Waterbury Public Schools Roll Out Presentation of The Common Core State Standards for Mathematics

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Lessons Learned from the Past

- TIMSS: math performance is being compromised by a lack of focus and coherence in the "**mile wide. Inch deep" curriculum.**
- Hong Kong students outscore US students in the grade 4 TIMSS, even though Hong Kong only teaches about **half the tested topics. US covers over 80% of the tested topics.**
- High-performing countries spend more time on **mathematically central concepts: greater depth and coherence. Singapore: "Teach less, learn more."**

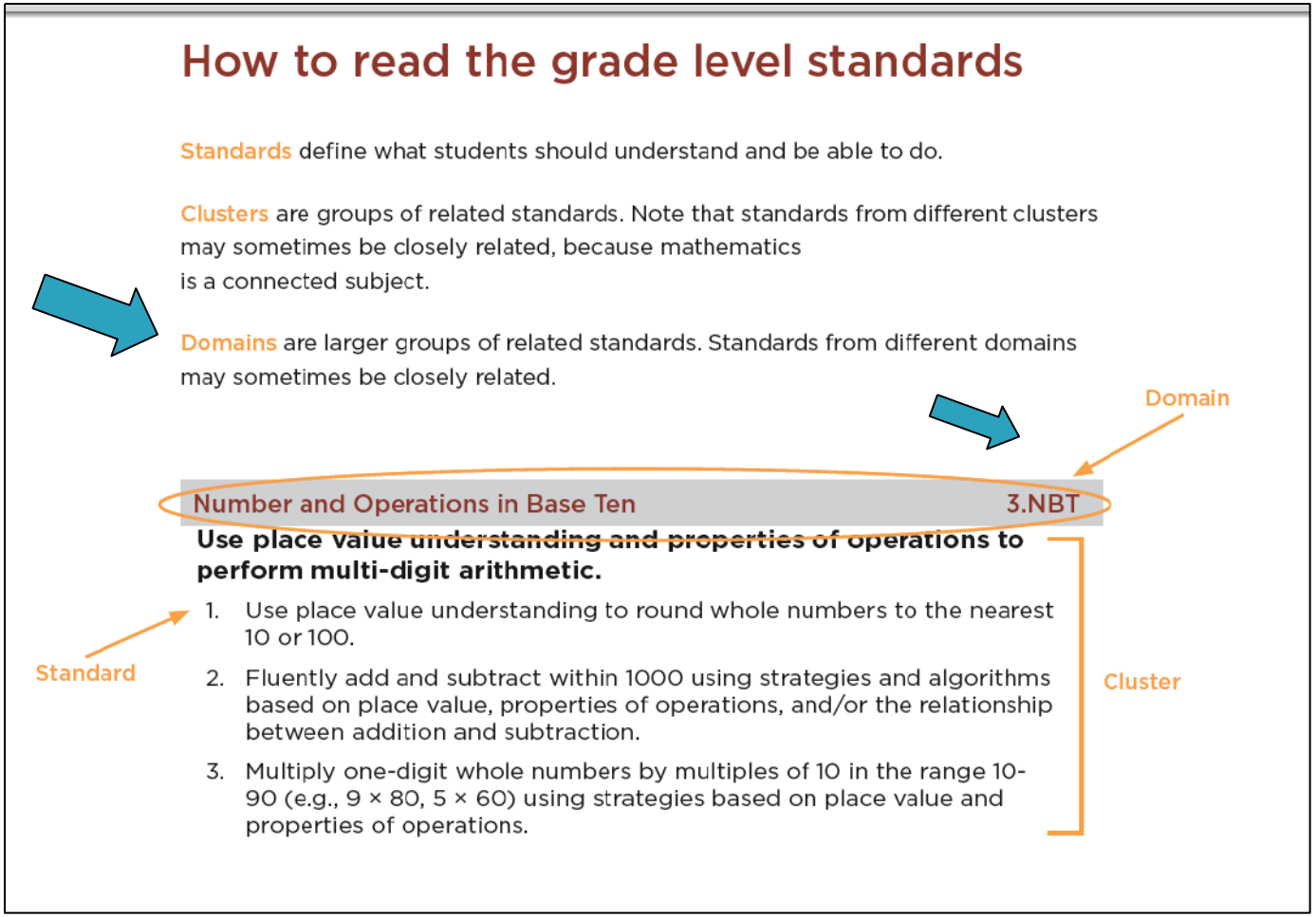
Focus and Coherence

- **Focus** is meant to **allow time for students and teachers to master the intricate, challenging, and necessary things** in each grade that open the way to a variety of applications even as they form the prerequisite study for future grades' learning. (SBAC 2011)
- **Coherence** means structuring learning so that math makes sense. It also **implies that the standards are more than a mere checklist of disconnected statements**; the cluster headings, domains, and other text in the standards all organize the content in ways that highlight the unity of the subject. (SBAC 2011)

Paradigm Shifts for Mathematics

- Bid Adieu to CMT Strand Land
- Bid Guten Tag to standards-based focused, coherent instruction
- Put the practice standards into practice
- CCSSM is built on Mastery. Content will end and will not be taught explicitly again.
  (Ex. Counting & Cardinality only in K)
- It is no longer acceptable for students to only be able solve a problem in only one way.

Mathematics Common Core Layout



Organization of Standards

- **Clusters** are groups of related standards.
- **Domains** or **conceptual categories** are larger groups of related standards.
- Each grade level begins with a brief narrative describing the focus on **critical areas of instruction**.

Grade 8 Critical Areas of Focus

Mathematics | Grade 8

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

(1) Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

K–8 Content Standards by Domain

DOMAINS	Counting & Cardinality	Operations & Algebraic Thinking	Number & Operations in Base Ten	Measurement & Data	Geometry	Number & Operations: Fractions	Ratios & Proportional Relationships	The Number System	Expressions & Equations	Statistics & Probability	Functions
K	X	X	X	X	X						
1		X	X	X	X						
2		X	X	X	X						
3		X	X	X	X	X					
4		X	X	X	X	X					
5		X	X	X	X	X					
6					X		X	X	X	X	
7					X		X	X	X	X	
8					X			X	X	X	X

Key Fluencies

Grade	Required Fluency
K	Add/subtract within 5
1	Add/subtract within 10
2	Add/subtract within 20 Add/subtract within 100 (pencil and paper)
3	Multiply/divide within 100 Add/subtract within 1000
4	Add/subtract within 1,000,000
5	Multi-digit multiplication
6	Multi-digit division Multi-digit decimal operations
7	Solve $px + q = r$, $p(x + q) = r$
8	Solve simple 2×2 systems by inspection

Exploring Waterbury Mathematics Curriculum Documents

Curriculum Articulation by Grade Level

- Includes:
  - Philosophy of WPS Mathematics Department
  - Standards Overview
  - Math Practice Standards
  - Lists all the standards in that grade level.
  - Aligns standards with the Mathematical Practices that are most inherent to the standard.
  - Aligns standards with an Example and/or Explanation that illustrates the meaning of the standard.
  - Aligns standard with the Connecticut Unit it is located within.
  - Aligns standards with instructional resources teachers can use to teach the standard. (some resources have hyperlinks that link them directly to the lesson or activity ideas)
  - Aligns standards with **minimum** required strategies for teachers (meaning teachers can use other strtegies but they must utilize the identified strategies first).
  - Aligns standards with technology lessons/activities that can be used to teach the standard.
  - Identifies whether a standard has a CMT/CAPT correlation.

Allow teachers 15 -20 minutes to review the documents.

Full documents will be sent electronically and be available on the WPS Mathematics Department Webpage

Exploring Waterbury Mathematics Curriculum Documents

Unit Instructional Tool

- Developed based on the Instructional Unit Shells created by the CSDE using Rigorous Curriculum design Protocols.
- Includes:
  - Pacing- Days/periods
  - Identifies **Priority** vs. Supporting Standards within the unit. (All standards are important and fair game for testing but all standards are not created equal. More time must be spent on some standards than others. Those standards are in **bold** and are priority standards.)
  - Identifies the Performance Objectives that are aligned to the standards in the unit.
  - Identifies instructional strategies that are aligned to the performance objectives. (Some strategies are hyperlinked to samples and examples of the strategy)
  - Identifies the resources that are aligned to the performance objectives. (Some resources are hyperlinked to the lesson/activity/webpage associated with the resource)
  - Identifies pre-requisite knowledge the performance objectives were built upon.

Allow teachers 10 -15 minutes to review the documents.

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Focus, Focus, Focus

- Marzano ETS Strategies
  - Identifying Similarities and Differences
  - *Note Taking
  - *Summarizing
  - Cooperative Learning
  - Nonlinguistic Representations
  - *Vocabulary Development

Resources

- Boardworks Middle School Math CC – SharePoint
- Grade 6, 7 and 8 Math Station Activities – SharePoint
- Expeditions Middle School Math – Performance Tasks – SharePoint
- Daily Warm-Ups – Pre-Algebra – SharePoint

Mathematically Proficient Students Will…

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

2. Reason abstractly and quantitatively.

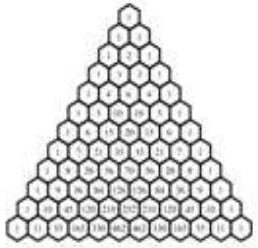
3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

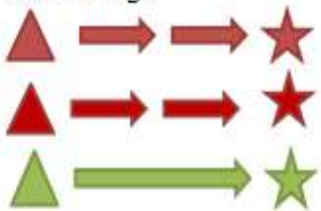
5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.



8. Look for and express regularity in repeated reasoning.



Adapted from *Inside Mathematics*

Make sense of problems and persevere in solving them

When presented with a problem, I can make a plan, carry out my plan, and evaluate its success.

BEFORE...

EXPLAIN the problem to myself.

- *Have I solved a problem like this before?*

ORGANIZE information...

- *What is the question I need to answer?*
- *What is given?*
- *What is not given?*
- *What are the relationships between known and unknown quantities?*
- *What tools will I use?*
- *What prior knowledge do I have to help me?*

DURING...

PERSEVERE

MONITOR my work

CHANGE my plan if it isn't working out

ASK myself, "Does this make sense?"

AFTER...

CHECK

- *Is my answer correct?*
- *How do my representations connect to my algorithms?*

EVALUATE

- *What worked?*
- *What didn't work?*
- *What other strategies were used?*
- *How was my solution similar to or different from my classmates'?*

Reason abstractly and quantitatively

I can use reasoning habits to help me contextualize and decontexualize problems.

CONTEXTUALIZE

I can take numbers and put them in a real-world context.

For example, if given
3 x 2.5 = 7.5
I can create a context:

I walked 2.5 miles per day for 3 days. I walked a total of 7.5 miles.

DECONTEXTUALIZE

I can take numbers out of context and work mathematically with them.

For example, if given
'I walked 2.5 miles per day for 3 days. How far did I walk?',
I can write and solve

3 x 2.5 = 7.5

Reasoning Habits include *1) creating an understandable representation of the problem solved, 2) considering the units involved, 3) attending to the meaning of quantities,* and *4) using properties to help solve problems.*

Construct viable arguments and critique the reasoning of others

I can make conjectures and critique the mathematical thinking of others.

I can ***construct***, ***justify***, and ***communicate*** arguments by...

- considering context
- using examples and non-examples
- using objects, drawings, diagrams and actions

I can ***critique the reasoning of others*** by...

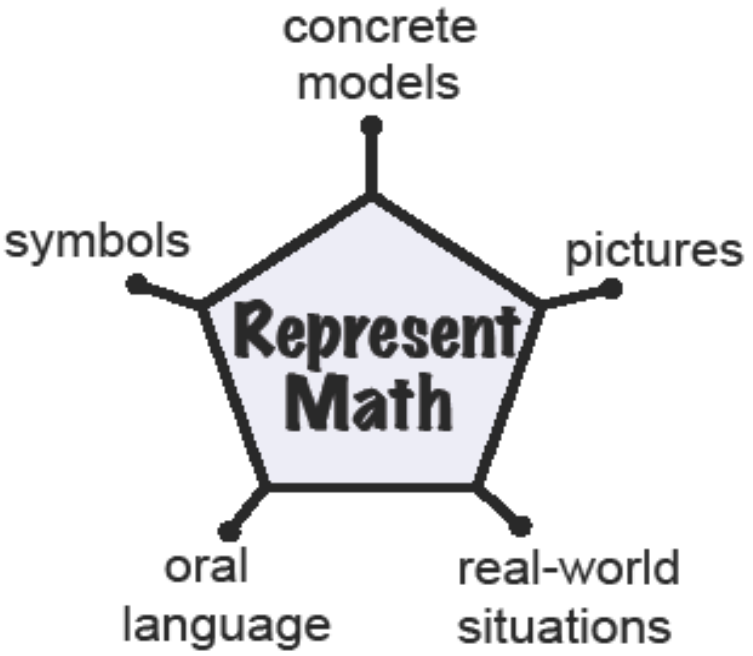
- listening
- comparing arguments
- identifying flawed logic
- asking questions to *clarify* or *improve arguments*

Model with mathematics

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

I can...

- make assumptions and estimate to make complex problems easier
- identify important quantities and use tools to show their relationships
- evaluate my answer and make changes if needed

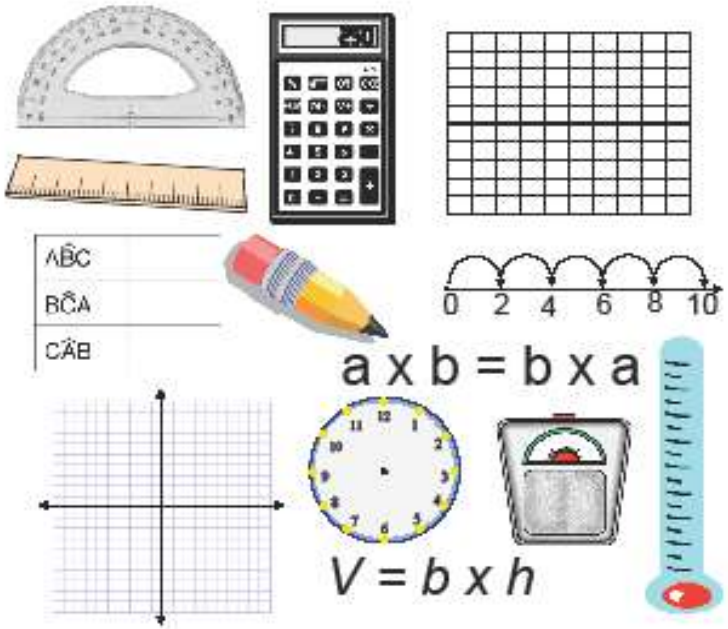


Use appropriate tools strategically

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

I have a <u>math toolbox</u>.

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



Attend to precision

I can use precision when solving problems and communicating my ideas.

Problem Solving

- I can calculate *accurately*.
- I can calculate *efficiently*.
- My answer matches what the problem asked me to do – *estimate* or find an *exact answer*.

Communicating

- I can SPEAK, READ, WRITE, and LISTEN mathematically.
- I can correctly use...
  - math symbols
  - math vocabulary
  - units of measure

Look for and make use of structure

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

Numbers

For Example:

- Base 10 structure
- operations and properties
- terms, coefficients, exponents

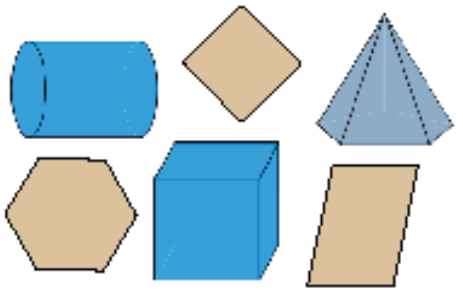
	10	+ 3
10	100	30
+		
5	50	15

13 x 15
(10 + 3) x (10 + 5)
100 + 30 + 50 + 15
195

Spaces

For Example:

- dimension
- location
- attributes
- transformation



Look for and express regularity in repeated reasoning

I can notice when calculations are repeated. Then, I can find more efficient methods and short cuts.

For example: $25 \div 11$

$$
\begin{array}{r}
2.2727 \\
11\overline{)\,25.0000} \\
-22 \\
\hline
30 \\
-22 \\
\hline
80 \\
-77 \\
\hline
30 \\
-22 \\
\hline
80 \\
-77 \\
\hline
30
\end{array}
$$

I am repeating this calculation. The quotient is a repeating decimal.

TEACHER'S ROLE IN IMPLEMENTING THE PRACTICE STANDARDS

Teachers will need to provide:

- Rich problems and tasks for students to consider.
- Time for students to reflect on their own thinking.
- Opportunities for students to dialogue with other students.
- A safe environment for students to share their solutions with other students.

Activity

Connecting Mathematical Practices to Daily Teaching and Learning

JigSaw

- Split into 8 Groups – Not by grade level this time.
- Assign each group a Mathematical Practice Standard – (Assign a scribe for each group)
- Each group will read their practice Standard and discuss what implications does this practice standard have for teaching and learning in math at my grade level or in my discipline. (i.e. what should I have students engaged in during class if I want to see students "**Attending to Precision"** in class. – MP6")
- Give each group 10 min then share out.

Practice Standards In Action

- Click on a Practice Standard to go to see video vignettes and commentary of the Mathematical Practice Standards in Action. There will be videos at multiple grade levels.

Practice Standards are "Standards" Meaning that a student's level of performance on a practice standard will be tested by the assessment.

1. Make sense of problems and persevere in solving them.
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3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Assessment

- CMT and CAPT will remain in place for accountability purposes through 2013-2014. (But we **will not** wait until 2014 to prepare our students. These are not standards to try to catch up to.)
- School year 2014/2015, SMARTER Balanced Assessment Consortium (SBAC) assessment system operational for students in Grades 3-8 and 11.
- CMT/CAPT Practice will be included weekly on CMT/CAPT Wednesdays.

CMT/CAPT WEDNESDAYS

- Math lesson/activity each Wednesday from Sept. 2012 thru Feb 28, 2013 devoted to CMT/CAPT math strands/categories.
- Lessons/activities must be done within CCSS framework meaning the teacher **cannot** just provide worksheets and sit back and the teacher **cannot** be the sole source of learning.
- Lessons must be interactive and student focused where students are sharing, explaining and proving their knowledge of CMT Math in multiple ways. Lessons/activities must be **planned**. Teachers are to facilitate learning.

Examples (Use CMT/CAPT materials already in your school or go to CREC.org website for materials. Teacher Login: Username: twaterbury Password: 13waterb)

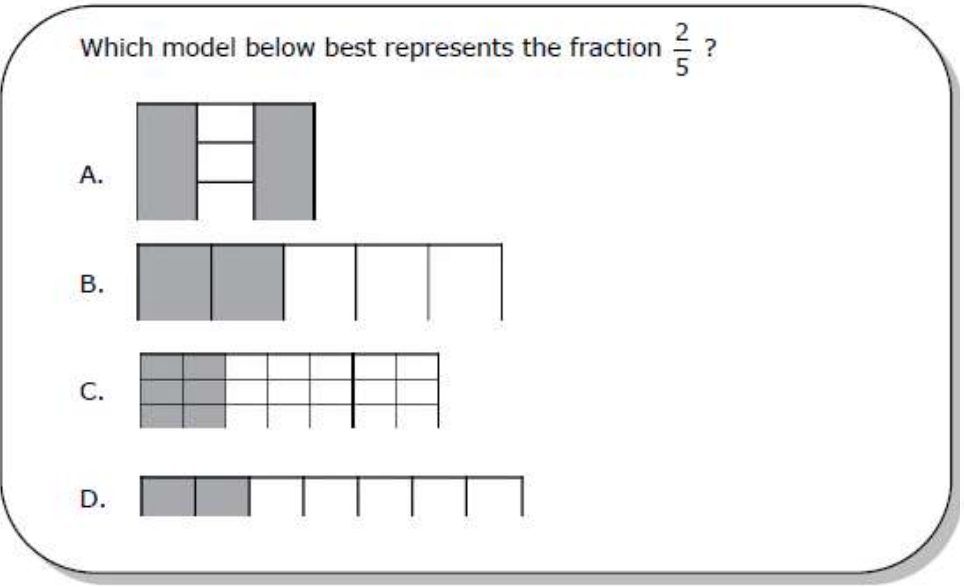
- **CMT/CAPT Centers**
  - Set up centers in your classroom with different CMT/CAPT problems.
  - Group the students by ability, mixed ability, etc.
  - Very weak students stay with you while others go around with notebooks and work out the problems. Be sure to tell them they will have to explain and prove their answer somehow. You may need to have manipulatives available.
  - When you bring all students back together call on some to provide answers and explain. The student may call on other group members to help.
- **CMT/CAPT JigSaw**
  - Set up groups
  - Give each group a set of problems from a particular strand or set of strands. Each group should have problems from a different strand or set of strands.
  - Let the students work on the problems and then have them share out. They should state the problem, the answer and how they solved the problem.
  - Each group should be asked at least 2 questions from the class. Give the other groups question prompts to ask until they can start to come up with their own questions: like "Can you solve that problem another way?" or why did you use that method? Etc.
- **CMT/CAPT "I Can Prove it"**
  - Can be whole group.
  - Teacher places a problem on the board or Smartboard and the students have to work on the problem at their desk.
  - The teacher chooses student 1to provide the answer.
  - The teacher then picks student 2 and that student says "I can prove it."
  - Student 2 must come up and prove whether student 1 was correct or not.
  - If student 2 gets stuck he or she can use a life line and call another student up to help.

Examples continued….

- **CMT/CAPT "Is he/she right?"**
  - Can be a group or whole class activity.
  - Students must remove all paper and pencils from their desk. This is a mind training activity.
  - The teacher puts a problem up on the board with either the correct or incorrect problem solving steps.
  - The teacher asks is he or she right?
  - Students must explain whether the process is correct or incorrect verbally.
- **CMT/CAPT "Come up with a problem…"**
  - Can be a group or in pairs.
  - Teacher will identify the strands or conceptual categories they will use for content.
  - Teacher asks the students to come up with a problem and the solution to the problem.
  - E.g. the teacher will says "**come up with a problem"** where a student has to:
    - find the sum of two numbers
    - draw a line of symmetry through a polygon.
    - write a story problem using 2/3 x 5
    - rind the volume of a prism
    - find the slope of line given 2 points
  - The students will exchange problems with another student and have them solve it.
  - Students will check their answers and discuss.
- **CMT/CAPT "Restate the Question"**
  - Teacher will place several open-ended questions on the board and ask the students to restate the question in a form so you know what answer you are looking for.
  - Students will write restatements in their notebooks.
  - Students will share out and critique each others restatements of the problems.
- **CMT/CAPT "Pick a Strategy"**
  - Can be group or whole class activity..
  - Teacher will place a problem on the board or Smartboard.
  - Below the problem will list multiple strategies to solve the problem.
  - Students will decide which strategy to use and then use that strategy to solve the problem. If using groups; groups must discuss and come to consensus on which problem to solve.
  - Students will then share their answer, strategy chosen and why they chose that strategy.

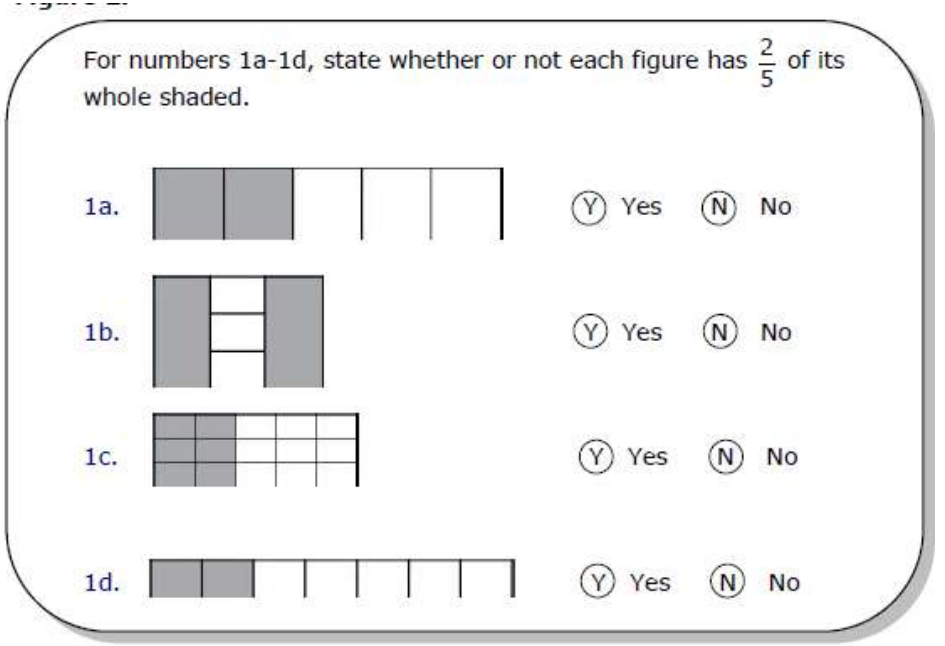
Selected Response Examples

CMT Selected Response



Even if a student does not truly have a deep understanding of what 2/5 means, he or she is likely to choose option B over the rest of the options because it looks to be a more traditional way of representing fractions.

Common Core Selected Response



This item is more complex in that a student now has to look at each part separately and decide whether 2/5 can take different forms. Score with a (0-2) Rubric.

Constructed Response

Grade 1 - Assessment Items

Unit 4 - Exploring Addition and Subtraction within 100

Write a number sentence and solve the problem. Use manipulatives (base-ten blocks, hundreds chart, number lines) or a drawing to show how to solve this problem.

Mrs. Jones needs 42 cupcakes for the class picnic.
She has 32 cupcakes.

How many more cupcakes does she need to buy?

This is how Joe found the answer to $29 + 30 + 1$

$29 + 30 + 1 = 30 + 30 = 60$

What did Joe do to solve the problem?

Technology Enhanced Items – Elem/MS

(Click Screen to start animation)

13.

The number line below is divided into equal parts. The zero (0) is already placed on the number line.

Place each of the following numbers in the proper place on number line. To place a number, click on a tile and then click on the number line. You may move and clear numbers as needed.

Reset

$\frac{2}{1}$ $\frac{3}{5}$ 1

Performance Tasks Items (Click on Text to go to Performance Task Examples)

- Grade 3 Cookie Dough
- Grade 7 Proportional Reasoning
- High School Geometry – Logo Design

Common Core Math Teaching Tips

- Current Paradigm – **Answer Getting**
- New Paradigm – **Understanding and Transferability.**
- How do I pose problems to the class?
- What Problems do I use?
- What is Conceptual Coherence?
- What is evidence of student growth we cannot get from rubrics or test scores?

Three Responses to a Math Problem

1. Answer getting – **Current Paradigm**
   - Getting the answer one way or another and then stopping
   - Learning a specific method for solving a specific kind of problem (100 kinds a year)

New Paradigm

2. Making sense of the problem situation
3. Making sense of the mathematics you can learn from working on the problem

Answers Are a Black Hole: Hard to Escape the Pull

- Answer getting short circuits mathematics, **especially making mathematical sense.**
- Very habituated in US teachers versus Japanese teachers.
- High-achieving countries **devise methods for slowing down, postponing answer getting.**

How do I pose problems to the class?

- Whole class: pose problem, make sure students understand the language, **no hints at solution.**
- Focus students on the problem situation, **not the question/answer game**. Hide question and ask them to formulate questions that make situation into a word problem.
- Ask 3-6 questions about the same problem situation; **ramp questions up toward key mathematics** that transfers to other problems.

What Problems do I use?

- Problems that draw thinking toward the mathematics you want to teach. **NOT too routine**, right after learning how to solve the problem.
- Ask about a chapter: what is the most important mathematics students should take with them? **Find problems that draw attention to this math**.
- Begin chapter with this problem or type of problem. This has diagnostic power. Also shows you where time has to go.
- Near end of chapter, external problems needed, e.g. Shell Centre

Resources
Moving Forward Professionally

NCSM Illustrating Mathematical Practices

- Diving Deeper into the Common Core Standards for Mathematics: Leading with the Mathematical Practices -A webinar that introduces Mathematical Practices. http://ncsmonline.org/docs/events/webinars/NCSMCCSSWebinar2011-02-23Presentation.pdf
- These ready-to-use PD materials are designed to help teachers understand the Standards for Mathematical Practice and implement them in their classrooms. Each module supports a 1.5- to 3-hour session that focuses on one or two mathematical practices. http://www.ncsmonline.org/ccss/materials.html

Moving Forward Professionally

- The Hunt Institute videos are vignettes that explain the Standards in far greater depth.
  - Several of the key Standards writers were asked, in their own words, to talk about how the Standards were developed and the goals they set for all students.

CCSSO video vignettes were developed to help diverse groups – educators, policymakers, parents – better understand the breadth and depth of the Standards and how they will improve teaching, make classrooms better, create shared expectations, and cultivate lifelong learning for all students.

Moving Forward Professionally

- The Illustrative Mathematics Project will provide guidance to states, assessment consortia, testing companies, and curriculum developers by illustrating the range and types of mathematical work that students will experience in a faithful implementation of the Common Core State Standards, and by publishing other tools that support implementation of the standards.
- Achieve the Core
- The Mathematics Assessment Project

Moving Forward Professionally

- **Explore RIGOR by Connecting the Standards for Mathematical Practice to the Content Standards:** Participants examine content standards to see how they connect with the Standards for Mathematical Practice and how in tandem they form the basis of a rigorous curriculum. (Appropriate for Pre-K-12.)
  http://www.doe.mass.edu/candi/commoncore/mathexplore/

- Inside Mathematics a professional resource for educators passionate about improving students' mathematics learning and performance. This site features classroom examples of innovative teaching methods and insights into student learning, tools for mathematics instruction that teachers can use immediately, and video tours of the ideas and materials on the site.

- The Teaching Channel, a resource featuring videos, lesson plans and strategies that demonstrate inspired teaching design to inspire teaching.

Other States…

- Alaska Standards
- Kentucky materials
- Georgia materials
- Hawaii materials
- NY materials