Coaching the Practices NCTM 2013

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Phil Daro says…

"If the Standards for Mathematical Practice are not in place, well then, you're not really using the Common Core."

Mathematical Practices

- The 8 Standards for Mathematical Practice begin with 3 words.

- Whisper to your neighbor-What are those 3 words?

Mathematics | Standards for Mathematical Practice

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. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1 Make sense of problems and persevere in solving them.
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2 Reason abstractly and quantitatively.
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems

Habits of Mind of a Productive Mathematical Thinker	Reasoning and Explaining
MP.1 Make sense of problems and perservere in solving them.	**MP.2** Reason abstractly and quantitatively.
MP.6 Attend to precision.	**MP.3** Construct viable arguments and critique the reasoning of others.
	Modeling and Using Tools
	MP.4 Model with mathematics.
	MP.5 Use appropriate tools strategically.
	Seeing Structure and Generalizing
	MP.7 Look for and make use of structure.
	MP.8 Look for and express regularity in repeated reasoning.

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

When given a problem, I can make a plan, carry out my plan, and check my answer.

BEFORE...

Think about the problem.

Ask myself, "Which strategy will I use?"

Make a **plan** to solve the problem.

DURING...

Stick to it!

Ask myself, "Does this make sense?"

Change my plan if it isn't working out.

AFTER...

CHECK my work.

Ask myself, "Is there another way to solve the problem?"

Attend to precision.

Mathematical practice 6

I can be precise when solving problems and clear when I share my ideas.

Careful and clear mathematicians use...

symbols

PLUS: join

EQUAL: the same as

23¢ + 52¢ = 75¢

units of measure: CENTS

- math vocabulary
- symbols that have meaning
- context labels
- units of measure
- calculations that are accurate and efficient

What will students be doing?

Reason abstractly and quantitatively.

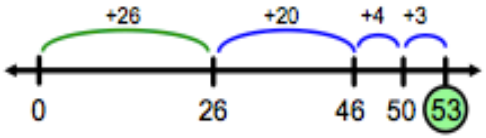
Mathematical Practice 2

I can use numbers and words to help me make sense of problems.

Numbers to Words

26 + 27 = 53

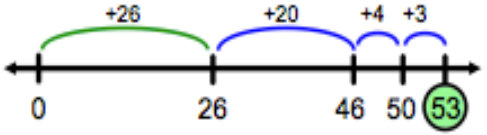
There are 26 boys and 27 girls on the playground.
How many children are on the playground?



26 + 20 = 46
46 + 4 = 50
50 + 3 = 53

Words to Numbers

There are 26 boys and 27 girls on the playground.
How many children are on the playground?



26 + 20 = 46
46 + 4 = 50
50 + 3 = 53

26 + 27 = 53

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

I can explain my thinking and respond to the mathematical thinking of others.

I can explain my strategy using...

- objects, drawings, and actions 
- examples and non-examples
- contexts

I can compare strategies with others by...

- listening 
- asking useful questions 
- understanding mathematical connections between strategies

Model with mathematics.

Mathematical Practice 4

I can recognize math in everyday life and use math I know to solve problems.

I can use....

I can use take-away to find the difference between the number of crayons Jill and Rob have.

(Words)

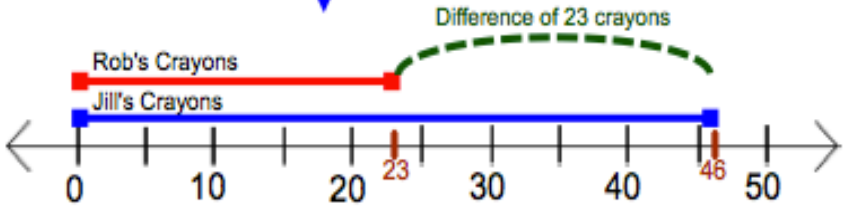
Rob has 23 crayons. Jill has 46 crayons. How many more crayons does Jill have than Rob?

(Symbols)

$$\begin{array}{r} 46 \\ -\ 23 \\ \hline 23 \end{array}$$

(Objects)

(Pictures)



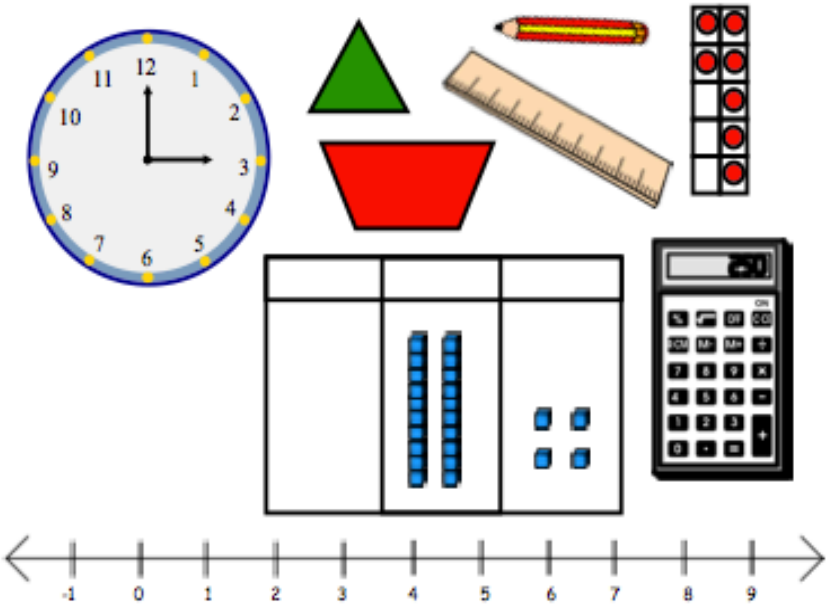
...to solve everyday problems.

Use appropriate tools strategically.

Mathematical Practice 5

I can use certain tools to help me explore and deepen my math understanding.

I have a math toolbox.

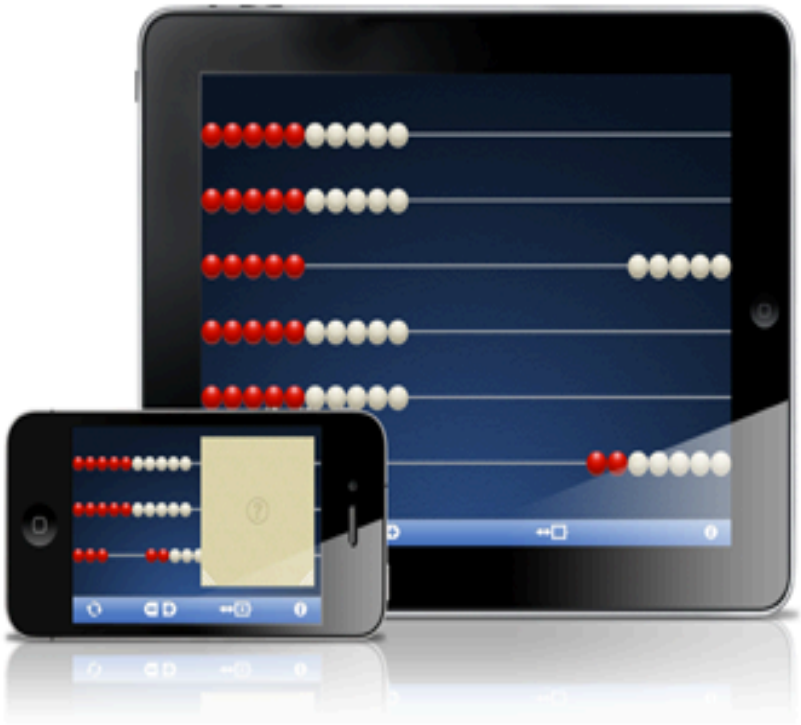


- I know *HOW* and *WHEN* to use math tools.
- I can reason: *"Did the tool I used give me an answer that makes sense?"*

Online apps are tools too!

Math Learning Center Apps

Number Rack



The Number Rack facilitates the natural development of children's number sense. Rows of moveable, colored beads encourage learners to think in groups of fives and tens, helping them to explore and discover a variety of addition and subtraction strategies. Learn More...

Download on the App Store

Also Available as a Web App

The free, web app version of the Number Rack works on all modern browsers, including Internet Explorer 9.

Number Rack Web App

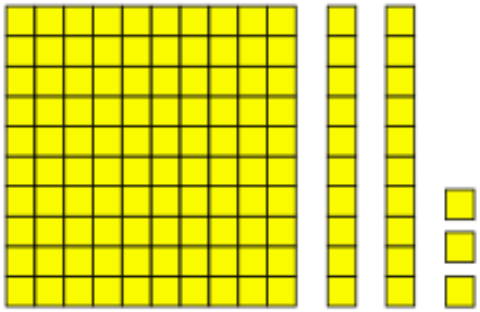
Look for and make use of structure.

Mathematical Practice 7

I can see and understand how numbers and shapes are organized and put together as parts and wholes.

Numbers

For example:



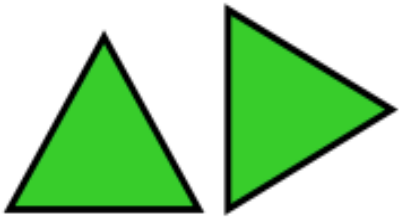
123

1 hundred, 2 tens, and 3 ones

Base Ten System

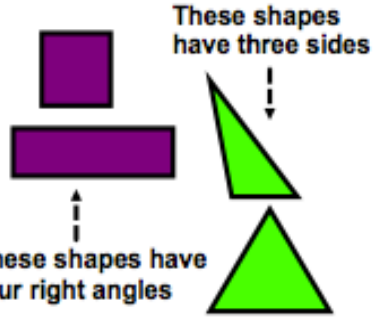
Shapes

For example:



These are the same!

Orientation



Attributes

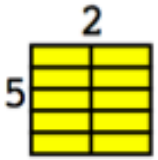
Look for and express regularity in repeated reasoning. Mathematical Practice 8

I can notice when calculations are repeated.

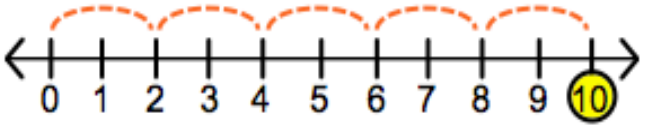
5 x 2 = 10

2 + 2 + 2 + 2 + 2 = 10

I am adding 2 five times.



I am counting rows with 2 in each row five times.



I am making 5 hops of 2 on the number line.

What does the teacher do?

- Use rich problems and tasks with materials.
- Provide time for students to reflect on their own thinking.
- Provide opportunities for students to dialogue with other students.
- Create a safe environment for students to share their solutions with each other.

The authors of the CCSS recognize that teachers need to increase their content knowledge as well.

How will coaches help teachers facilitate these shifts?

A COACH IS JUST ONE PERSON!

- How can one person make an impact on a whole school, several schools, or a district??

- Create Coaching/Teaching Cohorts!

Here's one model...

- Grade level teams met 7 times a year, for 3 hours.
- Teachers brought the standards and their teacher's manuals.
- Teachers were assigned a specific lesson to read ahead of time.

Pre-conferenced about a lesson

- What is the lesson about? Big ideas?
- What instructional strategies will be used?
- What are the possible misconceptions and difficulties?
- What math practices will be highlighted?

The coach was willing to model some of the time, but encouraged other teachers to step up to the plate, too!

Guiding Questions for the Math Lesson

- What is the purpose of the lesson? How does it fit into the unit/month work?
- How does the content align with the standards?
- What do students need to <u>know</u> and <u>be able to do</u> in order to be successful with this material?

- What accommodations could you make to meet the needs of individual learners? This might include challenge and support.

Observed the lesson

The criteria were agreed upon and evidence on the following look-fors was collected:

- Student talk/teacher talk and vocabulary
- Questioning strategies
- Student engagement
- Use of models and manipulatives
- Classroom community
- Evidence of Differentiation

Post-conferenced about the lesson

Establishing a PLC is KEY to cohort work!

- Teachers shared feedback based on their notes from the Classroom Look For document. They shared specific evidence.
- Initially, there was only praise but over time, teachers began to ask, “I wonder if…” questions.
- How did the pre-conference objectives align with the lesson?
- What are the next steps for the teacher?

Our cohort goals were

1. To positively impact student achievement by increasing teacher pedagogy and content knowledge… All schools that participated in the cohort made AYP in Mathematics!

2. To look at student work and assessment data, thereby monitoring teaching and learning more effectively, using differentiated instruction practices… Teachers reported more effective questioning strategies helped them differentiate their practice.


Hundreds Board
February
March
April
May
June
July
August
September
October
November
December
April
2009
Days This Month
Days in School
Coins
Monday's Money

3. We used the rubric from *Describing Levels and Components of a Math-Talk Community* by Hufferd-Ackles, Fuson, and Sherin (2004) to examine questioning, explaining mathematical thinking, identifying the source of mathematical ideas and responsibility for learning. All teachers reported a change in practice from fall to spring, and fall to fall the following year.

4. To participate in the lesson study process, providing ongoing feedback and support to novice and veteran teachers.

5. To correlate the lessons to the standards; gaps are identified and units are now aligned!

6. To encourage teachers to observe one another using the same format/lesson study approach. Over 200 observations are on record.

7. To create a cohort of professionals district wide, that continue to comprehensively implement a standards-based curriculum and support one another.

Thank you for coming to hear about some possibilities…

Also by the presenter…

- *Mathematics Coaching Handbook*, published by Eye on Education,
- Teaching Children Mathematics, *One Elementary School's Journey from Research to Practice*, October, 2007,
- Teaching Children Mathematics, *Shifting Roles and Responsibilities*, October, 2008.
- Bridges in Mathematics, Grade 3, Math Learning Center, 2005

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