Mathematics Leadership at Work:

Moving the Common Core State Standards from Vision to Action

Francis (Skip) Fennell, McDaniel College (Westminster, MD)

Beth Kobett, Stevenson University (Baltimore, MD)

Jon Wray, Howard County Public Schools (Ellicott City, MD)

2011 NCSM Summer Leadership Academy, Atlanta, GA

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Elementary Mathematics Specialists & Teacher Leaders Project

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ems&tl Project Goals

- A master of science degree program which includes certification as an Elementary Mathematics Instructional Leaders (EMIL);
- A nationally respected clearinghouse (www.mathspecialists.org) designed to address the growth, development, and ongoing needs relative to elementary mathematics specialists;
- Collaborative work with a core group of elementary mathematics specialists from central Maryland. This element of the ems&tl Project provides project leaders with the needs and day-to-day challenges, milestones, and ideas which influence our work;
- Providing professional development opportunities for area elementary mathematics specialists;
- **Providing professional development for mathematics specialists – nationally, through the National Council of Supervisors of Mathematics' (NCSM) leadership conferences, prior to National Council of Teachers of Mathematics regional conferences and during the NCSM Summer Leadership Academy.**
- The project seeks to determine the impact of work related to mathematics specialists at the regional and national level through the study of course offerings at the college/university level; review of state certification efforts; and analysis of school and school district programs which involve specialists, with particular attention to student achievement and teacher background.

Cell Phone Survey

Where is your school/district starting its work related to the CCSS?

 Text a **CODE** to **22333**  Submit responses at **pollev.com/jonwray**

Standards for Mathematical Practice	**194814**
Common Core Content Standards	**194820**
Both of the above	**194821**
None of the above	**194822**
I'm not sure	**194823**

Total Results: **0**

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EMS&TL Leadership Framework

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Adult Learner

- Realizing for the first time that interacting with my professional colleagues is simultaneously different and similar to interacting with 8-year olds!
- "Why is it that my 2nd grade team seems to look right through me when I am talking? And I know they have no interest in implementing what I am talking about unless I am literally standing right over them AND even them it will be grumble, grumble, whine, whine every step of the way."
- Providing time for my teachers to "get it."

Coaching

- "I realized that a way for me to connect with my teachers is to get engaged with their students…"
- "My best 1-1 time was early over coffee – especially if I can meet with 'my teacher' off site."

Navigating Relationships

- "I've got one principal who wants me to get the staff to begin implementing the CCSS-M for levels K-2 this coming year. The other one – clueless. I need to get her moving…"
- "In my school, if I can't get the 4th grade team leader on board – nothing happens. So, I work on her first."

Professional Learning Community

"It has taken about 4 years, but I actually believe we are now a PLC. Math conversations are not a special deal, we meet, as grade level groups and sometimes as a full faculty. The other day some of my teachers asked me to just talk about what the PARCC assessment might mean for us. This would have **never** happened a year ago!"

Challenges

- **Adult Learners** – shifting to working mostly and solely with adults is not trivial, it takes time.
- **Coaching** – learning to mentor and addressing the needs of those mentored takes time.
- **Navigating Relationships** – teachers, principals, board members, friends, former friends – *why did I take this job!*
- **Professional Learning Communities** – can you get there? Time…

Value Line Activity

Think about the characteristics of a **good mathematics student**. Where would you place "your" characteristic on this value line (**1** being *least important* and **5** being *most important*)?

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Value Line Activity

Think about the characteristics of a **good mathematics teacher**. Where would you place "your" characteristic on this value line (**1** being *least important* and **5** being *most important*)?

"The ***Standards for Mathematical Practice*** describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important 'processes and proficiencies' **with longstanding importance in mathematics education.**"

CCSSO, 2010, p. 6

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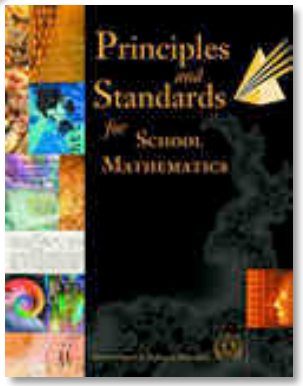
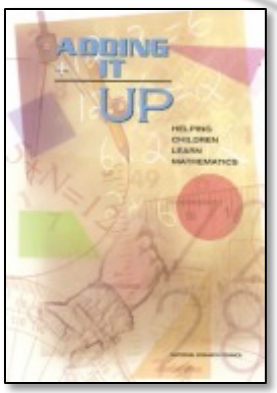
COMMON CORE
STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER

Standards for Mathematical Practice



NCTM Process Standards
PSSM (2000)



Strands of Mathematical Proficiency
Adding It Up (2001)

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How this got started…

NCTM Processes	*CCSS – Standards for Mathematical Practice*	*Adding it Up – Strands of Mathematical Proficiency*
Problem Solving	***Make sense of problems and persevere in solving them.***	Strategic competence
Reasoning and Proof	***Reason abstractly and quantitatively.***	Adaptive reasoning
Reasoning and Proof	***Construct viable arguments and critique the reasoning of others.***	Adaptive reasoning
Connections	***Model with mathematics.***	Strategic competence
Representation	***Use appropriate tools strategically.***	Strategic competence
		Conceptual understanding
Communication	***Attend to precision.***	Procedural fluency.
Connections	***Look for and make use of structure.***	Strategic competence
Reasoning and Proof	***Look for and express regularity in repeated reasoning.***	Adaptive reasoning
		*Productive disposition

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Making sense of all of this…

1. Talk with colleagues at your table about how the *NCTM Process Standards*, *Strands for Mathematical Proficiency* (SFMP), and *Standards for Mathematical Practice* (SFMP) are related.

2. How would you summarize *all of this* to people who have little or no awareness of these factors (e.g., colleagues, parents, students, and others)?

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Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Area Activity

- Can you represent the area of a rectangle that measures 5 in by 8 in? Use grid paper for your representation.

- What if the rectangle measured 5.5 in by 7.5 in? How would you represent the area? Would the area for this rectangle be the same as for the rectangle above?

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Before you can 'look for'…

- Teacher content background
- Teacher pedagogical background
- Issues:
  - Is the problem appropriate?
    - *Does it build from prior experiences?*
  - Representations appropriate?
  - Access to materials?

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Before you can 'look for'…

- **Instructional Issues**
  - Do the students have enough TIME to consider the problems, solve them, and discuss them – including similarities and differences?

- **Classroom norms for:**
  - Discussing?
  - Engaging others – engaging all?
  - Presenting and accepting arguments?

Developing Arguments/Strategies

Why aren't we comfortable with the idea of "arguing" an idea or point in mathematics?

How can we develop the concept of argument?

Barlow, Angela. & McCrory, Michael. (2011). Engage your students in reasoning and sense making with these effective instructional plans. *Teaching Children Mathematics, 17*(9), 530-539.

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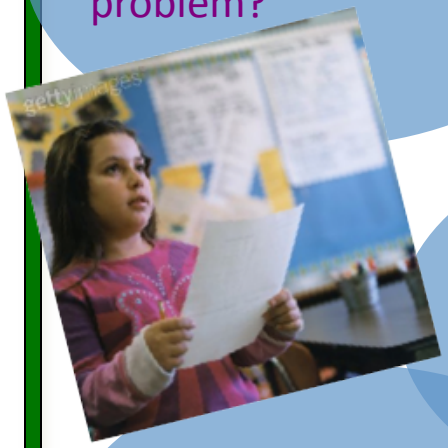
A common approach used in classrooms…

- "How did you get that answer?"
- "Do you agree or disagree with someone else's answer?"
- While nice questions, they don't elicit the kind of rich discussions that support deep thinking.

Sharing Thinking…

Do you understand how ____ solved the problem?

What are some of the decisions ____ made? Do agree or disagree with those decisions?



Did _____ use any models or other representations to help him/her solve?

Did you solve the problem in a different way? How do you know?

Would you like to change something about your solution now that you have heard _____'s narrative?

Does _____'s answer make sense to you?

How are _____ and _____ explanations the same? Different?

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Specific Strategies Can enhance the students' abilities to construct arguments

Force students to choose a side!

Choosing sides naturally elicits opportunities for disagreements.

Barlow, Angela. & McCrory, Michael. (2011). Engage your students in reasoning and sense making with these effective instructional plans. *Teaching Children Mathematics, 17*(9), 530-539.

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Is 4 x 8 *the same as* 8 x 4?

Support your reasoning!

Defend your answer!

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What does it take

to engage in the practices?

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Lunchtime

11:45-12:40

When you return, remember to sit in your new table groups by Practice (1-8)

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What's a LOOK FOR?

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Standards for Mathematical Practice

Key student dispositions:	**Teacher actions that will engage students in practices:**
Comments:	

* All indicators are not necessary for providing full evidence of practice(s). Each practice may not be evident during every lesson.

Standards for Mathematical Practices - "Student Look-fors"

School:	Teacher(s):	Course/Period:	Start/End Times:
Mathematical Topic(s):			

1. Make sense of problems and perseveres in solving them

- ☐ Understand the meaning of the problem and look for entry points to its solution
- ☐ Analyze information (givens, constrains, relationships, goals)
- ☐ Make conjectures and plan a solution pathway
- ☐ Monitor and evaluate the progress and change course as necessary
- ☐ Check answers to problems and ask, "Does this make sense?"

Comments:

2. Reason abstractly and quantitatively

- ☐ Make sense of quantities and relationships in problem situations
- ☐ Represent abstract situations symbolically and understand the meaning of quantities
- ☐ Create a coherent representation of the problem at hand
- ☐ Consider the units involved
- ☐ Flexibly use properties of operations

Comments:

3. Construct viable arguments and critique the reasoning of others

- ☐ Use definitions and previously established causes/effects (results) in constructing arguments
- ☐ Make conjectures and use counterexamples to build a logical progression of statements to explore and support their ideas
- ☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, actions
- ☐ Listen to or read the arguments of others
- ☐ Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments

Comments:

4. Model with mathematics.

- ☐ Apply prior knowledge to solve real world problems
- ☐ Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- ☐ Make assumptions and approximations to make problem simpler
- ☐ Check to see if an answer makes sense within th context of a situation and change a model when necessary

Comments:

5. Use appropriate tools strategically.

- ☐ Make sound decisions about the use of specific tools. Examples might include:
  - ☐ Calculator
  - ☐ Concrete models
  - ☐ Digital Technology
  - ☐ Pencil/paper
  - ☐ Ruler, compass, protractor
- ☐ Use technological tools to visualize the results of assumptions, explore consequences and compare predications with data
- ☐ Identify relevant external math resources (digital content on a website) and use them to pose or solve problems
- ☐ Use technological tools to explore and deepen understanding of concepts

Comments:

6. Attend to precision.

- ☐ Communicate precisely using clear definitions
- ☐ State the meaning of symbols, carefully specifying units of measure, and providing accurate labels
- ☐ Calculate accurately and efficiently, expressing numerical answers with a degree of precision
- ☐ Provide carefully formulated explanations
- ☐ Label accurately when measuring and graphing

Comments:

7. Look for and make use of structure.

- ☐ Look for patterns or structure, recognizing that quantities can be represented in different ways
- ☐ Recognize the significance in concepts and models and use the patterns or structure for solving related problems
- ☐ View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems

Comments:

8. Look for and express regularity in repeated reasoning

- ☐ Notice repeated calculations and look for genera methods and shortcuts
- ☐ Continually evaluate the reasonableness of intermediate results (comparing estimates) while attending to details and make generalizations based on findings

Comments:

Additional notes:

Non-evaluative visitor(s): _____ **Date:** _____

Standards for Mathematical Practice – Student "Look-fors"

Overarching *habits of mind* of a productive mathematical thinker

1. Make sense of problems and perseveres in solving them

- ☐ Understand the meaning of the problem and look for entry points to its solution
- ☐ Analyze information (givens, constrains, relationships, goals)
- ☐ Make conjectures and plan a solution pathway
- ☐ Monitor and evaluate the progress and change course as necessary
- ☐ Check answers to problems and ask, "Does this make sense?"

Comments:

6. Attend to precision.

- ☐ Communicate precisely using clear definitions
- ☐ State the meaning of symbols, carefully specifying units of measure, and providing accurate labels
- ☐ Calculate accurately and efficiently, expressing numerical answers with a degree of precision
- ☐ Provide carefully formulated explanations
- ☐ Label accurately when measuring and graphing

Comments:

Reasoning and explaining

2. Reason abstractly and quantitatively

- ☐ Make sense of quantities and relationships in problem situations
- ☐ Represent abstract situations symbolically and understand the meaning of quantities
- ☐ Create a coherent representation of the problem at hand
- ☐ Consider the units involved
- ☐ Flexibly use properties of operations

3. Construct viable arguments and critique the reasoning of others

- ☐ Use definitions and previously established causes/effects (results) in constructing arguments
- ☐ Make conjectures and use counterexamples to build a logical progression of statements to explore and support their ideas
- ☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, actions
- ☐ Listen to or read the arguments of others
- ☐ Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments

Comments:

Modeling and using tools

4. Model with mathematics

- ☐ Apply prior knowledge to solve real world problems
- ☐ Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- ☐ Make assumptions and approximations to make a problem simpler
- ☐ Check to see if an answer makes sense within the context of a situation and change a model when necessary

5. Use appropriate tools strategically

- ☐ Make sound decisions about the use of specific tools. (Examples might include: calculator, concrete models, digital technology, pencil/paper, ruler, compass, protractor.)
- ☐ Use technological tools to visualize the results of assumptions, explore consequences and compare predications with data
- ☐ Identify relevant external math resources (digital content on a website) and use them to pose or solve problems
- ☐ Use technological tools to explore and deepen understanding of concepts

Comments:

Seeing structure and generalizing

7. Look for and make use of structure

- ☐ Look for patterns or structure, recognizing that quantities can be represented in different ways
- ☐ Recognize the significance in concepts and models and use the patterns or structure for solving related problems
- ☐ View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems

8. Look for and express regularity in repeated reasoning

- ☐ Notice repeated calculations and look for general methods and shortcuts
- ☐ Continually evaluate the reasonableness of intermediate results (comparing estimates) while attending to details and make generalizations based on findings

Comments:

Teacher(s): _____ Grade/Course: _____ Date: _____ Start/End Times: _____ # of Students: _____

Mathematics Practices		Students:	Teachers:
Overarching habits of mind of a productive math thinker	**1. Make sense of problems and persevere in solving them**	☐ Analyze information and explain the meaning of the problem ☐ Actively engaged in problem solving (Develop, carry out, and refine a plan) ☐ Show patience and positive attitudes ☐ Ask if their answers make sense ☐ Check their answers with a different method Comments:	☐ Pose rich problems and/or ask open ended questions ☐ Provide wait-time for processing/finding solutions ☐ Circulate to pose probing questions and monitor student progress ☐ Provide opportunities and time for cooperative problem solving and reciprocal teaching Comments:
	6. Attend to precision	☐ Calculate accurately and efficiently ☐ Explain thinking using mathematics vocabulary ☐ Use appropriate symbols and specify units of measure Comments:	☐ Recognize and model efficient strategies for computation ☐ Use (and challenging students to use) mathematics vocabulary precisely and consistently Comments:
Reasoning and Explaining	**2. Reason abstractly and quantitatively**	☐ Represent a problem symbolically ☐ Explain their thinking ☐ Use numbers and quantities flexibly by applying properties of operations and place value ☐ Examine the reasonableness of their answers/calculations Comments:	☐ Ask students to explain their thinking regardless of accuracy ☐ Highlight flexible use of numbers ☐ Facilitate discussion through guided questions and representations ☐ Accept varied solutions/representations Comments:
	3. Construct viable arguments and critique the reasoning of others	☐ Make conjectures to explore their ideas ☐ Justify solutions and approaches ☐ Listen to the reasoning of others, compare arguments, and decide if the arguments of others makes sense ☐ Ask clarifying and probing questions Comments:	☐ Provide opportunities for students to listen to or read the conclusions and arguments of others ☐ Establish and facilitate a safe environment for discussion ☐ Ask clarifying and probing questions ☐ Avoid giving too much assistance (e.g., providing answers or procedures) Comments:

* All indicators are not necessary for providing full evidence of practice(s). Each practice may not be evident during every lesson.

	Mathematics Practices	Students:	Teacher(s) promote(s) by:
Modeling and Using Tools	**4. Model with mathematics**	☐ Apply prior knowledge to new problems and reflect ☐ Use representations to solve real life problems ☐ Apply formulas and equations where appropriate Comments:	☐ Pose problems connected to previous concepts ☐ Provide a variety of real world contexts ☐ Use intentional representations Comments:
	5. Use appropriate tools strategically	☐ Select and use tools strategically (and flexibly) to visualize, explore, and compare information ☐ Use technological tools and resources to solve problems and deepen understanding Comments:	☐ Make appropriate tools available for learning (calculators, concrete models, digital resources, pencil/paper, compass, protractor, etc.) ☐ Embed tools with their instruction Comments:
Seeing structure and generalizing	**7. Look for and make use of structure**	☐ Look for, develop, and generalize relationships and patterns ☐ Apply conjectures about patterns and properties to new situations Comments:	☐ Provide time for applying and discussing properties ☐ Ask questions about the application of patterns ☐ Highlight different approaches for solving problems Comments:
	8. Look for and express regularity in repeated reasoning	☐ Look for methods and shortcuts in patterns in repeated calculations ☐ Evaluate the reasonableness of intermediate results and solutions Comments:	☐ Provide tasks and problems with patterns ☐ Ask about possible answers before, and reasonableness after computations Comments:

* All indicators are not necessary for providing full evidence of practice(s). Each practice may not be evident during every lesson.

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Reflection

- What if you are supporting teachers (who are teaching students) who are *not* exhibiting these behaviors?
- How might you lead discussions about about lessons that help deepen student understanding through the Practices?
- What types of coaching questions could you ask to help a teacher (student, parent) focus on what to do to foster student behaviors for SFMP?

The Standards for Mathematical Practice… A Closer Look

Overarching *habits of mind* of a productive mathematical thinker

1. Make sense of problems and persevere in solving them. **56%**

6. Attend to precision. **40%**

Reasoning & explaining

2. Reason abstractly and quantitatively. **56%**

3. Construct viable arguments and critique the reasoning of others **38%**

Modeling & Using Tools

4. Model with mathematics. **40%**

5. Use appropriate tools strategically. **49%**

Seeing Structure & Generalizing

7. Look for and make use of structure. **21%**

8. Look for and express regularity in repeated reasoning. **17%**

As of June 16, 2011: N = 332; 90% - classrooms with students exhibiting 1 or more Practices, 10% - no evidence of students exhibiting any Practices

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Howard County Public Schools; adapted from *Tools for the Common Core (2011)*

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Transition to the Common Core

A First Step

Online Module:

http://www.mathspecialists.org/LIM/player.html

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Summing Up and Connecting Back

- *Why* the Practices?
- *How* will we do this?
- Leadership Framework

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