Step Back and Let Them Think:
Simple Investigations to Prompt Math Discovery K-5

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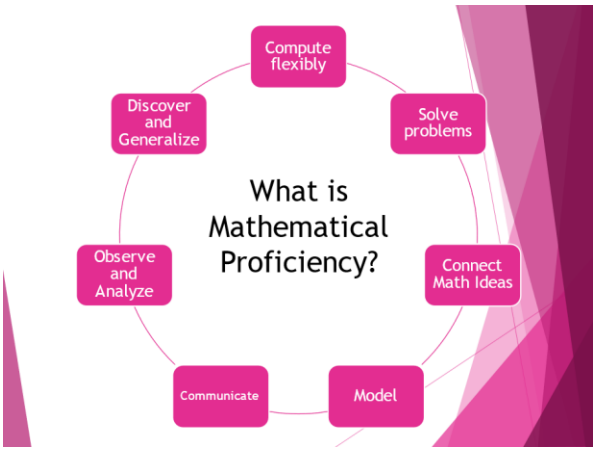
What is mathematical proficiency?
How has it changed since you were a student in math class?



Rethinking Our Practices
What questions do you ask?

- What is the answer?
- How did you get the answer?
- Could you solve it another way? Explain.
- How might you prove your answer is correct?
- Did you notice any patterns? Explain.
- What was challenging about the problem?
- What do you know about…?

Lesson Sequence
I Do, We Do, You Do

- What is the student's role?
- Is memorization or mimicking our goal?

The Role of Problems

- Why were problems posed at the end of class?
- Does it make sense to pose a problem at the start of class even if students aren't sure how to solve it?
- How might posing a problem to start class help students make sense of the computations?

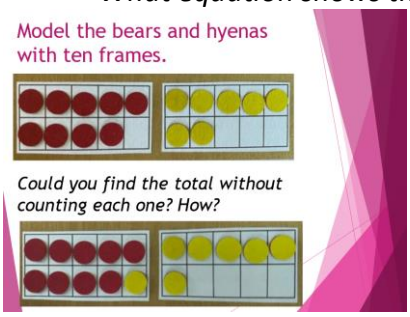
Teacher Telling vs. Investigations
What investigations, models, and questions help K-5 students make sense of math?

Strategies for Adding 9 + 7

Read *Dinner at the Panda Palace* by Stephanie Calmenson

Pose: The bears and hyenas are at the restaurant. They decide to sit at the same table. How many seats will they need?

- *Retell the problem.*
- *What operation would you use? Why?*
- *What equation shows this problem? Explain your thinking.*



Do more trials and record the data.

9 + 7 = 16
9 + 5 = 14
9 + 8 = 17

How does this approach support fluency?

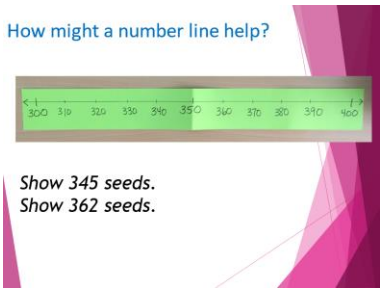
What do you notice?
Predict the sum of 9 + 6.
Try it. Were you right?
Does this make sense? Why or why not?
What can you think about when adding a number to 9?

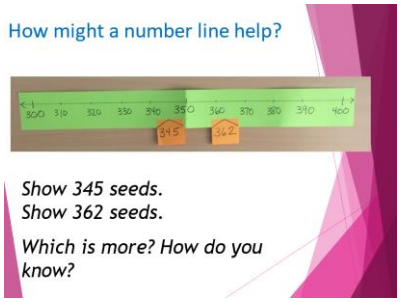
Comparing 3-digit Numbers

Read How Many Seeds in a Pumpkin? by Margaret McNamara

Which pumpkin has more seeds?

- Kimmy's pumpkin – 362 seeds
- Charlie's pumpkin – 345 seeds





Analyze the Data

362 > 345
328 > 317
375 > 352
362 > 357

How do students' comments help you decide what to do next?

What do you notice?
Does it make sense? Why or why not?
Predict which is greater 312 or 321?
Try it. Were you right?
How can you tell which is greater by looking at the numbers?

Or how might thinking about expanded form help?

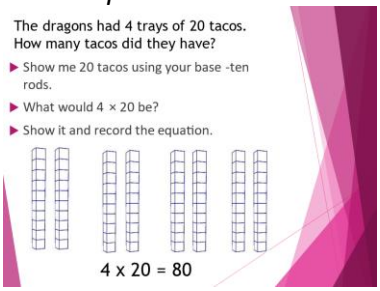
345 seeds = 300 + 40 + 5
362 seeds = 300 + 60 + 2
What do you notice? Which is more? How do you know?

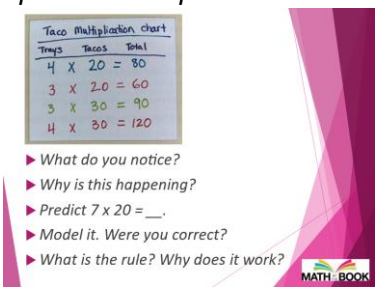
Multiplying by Multiples of Ten

Read *Dragons Love Tacos* by Adam Ruben

Pose: The dragons had a taco party. If they served 4 trays with 20 tacos on each tray, how many tacos were served?

What operation could you use to solve this problem?
What equation works with this problem? Explain.



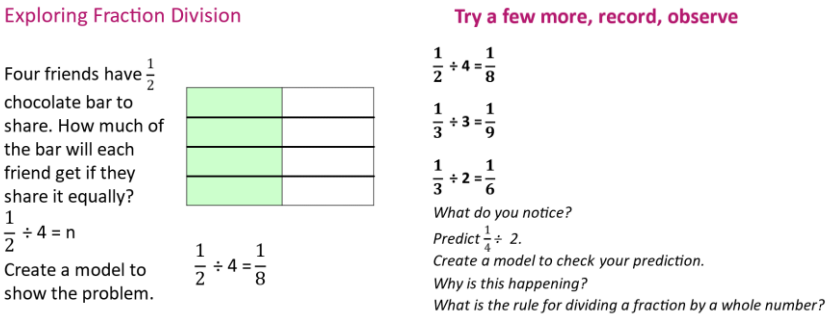


Dividing a Fraction by a Whole Number

Pose: Four friends have ½ chocolate bar to share. How much of the bar will each friend get if they share it equally?

½ ÷ 4 = n

Create a model to show the problem.



What do these investigations have in common?

- Who did the thinking?
- How did the materials/models help?
- Was the math in context? How did I provide context?
- How did the charts/recordings help?
- What questions did I ask to prompt discovery?
    - What do you notice?
    - Why is it happening?
    - Does it make sense?
    - Can you predict?
    - What is the rule?

What are the benefits of students discovering math ideas?

- Engagement
- Curiosity
- Ownership
- Conversations
- Practice analyzing data and looking for patterns
- Generalizing

"Sometimes telling kids where they are going spoils the journey."

Dylan Wiliam

A Focus on Strong Instruction

1. Step back and let them think.
2. Give math a context. Make connections.
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*

How we teach is as important as what we teach.
Don't tell them. Step back and let them think!

Teacher Resource Books
Published by Heinemann (www.heinemann.com)

Math by the Book (**www.mathbythebook.com**), Susan O'Connell and colleagues
This series explores the teaching of math concepts through children's literature. Lessons, word problems, discussion questions, differentiation ideas, and practice tasks are all included to teach grade-specific skills and concepts through the story context. There is a book for each grade level K-5, including a wealth of online resources, and each book includes ideas for twenty skills taught during that year.

Math in Practice (**www.mathinpractice.com**), Susan O'Connell and colleagues
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 **www.mathinpractice** to view the materials.

Putting the Practices into Action - Implementing the Common Core Standards for Mathematical Practice K-8
Susan O'Connell and 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
Susan O'Connell and 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, Susan O'Connell and colleagues
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.

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