

Making Sense of Numbers Through Models, Discussion, and Discovery K-2

Woodward Academy Summit for Transformative Learning 2018

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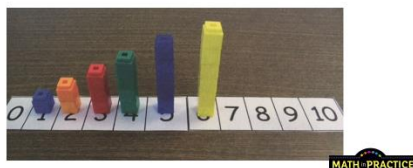
How has the teaching of mathematics changed since you were a student?

What do your students need to know and be able to do?

What can we do? Step Back and Let Them Think

Observing Numbers

What do you notice?
What do you think a tower of 7 cubes will look like?
Why?
Try it. Were you right?
Does this make sense?



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 did you find the total each time?
Do the different ways of counting give you the same answer? Why?
How many filled ten frames in 25?
How many leftover ones?
Create a chart to record students' data.

Observe and Consider

Number of Counters	Filled Ten Frames	Leftover Ones
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 ten frames will be filled without actually filling them? How?

Brendan had 142 baseball cards in his collection.
His mom gave him a package with 10 more cards.
How many cards did he have in his collection then?

How would you show adding 10?
Where do you place the ten rod? Why?
What is the new number?

Hundreds	Tens	Ones
1	45	2

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?

The Importance of Our Questions

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

“Education is the kindling of a flame, not the filling of a vessel.”
Socrates

Make Math Real

When this is posed, what will be the focus of discussions?

$$7 + 5 + 3 = \underline{\quad}$$

What are the advantages of posing this?

Bailey collected 7 black shells, 5 tan shells, and 3 white shells.
She put them in her bucket.
How many shells did she put in her bucket?

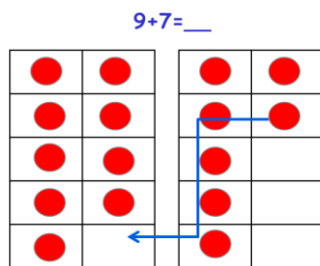
Literature as a Context for Math Learning

Monster Math by Grace Maccarone (one less)

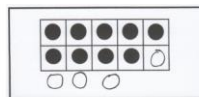
Quack and Count by Keith Baker (decomposition)

Dinner at the Panda Palace by Stephanie Calmenson (addition)

Help Our Students “See” Math

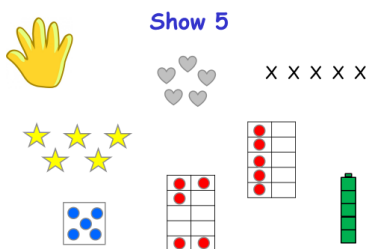


Does this show $9 + 4$?

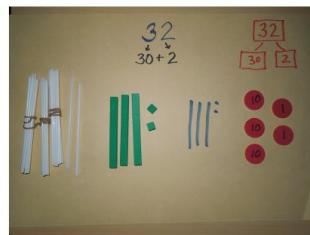


Do you see $10 + 3$?

Routine: Number of the Day



How might you show 32?



The Power of Exploring Varied Models

Get Them Talking

What questions were you asked?

- What is the answer?

What questions might you ask?

- How did you do it?

- Why? Prove your answer.
- How is this like...? How is it different?
- What do you notice?
- What is the big idea (rule)?
- What did you learn?

Revisit Concepts with Simple Routines

Agree or Disagree?

Think about: models, reasoning, computations

Examples:

10 is more than $6 + 2$

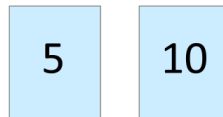
5 tens and 3 ones is the same as 4 tens and 13 ones.

16 is an odd number.

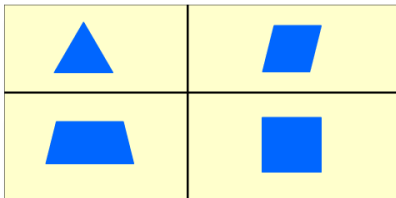
Alike and Different



Alike and Different



Eliminate It!



Eliminate It!

10	2
5	8

What do you notice?
What do you wonder?

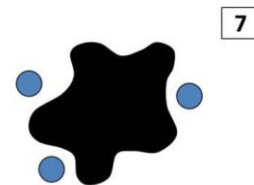


What do you notice? What do you wonder?
<http://ntimages.weebly.com/>



SPLAT!

<http://www.stevewyborne.com/?p=893>



Twitter as a Resource to Gather/Share Ideas/Insights

#elemmathchat (Thursdays at 8pm CST)

@NCTM

@SueOConnellMath

@JoBoaler

@YouCubedOrg

@WithMathICan

Weighing Resources

Strong sites:

Illuminations - <https://illuminations.nctm.org/>

Illustrative Mathematics - <https://www.illustrativemathematics.org/>

Focus on Problems

Pose a set of data. Each day, have students discuss a different problem related to the set of data.

The P.E. teacher put all of the sports balls in a closet. Here is what was in the closet:

8 soccer balls

11 basketballs

16 softballs

6 footballs

1. How many more basketballs than footballs were in the closet?
2. The teacher took the soccer balls and footballs out of the closet. How many balls did she take out of the closet?
3. The teacher put more soccer balls in the closet. Now there are 12 soccer balls. How many more did she put in the closet?
4. Some of the basketballs were orange and some were brown. How many of each color were there?
5. The teacher took 10 softballs out of the closet. How many balls were still in the closet?

Modified for Kindergarten

Abby put 5 pumpkins on the porch...

- ...and she put 2 pumpkins in the yard. How many pumpkins were there?
- Her mom put 3 more pumpkins on the porch. How many pumpkins are on the porch now?
- Two of the pumpkins rolled off the porch. How many were still on the porch?
- Some pumpkins had happy faces and some had scary faces. How many of each?

Problem-solving Website to Explore

Solving Real World Problems: Involving Students in Inquiry and Discussion

<https://gfletchy.com/humpty-dumpty/>

<https://gfletchy.com/Snack-machine/>

<https://gfletchy.com/the-whopper-jar/>

Watch and Listen to Students

Formative Assessment – Observations

Watch as students...

...match ten-frame cards to digit cards.

...choose a number card that is greater or less than another.

...use base-ten blocks to model three-digit numbers.

Formative Assessment – Models

Students draw 11 of any item and then show it as 10 and ___ more.

Double the number 5. Show it with a picture and an equation.

Use base-ten blocks to show how you solve $38 + 40$.

Compare 357 and 329. Justify your thinking using base-ten drawings or a number line.

Formative Assessment – Exit Tickets

Solve and show your work:

$$23 + 4 = \underline{\quad}$$

$$23 + 8 = \underline{\quad}$$

Are the following numbers odd or even: 6, 9, 12, 17? Prove your answers.

Formative Assessment – Interviews

Ask students:

- What number comes after 29 when you count? How do you know?
- What is an even number?

Formative Assessment – Writing

- What does it mean to double a number?
- What is a quick way to solve $2 + 11$?
- What happens when you subtract 10 from a two-digit number? Explain why it happens.

Formative Assessment – Pose a Problem

Pose a problem to analyze students' problem solving, computation, and communication skills.

- There are 8 cookies on a plate. Mom put 4 more cookies on the plate. How many cookies are on the plate now? Show/tell how you solved it.
- Elliott found 57 shells at the beach. He decided to give some to his sister. If Elliott kept 32 shells, how many shells did he give his sister? Explain how you solved it.

Accept and Celebrate Mistakes

Read *The Most Magnificent Thing* by Ashley Spires

- Retell the main events in the story.
- Why did she get mad? What happened when she got mad?
- What did she do when she got very frustrated? Was that a good idea? Why or why not?
- Some parts that she first thought were “not quite right” seemed “quite right” after her walk. Why do you think that was the case?
- When in the story did she show perseverance? Share examples.

Idea to try:

Welcome students to your math class with erasers!

Let them know that mistakes are okay in your classroom.

Our Mission

Less telling. More asking.

Less assigning. More engaging.

Less focus on right or wrong. More focus on understanding.

Less talking. More listening.

Less anxiety. More joy.

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

Follow Sue on Twitter @SueOConnellMath

Like our Facebook page – Quality Teacher Development

Join the Math in Practice Facebook group!