

Connecting the Standards for Mathematical Practice (SMP) and the Learning Observation Instrument (LOI)

LOI Element	SMP #	SMP	LOI and SMP Evidence
Conceptual Understanding	1	Students make sense of problems and persevere in solving them	<p>Utilizes questions that support student understanding and stimulate discussion for a specific purpose; <u>SMP Student Actions:</u> Be able to use and make sense of strategies; Monitor, evaluate progress and change course if needed; Be able to show, use, and explain representations <u>SMP Teacher Actions:</u> Provide open-ended and rich problems; Ask probing questions; Probe student responses (correct or incorrect) for understanding and multiple approaches</p>
	2	Reason abstractly and quantitatively	<p>Guides all students to select their own representations and explanations of concepts through multiple ways/examples. <u>SMP Student Actions:</u> Create and explain multiple representations; Create and explain equivalent expressions or equations <u>SMP Teacher Actions:</u> Provide opportunities for students to listen to the reasoning of other students; Ask students to explain their reasoning; Value invented strategies and representations</p>
	4	Model with mathematics	<p>Demonstrate understanding of concepts through multiple ways/examples <u>SMP Student Actions:</u> Use mathematics (numbers and symbols) to solve/work out real-life situations; Mathematize situations using numbers; Make sense of the symbols and quantities in an equation or function (as they relate to the context) <u>SMP Teacher Actions:</u> Provide meaningful, real world, authentic, performance-based tasks; Stress the importance of connecting the context, equations, tables and/or graphs; Emphasize sense making between a context, symbols and quantities in an equation</p>
	5	Use appropriate tools strategically	<p>Guides all students to create or select their own representation and explanation of concepts; ensures students demonstrate understanding of concepts in multiple ways/examples <u>SMP Student Actions:</u> Choose the appropriate tool to solve a given problem and deepen their conceptual understanding; Choose the appropriate technological tool to solve a given problem and deepen their conceptual understanding <u>SMP Teacher Actions:</u> Make tools available for student selection; Provide tasks that require students to use manipulatives, calculators or software programs to develop conceptual understanding, solve problems, or predict solutions.</p>
	6	Attend to precision	<p>Guides students to create own explanations of concepts ...to demonstrate understanding of concepts through multiple ways/examples <u>SMP Student Actions:</u> State meaning of symbols; use appropriately; Carefully formulate explanations; Calculate accurately and efficiently <u>SMP Teacher Actions:</u> Model Think aloud/Talk aloud; Ask for more specificity about an explanation</p>
	8	Look for and express regularity in repeated reasoning	<p>Utilizes question at essential sub-objectives that support students understanding of the discipline and stimulate discussion for a specific purpose (e.g. encourage students to question and analyze ideas from diverse perspectives) <u>SMP Student Actions:</u> Continually evaluate reasonableness of intermediate results <u>SMP Teacher Actions:</u> Ask deliberate questions that enable students to reflect on their own thinking</p>
Task Analysis		Possibly 1-8. All need to be considered as lesson is planned.	Teacher plans for and teaches lesson fostering student use of SMPs.

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Instructional Approach		Students make sense of problems and persevere in solving them	<p>Presents problem/situation and allows open ended processing of thinking or experimentation;developing explanations...supporting students in justifying their ideas</p> <p><u>SMP Student Actions:</u> Be able to use and make sense of strategies; Communicate, verbally and in written format</p> <p><u>SMP Teacher Actions:</u> Provide open-ended and rich problems; Model multiple problem-solving strategies through Think-Alouds</p>
	2	Reason Abstractly and quantitatively	<p>Presents problem/situation and allows open-ended processing of thinking or experimentation</p> <p><u>SMP Student Actions:</u> Create and explain multiple representations; Create and explain equivalent expressions or equations</p> <p><u>SMP Teacher Actions:</u> Develop opportunities for problem solving; Give time for processing and discussing; Ask students to explain their reasoning; Emphasize reasoning, not just answer getting</p>
	3	Construct viable arguments and critique the reasoning of others.	<p>...uses precise vocabulary while clarifying understandings, developing explanations and communicating ideas...while eliciting student predictions or conjectures about content, and supporting students in justifying their ideas</p> <p><u>SMP Student Actions:</u> Justify and communicate predictions and conclusions; Use examples and non-examples; Use mathematics vocabulary, properties, and definitions in support of statements</p> <p><u>SMP Teacher Actions:</u> Create a safe environment for risk-taking and critiquing with respect; Provide time for student presentations and student-to student discourse; Provide complex, rigorous tasks that foster deep thinking</p>
	4	Model with mathematics	For modeling to occur problems with a context, real or not, must be presented to students. Students must then interpret the context and translate the situation using some mathematical notation (equation, table, graph) to represent the context.
	5	Use appropriate tools strategically	<p>Presents problem/situation and allows open-ended processing of thinking or experimentation</p> <p><u>SMP Student Actions:</u> Use technology to explore mathematical situations; Choose the appropriate tool to solve a given problem and deepen conceptual understanding</p> <p><u>SMP Teacher Actions:</u> Make tools available for student selection; Provide tasks that require students to use manipulatives, calculators or software programs to develop conceptual understanding, solve problems, or predict solutions.</p>
	6	Attend to precision	<p>...uses precise academic vocabulary; Supports students...in using clear academic vocabulary to solidify learning</p> <p><u>SMP Student Actions:</u> Communicate with precision-orally and written; State meaning of symbols; use appropriately; Carefully formulate explanations</p> <p><u>SMP Teacher Actions:</u> Model Think aloud/Talk aloud; Ask probing questions related to the content; Ask for more specificity about an explanation</p>
	7/8	Look for and make use of structure. / Look for and express regularity in repeated reasoning.	<p>...eliciting student predictions or conjectures about content</p> <p><u>SMP Student Actions:</u> Look for, interpret, and identify patterns and structures; Make connections to skills and strategies previously learned to solve new problems/tasks; Identify patterns and make generalizations</p> <p><u>SMP Teacher Actions:</u> Provide rich and varied tasks that allow students to generalize relationships and methods, and build on prior math knowledge</p>

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Practice Aligned Activity	1	Students make sense of problems and persevere in solving them	<p>Provides sufficient, aligned practice or conceptual development activity aligned to the appropriate sub-objective(s). <u>SMP Student Actions:</u> Be able to use and make sense of strategies; Be able to deduce what is a reasonable solution in the context of the problem <u>SMP Teacher Actions:</u> Provide open-ended and rich problems; Probe student responses (correct or incorrect) for understanding of approaches</p>
	2	Reason abstractly and quantitatively	<p>Engages all students in examining their own thinking and/or learning <u>SMP Student Actions:</u> Make sense of and explain quantities and relationships in problem situations; Create and explain multiple representations <u>SMP Teacher Actions:</u> Value the path to developing efficient strategies; Value the path to developing efficient strategies</p>
	3	Construct viable arguments and critique the reasoning of others	<p>Engages all students in examining their own thinking and/or learning, students effectively provide support for one another <u>SMP Student Actions:</u> Ask questions of students and teacher; Listen and respond to others; Question and comment on other's work/ideas <u>SMP Teacher Actions:</u> Create a safe environment for risk-taking and critiquing with respect; Plan effective questions and student grouping</p>
	4	Model with mathematics	<p>Provides sufficient, aligned practice or conceptual development activity aligned to the appropriate sub-objective(s). Note: For SMP 4, practice needs to involve contextual situations and writing equations, completing tables, or graphing. etc. <u>SMP Student Actions:</u> Mathematize situations using numbers, symbols, equations, tables, graphs, or formulas; Use mathematics (numbers and symbols) to solve/work out real-life situations <u>SMP Teacher Actions:</u> Emphasize sense making between a context, symbols and quantities in an equation; Provide meaningful, real world, authentic, performance-based tasks (non traditional word problems)</p>
	6	Attend to precision	<p>Provides sufficient, aligned practice or conceptual development activity to support successful learning of the lesson objective, students effectively provide support for one another <u>SMP Student Actions:</u> Formulate precise definitions with others <u>SMP Teacher Actions:</u> Guide inquiry: teacher gives problem, students work together to solve problems, and time is given for discussing/sharing/comparing</p>
	8	Look for an express regularity in repeated reasoning.	<p>Provides sufficient, aligned practice or conceptual development activity aligned to the appropriate sub-objective(s). Note: For SMP8: tasks should allow students to generalize. <u>SMP Student Actions:</u> <u>SMP Teacher Actions:</u> Provide rich and varied tasks that allow students to generalize relationships and methods, and build on prior math knowledge</p>

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Student-to-Student Interactions	1	Students make sense of problems and persevere in solving them	Students engage in focused learning conversations to build on other students' thoughts/ideas/writing/non-linguistic representation (e.g. questioning, piggybacking, summarizing, clarifying, paraphrasing). Students respond to shifts in conversation as they explore the topic, <u>SMP Student Actions:</u> Use patience and persistence to listen to others; Communicate, verbally and in written format <u>SMP Teacher Actions:</u> Promote and value discourse, collaboration, and student presentations
	2	Reason abstractly and quantitatively	Students engage in focused learning conversations to build on other students' thoughts/ideas/writing/non-linguistic representation (e.g. questioning, piggybacking, summarizing, clarifying, paraphrasing). Students respond to shifts in conversation as they explore the topic, <u>SMP Student Actions:</u> Make sense of and explain quantities and relationships in problem situations; Create and explain multiple representations; Create and explain equivalent expressions or equations <u>SMP Teacher Actions:</u> Provide opportunities for students to listen to the reasoning of other students; Give time for processing and discussing
	3	Construct viable arguments and critique the reasoning of others	Students engage in academic dialogue aligned to the lesson objective in order to develop expressive language proficiency and solidify learning. Students engage in focused learning conversations to build on other students' thoughts/ideas/writing/non-linguistic representation....and demonstrate keep or extended learning. Students respond to shifts in conversation as they explore the topic; different students may emerge as experts <u>SMP Student Actions:</u> Ask questions of students and teacher; Justify and communicate predictions and conclusions; Use mathematics vocabulary, properties, and definitions in support of statements; Use objects, drawings, diagrams, and actions <u>SMP Teacher Actions:</u> Create a safe environment for risk-taking and critiquing with respect; Provide time for student presentations and student-to student discourse; Ask students to agree, disagree, support and compare the ideas of others
	6	Attend to precision	Students demonstrate individual accountability, equal participation, application of content vocabulary, and justification of ideas <u>SMP Student Actions:</u> Communicate with precision-orally and written; Carefully formulate explanations <u>SMP Teacher Actions:</u> Guide inquiry: teacher gives problem, students work together to solve problems, and time is given for discussing/sharing/comparing
	7/8	Look for and make use of structure. / Look for and express regularity in repeated reasoning.	Students engage in focused learning conversations to build on other students' thoughts/ideas/writing/non-linguistic representation (e.g. questioning, piggybacking, summarizing, clarifying, paraphrasing). Students engage in structured, scaffolded, Student to Student academic dialogue aligned to the lesson objective in order to develop expressive language proficiency and solidify learning <u>SMP Student Actions:</u> Make connections to skills and strategies previously learned to solve new problems/tasks <u>SMP Teacher Actions:</u> Carefully select tasks that allow for students to make connections; Provide adequate time for exploration

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Critical Thinking	1	Students make sense of problems and persevere in solving them.	<p>Students use complex reasoning to make new meaning not provided by the teacher (e.g. applying a concept in a new context, develop a plan or sequence of steps, select or devise an approach to research a problem, recognize and explain misconceptions, propose and evaluate solutions to problems, draw conclusions, making connections across time and place to explain a concept or big idea)</p> <p><u>SMP Student Actions:</u> Monitor progress and change course, if needed</p> <p><u>SMP Teacher Actions:</u> Probe student responses (correct or incorrect) for understanding of approaches</p>
	2	Reason abstractly and quantitatively	<p>Students use complex reasoning to make new meaning not provided by the teacher (e.g. applying a concept in a new context, develop a plan or sequence of steps, select or devise an approach to research a problem, recognize and explain misconceptions, propose and evaluate solutions to problems, draw conclusions, making connections across time and place to explain a concept or big idea)</p> <p><u>SMP Student Actions:</u> Use context to reason about an operation, an answer or the units of the answer</p> <p><u>SMP Teacher Actions:</u> Tie content areas together to help make connections; Emphasize reasoning, not just answer getting</p>
	3	Construct viable arguments and critique the reasoning of others	<p>Students monitor their thinking to ensure learning, seek knowledge about how they learn new concepts, facts and procedures; gain control in directing their solution process</p> <p><u>SMP Student Actions:</u> Justify and communicate predictions and conclusions; Analyze data, use to make arguments</p> <p><u>SMP Teacher Actions:</u> Create a safe environment for risk-taking and critiquing with respect; Ask students to agree, disagree, support and compare the ideas of others</p>
	5	Use appropriate tools strategically	<p>Students use complex reasoning to make new meaning not provided by the teacher (e.g. applying a concept in a new context, develop a plan or sequence of steps, select or devise an approach to research a problem, recognize and explain misconceptions, propose and evaluate solutions to problems, draw conclusions, making connections across time and place to explain a concept or big idea)</p> <p><u>SMP Student Actions:</u> Choose the appropriate tool to solve a given problem and deepen conceptual understanding; Choose the appropriate technological tool to solve a given problem and deepen conceptual understanding</p> <p><u>SMP Teacher Actions:</u> Maintain knowledge of appropriate tools; Model a situation where the decision needs to be made as to which tool should be used</p>
	8	Look for an express regularity in repeated reasoning	<p>...: (e.g.....draw conclusions, make connections across time and place to explain a concept or big idea; develop generalizations), gain control in directing their solution process</p> <p><u>SMP Student Actions:</u> Identify patterns and make generalizations; Maintain oversight of the process</p> <p><u>SMP Teacher Actions:</u> Provide rich and varied tasks that allow students to generalize relationships and methods, and build on prior math knowledge</p>