Central Question?

How can teachers build mathematically powerful students who can solve real-life problems, communicate their understanding to others, and perform well on state assessments?
Engaging Students in a “Balance” of Activities

**BUILD** - computational (procedural) skills

**DEVELOP** - mathematical reasoning and problem-solving abilities

**DEEPEN** - conceptual understanding

**ALLOW** - students to demonstrate their understanding in a variety of assessment formats
Five Easy Steps to a Balanced Math Program

- Researched-based instructional model
- Framework - not a program
- Relevant, practical and easy to implement
- Builds computational skills and number sense
- Develops mathematical reasoning and problem-solving abilities.
GCCS Timeline - Where have we been?

- **2007-09**
  - Four, 1-day sessions - Five Component overview on volunteer basis
- **Summer 2009**
  - Train the Trainer (25 staff)
- **2009-10**
  - Math Review and Mental Math
- **2010-11**
  - Problem Solving and Unit / Assessments
- **2011-12**
  - Develop Assessments and Rubrics
- **Summer 2014**
  - Two-day training (new trainers added)
GCCS Math Data

Why we are continuing: 20%+ gains

<table>
<thead>
<tr>
<th></th>
<th>Spring ’09</th>
<th>Spring ’10</th>
<th>Spring ’11</th>
<th>Spring ’12</th>
<th>Spring ’13</th>
</tr>
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<tbody>
<tr>
<td>Elementary</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>63%</td>
<td>73%</td>
<td>81%</td>
<td>79%</td>
<td>83%</td>
</tr>
<tr>
<td>Middle</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>56%</td>
<td>69%</td>
<td>74%</td>
<td>76%</td>
<td>78%</td>
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</table>
GCCS Timeline - Where are we going?

2014-15
- Semester 1 - Focus on Daily Math Review and Mental Math
- Semester 2 - Focus on Problem Solving Process and Strategies
- Walk-throughs and professional development in schools
Overview - Five Components

Step 1 - Computational Skills (Math Review and Mental Math)
Step 2 - Problem Solving
Step 3 - Conceptual Understanding
Step 4 - Mastery of Math Facts
Step 5 - Common Formative Assessments
STEP 1 - Computational Skills

**Math Review** emphasizes the development of number sense as students practice procedural math and computational skills every day.

**Mental Math** helps students become skillful in computing math problems mentally.
STEP 2 - Problem Solving

This step provides both a structure for problem-solving activities related to the current conceptual unit focus and a general problem-solving rubric, or scoring guide, that is used throughout the year to assess student work.
STEP 3 - Conceptual Understanding

Identifies math standards in a particular grade or course that are essential for student understanding. These topics becomes the focus of conceptual math units that are deliberately designed to align instruction with end of year assessments.
STEP 4 - Mastery of Math Facts

The emphasis is on fact recall through student understanding of patterns. This process begins with the faculty mapping all of the addition, subtraction, multiplication and division facts across grades K-5 so that students enter middle school already knowing their math facts.
STEP 5 - Common Formative Assessments

The final step aligns school-based assessments for learning to math Power Standards. Assessments are collaboratively designed, administered, scored and analyzed with each grade level during the year. Assessments provide teachers with valid feedback as to students’ current understanding of the Power Standards in focus.
Computational Skills - Focus Step 1

What is number sense?

How do students develop number sense?
Number Sense

- Knowledge of number system
- Patterns in the number system
- Sense of quantity and relationship to that quantity
- Reasonable answer
- Developed by daily student practice with patterns

NOT JUST PLACE VALUE
Number Sense - Students need to find a comfortable, reliable strategy

EXAMPLES:
- Addition for Subtraction
- Doubles
- Building up through 10
- Anchors of 5 and 10
- Multiples of 10
- Doubles plus 1
Daily Math Review - DMR

Provides:

- Repeated Reasoning
- Effective Feedback
- Relational Thinking
Format for DMR

- Three to five problems
- 15-20 minutes at the beginning of class
- Reinforce grade-level Power Standards
- Reflect computational standards
- Reinforce prior math skills
- Promote mathematical reasoning and develop number sense
- Include feedback, error analysis and student reflection
Criteria for Category Selection

● Concepts students should know, but they don’t know
● Essential concepts in current grade
● Next grade level
● State standards and testing
### Sample format for grade 3

#### Grade 3 Math Review Template

<table>
<thead>
<tr>
<th>Student Name</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>453 =</th>
<th>474 + 227</th>
</tr>
</thead>
</table>

#### Place Value
(Expanded Notation)

<table>
<thead>
<tr>
<th>40</th>
<th>Illustrate 3 × 6</th>
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</thead>
<tbody>
<tr>
<td>19</td>
<td>Conceptual Unit</td>
</tr>
</tbody>
</table>

#### Addition

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
</table>

#### Subtraction

| in = 2 ft |
| cm = 1 m |
| days = 1 year |

#### Measurement

*Beginning of year.*

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**STEP 1 Computational Skills**
<table>
<thead>
<tr>
<th>Fractions/Decimals/Percents</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1}{3} ) = ____ = ____ %</td>
</tr>
<tr>
<td>( \frac{3}{8} ) = ____ = ____ %</td>
</tr>
</tbody>
</table>

**Exponents**

\( 4^{-3} = \)

**Integers**

If 4 pizzas cost $15.00, how much will 10 pizzas cost?

**Ratio/Proportion**

Complete the “triples.”

\( 3, \ 4, \ \_ \)
\( 5, \ 12, \ \_ \)
\( 8, \ 15, \ \_ \)

**Geometry**

*Beginning of year.*
Key Elements when Processing Math Review Problems

Number Sense - reasonable answers
Error analysis
Student reflection
Key idea statements
Methods for Processing DMR

- Teacher-directed (3 days)
- Student-directed
- Group Answer
- “Pass the Pen”
Student Reflection

Students reflect on bottom or back of paper. You can design reflection question.

What did I find easy?
What did I find difficult?
How can I improve?
Where do I need help?
DMR -
Math Review - Video
Questions
Reflect
Mental Math

Immediately follows processing of DMR

- Mental practice with:
  - Basic number facts
  - Combining operations

- Reinforce Number Sense:
  - Properties of number system
  - Measurement concepts
  - Reasonableness of answers
  - Math vocabulary
Mental Math Themes

Mental Math themes are patterns that exist within the number system that will support development of computational skills.

- Number facts
- Powers of 10
- Fractional parts
- Measurement conversions
- Skip-counting
- Inverse operations
Mental Math Procedure

1. Teacher dictates string of numbers and operations, pausing after each operational step for students to mentally compute
2. Students write down answers
3. Teacher repeats string once more to allow students to verify their solution
4. Students answer aloud; answer confirmed
5. Do one or more problems, time permitting
Mental Math

Video

Questions

Reflect
Problem Solving

Teacher attitude: Problem solving is a risky, messy process full of tremendous benefit to students and teachers.

Create enthusiasm: Success, honor student ideas, public display of work
Problem Solving

To solve problems successfully students must:

● Define the problem
● Select relevant information
● Formulate and represent that information
● Plan and then modify the process as needed
● Verify that their strategy works
Selecting the Problem-Solving Task

- Does it relate to current focus?
- Is it accessible to all students?
- Does it challenge mathematical understanding?
- Does it involve ideas from more than one mathematical strand?
- Do I understand the math in the problem?
Poster Method

- Individual Work - (10-12 minutes)
  - Individual data sheet - student reflects
- Group Work - (20-30 minutes)
  - Group data sheet
  - Represent all ideas
  - Visit other groups (3 minutes) timed
  - Group agrees and finalizes answer
  - Group creates written explanation
- Circle discussion - share from all groups
- Class determines solution
Problem-Solving Task Write-Up Guide: Upper-Elementary Grades

Data Sheet
1. Head a piece of paper with your name, date, title of problem (if given), and the words “Data Sheet.”
2. Show all the work you did to solve the problem, using computation and graphic representation (words, pictures, and/or numbers).
3. Number each step as you work to solve the problem.
4. Write a number sentence that matches the problem.
5. Write a word sentence at the end of your Data Sheet that states the answer to the problem.

Write-Up
1. Using a separate piece of paper, head the paper with your name, date, title of problem (if given), and the words “Write-Up.”
2. Copy the title of each paragraph before you write your sentences for that paragraph.
3. Use the space below to complete your write-up. Everything you write must refer to the math content, procedures you followed, and strategies you used to solve the problem.

Paragraph One: Problem Statement
This problem is called __________________. It is about __________________.
I’m supposed to find __________________.

Paragraph Two: Work Write-Up
Explain step-by-step, in detail, everything you did to complete your Data Sheet and arrive at your answer. Refer back to your numbered steps on the Data Sheet to help you. Think of it like writing a recipe for someone to follow or giving a friend exact directions to your house. Use as many of these transition words as you need to describe each of your math steps: first, next, then, after, finally.

Paragraph Three: Answer
My answer is __________________. I think my answer makes sense because __________________.
(Verify or prove your answer by referring to the math you did. It is not enough just to write that you checked it on the calculator, or that you checked it twice, or that a friend or parent or teacher told you so.)
Alternative Method

- Teacher poses complex problem
- Students work to solve in small group
- Students share insights to solve problem
- Small group debates alternative solutions and reach tentative solution
- Next day, students share their solutions
- Teacher discusses and confirms correct solution
- Students reflect on individual performance
Alternative Task Write-up

Step 2 Activity: Alternative Problem-Solving Method

Alternative Problem-Solving Task Write-Up

Title of the Problem

1. Individual work (record what you did to try to solve the problem by yourself).

2. Cooperative work (record what you did to try to solve the problem with others).

3. Answer and verification (write your answer and explain how you know your answer is correct mathematically). Use the back of the paper.
Resources

My Big Campus
Search for Balanced Math group
Code to join: d7hum62a

J.A. Van de Walle: Elementary and Middle School Mathematics: Teaching Developmentally
2014-15 School Goals

Where are we?

What PD will be needed?

Who will lead in our building?

How will we share with grade level/course?
Questions??