Transitioning to the Common Core
using MDTP Written Response Materials
Curtis Center Conference March 2014

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I taught my dog to whistle

I don't hear him whistling?

I said I taught him, I didn't say he learnt it!
Mathematics Diagnostic Testing Project

- Statewide project of UC/CSU funded to support math instruction, 30+ years
- What we do
  - Multiple choice diagnostic tests (develop, provide materials, scoring, reporting)
  - WRI
  - Field testing
  - Workshops
  - Site visits and support
  - Staffed by CA math educators
- Materials and services provided at no charge
Agenda

CCSS Transition
General Info About WRI
Using a WRI to Infuse the CCSS MP
The Common Core Transition
Moving from Old to CCSS

Old CA standards emphasized... doing isolated skills

- Memorize
- Solve
- Graph
- Compute
- Define
- Use

CCSS emphasizes... understanding concepts, connections

- Understand
- Explain
- Analyze
- Reason
- Compare and contrast
- Plan
Overarching habits of mind of a productive mathematical thinker.

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.

Reasoning and explaining:

Modeling and Using tools:

Seeing structure and generalizing:
## Common Core Math Practices

**Please jot some ideas about classroom “moves” that:**

<table>
<thead>
<tr>
<th>Support making sense of math</th>
<th>Do not support making sense</th>
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<table>
<thead>
<tr>
<th>Develop perseverance</th>
<th>Do not develop perseverance</th>
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<tr>
<th>Encourage constructing viable arguments and critiquing the reasoning of others</th>
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<th>Develop attention to precision</th>
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MP 1
Making sense of math

• Rich tasks
• Approximation, estimation
• Multiple representations (including context)
• Writing and talking through our ideas, strategies, comparing with others
• Connecting with prior understandings and concepts ...

Give meaning to the mathematics being learned
MP1 Perseverance

- Effective solution strategies may take a while to find (more than just get it or not)
- Know they have a math toolbox (look for patterns, make a table, guess and check)
- Tinker around and try something
- Reflect
- Revise
- Try again
“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.”

“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.”

- Need rich tasks that allow students to make arguments
- Students need to work with each other students to develop these abilities
- Need opportunity to improve arguments (revision)
What does this mean for the classroom?

More than just good tasks...

- Move away from teacher-telling, “answer getting”, island lessons
- Build on prior knowledge and use context to ground the math discussion
- Emphasize process; student thinking; sense-making
- Total participation
- Peers work together to brainstorm, wrestle with each other’s thinking
- Compare and contrast representations and solution strategies
- Cherish, confront, correct misunderstandings
- Reflect, verify reasonableness of answers, revise
About WRI
MDTP Written Response Items

- Developed in concert with multiple choice items
- Designed to encourage students to write out their mathematical reasoning and thus, think more deeply and carefully about the math
- Designed for teachers to learn more about their students’ strengths and weaknesses
- Opportunity to address weaknesses in a new context
- Provide enrichment
- Promote analysis/discussion and refine expectations of student work by teachers
A Variety of Problems

- [E:\MIC\mdtpUptoDate\WRI\MDTP_WrittenResponseMaterials\wC AHSEE.pdf](E:\MIC\mdtpUptoDate\WRI\MDTP_WrittenResponseMaterials\wC AHSEE.pdf)
- Order free CD through online MDTP order form.
- Document is copyrighted and secured but any pages may be printed.
Written Response Item Components

- Master copy of problem
- Essence Statement
- General scoring rubric
- Specific scoring rubric
Delving into a Written Response Problem
Choosing a Problem

- Foundational to Next Unit
- Noted difficulty in classwork
- Results of diagnostic
- Enrichment
- Departmental Initiative
6. Using the circular spinner shown to the right, what is the probability that on any spin the arrow will land in area $T$?

(A) $\frac{1}{16}$  (B) $\frac{1}{8}$  (C) $\frac{1}{4}$  (D) $\frac{1}{2}$
28. A number \( k \) is greater than 3. Which of the following is true about \( \frac{k}{3} \)?

(A) It is between 0 and \( \frac{1}{3} \).  
(B) It is between \( \frac{1}{3} \) and 1.

(C) It is equal to 1.  
(D) It is greater than 1.
Which of the fractions shown in the box to the right is the largest?

A) $\frac{3}{4}$  
B) $\frac{5}{6}$  
C) $\frac{11}{12}$  
D) $\frac{19}{24}$
For this written response activity, your work should clearly show how you solved each part. Label any figures you draw.

Tara is starting to learn about fractions. She asks you for help.

A. Which of the two fractions, \( \frac{3}{6} \) or \( \frac{4}{6} \), is greater? Show how you would convince Tara that your answer is correct.

B. Which of the two fractions, \( \frac{5}{6} \) or \( \frac{5}{8} \), is greater? Show how you would convince Tara that your answer is correct.

C. Which of the two fractions, \( \frac{1}{8} \) or \( \frac{3}{25} \), is greater? Show how you would convince Tara that your answer is correct.

DO NOT USE DECIMALS IN YOUR EXPLANATIONS BELOW.
Using WRI and Infusing MP...
It is all about enactment

- Choose a problem
- Work the problem yourself.
- Set some expectations.
- Decide how use the problem in the classroom.
WRI / MP Cycle

Goals and expectations → Pre-assessment → Analyze results
Provide feedback → Evaluate / Next steps
Student revises work → Follow-up instruction

Setting Goals and Expectations

- Work with other teachers to set goals and expectations
- Showcase some strategies to use with students
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DO NOT USE DECIMALS IN YOUR EXPLANATIONS BELOW.
General Scoring Rubric for Written Response Items

| Excellent | 4  | The response demonstrates a complete understanding of the problem, is correct, and the methods of solution are appropriate and fully developed. The response is logically sound, clearly written, and does not contain any significant errors. Requested examples are well chosen and illustrate the desired conclusions. |

NOTES EXPLAINING HOW TO USE SPECIFIC ITEM RUBRICS

Scoring is based not just on the correctness of the math, which might rate a 1 or 2, but on the clarity, organization, completeness of the presentation.
RUBRIC

Note:
- A correct response to any part consists of identifying the “greater” fraction. Note:
- A complete response to any part is a correct response with a complete justification.
- A justification with an arithmetic error will not be considered a complete justification.
- Only using the cross product will not be considered a complete justification.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Two correct responses.</td>
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<tr>
<td>2</td>
<td>One complete response OR three correct responses.</td>
</tr>
<tr>
<td>3</td>
<td>Three correct responses with a complete response to Part B or Part C OR two complete responses.</td>
</tr>
<tr>
<td>4</td>
<td>Complete responses to all parts.</td>
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</table>
Make Thinking Visible and Important

Think-Share-Poster

- Independent work
- One-by-one share work with others
- Listeners look for something good, suggest way to improve.
- Discuss/design poster. (Think multiple representations/strategies)
- Each makes part of poster
Swap Meet
  • Two students from each group visit another group’s poster. (right and left)

  • If you are staying at your poster, be ready to explain the reasons for your group's work.

  • If you are visiting another group:
    • Check to see what is different from your groups work.
    • If there are differences, ask for an explanation. If you still don’t agree, explain your own thinking.
    • When you return to your own group, you need to consider as a group whether to make any changes to your own poster.
Debrief

- Did this help you to think more deeply about the problem?
- Did anyone improve their responses - expand, refine, find another way?
My Goals and Expectations for PRFRCO

• Improve number sense: size of fractions, ability to estimate
• Meaning of fractions: One, not 2 separate numbers
• Compare fractions: common denominator, common numerator, compare to benchmarks
• Use representations: words, numeric(equation/inequality), pics, context
• MP1: Make sense, persevere
• MP6: Attend to precision
• MP3: Construct viable arguments, critique reasoning of others
Possible ways of showing work: In words

- $\frac{3}{6}$ means three of six equal parts
- $\frac{4}{6}$ means four of six equal parts
- So $\frac{4}{6} > \frac{3}{6}$
Possible ways of showing work: Pics

Length Model

Area Model:

\[
\frac{4}{6} = \frac{3}{6} + \frac{1}{6}
\]

Six equal pieces of 1/6 each

Set Model

\[
\frac{4}{6} > \frac{3}{6}
\]
Possible ways of showing work: Numeric

- \( \frac{3}{6} = 3 \left( \frac{1}{6} \right) = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} \)
- \( \frac{4}{6} = 4 \left( \frac{1}{6} \right) = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} \)

So \( \frac{4}{6} = \frac{3}{6} + \frac{1}{6} \)

And \( \frac{3}{6} < \frac{4}{6} \)
Possible ways of showing work:

Situation

- If Juan runs $\frac{3}{6}$ of an 18 mile race and Lucy runs $\frac{4}{6}$ of the race. Who runs further?

- Lucy runs $\frac{1}{6}$ further
Student work
PRFRCO
Analyze Student Work

- Can be mind-boggling: helps to work with other teachers
- Helps to sort into categories: strategy used; “better”; “worse”
- Looking for
  - What they know as a collective
  - Where are the gaps
  - What needs refinement
- Make some prelim observations

Analyze results
Some observations:
What they know

- Know where denominator is and that it divides whole into pieces
- Use area model, number line, set model
- They circled answers
- Use words to explain

Analyze results
Some observations: What needs improvement

- Drawings inaccurate/imprecise (denominator = sized pieces, use same unit)
- Confusion about when larger numbers mean bigger/smaller fraction
- Compare units of different sizes
- Size related to number of pieces left over
- Comparison to 0/1 may be inaccurate
- Limited representations
Feedback

- Grade = students stop learning
- Make a list of questions that help students think more carefully and reflect on their own work (in light of the instruction to follow)
- In order for me to make sense, I did some sorting...
How does this show Tara why \( \frac{4}{6} \) is greater?
You have drawn 6 slices, but some appear to be different sizes, does that matter?

I see 6 parts in each circle.
What do we know about each of the 6 parts?
How do you know \( \frac{4}{6} \) is closer to 1? Can you draw a picture to help convince Tara?
• What does the numerator and denominator tell you?
• Can you make a drawing or draw yours more precisely?
• If you have the same denominators what do you know?
• If you have the same numerators, what do you know?
• How do you know that 4/6 is closer to 1 than 3/6?
• How do you know that ½ is bigger than 2/3?
• What does the 3 and 4 represent in 3/6 and 4/6?
• Can you draw a number line to represent this?
• Can you make an equation/inequality that compares 3/6 and 4/6
Follow-Up Instruction

- Depends on analysis...may just need some refinements, but may need to spend extended time
- Reactivate and build on what they know
- Fill-in gaps
- Confront and correct misunderstandings
- Not re-teaching
- Not practice
Make Thinking Visible

- Think-Pair-Share/Pairs Check
- Poster
- Swap Meet
Activities

- Error Analysis and Correction
- Sorting
- Open-Ended Questions
- Math Routines

...Total participation
Two students were comparing 2/5 and 3/5. Identify any issues and provide suggested improvements.

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<thead>
<tr>
<th>Original</th>
<th>Suggestions</th>
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<tbody>
<tr>
<td>1. <img src="image1.png" alt="Image" /></td>
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<tr>
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<td><img src="image4.png" alt="Image" /></td>
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<td><img src="image6.png" alt="Image" /></td>
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<tr>
<td>4. <img src="image7.png" alt="Image" /></td>
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Error Analysis:
Confront and Correct

Follow-up Instruction
Identify and Correct the Error

1. \[-3(4 + 3 \cdot 2) + 2 \cdot 5^2\]
   \[= -3(7 \cdot 2) + 2 \cdot 25\]
   \[= -3(14) + 50\]
   \[= -42 + 50\]
   \[= -8\]

2. \[-3(4 + 3 \cdot 2) + 2 \cdot 5^2\]
   \[= -3(4 + 6) + 10^2\]
   \[= -3(10) + 100\]
   \[= -30 + 100\]
   \[= 70\]

3. \[-3(4 + 3 \cdot 2) + 2 \cdot 5^2\]
   \[= -3(4 + 6) + 2 \cdot 25\]
   \[= -3(10) + 50\]
   \[= -30 + 50\]
   \[= 80\]

4. Try this problem to check your understanding:
   \[3 \cdot 4^2 - 6(8 + 8 \div 2)\]
   What is a common error students might make when calculating the second term?

Follow-up Instruction
Revision

- Give students the opportunity to revise PRFRCO work, improve arguments ... build perseverance
Next Steps

- Evaluate revised work
- May want to grade with rubric
- May want to give scores only to students with Excellent responses, work with others to improve
- Did the students meet my goals?
- Are we ready to move on?
WRI / MP Cycle

- Goals and expectations
- Pre-assessment
- Analyze results
- Provide feedback
- Student revises work
- Follow-up instruction

In summary

- MDTP WRI provide field-tested tasks that can help you infuse the CC Math Practices
- Shift focus from answers & teacher explanations to discussion of student thinking, strategies
- Student work needs to be visible
- Students need to work together...brainstorm, wrestle with and refine arguments
  - Think-Pair-Share, Posters, Swap meet
- Error analysis and correction
- Provide meaningful feedback
- Provide opportunities to revise work
- Contact me
Some References to Check Out

- Order MDTP materials from mdtp.ucsd.edu
- Achieve the Core: http://www.achievethecore.org/page/762/introductory-videos-on-the-common-core-state-standards
- Learning Progressions: http://ime.math.arizona.edu/progressions/
- SmarterBalanced http://www.smarterbalanced.org/
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