

# From Models to Meaning: Helping Students Make Sense of Mathematics

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## Essential Questions:

How do we build mathematical thinkers?

How do we step back and let our students do the thinking?

How might models play a role?

## Critical Instructional Practices

1. Step back and let them think.
2. Give math a context and make connections between ideas.
3. Make math visual. Let them see it, touch it, and move it.
4. Get them talking.
5. Watch, listen, and adjust our math instruction. Let our students guide us.

From *Math in Practice: A Guide for Teachers* (Heinemann, 2016)

## How might models be woven into math lessons to nudge insights about big ideas?

**Each counting number represents a quantity that is one more than the one said before it.**

How might models and math talk help students discover this big idea about numbers?

### Exploring Counting Numbers

Read a counting book.

Have students show each number with towers of cubes.



*What do you notice?*

*Predict how a tower of 7 cubes might look.*

*Try it. Were you right?*

*Do you think this will keep happening?*

From *Math in Practice*, Grade K (Heinemann, 2016)

## Understanding teen numbers

Read *Grandma's Tiny House* by Ja'Nay Brown-Wood

Grandma has lots of friends, neighbors, and family, and she is going to have a feast.

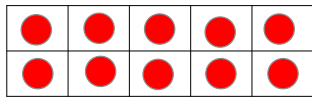
*What do you think her friends and neighbors will bring to the feast?*

Read to find out.

Students use ten frames and counters to show items brought to the feast.

What happened?  
 How many didn't fit?  
 Let's try some more.

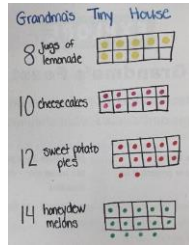
14 is 10 and 4 more



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### Grandma's Feast

Teacher records on the board.



Is 12 more than 10?  
 How do you know?  
 Is 14 more than 10?  
 How many more than 10?

### Record their findings.

14 is 10 and 4 more  
 15 is 10 and 5 more  
 12 is 10 and 2 more  
 17 is 10 and 7 more

What do you notice?

Tell your partner what you think 13 will look like.

Try it. Were you right?

Why did you think that?

From *Math by the Book* for Grade K (Heinemann, 2021)

## Diving Deeper into Place Value

How many markers fit in each box?

If you have 25 markers, how many boxes can you fill?

Will you have any leftover markers? How many?



### Our Investigation

1. Have partners count out 25 unifix cubes.
2. Have them put the cubes on ten frames and then check the total.

How many filled boxes of markers with 25 markers?

How many leftover markers?

Create a chart to record students' data.



### Observe and Consider

| Number of Markers | Filled Boxes of 10 | Leftover Markers |
|-------------------|--------------------|------------------|
| 25                | 2                  | 5                |
| 32                | 3                  | 2                |
| 14                | 1                  | 4                |
| 26                | 2                  | 6                |
| 38                | 3                  | 8                |

What do you notice?

What do you wonder?

Predict how many tens and ones are in 38.

Try it and see if you were right.

Can you figure out how many boxes of ten markers you have without actually filling them? How?

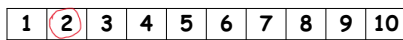
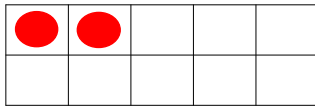
From *Math in Practice*, Grade 1 (Heinemann, 2016)

## Understanding the Concept of Adding 1

Read *One More Dino on the Floor* by Kelly Starling Lyons

How many dinos?

$$1 + 1 = 2$$



Gr K  
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### Record and discuss results.

$$3 + 1 = 4$$

$$5 + 1 = 6$$

$$7 + 1 = 8$$

$$2 + 1 = 3$$

What do you notice?

If there were 4 dinos and 1 more joined, how many would there be?

Try it. Were you right?

Could you add 1 without using the counters?

How?

What happens when you add 1 to a number?

From *Math by the Book* for Grade 1 (Heinemann, 2021)

## Mentally Add 10 to a 3-digit Number

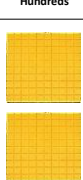


How Many Cards?

Brendan had 142 baseball cards in his collection.

Then, his mom gave him a pack of 10 cards.

How many cards did he have in his collection then?

Add 10.  
Where do you place the ten rod? Why?  
What is the new number?

| Hundreds  | Tens  | Ones  |
|---|---|---|
|  |  |  |
| 2   | 34  | 5   |

### Figuring Out the Rule

Repeat with other numbers.  
What do you notice?

142    235    421    648  
152    245    431    658

What digit changes? Why?  
Predict: What is  $368 + 10$ ?  
Check your prediction with a model.  
Does this make sense? Explain.  
What is the rule?

From *Math in Practice*, Grade 2 (Heinemann, 2016)

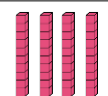
### Subtracting Multiples of 10 from Multiples of 10

Read *Pete the Cat Snow Daze* by James Dean

#### The Snowball Fight

- If Pete made 40 snowballs and threw 10 of them. How many would he have left?
- How can you show what happened in the problem?

$$40 - 10 = 30$$

| tens   | ones |
|--|------|
|  |      |

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#### The Snowball Fight

Pose more problems for students to model and solve.  
Record the equations.

$40 - 10 = 30$   
 $60 - 20 = 40$   
 $80 - 30 = 50$   
 $50 - 30 = 20$

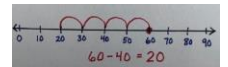
What do you notice?  
Does it make sense? Why or why not?  
Predict  $70 - 30$ . Try it to see if you were right.  
Can you find the solution without using a model? How?

#### Varied Models

Use tens cards to build the multiple of 10, then remove cards to show the subtraction.



Or use number lines to model the subtraction.



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From *Math by the Book* for Grade 1 (Heinemann, 2021)

### Exploring x5 Math Facts

Read *Hanukkah Bear* by Eric A. Kimmel

How many latkes were on 1 plate? (see illustration of bear popping 5 latkes in his mouth)

How many latkes would Old Bear eat if he had 2 plates of latkes?

#### Exploring x5 Facts



How many latkes were on 1 plate?  
How many latkes would Old Bear eat if he had 2 plates of latkes?



$$2 \times 5 = 10$$



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#### Exploring x5 Facts

Plates of Latkes  
1 Plate of latkes = 5 latkes  $1 \times 5 = 5$   
2 Plates of latkes = 10 latkes  $2 \times 5 = 10$   
3 Plates of latkes = 15 latkes  $3 \times 5 = 15$

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |

Have students shade the products on a 1-50 chart.  
What do you notice?  
What patterns do you see?  
Does it make sense? Explain your thinking.  
Are all of the multiples of 10 also multiples of 5? Does that make sense? Why or why not?  
What is the connection between x5 and x10 facts?

From *Math by the Book* for Grade 3 (Heinemann, 2021)

## Reflection

What are the advantages of letting students discover math ideas?

What is the role of models in these investigations?

**“ Sometimes, telling kids where they are going spoils the journey.”**

**Dylan Wiliam**

## The Importance of Our Questions

- *What do you notice? What do you wonder?*
- *Why is it happening?*
- *Does it make sense? Why or why not?*
- *Can you predict...?*
- *What is the rule?*

## Big Ideas for Building Mathematical Thinkers

- Give math a context to help it make sense.
- Let them see it, touch it, and move it.
- Prompt them to talk about what they see.
- Ask questions that connect varied representations of the math.
- Prompt them to make predictions and generalizations.
- Step back and let students do the thinking!

**For more resources to explore hands-on tasks,  
see the following resources by Sue O'Connell (Heinemann Publishing Company):**

***Math in Practice* (Heinemann, 2016)**

This series is filled with lesson ideas, instructional strategies, sample teacher questions, 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* for math coaches and district math leaders. Visit the website at [www.mathinpractice.com](http://www.mathinpractice.com) to view the materials. *Math in Practice* is PD in a book - like having a math coach for every teacher!

***Math by the Book* (Heinemann, 2021)**

This k-5 series shows ways to teach mathematics through the context of children's literature. It is filled with lessons, games to practice skills, word problems, and lots of talk/writing prompts. Visit the website at [www.mathbythebook.com](http://www.mathbythebook.com) to learn more.

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

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 (Heinemann)

Through investigations, teacher questioning, student discussions, visual models, children's literature, and hands-on explorations, students explore math operations, and through engaging, interactive practice achieve fluency with basic facts. Online resources contain customizable activities, templates, recording sheets, and teacher tools to simplify your planning and preparation. Reproducibles are in English and Spanish translation.

**Stay in Touch with Sue**

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