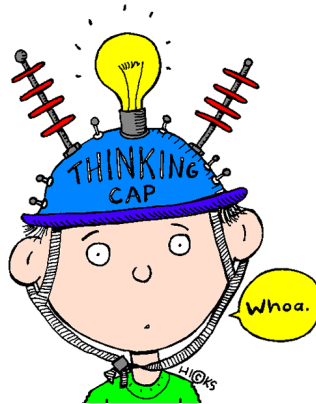


Building Mathematical Thinkers

A Focus on Problem Solving



Sue O'Connell
@SueOConnellMath

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What does it take to be a problem solver?

- Understand how to move through the process of solving a math problem
- Know and apply strategies to solve problems
- Have a positive disposition toward solving problems

Do they understand the problem?

Comprehension strategies

- Retelling
- Visualizing/Diagramming

Understanding Operations

- Story structures

Solve It

If you fold a square piece of paper in half 8 times, how many sections will be on the paper? Justify your answer.

Focus on the Question: Carnival Rides

Tickets Needed for Each Ride

Scrambler – 4 tickets

Carousel – 2 tickets

Bumper cars – 5 tickets

Roller coaster – 6 tickets

Day 1: Bailey loves the roller coaster and went on it 4 times. How many tickets did she use? Tell how you would solve the problem.

Day 2: Kellen had 20 tickets. He rode the scrambler three times. How many tickets did he have left? Tell how you would solve the problem.

Day 3: Blake rode the carousel, scrambler, and roller coaster. How many tickets did she use? Tell how you would solve the problem.

Day 4: Colin rode the roller coaster 3 times and Molly rode the carousel 6 times. Who used more tickets? How many more? Tell how you would solve the problem.

Day 5: Tickets cost 50¢ each. Liam rode the roller coaster 3 times. How much money did it cost? Tell how you would solve it.

Focus on the Question: Tasty Treats

Molly's Pastry Shop baked these tasty treats.

120 candy cane cookies

125 gingerbread men

55 apple pies

65 pumpkin pies

1. Mr. Gray bought 2 dozen of the gingerbread men. How many were left at Molly's Pastry Shop?

Tell how you would solve it.

2. Mrs. King bought one-fourth of the candy cane cookies for a class party. How many cookies did she buy? Tell how you would solve it.

3. Molly rolled out the crusts for the pies. The apple pies each needed 2 crusts. The pumpkin pies only needed one crust. How many crusts did she need to roll? Tell how you would solve it.

4. Molly made \$3.00 for every pie sold. If she sold all of her pies, how much money did she make? Tell how you would solve it.

5. Molly placed the apple pies on the bakery shelves. Each shelf held 5 pies. How many shelves did Molly need for the apple pies? Tell how you would solve it.

Focus on the Question: Road Runners Running Club

On Monday, the members of the Road Runners ran the following distances:

Colin $1\frac{1}{2}$ miles

Liam $2\frac{1}{4}$ miles

Molly $1\frac{3}{4}$ miles

Bailey $2\frac{2}{3}$ miles

Blake $2\frac{3}{4}$ miles

Kellen $1\frac{1}{3}$ miles

Day 1: How much farther did Liam run than Bailey?

Day 2: On Tuesday, Kellen ran $\frac{3}{4}$ mile more than he ran on Monday. How far did he run on Tuesday?

Day 3: Liam ran the same distance every day that week. How many miles did he run that week?

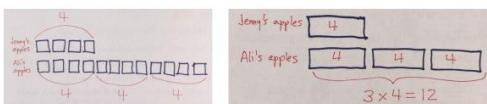
Day 4: Blake's sister, Kara, ran $\frac{1}{2}$ of the distance Blake ran. How far did Kara run?

Day 5: How many total miles did members of the club run on Monday?

Visualizing Multiplicative Comparison

Visualizing Multiplicative Comparison

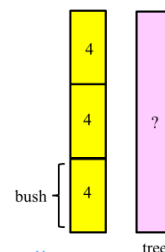
Jenny had 4 apples. Ali had 3 times as many apples as Jenny. How many apples did Ali have?



MATH PRACTICE

Bar Model

A rose bush is 4 feet tall. A tree is 3 times as tall as the rose bush. How tall is the tree?



$$3 \times 4 \text{ ft. tall} = 12 \text{ ft. tall}$$

Pinch Cards

Each student has a card with the symbols for the 4 operations.

Pose a problem and ask:

1. Pinch the operation you would use to solve it.
2. Talk to your partner and share which operation you chose and why.
3. Lead a class discussion about which operation(s) might work and why. Build the equation together.

Integrate Problem Solving Into Daily Lessons

Pose this. What discussions will follow?

$$3 \times 5 = \underline{\quad}$$

Pose this. What discussions will follow?

Molly has 3 pages of stickers. Each page has 5 stickers. How many stickers does she have?

Pose this. What discussions will follow?

$$\frac{3}{4} - \frac{1}{2} = \underline{\quad}$$

Pose this. What discussions will follow?

Liam ran $\frac{1}{2}$ mile and Colin ran $\frac{3}{4}$ mile. How much farther did Colin run?

Pose Problems Related to Varied Content

Mrs. Johnson made 3 pitchers of lemonade for the sale. Each pitcher held 900ml of lemonade. How much lemonade did she make?

Mrs. Clark's dining room is square and has a perimeter of 52 feet. She has a new cabinet that is 12 feet long. Will it fit along 1 of her walls? How do you know? She also wants to put new carpet in her dining room. How many square feet will she need to purchase? Explain.

Liam ran 3 kilometers. Colin ran 7 laps on the track. If each lap was 400 meters, who ran a longer distance? Prove your answer.

Olivia measured two pieces of string. The first one was 30 centimeters long. The second one was 500 millimeters long. Which one was longer? How much longer?

Focus on the Question

Capacity

Milk carton – 250ml

Juice box – 120ml

Small bottle of water – 235ml

Medium water bottle – 500ml

Large bottle of water – 1 liter

Large bottle of soda – 2 liter

What might you ask?

Pose Rich Problems

Bikes and Trikes

There were 35 wheels in the Bicycle Shop. How many bicycles and how many tricycles were in the shop? Justify your answers.

Can you find more than one solution?

Which solution has the fewest cycles?

Which Coins?

- Anna took 5 coins out of her pocket. She had more than 50 cents but less than 73 cents. What could her coins have been? Prove your answer.
- Carter took 7 coins out of his pocket. He did not have any pennies. He had more than \$0.95 but less than \$1.13. What could his coins have been? Prove your answer.

What questions do you ask?

Ask students to make sense of problems.

- Retell the problem in your own words.
- What information will help you solve it? Why?
- Will you build an equation? If so, what equation? Why does it work for this problem?

Ask students to explain how they solve problems.

- List the steps you used to solve this problem.
- Explain how you solved this problem.
- What might be another way to solve this problem?

Ask students to justify their answers or their decisions.

- Which strategy did you choose? Why do you think that strategy was a good choice for solving this problem?
- Justify why you believe your answer is correct.
- Explain why you set up your (table, diagram, list...) the way you did.

Ask students to connect problems to others they have seen.

- Does this problem remind you of any others you have solved?
- How is it like the other problem?
- What did you do to solve that problem? Will it work here?

Ask students to write problems of their own.

- Write a problem that can be solved using (multiplication, division, working backward...)
- Write a problem about 4×15 .
- Write a problem that requires several steps in order to be solved.

Ask students to reflect on their strengths, weaknesses, and feelings as they learn problem solving.

- What was easy about solving this problem? What was hard?
- I get frustrated when...
- When I don't know what to do I...
- Next time I will...

Teacher Resource Books by Sue O'Connell
Published by Heinemann (www.heinemann.com)

***Math in Practice* (www.mathinpractice.com)**

This series is filled with lesson ideas, instructional strategies, practice tasks, and many online printable resources to make teaching K-5 math more meaningful and more fun. There is a book for each grade level K-5 that contains a wealth of grade-specific activities, as well as a *Guide for Teachers* filled with instructional strategies and an *Administrator's Guide*. Visit the website or www.mathinpractice.com to view the materials.

***Putting the Practices into Action - Implementing the Common Core Standards for Mathematical Practice K-8*
with John SanGiovanni**

The Standards for Math Practice are the heart and soul of the Common Core State Standards. This book explains each standard in teacher-friendly terms and highlights practical activities to make the standards come alive in classrooms. It contains PLC study group questions and online resources.

***Mastering the Basic Math Facts for Addition and Subtraction*
Mastering the Basic Math Facts for Multiplication and Division
with John SanGiovanni**

Through investigations, discussions, visual models, children's literature, and hands-on explorations, students explore the math operations, and through engaging, interactive practice achieve fluency with basic facts. A teacher-friendly CD filled with customizable activities, templates, recording sheets, and teacher tools simplifies your planning and preparation. Over 450 pages of reproducible forms are included in English and Spanish translation.

The Math Process Standards Series

Each book in this series is a practical guide for helping students refine their skills in the highlighted math process (problem solving, communication, reasoning, representations, connections). You will find specific teaching strategies and tips to help all students strengthen their skills. Included with each book is a CD filled with teacher tools and customizable student activities to allow you to change names, data, or spacing for a quick way to differentiate instruction within your classroom.

<i>Introduction to Problem Solving</i>	<i>Introduction to Communication</i>
<i>Introduction to Representation</i>	<i>Introduction to Reasoning and Proof</i>
<i>Introduction to Connections</i>	

All books in this series are available for Grades PK-2, Grades 3-5, and Grades 6-8.

Now I Get It: Strategies for Building Confident and Competent Mathematicians, K-6

Good teaching is the critical factor that helps students "get" math. This book is a practical handbook for the teaching of mathematics, with chapters addressing the teaching of problem solving, the use of manipulatives, differentiating instruction, effective teacher questioning, increasing math talk, and much more. The book includes a CD with over 100 pages of resources to support teachers including manipulative templates, math facts game templates, a bibliography of math-related literature, center ideas, math websites, problem-solving and writing tasks, and a variety of other practical resources.

For additional resources, visit Sue's website at www.qualityteacherdevelopment.com

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