

2012 Mathematics SOL Institutes

The purpose of the 2012 Mathematics Standards of Learning (SOL) Institutes was to provide teachers with professional development on using formative assessment resources to drive instructional decisions.

Introduction and Instructions

The product of the 2012 Mathematics SOL Institutes is a set of six online professional development modules designed to be used by a group of teachers of a specific grade level or course. Modifications could be made to adapt the professional development for more than one grade level or for large groups. Each group of teachers should select a facilitator for which this Facilitator’s Guide was written. Facilitators should review the activities and handouts prior to facilitating this professional development. When scheduling for this professional development, please allow adequate time to complete all six of the modules while minimizing the amount of time between module sessions.

A **Mathematics Performance Task** is an assessment that requires students to synthesize mathematical content in a problem-solving setting that requires communication, reasoning, use of multiple representations, and making mathematical connections. Read more about [Virginia’s Process Goals](#) for students.

Time	Facilitator Instructions	Materials
45 minutes total	Module 1: Performance Tasks Purpose: To anticipate common student misconceptions and errors associated with a mathematics performance task.	Handouts Needed:
15 minutes	1) Distribute the performance task. 2) Ask participants to work on the performance task individually. While working on the task, participants should anticipate and record common student misconceptions and errors on the Common Misconceptions and Errors Recording Sheet.	<ul style="list-style-type: none"> Selected Mathematics Performance Task (select the performance task for your course) <ul style="list-style-type: none"> Algebra I Geometry Algebra II Common Misconceptions and Errors Recording Sheet (a summary recording sheet will be used in Module 3)
30 minutes	1) Have participants discuss their solution strategy with a partner or small group and then the facilitator should select varied solutions to be shared with the whole group. 2) Have participants discuss their recorded misconceptions and errors with a partner or small group. 3) Have groups share their recorded misconceptions and errors. For large groups, you may want to group participants by individual parts of the problem. 4) Record a summary of Common Misconceptions and Errors.	Other: <ul style="list-style-type: none"> Graphing Calculators

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	Participants will need the summary of Common Misconceptions and Errors for discussion in Module 3.	
45 minutes total	<p>Module 2 Part 1: Student Work and Rubrics Purpose: To analyze student work on a selected mathematics performance task, apply a general rubric to student work, and use a task specific rubric to analyze student work.</p>	Handouts Needed: <ul style="list-style-type: none"> • Student Work for selected task <ul style="list-style-type: none"> – Algebra I – Geometry – Algebra II • Mathematics Performance Task Rubric • Mathematics Performance Task Student Rubric • Student Work Sort Recording Sheet • Introduction to Rubrics Voiceover PowerPoint (after opening, view the PowerPoint show to hear voiceover)
35 minutes	<p>Analyzing Student Work</p> <ol style="list-style-type: none"> 1) Provide sets of student work samples to each teacher, pair of teachers, or small group. 2) Have participants work individually or in groups to sort the student work samples into four levels of performance on a scale of 1 (lowest level of student understanding) to 4 (highest level of student understanding). 3) Each individual or group should record the level of performance (1-4) for each student work sample on the Student Work Sort Recording Sheet. (Participants should keep a record for themselves to be used later.) 4) Ask participants or groups to share, compare, and contrast sort criteria for each level. 5) Ask participants “If you were to sort the student work again, would your criteria change?” Facilitate a follow-up discussion. <p>Note: A rubric is a tool that will help define the levels of student performance based on a set of specific evaluation criteria. It helps to standardize the review of student work and reduce subjectivity in evaluation. <i>(Listen for this idea as teachers are sorting the samples and share their ideas.)</i></p>	
10 minutes	<p>Introduction to Rubrics</p> <ol style="list-style-type: none"> 1) Distribute the Mathematics Performance Task Rubric and Mathematics Performance Task Student Rubric. 2) Have participants watch the Introduction to Rubrics voiceover PowerPoint (after opening, view the PowerPoint show to hear the voiceover). 3) Ask participants to decide which type of rubric, although ‘unwritten,’ that they were using for their initial sort of student work. 	

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45 minutes total	<p>Module 2 Part 2: Student Work and Rubrics</p> <p>Purpose: To analyze student work on a selected mathematics performance task, apply a general rubric to student work, and use a task specific rubric to analyze student work.</p>	<p>Handouts Needed:</p> <ul style="list-style-type: none"> • Student Work for selected task • Mathematics Performance Task Rubric (from in Module 2 Part 1) • Mathematics Performance Task Student Rubric • Student Work Sort Recording Sheet (completed recording sheet will be used in Module 2 Part 3) 																																		
25 minutes	<p>Using Rubrics to Analyze and Evaluate Student Work</p> <p>1) Have participants read the evaluation descriptors in the first criteria row of the Mathematics Performance Task Rubric – Problem Solving and Reasoning. Participants should highlight key words or phrases that help to distinguish the differences. As whole group, ask them to discuss the differences noticed between the descriptors of the levels of performance.</p> <table border="1" data-bbox="688 613 1276 1026"> <thead> <tr> <th colspan="5">Mathematics Performance Task Rubric</th> </tr> <tr> <th>Process Goals for Students</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Problem Solving and Reasoning</td> <td colspan="4" style="text-align: center;">Levels of Performance</td> </tr> <tr> <td> - connects mathematics with a thorough understanding of concepts and procedures associated with the problem - identifies and extends one or more student strategies that lead to a correct solution - uses correct reasoning and justification and achieves a correct or reasonable answer with thorough and precise explanation or justification as a systematic approach to solve the problem </td> <td> - shows an understanding of concepts and procedures associated with the problem - develops and applies an appropriate strategy to solve the problem that leads to a correct solution - uses correct reasoning and justification and achieves a correct or reasonable answer (possibly with minor mistakes) - uses a systematic approach to solve the problem </td> <td> - shows partial understanding of concepts and procedures associated with the problem - chooses a strategy that leads to a partial solution - uses mostly unsystematic trial and error to solve the problem - provides a partially correct answer </td> <td> - shows limited or no understanding of concepts and procedures associated with the problem - chooses a strategy that does not match the problem and/or lead to a solution - provides no correct reasoning or justification </td> </tr> <tr> <td>Representations and Connections</td> <td colspan="4" style="text-align: center;">Evaluation Descriptors</td> </tr> <tr> <td></td> <td> - uses abstract or symbolic representation to record information and solve the problem - recognizes and uses the mathematical connections to find or generalize patterns </td> <td> - uses appropriate representation to record information and solve the problem - notices and describes patterns </td> <td> - makes no attempt to construct a representation to organize and record information from the problem that may be partial or inaccurate - indicates partial or incorrect patterns </td> <td> - makes no attempt to construct a representation - makes no identification of patterns </td> </tr> <tr> <td>Communication</td> <td> - uses precise mathematical language to clearly communicate ideas and thinking </td> <td> - communicates process and thinking in a sequential, coherent way </td> <td> - provides a partial communication of process or thinking </td> <td> - shows little or no communication of process or thinking </td> </tr> </tbody> </table> <p>2) Have participants in small groups sort the student work according to the Problem Solving and Reasoning criteria. When evaluating, groups should note specifics about the student work that leads to the selected level of performance of 1-4.</p> <p>3) Record the level of performance given to each student by tally on the Student Work Sort Recording Sheet. Ask groups to justify their ratings and discuss.</p>		Mathematics Performance Task Rubric					Process Goals for Students	4	3	2	1	Problem Solving and Reasoning	Levels of Performance				- connects mathematics with a thorough understanding of concepts and procedures associated with the problem - identifies and extends one or more student strategies that lead to a correct solution - uses correct reasoning and justification and achieves a correct or reasonable answer with thorough and precise explanation or justification as a systematic approach to solve the problem	- shows an understanding of concepts and procedures associated with the problem - develops and applies an appropriate strategy to solve the problem that leads to a correct solution - uses correct reasoning and justification and achieves a correct or reasonable answer (possibly with minor mistakes) - uses a systematic approach to solve the problem	- shows partial understanding of concepts and procedures associated with the problem - chooses a strategy that leads to a partial solution - uses mostly unsystematic trial and error to solve the problem - provides a partially correct answer	- shows limited or no understanding of concepts and procedures associated with the problem - chooses a strategy that does not match the problem and/or lead to a solution - provides no correct reasoning or justification	Representations and Connections	Evaluation Descriptors					- uses abstract or symbolic representation to record information and solve the problem - recognizes and uses the mathematical connections to find or generalize patterns	- uses appropriate representation to record information and solve the problem - notices and describes patterns	- makes no attempt to construct a representation to organize and record information from the problem that may be partial or inaccurate - indicates partial or incorrect patterns	- makes no attempt to construct a representation - makes no identification of patterns	Communication	- uses precise mathematical language to clearly communicate ideas and thinking	- communicates process and thinking in a sequential, coherent way	- provides a partial communication of process or thinking	- shows little or no communication of process or thinking
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20 minutes	<p>1) Divide the participants into two groups. Have one group look at student work according to the Representations and Connections criteria and the other group look at the student work according to the Communication criteria.</p>																																			

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	2) Groups should read their assigned row of the rubric and discuss how they interpret the differences between the levels of performance. 3) Have groups sort their student work samples according to their assigned criteria (Representations and Connections or Communication) and record student levels of performance. 4) Form new groups (size and number of the groups will depend on the total number of participants) so that each group has a representative from the Representations and Connections group and the Communication group. 5) Have each person in the group share their ratings, insights, and difficulties. After two minutes, switch roles and repeat. Participants will need to bring the materials from Module 2 Part 2 to the Module 2 Part 3 discussion.	
45 minutes total	Module 2 Part 3: Using Task Specific Rubrics Purpose: To analyze student work on a selected mathematics performance task, apply a general rubric to student work, and use a task specific rubric to analyze student work.	Handouts Needed: <ul style="list-style-type: none"> • Student Work for selected task • Mathematics Performance Task Rubric
30 minutes	1) Group participants into 3 groups. 2) Distribute the Task Specific Rubric with Holes for the selected performance task. 3) Assign each group an evaluation criterion (Problem Solving and Reasoning, Representations and Connections, or Communications). Ask each group to add evaluation descriptors to fill the 'hole.' Encourage participants to utilize their notes from the prior discussions in Module 2 Part 1 and 2 when completing the evaluation descriptors in the rubric. Participants should be as specific as possible when completing the rubric. 4) Have groups share their work with the entire group. After each group has shared, distribute the Task Specific Rubric (without holes). Module 2 Part 3 continued on next page.	<ul style="list-style-type: none"> • Mathematics Performance Task Student Rubric • Student Work Sort Recording Sheet (from Module 2 Part 2) • Task Specific Rubric with Holes for selected task <ul style="list-style-type: none"> - Algebra I - Geometry - Algebra II • Task Specific Rubric for selected task <ul style="list-style-type: none"> - Algebra I - Geometry - Algebra II

Time	Facilitator Instructions	Materials
15 minutes	1) Discuss how a task specific rubric can assist in evaluating student work on a selected task. 2) Distribute the Mathematics Performance Task Student Rubric. Discuss how the student version of the rubric could assist students.	
45 minutes total	<p>Module 3: Using Student Work to Drive Instruction</p> <p>Purpose: To facilitate discussions about using student work to drive instructional decisions for intervention.</p> <p>Prior to facilitating this module, facilitators should revisit the summary of Common Misconceptions and Errors generated in Module 1.</p>	<p>Handouts Needed:</p> <ul style="list-style-type: none"> • Selected Performance Task • Summary of Common Misconceptions and Errors Recording Sheet (completed in Module 1)
25 minutes	<ol style="list-style-type: none"> 1) Have participants review the summary of Common Misconceptions and Errors generated from discussions in Module 1. 2) Ask participants which misconceptions/errors they perceive as the most common or most difficult to correct?" 3) Create one group of participants for each misconception/error and assign one misconception/error to each group. 4) Have groups write the misconception/error on large paper. 5) Have groups discuss the causes of the misconception/error (gaps in mathematical content, vocabulary issues, etc.). 6) Have groups brainstorm and record possible intervention strategies that would be helpful for students that exhibit the misconception/error. <i>(It may be helpful if participants take a few minutes to first locate the student work samples that exemplify that particular misconception/error. This helps ground the work with a focus on a student or students.)</i> <p>Vertical Articulation Documents <i>(great resource for thinking through next steps)</i></p> <ul style="list-style-type: none"> • help us to identify the important mathematics that we want students to learn • help us know what prior knowledge students might bring • help us know how the understanding they are developing will be used in later grades 	<ul style="list-style-type: none"> • Student Work for selected task • Intervention Guide for selected task <ul style="list-style-type: none"> - Algebra I - Geometry - Algebra II <p>Other:</p> <p>Large Paper (for posting on the wall and sharing)</p> <p>Vertical Articulation Documents</p> <ul style="list-style-type: none"> - Grades K-3 (PDF) - Grades 3-6 (PDF) - Grades 5-8 (PDF) - Algebra (PDF) - Geometry (PDF)

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20 minutes	<ol style="list-style-type: none"> 1) Have each group post their brainstormed intervention strategies on the wall. 2) Have groups spend 2 minutes reviewing each intervention strategies list. 3) Group members should place a check or star beside any intervention with which they agree. Place a question mark beside any intervention that might require more information from the writers. Add any additional strategies. 4) Rotate to the next brainstormed list after 2 minutes. 5) When groups return to their original poster, give them an opportunity to reflect on anything that the other groups added. If necessary, give groups an opportunity to respond to any question marks. 6) Distribute the Intervention Guide for the selected task. Have participants compare and contrast their brainstormed intervention strategies with those listed in the Intervention Guide. 	
25 minutes total	<p>Module 4: Closure Purpose: To facilitate discussions about next steps to improve student understanding and achievement through effective use of assessments</p>	Handouts Needed: Closure Questions for Group Discussion
25 minutes	<ol style="list-style-type: none"> 1) Distribute the handout called Closure Questions for Group Discussion. 2) Facilitate a group discussion on the four questions provided. 3) Record responses to question #4 for team goal setting. 	