Starting with a Story: Using Children's Literature to Launch Math Investigations to Build Deep Understanding and Positive Math Identity
Grades 3-5
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How might teaching through investigations deepen students' math understanding as well as their curiosity, confidence, identity, and math joy?
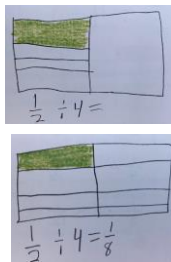
Highlighted Investigations

Dividing a unit fraction by a whole number
Context: Born and Bred in the Great Depression

But what if they didn't have a whole loaf of bread to share?
Create a model to show the way $\frac{1}{2}$ loaf of bread might be shared by 4 people. How much of the whole loaf would each person get? What division equation shows what you did? Explain.

Record the data.

- *What do you notice?*
- *Do the quotients make sense? Why or why not?*
- *Could you find the denominator without drawing the model? How?*
- *Predict: If there had only been $\frac{1}{5}$ loaf of bread for them to share, how much of a whole loaf would each person get?*
- *Draw a model to see if you were right.*
- *Can you divide unit fractions by whole numbers without using a model? How?*

$$\frac{1}{2} \div 4 = \frac{1}{8}$$
$$\frac{1}{4} \div 4 = \frac{1}{16}$$
$$\frac{1}{3} \div 4 = \frac{1}{12}$$

For photos during the Great Depression: *Children of the Great Depression* by Russell Freedman

Adding fractions with like denominators
Context: *Enemy Pie* by Derek Munson

Investigate

Dad cut the enemy pie in sixths. Show it with your pattern blocks.

Dad ate 2 sixths of the pie and Jeremy ate one sixth of the pie. How many sixths did they eat?

2 sixths + 1 sixth = _____

Mathematicians don't write out the words like we did. Turn and share how a mathematician would write this.

$\frac{2}{6} + \frac{1}{6} = \frac{3}{6}$

Pose more problems.

$$\frac{2}{6} + \frac{1}{6} = \frac{3}{6}$$
$$\frac{2}{6} + \frac{3}{6} = \frac{5}{6}$$
$$\frac{2}{6} + \frac{2}{6} = \frac{4}{6}$$

What do you notice?
Why is it happening?
Why are the denominators staying the same?
Why are the numerators changing?
If Dad had $\frac{3}{6}$ and Jeremy had $\frac{1}{6}$, how many sixths do you think they would have eaten?
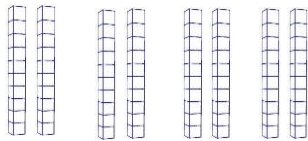Try it to see if you were right.
How can you add fractions without using the models?

Multiplying a single-digit number by a multiple of 10
Context: *Dragons Love Tacos* by Adam Rubin

The dragons had 4 trays of 20 tacos. How many tacos did they have?

- Show me 20 tacos using your base-ten rods.
- What would 4 × 20 be?
- Show it and record the equation.

4 x 20 = 80

- *What do you notice?*
- *Why is this happening?*
- *Predict 7 x 20 = __.*
- *Model it. Were you correct?*
- *What is the rule? Why does it work?*

Understanding the concept of area
Context: *The Raft* by Jim LaMarche

Investigate: Exploring Area

- Students use inch-grid paper to outline rafts of different sizes.
- Students explore the sizes of the rafts, record the data, and look for patterns to find the rule.

Length in Inches	Width in Inches	Area of the Rectangle in 1-inch squares
5	3	15 squares
3	4	12 squares
4	2	8 squares

What do you notice?
Try a few more. Does this keep happening?

Understanding the Concept of Volume
Context: *Crayon Man: The True Story of the Invention of the Crayola Crayon* by Natascha Biebow

Investigate: A Box of Crayons

Once a product is created, it has to be packaged for sale. How did they package crayons?
Is it important that the box is just the right size? Why or why not?
How did they know how big to make the box?
How big is a crayon?

Box templates are filled with centimeter cubes to find the volume.

What if we put 16 crayons in the box in 2 layers? Or 24 in 3 layers? What is the volume?

Investigate: Boxes of Crayons

Length of box (cm)	Width of box (cm)	Height of box (cm)	Total number of cm cubes
9	8	1	72
9	8	2	144
9	8	3	216

What do you notice?
What patterns do you see?
Do you have to fill a box and count the squares?
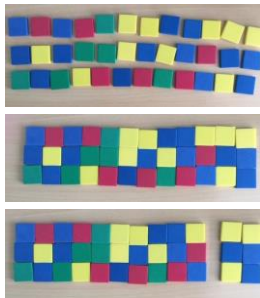*How else might you find the volume?*

Multiplying Multi-digit Numbers
Context: *Wangari's Trees of Peace* by Jeanette Winter

Investigate: Planting Trees

How could Wangari know how many seedlings the women planted in a day or a week?
How could we model the seedlings?
Work with a partner to model 3 rows of seedlings with 12 seedlings in each row.

From Tiles to Drawings

One day the women planted 6 rows of 24 seedlings. How many seedlings did they plant that day?
I am not sure we have enough square tiles. Is there another way we could model this without actually using square tiles?
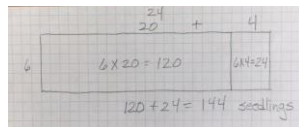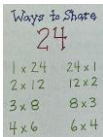
Understanding Prime and Composite Numbers
Context: *Bean Thirteen* by Matthew McElligott

Sharing Beans

• *Could they have fairly shared 24 beans?*
• *Could you use your tiles to make arrays to show how Ralph and Flora might have shared the beans?*
• *Do you think there is more than one way?*

Exploring Prime and Composite

What do you notice?
How are the posters alike? How are they different?
Without giving an explanation, rearrange the posters into 2 groups: ones with only one area model and ones with more than one area model. Label the groups as *prime* or *composite*.
Have student teams come up with the definitions of *prime* and *composite*.

Understanding Powers of Ten
Context: *Each Kindness* by Jacqueline Woodson

Week	My Thinking	Acts of Kindness
1	10×1	10
2	10×10	100
3	10×100 ($10 \times 10 \times 10$)	1,000
4	$10 \times 1,000$ ($10 \times 10 \times 10 \times 10$)	10,000
5	$10 \times 10,000$ ($10 \times 10 \times 10 \times 10 \times 10$)	100,000

Mathematicians show these quantities as 10^1, 10^2, 10^3... What do you think those numbers mean?

Thinking About the Investigations
• Who did the thinking?
• How did the context help?
• How did the materials help?
• Why did I record what students shared about their findings?
• What questions did I ask to prompt discovery?
• What are the benefits of stepping back and letting students discover math ideas through investigations?

Resources

For more investigations:
www.MathinPractice.com
www.MathbytheBook.com

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

Follow Sue on Twitter @SueOConnellMath

Join the Math in Practice Facebook group!

New from hand2Mind: Navigating Numeracy K-5 Center Kits - https://www.hand2mind.com/supplemental-curriculum/math/navigating-numeracy-learning-progression-centers

For literature to launch math lessons:

Padlet of K-2 Children's Literature Related to Math Skills/Concepts
https://padlet.com/sueoc46/j3uevoy154m1fuhb

Padlet of Grades 3-5 Children's Literature Related to Math Skills/Concepts
https://padlet.com/sueoc46/who7w8089bm6r6k2

Padlet of K-5 Culturally Diverse Children's Literature with Math Connections
https://padlet.com/georginarivera123/2ygfo12jusaomm7s

Download a list of 120 children's books and associated math topics at:
www.MathbytheBook.com