Making Connections to Make a Difference

Connecting Math to Strategies Using Visual Models

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http://goo.gl/zuXGD5
Introductions

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Class Objectives

Objectives:

• Understand how connecting math to visual models and strategies will increase students’ conceptual understanding.
  • Ten Frame
  • Number Track
  • Number Line
  • Tape Diagram
  • Arrays
  • Area Model
  • Equation
Class Objectives

- Understand how these visual models move students toward mental math.
- Solve real world problems using various visual models.
- Collaborate with other teachers to discuss ways to use visual models or to promote visual thinking in the classroom.
Reflection time...

What do you know about visual models?

How have you used them with your students?

Turn and talk.
Rate the following visual models on a scale of 1-10:

Ten Frames, Number Track, Number Line, Tape Diagram, Array, and Area Model
### Stage Description

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Representational</th>
<th>Abstract</th>
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<tr>
<td>Allow students to work with various manipulatives (red and yellow squares, buttons, connecting cubes, etc) to help them solve a problem.</td>
<td>Once students have grasped the Concrete representation of the problem, they will be ready to create pictures or a visual model to represent their problem.</td>
<td>First grade students should begin creating number sentences to describe their story problem after the use of manipulatives or a visual representation.</td>
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</table>
A ten frame is a simple graphic tool that allows students to “see” numbers.

- subitize - group the objects
- compose and decompose numbers
- facts to 5 and facts to 10
- place value
- addition and subtraction of numbers
- mental math fluency

Ten Frames
Sample Problems

There are 8 monkeys jumping in a tree. 3 monkeys jump off. How many monkeys are still in the tree?
Max has 2 red apples. He picks 3 more. How many apples does he have now?
Standards and Math Practices

**Grade.1.OA.1.** Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

**Grade.1.OA.2.** Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

**Grade.1.OA.5.** Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

**MP #3.** Construct viable arguments and critique the reasoning of others. Students defend their solution and analyzing a partner’s solution.

**MP#4.** Model with mathematics. Students use drawings, equations, and written responses to solve problems.
Adding with 9

1. Look at the problem. Use counters to build the number sentence on your double ten frame.

2. Make a ten on the double ten frame by rearranging the counters you’ve placed, and complete the second number sentence.

   \[
   9+7=10+ ___ \\
   9+6+10+ ___ \\
   9+3=10+ ___ \\
   \]

   \[
   9+2=10+ ___ \\
   9+5=10+ ___ \\
   9+4=10+ ___ \\
   \]

Learn Zillion Video - additional ways to add to 20 by regrouping.
Ten Frame Connections

- Game on illuminations
- Visualizing Number Combinations (video)
- Blackline, templates
- Ten Apples Up On Top song in the style of Jason Mraz
- Video of ten frame app
Reflection time...

Create a ten frame in your folded resource booklet.
A **number track** is a sequence of numbers, each inside its own square. Whereas, a **number line** is where the numbers are attached to markers on a line.

Number track is taught to students first; this leads to a number line.
Number Tracks

- Think of each move as a “jump”
- When solving problems, students will move from one space to the next through jumps.
- Students can move forward or backward on the number track to solve the problem.
Let’s try a problem. Show your work on a number track.

Mary has 5 blue trucks. She gets 3 more. How many blue trucks does she have now?
Technology Connections

NRich Examples
MathED Video
Using A Number Track-PPT
Origo Flare Activity
NumberTracks for Primary
Standards and Mathematical Practices

Where would number tracks be utilized in our math targets (CCSSM) specifically? **CCSSM**

What mathematical practices are connected to this visual model as well? **Mathematical Practices**

Feel free to add these standards and math practices to your foldable under number tracks.
Reflection time...

Create a number track in your folded resource booklet.

How might you use this in your classroom?
A **number line** is a visual representation of all real numbers.

An **open number** line is a visual representation for recording and sharing student’s thinking.

- shows the student’s thinking/reasoning
- decomposing numbers
- place value patterns (adding tens/hundreds)
Open Number Line - Subtraction Video
72-38= 172-59= 81-15=
DreamBox- Learn addition with a number line video
Middle School Number Line Video
ShowMe App example
Fraction Game and Video
The number line below is divided into equal parts. The zero (0) is already placed on the number line. 4.NF.1, 4.NF.2

Place each of the following numbers in the proper place on number line. To place a number, click on a tile and then click on the number line. You may move and clear numbers as needed.

1             2/1             3/5
Create a number line in your folded resource booklet.

How might you use this in your classroom?
What is a tape diagram?

A drawing that looks like a segment of tape, used to illustrate number relationships. Also known as a strip diagram, bar model, fraction strip or length model.

(CCSSM Glossary, p.87)

Resource book: Step by Step Model Drawing Solving Word Problems the Singapore Way (Char Forsten)
Tutorial using Thinking Blocks: **Part Whole Model**

Emma had some songs on her mp3 player. On Wednesday, she downloaded 35 songs. Now Emma has 50 songs. How many songs did Emma have at first?

Concrete → Representational → Abstract

\[ ? + 35 = 50 \]

\[ ? = 15 \text{ songs} \]
A total of 35 people were at the party. There were 12 children and the rest were adults. How many adults were at the concert?
Tape Diagrams

These “diagrams are a major step forward because the same diagrams can represent the adding and subtracting situations for all kinds of numbers students encounter in later grades (multi-digit whole numbers, fractions, decimals, variables).”

(OA Progressions for the Common Core State Standards in Mathematics, pp.16-17)
Jean and Marty have a paper route. They collect money from their customers. Jean collects 8 times as much as Marty. If Marty has collected $11, how much did Jean collect? (Hint: You need to make two separate tape diagrams.)
Reflection time...

Create a tape diagram problem in your folded resource booklet.

How might you use this in your classroom?
Arrays-a set of numbers or objects that will follow a specific pattern.
• an orderly arrangement using columns and rows
• used in multiplication and division
• shows multiplication as repeated addition
• shows division as fair shares
Arrays

If looking at just pure numbers it doesn’t matter if it is an array of 2 x3 or 3x2

Important to provide a context to the array problem.

Think about this...2 shelves with 3 books on each shelf is different than 3 shelves with 2 books on each shelf. While the total is the same, the context is different.

Understanding Arrays
Lizzie is looking to organize pictures on her wall. She has 12 frames and wants to create a rectangle with them. How many different ways can she arrange her pictures?
Arrays and Technology

Arrays Connected to Multiplication
How to Write Math Arrays
Array Practice
Learn Zillion Videos
Reflection time...

Create an array in your folded resource booklet. How might you use this in your classroom?
The area model, or connected array is a visual representation that can support students’ multiplicative understanding. This model with its row and column structure can be linked to the standard multiplication algorithm.

Make an area model using a grid.
Area Models

Area Model without the grid (Learnzillion)

Using Area Model for Multiplication (Learnzillion)

Building area models using Kidspiration (YouTube)

Using area model for multiplying decimals (NCTM)

Further resource for connecting multiplication using area models for Grades 3-5 (3.OA, 3.MD.7, 4.NBT.5, 5.NBT.5, 5.NT.7)
Practice: handout PSI.2 Solve both problems using an area model. Also write the equation that the area model represents.

Tom brought 22 packs of game cards. Each pack contains 35 cards. How many cards did Tom buy?
What about division?

How can students use an area model when solving division problems?

[Image of an area model division]

[YouTube link: Area model division]
Create an area model problem in your folded resource booklet.

How might you use this in your classroom?
Visible Thinking

- Increases student interest, engagement, and motivation
- Promotes connections to previous learning
- Provides opportunities to think deeply
- Encourages reasoning and sense making
- Opens dialogue and discourse within the classroom
- Promotes conceptual learning
- Increases student feedback through ongoing formative assessment
Visual Thinking

- Supports belief in effort over innate ability
- Broadens student understanding about learning mathematics.
- Promotes student responsibility for learning
- Fosters a community of learners.
# Categories of Research-Based Instructional Elements

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<td>Effort over innate ability</td>
<td>Feedback</td>
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<td>Rubric scoring</td>
<td>High expectations</td>
<td>Variety of strategies</td>
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