

AGENDA***Mathematical Thinking:
Representation and Procedural Fluency*****OVERVIEW**

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.

OUTCOMES

- Expand understanding of procedural fluency to include carrying out procedures flexibly, accurately, and appropriately
- Broaden the definition of mathematical tools to include anything that students use to think about mathematics
- 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

FLEXIBLE, ACCURATE, AND EFFICIENT

For many students, procedures have been the mainstay of learning mathematics. “Yours is not to reason why, just invert and multiply” was a phrase used by teachers to help students remember the procedure for dividing fractions. The approach to learning computational procedures was based on a set of steps, or an algorithm, learned through repeated practice and memorization.

OPENING—WELCOME, LOGISTICS, AND EXPERIENCES

This introduction includes the course goals, an explanation of the structure and layout of the *Participant Guide*, an overview of the pillars and the 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 introductory experience, participants focus on aspects of procedural fluency beyond performing procedures such as estimation and sensemaking.

USING TOOLS TO DEVELOP UNDERSTANDING

Manipulative materials coupled with good questions can prompt students to think about mathematical ideas and reflect on their understanding of them. In this experience, teachers engage in a mathematical investigation and examine the questions used to focus students' work with manipulatives on important mathematical ideas.

LUNCH**CONNECTING MULTIPLE REPRESENTATIONS**

In this portion of the day, participants explore multiple representations of a mathematics problem as physical or mental constructs that describe aspects of the concept. Participants consider the various representations as forms of an idea that allow the learner to interpret, communicate, and discuss the idea with others.

REFLECTION AND CLOSING

Participants take time to reflect on the experiences of the day and ways that these experiences will affect 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.