

2014 Mathematics Institutes

The purpose of the 2014 Mathematics Institutes is to provide teachers with professional development focused on the instruction that supports process goals for students in mathematics. The emphasis of this professional development will be on fostering students' abilities to make mathematical connections and use effective and appropriate representations in mathematics.

Professional Development Instructions

A product of the 2014 Mathematics Institutes is a set of online professional development modules designed to be used by a group of teachers of a specific grade level or course, facilitated by a member of the team. Modifications could be made to adapt the professional development for more than one grade level/course or for large groups. Facilitators should review the activities and handouts in this guide prior to facilitating this professional development.

[Virginia's Process Goals for Students](#)

SOL Vertical Articulation Technical Assistance Documents

- [Grades K-3](#)
- [Grades 3-6](#)
- [Grades 5-8](#)
- [Algebra](#)
- [Geometry](#)

Approximate Time	Facilitator Instructions	Materials
45 minutes total	<p>Module 1: Participant personal reflection on representations and connections Essential Question: What does it mean for students to represent and make connections in the mathematics classroom?</p> <p>1) Think (individually)/Pair (share with a partner)/Share (with the whole group):</p> <ul style="list-style-type: none"> - What does it mean for students to use effective and appropriate representations in the mathematics classroom? - What does it mean for students to make connections in the mathematics classroom? <p>2) Whole group discussion: Compare and contrast the groups' discussion points with Process Goals for Students: Representations and Connections document.</p> <p>3) Whole group discussion: Scenario - After analysis of both qualitative and quantitative data, the school's instructional team has determined that student understanding and achievement could be improved by instructional planning that emphasizes the use of mathematical representations and connections. What questions should be considered regarding representations and connections when planning for instruction? This list should be recorded for use in Module 5.</p>	<ul style="list-style-type: none"> • Process Goals for Students: Representations and Connections

45 minutes total	Module 2: Mathematical task	<ul style="list-style-type: none"> • Fraction Misconceptions • Mathematical task • K-5 Fraction Learning Progression
10 minutes	<ol style="list-style-type: none"> 1) Before solving a mathematical task involving fractions, work with your colleagues to brainstorm: What common misconceptions, error patterns, or confusions are evident in grades 3-5 when it comes to fractions? 2) Refer to the Fraction Misconceptions document. Consider the connections between your list and what the research says. 	
35 minutes	<ol style="list-style-type: none"> 3) Each person should solve the mathematics fraction task in at least two different ways. 4) Partner discussion: Share your work and discuss the following questions: <ul style="list-style-type: none"> - What representations are evident in the strategies that were used? - What connections can be made among the representations used? - What other representations might support student thinking? - What might be some representations that could limit student thinking? 5) Whole group discussion: Identify the mathematical content addressed in the task. What essential skills and knowledge do students need to be able to successfully complete the task? Refer to the K-5 Fraction Learning Progression document to address this question. 	
45 minutes total	Module 3: Looking at student work Essential Question: How are students using representations and making connections in their work?	<ul style="list-style-type: none"> • Student work samples A, B, C, and D <ul style="list-style-type: none"> - Grade 3 – Student A - Grade 4 – Student C and D - Grade 5 – Student B
	<ol style="list-style-type: none"> 1) Select the appropriate student work. 2) Partner or small group discussion: <ul style="list-style-type: none"> - What representations are evident in each student's work? - What does the student work tell us about their understanding? Are there obvious misconceptions or gaps in understanding? 3) Partner or small group discussion: <ul style="list-style-type: none"> - What evidence is shown that students are making connections within their own work? - How could the student work be used to help all students make connections <ul style="list-style-type: none"> ○ among representations, ○ among strategies, or ○ among mathematical ideas? 4) Whole group discussion: How do the various student representations communicate <ul style="list-style-type: none"> - student understanding of the mathematics; - student generalizations of the mathematics; and 	

	<ul style="list-style-type: none"> - mathematical relationships? <p>5) Having done the task and looked at student work, what might need to be clarified?</p> <p>6) Consider these questions related to mathematical tasks and the use of representations and connections:</p> <ul style="list-style-type: none"> - How can tasks be used before, during, and after instruction on a math concept or topic? - How can the use of students' work that emphasized mathematical representations and connections enhance students' progress toward meeting the other three process goals (communication, problem-solving, reasoning)? 	
<p>45 minutes total</p>	<p>Module 4: Planning for the use of representations and connections in instruction Essential Question: What should be considered regarding representations and connections when planning for instruction?</p>	<ul style="list-style-type: none"> • K-5 Fraction Learning Progression • Mathematics Instructional Connections for Physical and Visual Representations
<p>20 minutes</p>	<p>1) Small group or whole group discussion: Consider the mathematical task from Module 2.</p> <ul style="list-style-type: none"> - Refer to the K-5 Fraction Learning Progression document. <ul style="list-style-type: none"> o What is the related content (prior knowledge) from previous and future grade(s)/course(s)? o How is the objective connected to the related content and to the real world? - Refer to the Mathematics Instructional Connections for Physical and Visual Representations document. <ul style="list-style-type: none"> o What representations/strategies may have been used to develop prior knowledge? o What representations could be used to develop and reinforce understanding of the content? o Which representations/strategies will model the mathematics and deepen and extend students' mathematical understanding? o What are the strengths and limitations of the representation/strategy? 	<ul style="list-style-type: none"> • Fraction Track Video, <i>Annenburg Learner</i> • Playing Fraction Tracks Online, <i>National Council of Teachers of Mathematics</i> • Fraction Tracks Game board
<p>15 minutes</p>	<p>2) Take a look at the Fractions Tracks Video (if possible) and discuss:</p> <ul style="list-style-type: none"> - What number sense do the kids need to have in order to understand and enjoy this game? - What representations were utilized in this lesson? - What connections were being made? 	<ul style="list-style-type: none"> • Bean or other small counters • Roles of the Teacher and Student in Making Connections and Using Representations
<p>10 minutes</p>	<p>3) Read and discuss the Roles of the Teacher and Student in Making Connections and Using Representations document.</p> <ul style="list-style-type: none"> - Discuss what this currently looks like in your classroom? - Which areas could be further developed in your classroom? 	

45 minutes total	Module 5: Closure	<ul style="list-style-type: none"> • Planning Mathematics Instruction: Essential Questions • Skip Fennell's NCTM President's Message
	<ol style="list-style-type: none"> 1) Small group discussion: Review and revise the list of planning questions brainstormed in Module 1: "What questions should be considered regarding representations and connections when planning for instruction?" 2) Whole group discussion: In what ways did your small group discussion support the following quote? "Representation should be an important element of lesson planning. Teachers must ask themselves, 'What models or materials (representations) will help convey the mathematical focus of today's lesson?'" – Skip Fennell 3) Small group discussion: Compare your list of questions to be considered regarding representations and connections when planning for instruction with the Planning Mathematics Instruction: Essential Questions document. <ul style="list-style-type: none"> - Discuss with colleagues how you can be more purposeful in planning for connections and the use of representations in your instruction. 	