Citations

- CaCCSS-M Resources Home, (2011) http://caccsm.cmpso.org/k-8-modeling-task-force

- Written Response Items, of California, Mathematics Diagnostic Testing Project, The California State University and The University of California, Mathematics Diagnostic Testing Project, http://mdtp.ucsd.edu/


- Clarke, B. and Clarke, D. Using Questioning to Elicit and Develop Children’s Mathematical Thinking. NCTM.

Common Core State Standards for Mathematics

Two Types of Standards:

- **Mathematical Practice** (recurring throughout the grades)
- **Mathematical Content** (different at each grade level)
Standards for Mathematical Practice

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.
“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.”

(CCSS, 2010)
The Nature of Tasks Used in the Classroom …

Will Impact Student Learning!

Tasks as they appear in curricular materials → Student learning
But, WHAT TEACHERS DO with the tasks matters too!

The Mathematical Tasks Framework

Tasks as they appear in curricular materials → Tasks as set up by teachers → Tasks as enacted by teachers and students → Student learning

Stein, Grover & Henningsen (1996)
Smith & Stein (1998)
Stein, Smith, Henningsen & Silver (2000)
Can We Trust Maps?

• Mexico has an approximate area of 750,000 square miles.

• Estimate the areas of the other countries/regions such as Alaska, Algeria, Greenland that are on your chart using a method of your choice.
How does this activity relate to the Standards for Mathematical Practice?

- Using your copy of the Standards for Mathematical Practice, discuss with a neighbor which Standards for Mathematical Practice were addressed in this activity? What content is addressed?

- In what ways must classroom instruction change to support activities such as this map activity?
Using Questioning to Elicit Thinking

- To elicit and develop students’ mathematical thinking and reasoning:
  - Choose questions carefully
  - Hold back from telling students something they could work out for themselves
Responding to a Computation

- You complete the responses.
- Please, Miss, is this correct?
  
  81
  - 54
  
  33

Write at least four other possible responses.
Analyze Your Questions

- Consider each response on the handout in turn, and consider the questions below:
- Does this response help to elicit and develop children’s thinking? In what ways?
- Am I telling students something they could figure out for themselves?
Encouraging Thinking

- Look at the comments on handout 2.2. Select one comment that you believe would elicit student thinking and one that you think would not. Be prepared to give the reasons why or why not.
Generic Questions

- Questions such as
- How did you work that out?
- Could you solve that another way?
- Could you generalize your result?

What other generic questions could be added to the list?

How does this give you formative information about what the student knows and doesn’t know?
Open and Closed Questions

- Respond to the following two questions:
  - What is the mean 5, 11, 7, and 1?
  - I have four numbers with a mean of 6. What might those numbers be?
Consider...

- What kind of responses did each of the questions yield?
- What might students learn from answering each of the questions?
- What might the teacher learn from how students answer these questions?
• You add two fractions and the sum is $\frac{9}{10}$. What could the fractions be?

• The answer is 42. What is the question?

• Create your own open ended question.
Watson and Mason (1998) developed “stems” of questions “to provoke children into becoming aware of mathematical thinking processes”.

Using the concept on your file card, and the question stems on your handout, create at least three questions that you would believe would be powerful in eliciting and developing mathematical thinking for students.
What are the implications of this activity, considering that we will have the same textbooks for several more years?
The Mathematics Diagnostic Testing Project (MDTP) has responded to Common Core with the development of Written Response Items. These are in addition to the existing multiple choice items from Pre-Algebra Readiness through Calculus Readiness.
Thank You!