



**Bar Diagrams:  
Draw Your Way to Problem Solving Success**

**Robyn Silbey**

**rsilbey@hotmail.com ♦ [www.robynsilbey.com](http://www.robynsilbey.com)**

# What's the Problem with Problem Solving?



Basic computation:  
80-90% accuracy



Comprehension:  
\_\_\_\_\_ accuracy

# Agenda

1. Highlight the Common Core Standards for Mathematical Practice
2. Solve Enhanced Bar Diagrams
  - Learn
  - Teach
  - Solve problems grades 3-8



[Home](#)[About the Standards](#)[Voices of Support](#)[News](#)[Get Involved](#)[FAQ](#)[The Standards](#)

## Common Standards

Building on the excellent foundation of standards states have laid, the Common Core State Standards are the first step in providing our young people with a high-quality education. It should be clear to every student, parent, and teacher what the standards of success are in every school.

[Learn more »](#)[Common Standards](#)[State Adoption](#)[Voices of Support](#)

<http://corestandards.org/>





## Table of Contents

Introduction	3
Standards for Mathematical Practice	6
Standards for Mathematical Content	
Kindergarten	9
Grade 1	13
Grade 2	17
Grade 3	21
Grade 4	27
Grade 5	33
Grade 6	39
Grade 7	46
Grade 8	52
High School — Introduction	
High School — Number and Quantity	58
High School — Algebra	62
High School — Functions	67
High School — Modeling	72



# Mathematical Practices

The Standards of Mathematical Practice describe “processes and proficiencies” that maximize students’ deep and lasting conceptual understanding in mathematics.



# 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.





# 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.

# Agenda

1. Highlight the Common Core Standards for Mathematical Practice
2. Solve Enhanced Bar Diagrams
  - Learn
  - Teach
  - Solve problems grades 3-8

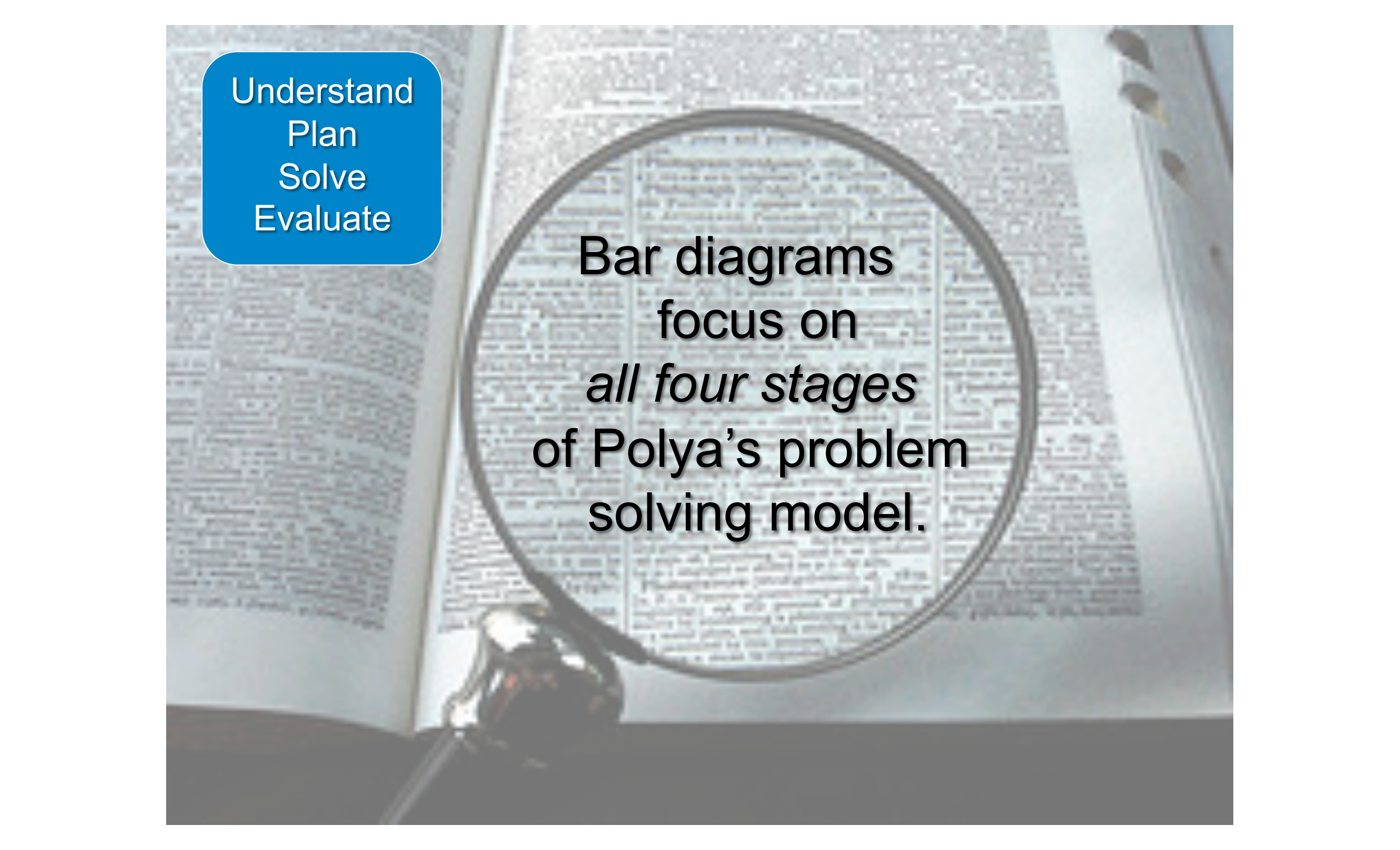
# Polya's Problem Solving Stages

1. **Understand:** Identify what is known and what is unknown.
2. **Plan:** Decide how you will solve the problem.



3. **Solve:** Execute the plan.
4. **Evaluate:** Assess reasonableness using substitution.





Understand  
Plan  
Solve  
Evaluate

Bar diagrams  
focus on  
*all four stages*  
of Polya's problem  
solving model.



There are 3 birds on a tree branch.  
2 birds fly over to the same branch.  
How many birds are on the branch now?

# Enhanced Bar Diagramming

## Understand

There are 3 birds on a tree branch.  
2 birds fly over to the same branch.  
How many birds are on the branch now?



How do words  
inside the model  
affect  
understanding?



# Enhanced Bar Diagramming

## Understand

There are 3 birds on a tree branch.

2 birds fly over to the same branch.

How many birds are on the branch now?



|-----3-----|

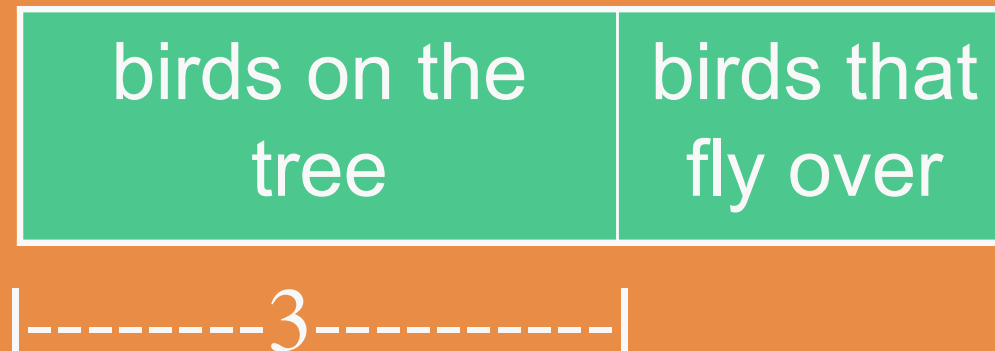
# Enhanced Bar Diagramming

## Understand

There are 3 birds on a tree branch.

2 birds fly over to the same branch.

How many birds are on the branch now?



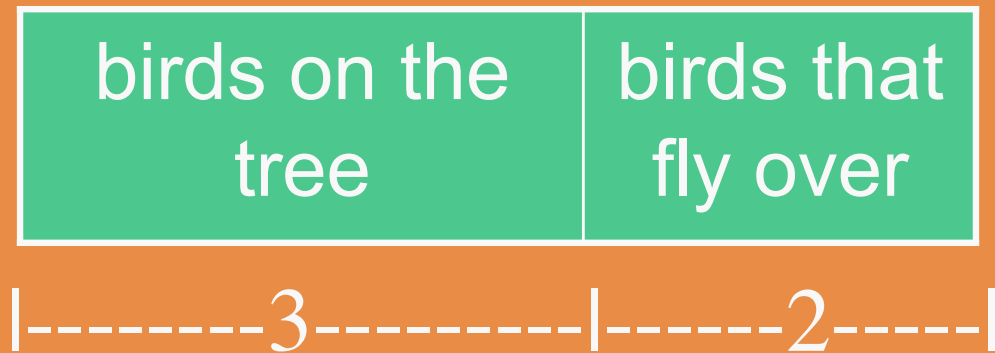
# Enhanced Bar Diagramming

## Understand

There are 3 birds on a tree branch.

2 birds fly over to the same branch.

How many birds are on the branch now?





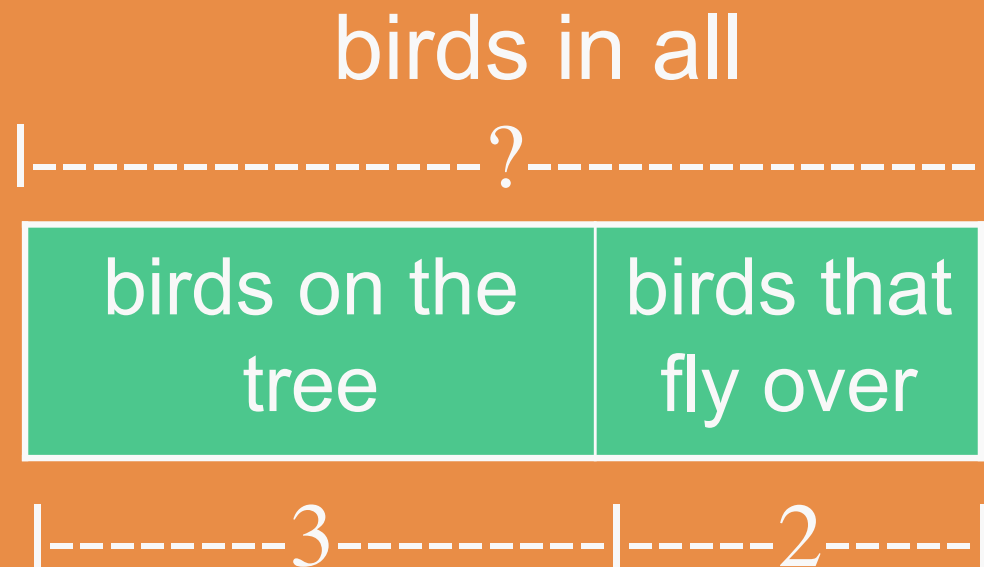
# Enhanced Bar Diagramming

## Understand

There are 3 birds on a tree branch.

2 birds fly over to the same branch.

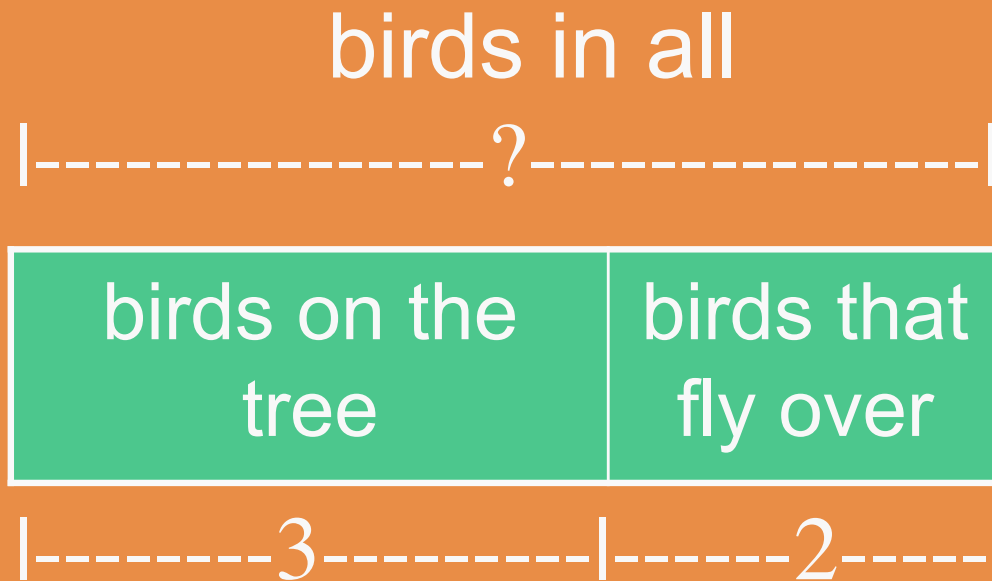
How many birds are on the branch now?



# Enhanced Bar Diagramming

## Plan and Solve

The “whole” is missing. Add.



How does the visual representation lead students to the plan and the solution?

# Enhanced Bar Diagramming

## Evaluate

Does the  
solution make  
logical sense in  
the context of  
the visual  
representation  
?





## Algebraic Reasoning

There are 5,691 birds on a tree branch.  
2,087 birds fly over to the same branch.  
How many birds are on the branch now?

# Enhanced Bar Diagramming

## Algebraic Reasoning

There are 5,691 birds on a tree branch.  
2,087 birds fly over to the same branch.  
How many birds are on the branch now?

|-----7,778-----|

birds on the tree	birds that fly over
----------------------	------------------------

|-----5,691-----|--2,087---|

# One Step: Addition

Rani earned \$128 mowing lawns and \$73 babysitting. How much money did Rani earn?

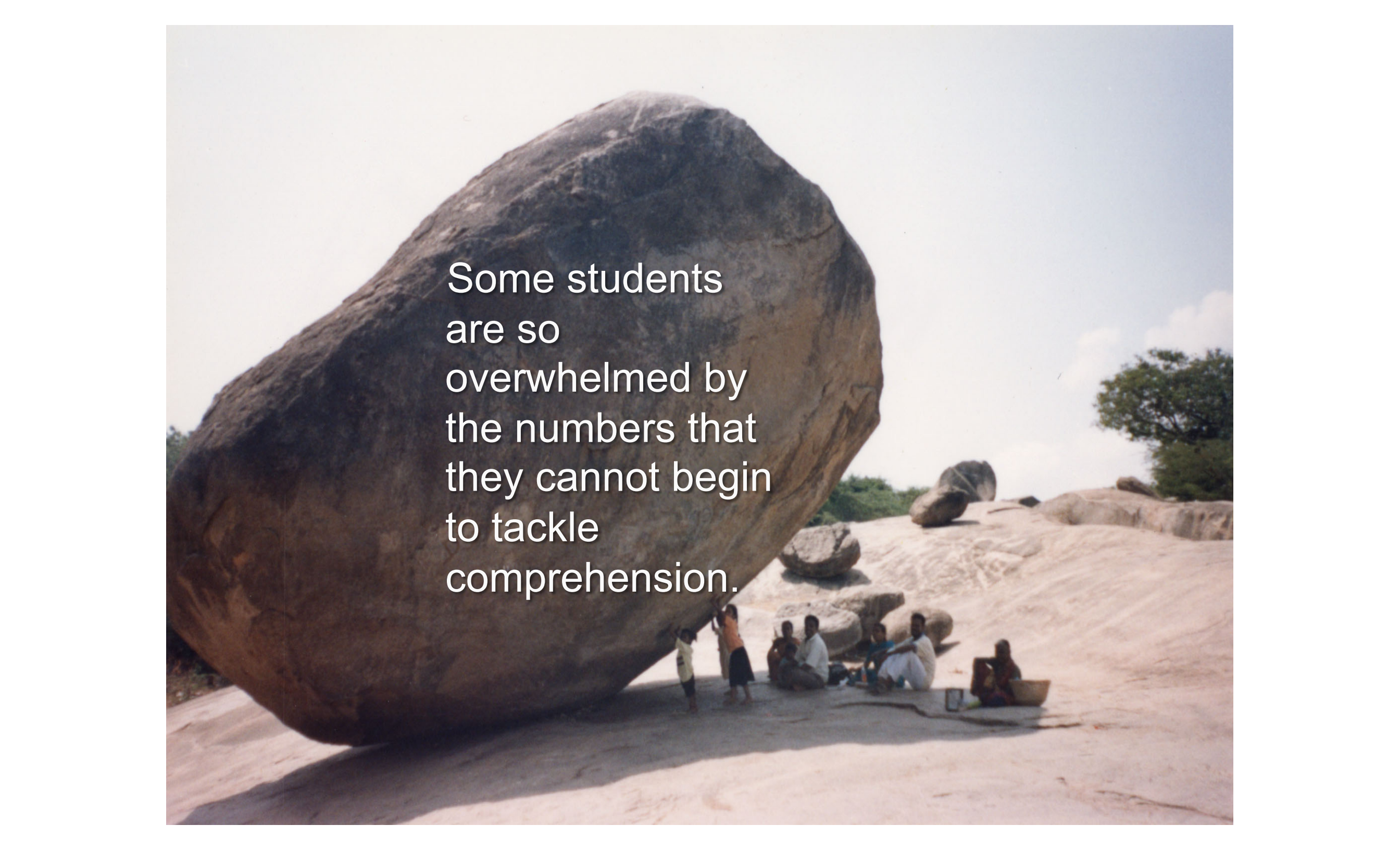




# One Step: Subtraction



Jin had \$67 in his pocket after he bought a radio controlled car. He went to the store with \$142. How much did Jin spend on the car?

A photograph of a massive, dark, rounded boulder resting on a light-colored, sandy or rocky ground. The boulder is the central focus, with its surface showing some texture and shadows. In the background, several other smaller rocks are scattered across the landscape. A group of people, including children and adults, are sitting on the ground near the base of the large boulder, providing a sense of scale. The sky is clear and blue, and there are some green trees in the distance on the right side.

Some students  
are so  
overwhelmed by  
the numbers that  
they cannot begin  
to tackle  
comprehension.



# One Step: Subtraction

\$2

Jin had ~~\$67~~ in his pocket after he bought a radio controlled car. He went to the store with ~~\$142~~. How much did Jin spend on the car?

\$5



# One Step: Multiplication

There are 9 puffy stickers. There are 3 times as many plain stickers as there are puffy stickers. How many plain stickers are there?



# One Step: Division

Four children share the cost of a gift equally. The gift costs \$28. How much does each child pay?





The background of the slide is a close-up photograph of numerous seashells of various shapes and sizes scattered on a sandy beach. The shells are mostly light-colored, with some showing distinct patterns and colors like orange, white, and grey. The sand is a fine, light brown color.

# Two-Step Problem

Rosa has 336 shells. She keeps 72 of the shells for herself, and shares the remaining shells evenly among 6 friends. How many shells does each friend receive?



# Two-Step Problem

A soccer ball and six golf balls weigh a total of 1 kilogram. Each golf ball weighs 70 grams. What is the weight of the soccer ball?

(Hint: 1 kg = 1,000 g)



# Two-Step Problem

Sara buys a printer for \$120. She buys a computer that costs 4 times as much as the printer.

- What is the cost of the entire purchase?
- How much more does the computer cost than the printer?

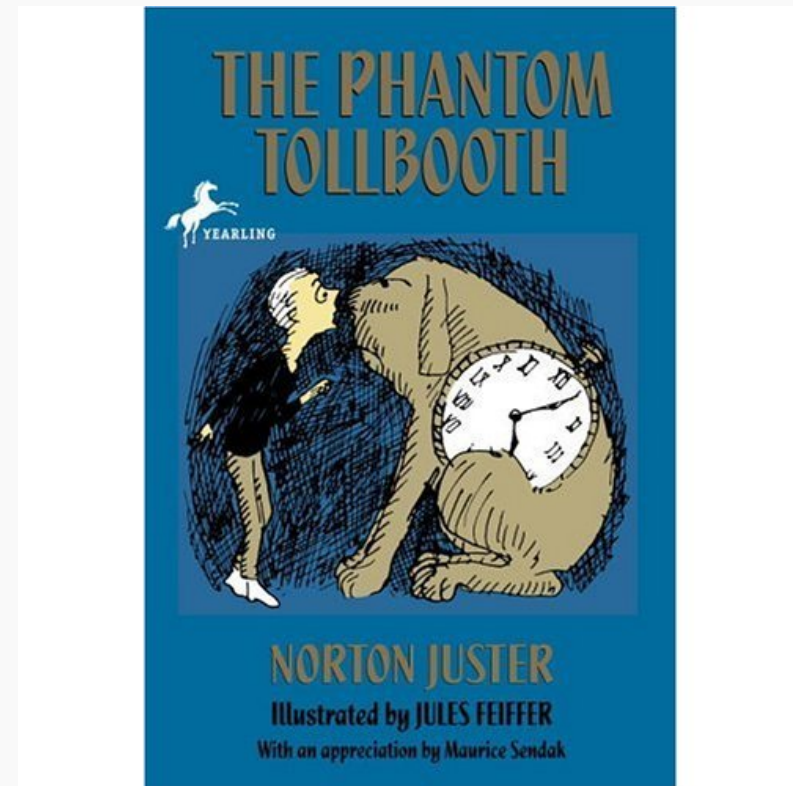


# Two Step: Proportion

The ratio of the length of Ribbon A to the length of Ribbon B is 7:4. If Ribbon A is 21 cm, what is the length of Ribbon B?

# Two Step: Fractions

David had \$40. He spent  $\frac{1}{5}$  of the money on a storybook and  $\frac{3}{10}$  on a calculator. How much did he spend?



# Multi-Step Problems



Liz put  $\frac{2}{5}$  of her money in the bank and spent  $\frac{1}{2}$  of the remainder. If she had \$30 left, how much money did Liz have at first?



# What This Means for YOU



- How do Enhanced Bar Diagrams support the Mathematical Practices in the CCSS??
- What are some things you find valuable about the Enhanced Bar Diagrams? How might you integrate Enhanced Bar Diagrams into your curriculum?



Bar diagramming  
helps students...

know how  
and also know why





[rsilbey@hotmail.com](mailto:rsilbey@hotmail.com)  
[www.robynsilbey.com](http://www.robynsilbey.com)

