CGI Professional Development
University of California, Los Angeles

Redondo Beach
Summer 2014

Presented by: Melissa Canham
Getting to Know You

- Mix-Freeze-Group
- Team Interview
- Quadrant Partners
- 3 Interesting Things
- One of These Things
Mix-Freeze-Group

1. Music starts-Mix around the room and greet all people you see
2. Freeze when music stops
3. Facilitator will ask a question
4. Participants show answer on fingers
5. Participants group according to answer
6. Form groups and prepare to engage
Three of These Things
Three of These Things
Three of These Things

<table>
<thead>
<tr>
<th>9</th>
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One of These Things: Debrief

- Where’s the math?

- Development of a critical eye
  - What possible benefits do you see for students to engage in this type of task?
  - When might this be a good task to pose to students?
  - How do we help students think about what they are doing (meta-cognition) and provide structure to developing these skills?
Today’s Agenda

- Common Core Overview
- Introduction to CGI
  - Research Problems
  - Problem Types
- Single Digit Strategy Development
- Reflection
Day 2 Agenda

- Single Digit Trajectory Review
- Math Game: Double Compare
- Multi-Digit Strategies
- Unpacking Problems
- Choral Counting
- Reflection
Day 3 Agenda

- Algebraic Reasoning: Equal Sign
- Grouping Problems: Multiplication & Division
- Classroom Connection: Analyzing Student Work
- Fair Share & Fractions
- CGI & the Standards for Mathematical Practice
- Reflection
Day 4 Agenda

- Tasks to Develop Number Sense
- Looking for Problem Solving in the CCSS-M
- Counting Collections
- Responsiveness in the Classroom
- Classroom Connection: Number Strings
- Big Ideas Review
- Planning: CGI in Your Classroom
A Look Inside the CCSS for Mathematics

COMMON CORE STATE STANDARDS FOR Mathematics
The 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.
## CCSS Domain Progression

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David Coleman
Three Shifts of the Common Core in Mathematics

- **Focus** strongly where the standards focus
- **Coherence**: Think across grades and link to major topics within grades
- **Rigor**: In major topics, pursue:
  - Conceptual understanding,
  - Procedural skill and fluency, and
  - Application

with equal intensity
<table>
<thead>
<tr>
<th>Grade</th>
<th>Focus Areas in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding</th>
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<tbody>
<tr>
<td>K-2</td>
<td>Addition and subtraction concepts, skills, and problem solving, and place value</td>
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<tr>
<td>3-5</td>
<td>Multiplication and division of whole numbers and fractions concepts, skills, and problem solving</td>
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<tr>
<td>6</td>
<td>Ratios and proportional reasoning; early expressions and equations</td>
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<tr>
<td>7</td>
<td>Ratios and proportional reasoning; arithmetic of rational numbers</td>
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<td>8</td>
<td>Linear algebra and linear functions</td>
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# Required Fluencies in K-6

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<th>Grade</th>
<th>Standard</th>
<th>Required Fluency</th>
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<tr>
<td>K</td>
<td>K.OA.5</td>
<td>Add/subtract within 5</td>
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<tr>
<td>1</td>
<td>1.OA.6</td>
<td>Add/subtract within 10</td>
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<tr>
<td>2</td>
<td>2.OA.2</td>
<td>Add/subtract within 20</td>
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<td>2.NBT.5</td>
<td>Add/subtract within 100</td>
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<td>3</td>
<td>3.OA.7</td>
<td>Multiply/divide within 100</td>
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<td></td>
<td>3.NBT.2</td>
<td>Add/subtract within 1000</td>
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<td>4.NBT.4</td>
<td>Add/subtract within 1,000,000</td>
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<td>5</td>
<td>5.NBT.5</td>
<td>Multi-digit multiplication</td>
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<td>6.NS.2,3</td>
<td>Multi-digit division</td>
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<tr>
<td></td>
<td></td>
<td>Multi-digit decimal operations</td>
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</tbody>
</table>
What is meant by fluent?

- **Efficient** – a reasonable amount of steps

- **Accurate** – the solution has a degree of precision appropriate for the problem context. The student knows why the solution works.

- **Flexible** – the student knows several strategies
  - 9 x 6 is 54 because…
    - 6 x 10 is 60, take away one group of 6 and it is 54
    - 5 x 6 is 30, 4 x 6 is 24, 30 + 24 is 54
    - 9 x 3 is 27, double that 20 + 20 is 40, 7 + 7 is 14, 40 + 14 is 54
Grade Level Introduction

Mathematics | Kindergarten

In Kindergarten, instructional time should focus on two critical areas. (1) Representing, relating, and operating on whole numbers, initially with sets of objects; (2) describing shapes and space. More learning time in Kindergarten should be devoted to number than to other topics.

(1) Students use numbers, including written numerals, to represent quantities and to solve quantitative problems, such as counting objects in a set; counting out a given number of objects; comparing sets; and modeling simple joining and separating situations with sets of objects, or eventually with equations such as 5 + 2 = 7 and 7 - 2 = 5. Kindergarten students should see addition and subtraction equations, and student writing of equations in kindergarten is encouraged, but it is not required.) Students choose, combine, and apply effective strategies for answering quantitative questions, including quickly recognizing the cardinalities of small sets of objects, counting and producing sets of given sizes, counting the number of objects in combined sets, or counting the number of objects that remain in a set after some are taken away.

(2) Students describe their physical world using geometric ideas (e.g.,...
Grade Level Overview

Grade 1 Overview

Operations and Algebraic Thinking

- Represent and solve problems involving addition and subtraction.
- Understand and apply properties of operations and the relationship between addition and subtraction.
- Add and subtract within 20.
- Work with addition and subtraction equations.

Number and Operations in Base Ten

- Extend the counting sequence.
- Understand place value.
- Use place value understanding and properties of operations to add and subtract.

Measurement and Data

- Measure lengths indirectly and by iterating length units.
- Tell and write time.
- Represent and interpret data.

Geometry

- Reason with shapes and their attributes.

Mathematical Practices

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.
Format of K-8 Standards

Operations and Algebraic Thinking

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.²

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.

Understand and apply properties of operations and the relationship between addition and subtraction.

3. Apply properties of operations as strategies to add and subtract.³ Examples:
   - If $8 + 3 = 11$ is known, then $3 + 8 = 11$ is also known. (Commutative property of addition.)
   - To add $2 + 6 + 4$, the second two numbers can be added to make a ten, so $2 + 6 + 4 = 2 + 10 = 12$. (Associative property of addition.)

4. Understand subtraction as an unknown-addend problem. For example, subtract $10 - 8$ by finding the number that makes 10 when added to 8.
Directions: Rank these problems from easiest to most difficult.

A. Carla has 7 dollars. How many more dollars does she have to earn so that she will have 11 dollars to buy a puppy?

B. Mr. Gomez had 20 cupcakes. He put the cupcakes into 4 boxes so that there were the same number of cupcakes in each box. How many cupcakes did Mr. Gomez put in each box?

C. Paco had 13 cookies. He ate 6 of them. How many cookies does Paco have left?

D. Tad had 15 guppies. He put 3 guppies in each jar. How many jars did Tad put guppies in?

E. Robin has 3 packages of gum. There are 6 pieces of gum in each package. How many pieces of gum does Robin have altogether?

F. Hannah has 12 balloons. Jacob has 7 balloons. How many more balloons does Hannah have than Jacob?
Kindergarten Problems

- Work through these items, trying to identify ways that young children might solve these problems.

- Note strategies you used to share later.

- Individually rank the problems from easiest (1) to most difficult (6) to solve.

- Rank as a group – come to a consensus on disagreements.
<table>
<thead>
<tr>
<th>A. Carla has 7 dollars. How many more dollars does she have to earn so that she will have 11 dollars to buy a puppy?</th>
<th>80% Ranking: 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Mr. Gomez had 20 cupcakes. He put the cupcakes into 4 boxes so that there were the same number of cupcakes in each box. How many cupcakes did Mr. Gomez put in each box?</td>
<td>70% Ranking: 6</td>
</tr>
<tr>
<td>C. Paco had 13 cookies. He ate 6 of them. How many cookies does Paco have left?</td>
<td>88.6% Ranking: 1</td>
</tr>
<tr>
<td>D. Tad had 15 guppies. He put 3 guppies in each jar. How many jars did Tad put guppies in?</td>
<td>74.3% Ranking: 4</td>
</tr>
<tr>
<td>E. Robin has 3 packages of gum. There are 6 pieces of gum in each package. How many pieces of gum does Robin have altogether?</td>
<td>87.1% Ranking: 2</td>
</tr>
<tr>
<td>F. Hannah has 12 balloons. Jacob has 7 balloons. How many more balloons does Hannah have than Jacob?</td>
<td>72.9% Ranking: 5</td>
</tr>
</tbody>
</table>
Dialogue

- Take a moment to talk to someone next to you about what you noticed about the difficulty of the problems and the rankings.

- Be prepared to share one of your ideas.
Video

- While watching the video, pay attention to:
  - Student strategies for solving
  - What might you do as a teacher to help this student develop more sophisticated or efficient problem solving strategies?

- Talk to a partner about what you noticed in the video. Did anything surprise you? What questions might you have?
Revisiting the Research Items

- Translate each story problem into a number sentence or equation.
  - What do you notice about the position of the unknown quantity in each equation?
  - How does the position of the unknown quantity appear to affect the difficulty in the problem?
Classification of Word Problems

• Not all addition and subtraction problems are the same. What are some of the distinguishing factors that relate to the difficulty in solving various problems?
  • Location of the unknown variable
  • The types of actions or relationships described in the problem
Children’s Solution Strategies

- Direct Modeling
- Counting Strategies
- Derived Facts
- Recall/Number Facts
Oliver’s Toy Cars

Oliver has 5 toy cars. His sister gives him 8 more toy cars for his birthday. How many toy cars does Oliver have now?

Please solve this problem in at least two different ways.

Compare your solution strategies with colleagues at your table.
Children’s Mathematics

- Read Chapters 1, 2 & 3 to review today’s learning

- Have a great evening and we will see you tomorrow!