Connecting Mathematical Practice to Content Using Rich Tasks

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Common Core Standards

- Content Standards
  - Focus
  - Coherence
  - Clarity and specificity

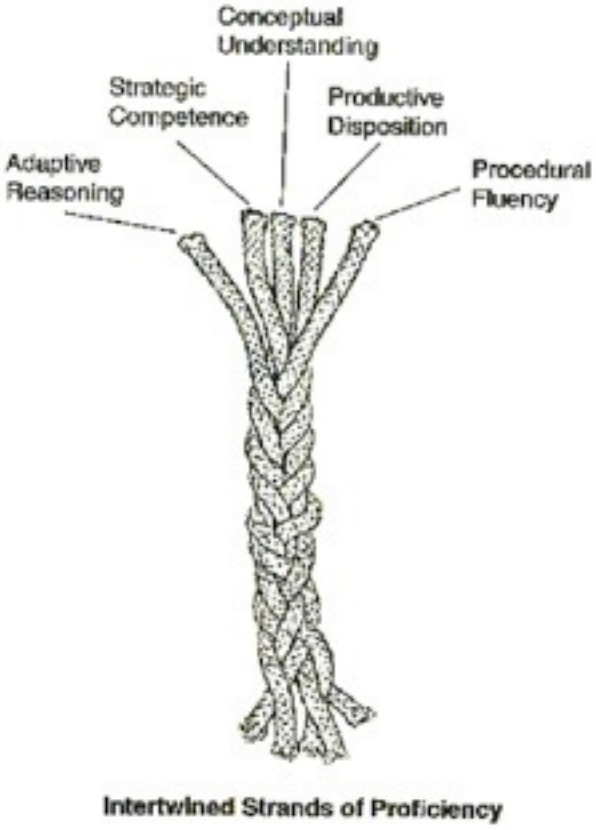
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

NCTM Process Standards

- Connections
- Communication
- Problem Solving
- Reasoning and Proof
- Representation

- How do you currently address the Process Standards in your classroom?

National Research Council's Strands of Proficiency Adding It Up, 2001



Intertwined Strands of Proficiency

- Adaptive Reasoning
- Strategic Competence
- Conceptual Understanding
- Productive Disposition
- Procedural Fluency
- www.nap.edu

Productive disposition –

habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy,

Never being of the mind to ask

WHEN ARE WE EVER GOING TO USE THIS?!

Common Core Standards

Standards for Mathematical Practice

For ALL students to become proficient in mathematics, they must internalize the eight mathematical practices as the means to learn, understand, and retain the content standards. The practices sustain mathematics as the content evolves. They define what is needed to be a quantitatively literate citizen.

8 CCSSM Mathematical Practices

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.

8 CCSSM Mathematical Practices

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.

I believe

We do not “teach” the practices, rather we design our instruction around tasks that give students the opportunity to use and develop the practices in learning and doing mathematics everyday, not only in mathematical class but in all aspects of their education and their lives that include opportunities for mathematical thinking.

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

Students should be able to:

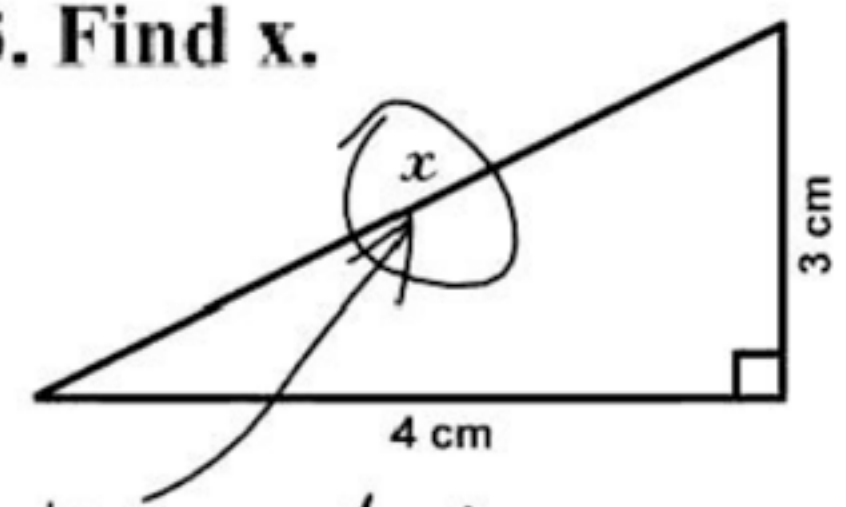
- Explain the meaning of the problem. May use concrete objects and/or pictorial representations.
- Develop a strategy for solving the problem.
- Identify the connections between two different approaches to a problem.
- Determine whether or not the solution makes sense.

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

To problem solve, students will need:

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

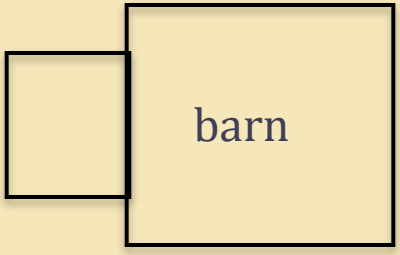
3. Find x.



Here it is

Moose's Playpen

- Tommy and Tessa want to fence in a play area for their dog, Moose. Moose is a big dog and they want to be sure to give him as much room as they can. They have 64 feet of fence. They can use up to 36 feet of the side of their barn as one side of the play area. The area must be rectangular and all of the sides must be a whole number of feet.



2. Reason abstractly and quantitatively.

Students should be able to:

- De-contextualize – comprehend a given situation and represent it symbolically.
- Contextualize – consider the referents for the symbols they are working with.
- Understand the meaning of the quantities, not just how to compute them.

Place the decimal point

1. 7.836 x 4.92 = 3855312

2. 534.6 x 0.545 = 291357

3. 5.03 x 17.6 = 88528

4. 49.05 x 6.044 = 2964582

Got Change?

Francine went to the store to buy some fruit. She can get 3 bananas for 50¢. She has lots of coins but no half dollars and no pennies. How many different ways could Francine make 50¢ to pay for the bananas?

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

Students should be able to:

- Make conjectures.
- Use counterexamples in their arguments.
- Justify their conclusions and explain them to others.
- Listen and/or read other's arguments and determine if they make sense.


$80,000 + 0 = $800,000
GIASBERGEN
"That's right, I've decided to give myself zero pay raise this year."

4. Model with mathematics.

Students should be able to:

- Apply the mathematics they know to solve everyday problems.
- Use equations, graphs, tables, diagrams, etc., to show the mathematical relationships in their model.
- Think about whether the model they have created makes sense and modify it if necessary.

Perplexing Population…

- In 1980, 2000 people lived in Carlson City. By 1990 the population had doubled. If this pattern continues, how many peoplewill live in Carlson city in the year 2020? Make a graph to show your results.

5. Use appropriate tools strategically.

Students should be able to:

- Consider which available tools (calculator, ruler, concrete objects…) they might use when solving a problem.
- Recognize the strengths and limitations of the tools they are using.
- Identify additional external resources, such as a website.

35 x 8

$15 \div .25$

Deal or No Deal

- Marty offers his parents a new deal for his allowance. Rather than getting $5 a week, he suggests they give him 1¢ for the first day, 2¢ for the second day, 4¢ for the third day and so on for the entire month of February. Should Marty's parents accept his deal?

6. Attend to precision.

Students should be able to:

- Communicate precisely to others.
- Use clear definitions in discussion.
- Explain the meaning of the symbols they choose.
- Specify units of measure and label axes.
- Calculate accurately and efficiently.

- My house number is a three digit number. Each digit is different. It is an even number. It is divisible by 3. It is the closest number to 600 that fits these clues. What is my house number?

7. Look for and make use of structure.

Students should be able to:

- Look closely to identify a pattern or structure.
- Step back for an overview and shift perspective.
- See complicated things as single objects or as being composed of several objects.

Acrobats, Grandmas, and Ivan

Who will win the third round of the tug of war?

Round 1: On one side are 4 acrobats, each of equal strength. On the other side are 5 grandmas, each of equal strength. The result is dead even.

Round 2: On one side is Ivan, a dog. Ivan is pitted against two of the grandmas and one acrobat. Again it's a draw.

Round 3: Ivan and 3 grandmas are on one side. The 4 acrobats are on the other side.

8. Look for and express regularity in repeated reasoning.

Students should be able to:

- Notice if calculations are repeated, and look for both general methods and for efficient ways to calculate.
- Maintain oversight of the process, while attending to the details.

$$\begin{array}{r} 50 \\ \times\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 50 \\ \times\ 70 \\ \hline \end{array}$$

$$8000 \times 5 =$$

We can best close the achievement gap by eliminating the opportunity gap. If we, as mathematics teachers K-12, each make it our personal goal for every student to have the opportunity to learn mathematics in ways that promote the habits of mind espoused in the standards for mathematical practice, we will be successful in helping all students to be successful in learning and doing mathematics.