

Step Back and Let Them Think:
Discovering Number Concepts Through Investigations and Math Talk
National Council of Teachers of Mathematics
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What does it mean to be mathematically proficient?

A focus on:


- Conceptual understanding
- Computational fluency
- Application (problem solving)

Standards for Mathematical Practice


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.
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.


These standards view mathematicians as thinkers, communicators, reasoners, and problem solvers.

Adding 10 to a One-digit Number


 **OUR COOKIES**
STUDENT INVESTIGATION

- Do you like chocolate chip cookies?
- Draw a cookie on your paper.
- Pick a 1-8 card to find out how many chocolate chips are in your cookie. Draw them.



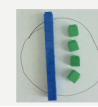
 **OUR COOKIES**
STUDENT INVESTIGATION

What if we added 10 more chips to your cookie? How many chips would be in your cookie?
Write the equation to show the total number of chips in your cookie.





$$4 + 10 = 14$$

SHARE YOUR ANSWERS.

1 + 10 = 11	What do you notice?
2 + 10 = 12	What patterns do you see?
3 + 10 = 13	Do they make sense?
4 + 10 = 14	Predict the sum of 9 + 10.
5 + 10 = 15	Were you right? Try it and see.
6 + 10 = 16	What happens when you add ten to a number?
7 + 10 = 17	
8 + 10 = 18	

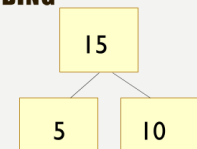


MAKING CONNECTIONS TO DECOMPOSITION



MATH PRACTICE

TRY A SIMILAR INVESTIGATION WITH A DIFFERENT WAY OF RECORDING


$$15 - 5 = 10$$
$$15 - 10 = 5$$

Adding 1 to a Number

Read *Fish Eyes* by Lois Ehlert

Show 5.
Add 1 more.

$5 + 1 = 6$

RECORD AND DISCUSS RESULTS.

$5 + 1 = 6$
 $3 + 1 = 4$
 $7 + 1 = 8$
 $2 + 1 = 3$

What do you notice?
What is $4 + 1$? How do you know?
Try it. Were you right?
Could you add 1 without using the counters?
How?
What happens when you add 1 to a number?

Place Value with 2-digit Numbers

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

How did you find the total each time? Count by ones? Count by tens and ones?
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		

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?

MATH PRACTICE

Mentally Adding 10 to a 3-digit Number

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?

BUILD 142.

Hundreds	Tens	Ones
1	4	2

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

Hundreds	Tens	Ones
1	5	2

FIGURING OUT THE RULE

Repeat with other numbers.

What do you notice?

142	235	421	648	783
152	245	431	658	793

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

Understanding the Commutative Property



DISCOVERING THE COMMUTATIVE PROPERTY

There were 5 cookies on the plate. Mom put 1 more on the plate. How many cookies were on the plate?

$$5 + 1 = 6$$

There was 1 cookie on the plate. Mom put 5 more cookies on the plate. How many cookies were on the plate?

$$1 + 5 = 6$$

Try some more. What do you notice?

WHAT DO YOU NOTICE?

$$5 + 1 = 6$$

$$1 + 5 = 6$$

$$3 + 1 = 4$$

$$1 + 3 = 4$$

$$7 + 1 = 8$$

$$1 + 7 = 8$$

Model $6 + 1$. Predict $1 + 6$.

Check it.

Does that make sense? Why?

Understanding Odd and Even Numbers

SPLITTING THE CHAIN

- Pick a number card.
 - Make a tower of unifix cubes.
 - Can you split it so both towers are even?
- Is there a leftover?



Is your number even or odd?
Place the card in the correct circle.

MATH PRACTICE

RECORD AND DISCUSS RESULTS.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

What do you notice about the even numbers?

Does it make sense? Explain.

Do you think 21 is an even number?

Try it. Were you right?

Could you figure out if a number is even without using cubes? Explain.

Using Mental Strategies to Add Single-digit Numbers

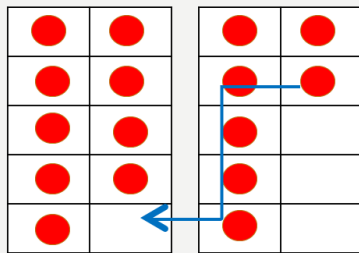
At the beach, Bailey found 9 shells and Molly found 7 shells. They put them all in a bucket. How many shells were in the bucket?

Use your double ten frames to show the shells.

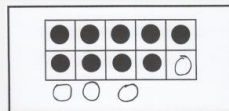
How many did they find?

How do you know? (counted)

$$9 + 7 = \underline{\quad}$$



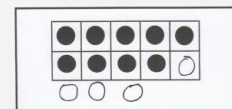
OR WHAT ABOUT THIS VISUAL?



There were 9 pennies. Mom gave me 4 more pennies. How many pennies did I have?

What do you notice?

DOES THIS SHOW $9 + 4$?



Do you see $10 + 3$?

Discovery vs Telling

What are the advantages of letting students discover math rules?

Questions

- What do you notice?
- Why is it happening?
- Does it make sense?
- Can you predict...?
- What is the rule?

Observing Models and Data

- Do students create the models and generate the data? Why is this important?
- How is the data organized and displayed? Why does that matter?
- Can students predict and generate next data? What does that indicate?
- Can students verbalize a generalization or rule based on their observations?

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 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.

Introduction to Problem Solving

Introduction to Communication

Introduction to Representation

Introduction to Reasoning and Proof

Introduction to Connections

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!

More math resources: www.heinemann.com/authors/1415.aspx