




Making the Most of Meaningful Models

James Burnett
Founder / CEO


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How do we foster **thinking** and a **deep understanding** of concepts?

- Language and discourse generated from open rather than closed questions
- Powerful visual models and tools
- Activities and games that require students to “think”

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WHAT'S IMPORTANT IN MATH TODAY?

Fostering thinking skills and conceptual understanding using:

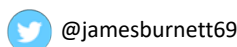
- Language, discourse and open questions
- Powerful visual models and tools



Why Discourse?

“When students are engaged as learners, sharing, discussing and evaluating one another’s thinking in a mutually supportive setting, they are constructing their own **understanding of the concepts** at hand.”

Hoffer, Wendy Ward. *Minds on Mathematics: Using Math Workshop to Develop Deep Understanding in Grades 4-8*. Portsmouth, NH: Heinemann, 2012.



Why Discourse?

Discourse:

- Engages learners
- Promotes understanding
- Develops communication and collaboration skills
- Supports academic language development

Hoffer, Wendy Ward. *Minds on Mathematics: Using Math Workshop to Develop Deep Understanding in Grades 4-8*. Portsmouth, NH: Heinemann, 2012.



Why Discourse?

As a teacher, you would be wise to focus your energy on building classroom discourse — as it is likely to result in two years of learning gains for every year of schooling.

John Hattie, et al. (2017). *Visible Learning for Mathematics: What works best to optimize student learning*. Thousand Oaks, CA: Corwin Mathematics.



WHAT'S IMPORTANT IN MATH TODAY?

Fostering thinking skills and conceptual understanding using:

- Language, discourse and open questions
- Powerful visual models and tools

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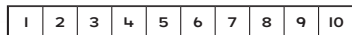
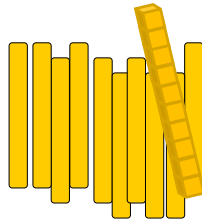
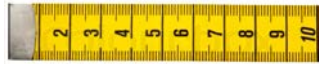
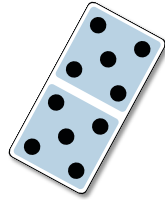
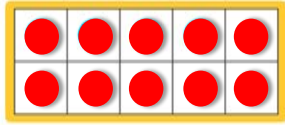
Number Models

- **Set model**
- Length model
- Number line model
- Array/Area model



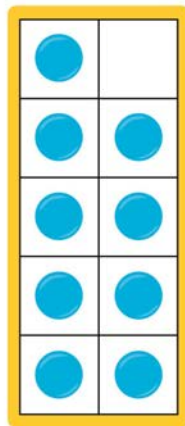
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Representations of Ten



Set Model

Representing Numbers to Ten

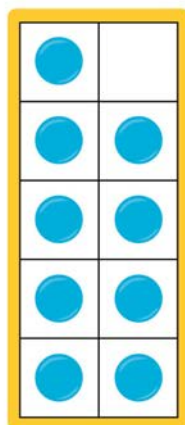


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Set Model

Representing Numbers to Ten

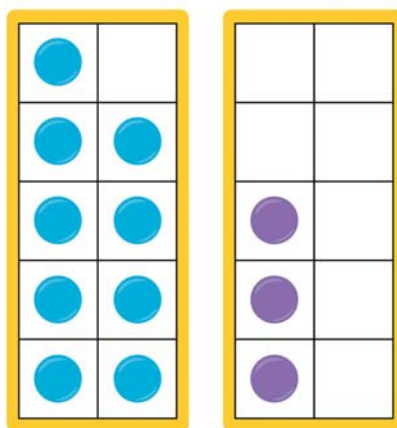


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Set Model

Introducing the Make-Ten Addition Strategy



THE BOX OF
FACTS

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Set Model

Extending the Make-Ten Addition Strategy

If you have a strategy to calculate

$$9 + 5 = \underline{\quad}$$



Set Model

Extending the Make-Ten Addition Strategy

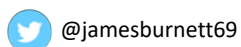
.... then use the same thinking to calculate

$$29 + 15 = \underline{\quad}$$

$$398 + 56 = \underline{\quad}$$

$$1.95 \text{ m} + 2.45 \text{ m} = \underline{\quad}$$

$$1\frac{5}{7} + \frac{4}{7} = \underline{\quad}$$



Set Model

Introducing the Doubles Addition Strategy

Double

Double-plus-1

Double-plus-2

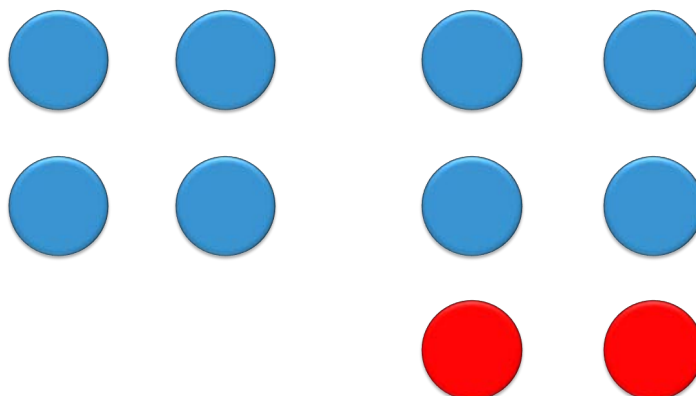


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Set Model

Introducing the Doubles-plus-2 Addition Strategy



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Number Models

- Set model
- **Length model**
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Length Model

Representing Quantity

Number Track



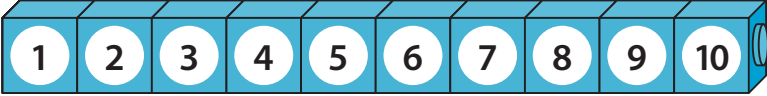
Bar model




Length Model


Building a Number Track


Concrete



Pictorial



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Length Model

Using a Hundreds Board for Computational Thinking

10

Here is a **chunk** of a hundred chart.

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

Here are some **pieces** of the same chart.

64

(A)

		76

(B)

		89

(C)

31


(D)


12	

(E)

Write the numbers that belong at A, B, C, D, and E.

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Length Model

Representing Fractions



In practice there should be more than one wall.

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Number Models

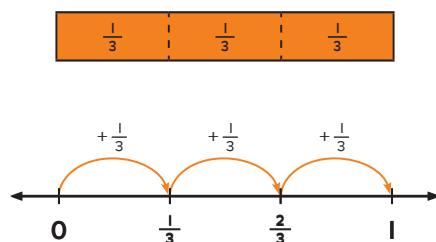
- Set model
- Length model
- **Number line model**
- Array/Area model



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Length vs. Number Line Model

Common Fractions



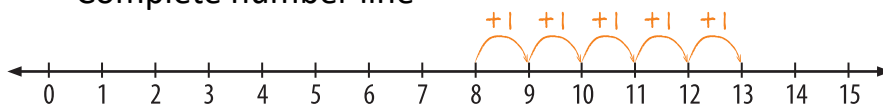
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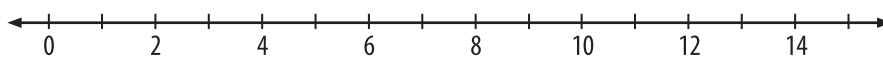
Number Line Model

Modeling Thinking Strategies

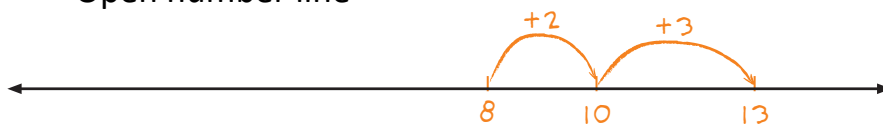
Complete number line




Partial number line



Open number line

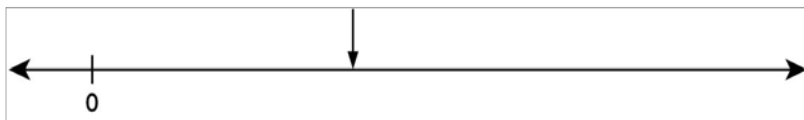


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Number Line Model

Exploring Relative Position of Number



If the arrow is pointing to 50, where do you think these numbers are located?

- 100
- 10
- 110
- 25

Three Types of Subtraction

Gemma had 12 apples in a bag.
She took out 7 apples.
How many apples are in the bag now?

Take From



Gemma needs 12 apples.
She has picked 7 apples.
How many more apples does she need?

Unknown Addend



Gemma has 12 red apples and 7 green apples.
What is the difference between the number of red and green apples?

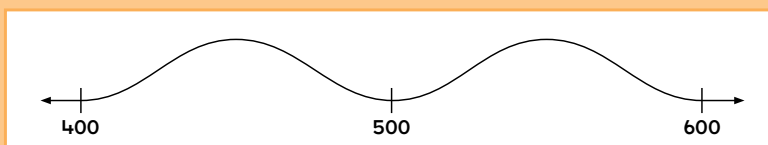
Comparison



Number Line Model

Rounding Numbers

Imagine you placed a ball on this special number line.



How could the ball help you decide which hundred is closest to 540?

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Number Line Model

Adding Fractions with Same Denominator

$$\frac{7}{10} + \frac{8}{10}$$

X



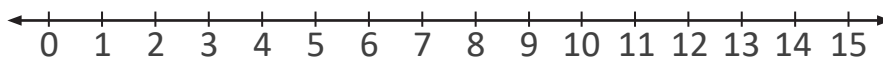
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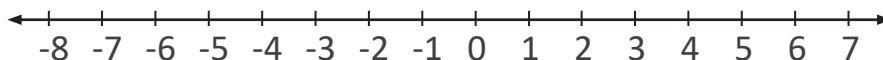
Number Line Model

Represents most Numbers

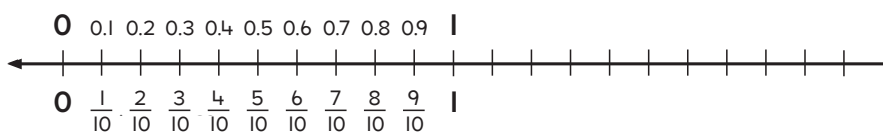
Whole numbers



Integers



Rational numbers



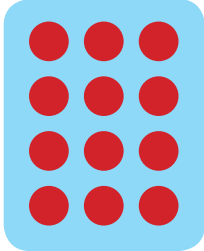
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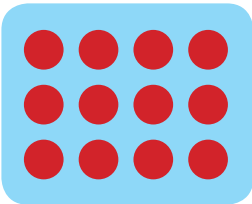


Array Model



Modeling the Commutative Property of Multiplication



4×3

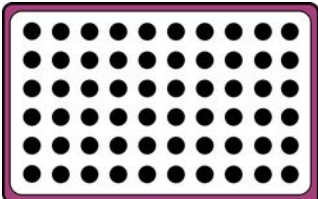


3×4

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Array Model

Introducing the Fives Facts Strategy



$6 \times 10 = \underline{\quad}$

$10 \times 6 = \underline{\quad}$

**THE BOX OF
FACTS**


Step In Multiplication: Extending the fives strategy

A bricklayer is laying a path. It is 5 bricks wide and 28 bricks long.
How many bricks will be needed?



I don't know 28×5 , but I do know 28×10 .
 $28 \times 10 = 280$ and a half of $280 = 140$
 So, $28 \times 5 = 140$

How could you use the same strategy to calculate these?

$16 \times 5 = \square$

$44 \times 5 = \square$

$25 \times 5 = \square$

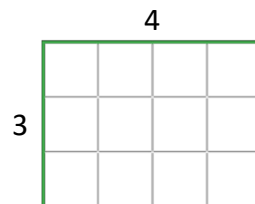
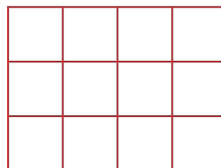
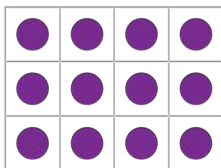
$34 \times 5 = \square$

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Array vs. Area Model

Whole Numbers




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Area Model

Multiplying Whole Numbers

$12 \times 35 = 10 \times 30$
 10×5
 2×30
 2×5


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Array Model

Multiplying Decimal Fractions

$1.4 \times 1.3 = \underline{\quad}$

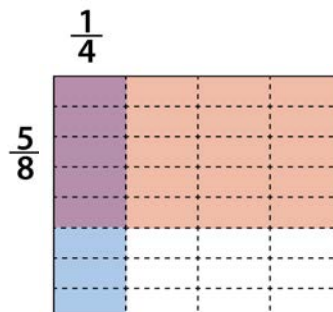
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Area Model

Multiplying Common Fractions

$$\frac{5}{8} \times \frac{1}{4} = \underline{\hspace{2cm}}$$



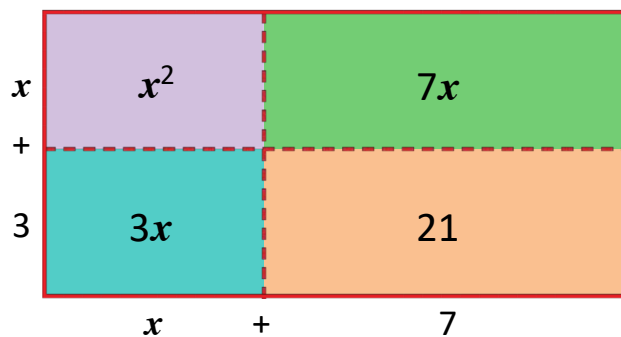
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Area Model

Algebra (Multiplying Binomials)

$$A = (x + 3)(x + 7)$$



A =

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WHAT'S IMPORTANT IN MATH TODAY?

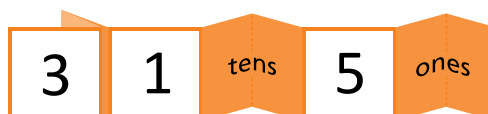
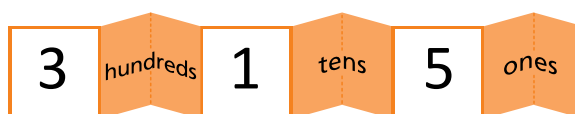
Fostering thinking skills and conceptual understanding using:

- Language, discourse and open questions
- Powerful visual models and tools



Visual Models/Tools


Numerals Expander



Visual Models/Tools

Numerals Expander

$$\begin{array}{r}
 \overset{2}{\cancel{3}}\overset{1}{1}5 \\
 - 283 \\
 \hline
 2
 \end{array}$$


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Visual Models/Tools

Numerals Expander

$$\begin{array}{r}
 \textcircled{3}15 \\
 - \textcircled{2}83 \\
 \hline
 32
 \end{array}$$

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WHAT'S IMPORTANT IN MATH TODAY?

We need to foster **thinking** with **conceptual understanding** using:


- Language and discourse generated from open questions
- A range of powerful visual models and tools
- Activities and games that require students to “think”


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Thank You

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