Ready to Go! Implementing Math Common Core
Shannon McCaw, SMc Curriculum

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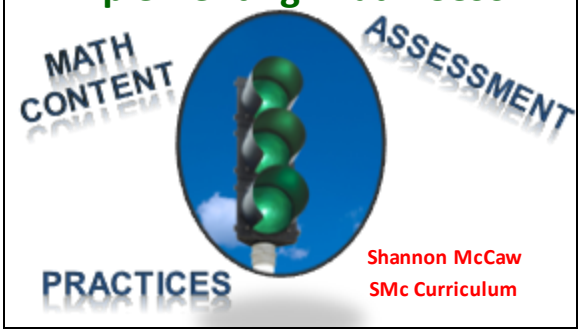
Implementing Math CCSS



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The Focus of the Content Standards

Do your teachers know the priority clusters for Smarter Balanced?

Do your teachers use that information to drive instruction?

Yearlong impact?

Daily impact?

The Three-Legged Stool
FOR PRIORITY CLUSTERS

- Conceptual Understanding
- Procedural Skill/Fluency
- Application

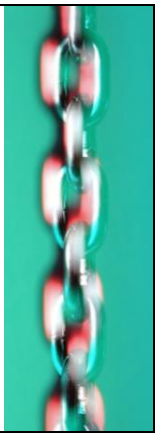
Coherence

Supporting clusters are CONNECTING clusters! Provides horizontal and vertical coherence.

Supporting Clusters:

- Clusters which connect to PRIORITY clusters within your own grade-level
- Additional content that connects to prior or future grade-level

Assessed at a much lower rate than Priority Clusters and outside of "Concepts and Procedures".



School-Wide Content Implementation

1. Compare scope and sequence to priority and supporting clusters to determine if shifts need to be made.
2. Survey teachers on program and individual weaknesses in terms of the "three-legged stool" (conceptual understanding, fluency, and application). Find curricular and teacher support systems.
3. Align reporting system (as soon as possible) to the priorities.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
6. Attend to precision.

2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others.	4. Model with mathematics. 5. Use appropriate tools strategically.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Math Practices "Look Fors"

Teacher Verbs	Student Verbs

School-Wide Practices Implementation

1. Ask teachers to know both what content standard(s) AND practice standard(s) are being addressed in each lesson. (Teacher teams may want to choose goal practice standards.
2. Create a teacher observation structure that allows teachers to observe other more-proficient teachers.
3. Create school-wide themes (across subject areas) to address the practices (such as perseverance or precision).

Assessments for the Common Core

- The purpose of Smarter Balanced (SBAC):
  - Summative benchmarking assessment to predict college and career readiness
- Large need for teachers to have formative and summative assessment system that mirrors SBAC expectations!

Claims Used in Smarter Balanced

Claim #1 Concepts & Procedures — **40%**

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Claim #2 Problem Solving

Claim #4 Modeling & Data Analysis — **60%**

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Claim #3 Communicating Reasoning

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

Cognitive Rigor and Depth of Knowledge (DOK)

- Level 1: **Recall and Reproduction**
  Requires eliciting information such as a fact, definition, term, or a simple procedure, as well as performing a simple algorithm or applying a formula.
- Level 2: **Basic Skills and Concepts**
  Requires the engagement of some mental processing beyond a recall of information.
- Level 3: **Strategic Thinking and Reasoning**
  Requires reasoning, planning, using evidence, and explanations of thinking.
- Level 4: **Extended Thinking**
  Requires complex reasoning, planning, developing, and thinking most likely over an extended period of time.

Sampling of Smarter Balanced DOK Level 3 Sentences

- "Use mathematics to justify your answer."
- "Show all work necessary to justify your answer."
- "Explain your reasoning."
- "Explain how you know your answer is correct."
- "Show another way to find (your answer)."
- YES/NO followed by explanation
- "Use words and/or numbers to show how you determined your answer."

Do similar sentences show up on assessments in your school? Do teachers know how to evaluate responses?

School-Wide Assessment Implementation

1. Analyze current assessments (both formative and summative) to compare to Claims and DOK levels. Make goals for changes needed.
2. Utilize a strong interim assessment system that gathers evidence of student growth throughout the school year (focuses on priority standards)
3. Create intervention systems for students not meeting minimum proficiencies in the priority topics.

SMc Curriculum Interim Assessment Package

- An interim assessment system for Grades 3 through High School
- Can be taken up to five times per year
- Strand reports focus on the Priority Clusters
- Perfect for growth goals and strategic intervention groups.
- Check out www.smciap.com!

SMc curriculum
improving math.

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What does a Common Core Assessment look like?

Depth of Knowledge Levels

Level 1: Recall and Reproduce (25% of seat time on assessment)

Level 2: Basic Skills and Concepts (50% of seat time on assessment)

Level 3: Strategic Thinking and Reasoning (25% of seat time on assessment)

Level 4: Extended Thinking (Separate assessment – performance task)

Claims

1. **Concepts and Procedures (40% of score on SBAC)**

2/4. **Problem-Solving (approx 40% of score on SBAC)**

3. **Communicating Reasoning (approx 20% of score on SBAC)**

Styles of Items

1. Selected Response
   - multiple choice
   - select all that apply
   - true/false or yes/no
   - drag and drop
2. Constructed Response
   - fill in the blank
   - numerical answer
3. Extended Response
   - explain your reasoning
   - show how you know your answer is correct
   - writing a note to convince someone
4. Performance Task

Depth of Knowledge (DOK)

Source: www.smarterbalanced.org Mathematics Content Specifications

A "Snapshot" of the Cognitive Rigor Matrix (Hess, Carlock, Jones & Walkup, 2009)

Depth of Thinking (Webb) + Type of Thinking (Revised Bloom)	**DOK Level 1** **Recall & Reproduction**	**DOK Level 2** **Basic Skills & Concepts**	**DOK Level 3** **Strategic Thinking & Reasoning**	**DOK Level 4** **Extended Thinking**
Remember	• Recall conversations, terms, facts			
Understand	• Evaluate an expression • Locate points on a grid or number on number line • Solve a one-step problem • Represent math relationships in words, pictures, or symbols	• Specify, explain relationships • Make basic inferences or logical predictions from data/observations • Use models/diagrams to explain concepts • Make and explain estimates	• Use concepts to solve non-routine problems • Use supporting evidence to justify conjectures, generalize, or connect ideas • Explain reasoning when more than one response is possible • Explain phenomena in terms of concepts	• Relate mathematical concepts to other content areas, other domains • Develop generalizations of the results obtained and the strategies used and apply them to new problem situations
Apply	• Follow simple procedures • Calculate, measure, apply a rule (e.g., rounding) • Apply algorithm or formula • Solve linear equations • Make conversions	• Select a procedure and perform it • Solve routine problem applying multiple concepts or decision points • Retrieve information to solve a problem • Translate between representations	• Design investigation for a specific purpose or research question • Use reasoning, planning, and supporting evidence • Translate between problem & symbolic notation when not a direct translation	• Initiate, design, and conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results
Analyze	• Retrieve information from a table or graph to answer a question • Identify a pattern/trend	• Categorize data, figures • Organize, order data • Select appropriate graph and organize & display data • Interpret data from a simple graph • Extend a pattern	• Compare information within or across data sets or texts • Analyze and draw conclusions from data, citing evidence • Generalize a pattern • Interpret data from complex graph	• Analyze multiple sources of evidence or data sets
Evaluate			• Cite evidence and develop a logical argument • Compare/contrast solution methods • Verify reasonableness	• Apply understanding in a novel way, provide argument or justification for the new application
Create	• Brainstorm ideas, concepts, problems, or perspectives related to a topic or concept	• Generate conjectures or hypotheses based on observations or prior knowledge and experience	• Develop an alternative solution • Synthesize information within one data set	• Synthesize information across multiple sources or data sets • Design a model to inform and solve a practical or abstract situation.

CCSS Math Walk-Through

Date:	Time: Beginning Middle End	Grade/Course:

1. Math content objective(s)/Learning Targets are visible. ☐ Visible ☐ Not Visible

Rigor Observed: ☐ Conceptual Understanding ☐ Fluency ☐ Application

2. Learning objective(s)/purpose of the lesson are evident to the students.

Student #1 can identify the objective of the lesson. *Ask: What are you learning right now?*	Student #2 can identify the objective of the lesson. *Ask: What are you learning right now?*
☐ Yes ☐ No	☐ Yes ☐ No

3A. Student evidence of learning the standards for mathematical practice (1-4).

1. Make sense of problems and persevere in solving them.	***2. Reason abstractly and quantitatively.***	***3. Construct viable arguments and critique the reasoning of others.***	***4. Model with mathematics.***
☐ Understand the meaning of the problem and look for entry points to its solution.	☐ Make sense of quantities and relationships in problem situations.	☐ Use previously learned mathematics when constructing arguments.	☐ Apply prior knowledge to solve real world problems.
☐ Analyze information (givens, constraints, relationships, goals)	☐ Represent abstract situations symbolically and understand the meaning of quantities.	☐ Make conjectures and use counterexamples as explanations.	☐ Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas.
☐ Make conjectures and plan a solution pathway.	☐ Create a coherent representation of the problem at hand.	☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, actions.	☐ Make assumptions and approximation to make a problem simpler.
☐ Monitor and evaluate the progress and change course as necessary.	☐ Consider the units involved.	☐ Listen to or read the arguments of others	☐ Check to see if an answer makes sense within the context of a situation and change a model when necessary.
☐ Check answers to problems and ask, "Does this make sense?"	☐ Flexibly use properties of operations.	☐ Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments.	

3B. Teacher actions that further the development of the standards for mathematical practice (1-4).

1. Make sense of problems and persevere in solving them.	***2. Reason abstractly and quantitatively.***	***3. Construct viable arguments and critique the reasoning of others.***	***4. Model with mathematics.***
☐ Allows students time to initiate a plan; use questions as prompts if needed.	☐ Expects students to interpret, model, and connect multiple representations.	☐ Encourages students to use proven mathematical understanding to support their reasoning.	☐ Provides experiences with the use of various math models.
☐ Continually asks students if their plans and solutions make sense.	☐ Asks students to explain the meaning of the symbols in the problem and in the solution.	☐ Asks questions so students justify their solution and their solution pathway.	☐ Questions students to justify their choice of model.
☐ Questions students to see connections to previous solution attempts and tasks.	☐ Expects students to give meaning to all quantities in the task.	☐ Prompts students to evaluate peer arguments when solutions are shared.	☐ Assists students in seeing and making connections among models.
☐ Consistently asks students to compare solution paths and justify solutions.	☐ Questions students to explain the relationships between quantities in a task.	☐ Creates opportunities for students to engage in math discussions (whole group, small group, etc.)	☐ Give students opportunities to evaluate the appropriateness of a model.
☐ Differentiates to keep advanced students challenged during work time.			

Adapted from *"CCL4s in Mathematics"* and "*Institute for Advanced Study/Park City Mathematics Institute*"

CCSS Math Walk-Through

4A. Student evidence of learning the standards for mathematical practice (5-8).

5. Use appropriate tools strategically.	*6. Attend to precision.*	*7. Look for and make use of structure.*	*8. Look for and make use of repeated reasoning.*
☐ Make sound decisions about the use of specific tools (calculator, concrete models, ruler, etc.)	☐ Communicate precisely using clear definitions.	☐ Look for patterns or structure, recognizing that quantities can be represented in different ways.	☐ Notice repeated calculations and look for general methods and shortcuts.
☐ Use technological tools to visualize the results of assumptions, explore consequences and compare predictions with data.	☐ State the meaning of symbols, carefully specifying units of measure, and providing accurate labels.	☐ Recognize the significance in concepts and models and use the patterns or structure for solving related problems.	☐ Continually evaluate the reasonableness of intermediate results (comparing estimates) while attending to details and make generalizations based on findings.
☐ Use tools to explore and deepen understanding of concepts.	☐ Calculate accurately and efficiently, expressing numerical answers with a degree of precision.	☐ View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems.	
	☐ Provide carefully formulated explanations.		
	☐ Label accurately when measuring and graphing.		

4B. Teacher actions that further the development of the standards for mathematical practice (5-8).

5. Use appropriate tools strategically.	*6. Attend to precision.*	*7. Look for and make use of structure.*	*8. Look for and make use of repeated reasoning.*
☐ Demonstrate and provide experiences with various math tools.	☐ Models precision in communication and in mathematical solutions.	☐ Encourages students to look for something they recognize and have students apply the information in identifying a solution path.	☐ Encourages students to connect task to prior concepts and tasks.
☐ Allow students to choose a tool.	☐ Expects students to use precise mathematical vocabulary during conversations.	☐ Expects students to explain the overall structure of the problem and the big math idea used to solve the problem.	☐ Prompts students to generate exploratory questions based on current tasks.
☐ Ask students to explain their thinking with a math tool.	☐ Questions students to identify symbols, quantities, and units in a clear manner.	☐ Expects students to see connections from past learning.	☐ Asks what math relationships or patterns can be used to assist in making sense of the problem.
☐ Ask students to explore other options when tools are not available.			☐ Questions students to assist them in creating generalizations based on repetition in thinking and procedures.

5. Identify student actions:

☐ Participating in discussion of content	☐ Engaged in test or quiz
☐ Working in collaborative student groups	☐ Actively reading (annotating, highlighting,etc.)
☐ Listening/note taking	☐ Answering questions individually
☐ Presenting or performing	☐ Station/Center work
☐ Engaged in computer-based learning activities	☐ Other:

6. Comments

Adapted from *"CCL4s in Mathematics"* and "*Institute for Advanced Study/Park City Mathematics Institute*"

Questions to Develop Mathematical Thinking

1. Make sense of problems and persevere in solving them.

- How would you describe the problem in your own words?
- How would you describe what you are trying to find?
- What do you notice about…?
- What information is given in the problem?
- Describe what you have already tried. What might you change?
- What steps in the process are you most confident about?
- What are some other strategies you might try?
- How else might you organize…represent…show…?

2. Reason abstractly and quantitatively.

- What do the numbers used in the problem represent?
- What is the relationship of the quantities?
- How is ___ related to ___?
- What does ___ mean to you? (e.g., symbol, quantity, diagram)
- What properties might we use to find a solution?

3. Construct viable arguments and critique the reasoning of others.

- What mathematical evidence supports your solution?
- What were you considering when…?
- How did you decide to try that strategy?
- How could you demonstrate a counterexample?
- How can you be sure that…? How can you prove that…? Will it still work if…?

4. Model with mathematics.

- What number model could you construct to represent the problem?
- What are some ways to represent the quantities?
- What's an equation or expression that matches the diagram? Number line? Chart? Table?
- What are some ways to visually represent…?
- What formula might apply in this situation?

5. Use appropriate tools strategically.

- What mathematical tools could we use to represent the situation?
- What approach are you considering trying first?
- Why was it helpful to use…?
- What can using ___ show us that ___ may not?
- In this situation would it be helpful to use a graph…, number line…, ruler…, diagram…, calculator, …manipulative?

6. Attend to precision.

- What mathematical terms apply in this situation?
- How do you know your solution is reasonable?
- Explain how you might show that your solution answers the problem.
- How are you showing the meaning of the quantities?
- What symbols are important in this problem?
- How could you test your solution to see if it answers the problem?

7. Look for and make use of structure.

- What observations do you make about…?
- What do you notice when…?
- What parts of the problem might you eliminate? Simplify?
- What patterns do you find in…?
- How do you know if something is a pattern?
- What ideas have we learned before that were useful in solving this problem?
- What are some other problems that are similar to this one?
- How does this relate to…?
- In what ways does this problem connect to other mathematical concepts?

8. Look for and express regularity in repeated reasoning.

- Will the same strategy work in other situations?
- Is this always true, sometimes true or never true?
- How would you prove that…?
- What do you notice about…?
- What would happen if…?
- Is there a mathematical rule for…?
- What predictions or generalizations can this pattern support?

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