the experiences of the day and plan what they will do differently in their *GO Math!* classrooms as a result of their new or deepened understanding.

Day Three: PROBLEM SOLVING—DEVELOPING DISPOSITION, COMPETENCE, AND CONFIDENCE

Current state standards call for students to make sense of problems and persevere in solving them. Teachers' instructional practices directly affect students' confidence in their mathematical skills and their willingness to persevere to solve difficult problems.

This full-day course provides teachers with a deeper look at building perseverance in problem solving. Participants learn strategies for engaging students in appropriate levels of constructive struggle, thus allowing all students to approach mathematics with confidence and competence. Teachers learn how to maintain the integrity of high-level tasks by structuring lessons to allow students to make connections and develop new mathematical knowledge.

Day Three: OUTCOMES

- Broaden participants' understanding of how students learn and the features of a *GO Math!* classroom environment that promotes confidence and perseverance in students

- Develop an understanding of constructive struggle as opportunities to engage students in rigorous math problems that require critical thinking and connections across multiple mathematical concepts, skills, and ideas
- Challenge students with lessons that require critical thinking and sense-making

OPENING—WELCOME, LOGISTICS, AND EXPERIENCES

In this session, participants solve a problem that introduces them to the notion of perseverance and confidence in problem solving—along with the role of the teacher in supporting and nurturing these qualities in students. They are introduced to the course learning outcomes and review the habits of mathematical thinkers to be addressed during the day.

THE NATURE OF TASKS

Both task selection and lesson facilitation promote a positive disposition in all students toward mathematics, competence in doing mathematics, and feelings of confidence in their ability to do mathematics. In this session, participants experience firsthand an example of a task that is rigorous yet accessible to all students. Following their experience, they reflect on the power of listening as a teaching strategy for building student confidence and perseverance in problem solving, and consider how this impacts implementation of lesson components of *GO Math!.*

PROBLEM SOLVING AND CONSTRUCTIVE STRUGGLE

This session highlights the importance of constructive struggle in *GO Math!* classroom environments that support students' practice of making sense of mathematical problems and persevering in solving them. Participants solve a problem that is an example of one that is accessible for all students yet maintains the rigor called for in current state standards. The task provides participants opportunity to communicate orally about their solutions and write to explain their thinking. In processing this experience, participants discuss important ideas about the role that constructive struggle plays in developing students' problem-solving skills.

ASPECTS OF LEARNING

The intent of current state standards is to move toward greater focus and coherence in teaching and learning math. In this session, participants identify grade appropriate mathematical concepts that students need to experience in a specific way so that these concepts make sense to them. After engaging in two different mathematical investigations, participants identify mathematical ideas around which students need to reason and make sense.

LUNCH

THE PROBLEM-SOLVING LESSON

This session focuses on structuring lessons to maximize students' opportunities to make sense of important mathematical ideas. During this session, participants engage in a lesson and use the experience to make explicit connections to role of the *GO Math!* teacher during each phase of the lesson. Participants consider problem solving opportunities embedded in *GO Math!* lessons.

REFLECTION AND CLOSING

Teachers need opportunities to translate professional learning experiences to practical classroom application. During this session, participants reflect on the types of work students need to be engaged in to be mathematically proficient and plan what they will do differently in their *GO Math!* classrooms as a result of their new or deepened understanding.

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.