Using CGI Research to Analyze Student Work

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What does CGI look like in the classroom?

- Problem solving is the focus of instruction; teachers pose a variety of problems.

- Many problem-solving strategies are used to solve problems. Children decide how they should solve each problem.

- Children communicate to their teachers and peers how they solve the problems.

- Teachers understand children’s problem-solving strategies and use that knowledge to plan instruction.
Five Practices of Productive Math Discussions

1. **Anticipating** likely student responses.

2. **Monitoring** student responses to the task (while students work on the task).

3. **Selecting** particular students to present their mathematical work during the class discussion.

4. **Sequencing** the student responses that will be displayed in a specific order.

5. **Connecting** different student responses and connecting the responses to key mathematical ideas.
Model of Teaching that is Responsive to Children’s Mathematical Thinking

Based on the work of Victoria Jacobs & Susan Empson, 2016
Problem Solving Trajectory for Addition and Subtraction

- **Direct Modeling**
  - Every number in the problem is represented by physical objects

- **Counting Strategies**
  - Parts of the problem will still be modeled by all numbers no longer need to be represented by physical objects
  - Counting-on/counting back, use of fingers, skip counting, open number line

- **Relational Thinking / Invented Algorithms**
  - Derived Facts – Doubles; use of 10-facts; Grouping – Combine 10s and 1s and group friendly numbers; Incremental; Compensation

**Standard Algorithm/ Recall**
# Framework of Questioning to Build on Children’s Thinking

<table>
<thead>
<tr>
<th>Categories of Teaching Moves</th>
<th>Description</th>
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<tr>
<td><strong>Ensuring the child is making sense of the story context</strong></td>
<td>Teacher discusses the problem (or a specific part of the problem) with the child. The conversation often involves unpacking the story context or highlighting the question posed in the problem.</td>
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<td><strong>Exploring details of the child’s existing strategy</strong></td>
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<td><em>Posing general starter questions to the child</em></td>
<td>Teacher poses a general question that invites the child to start a conversation about his or her strategy.</td>
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<td><em>Pressing the child for an explanation of specific parts of his or her problem-solving process</em></td>
<td>Teacher requests that the child explain or justify specific strategy steps that are mathematically important or points at which the child exhibited uncertainty in the problem-solving process.</td>
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<td><em>Linking the child’s representation and the story context</em></td>
<td>Teacher asks the child to link his or her representation back to the story context or to link the story context to his or her representation.</td>
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<td><em>Expanding the child’s understanding of quantities used during problem solving</em></td>
<td>Teachers engages the child in conversation about quantities stated in the problem or quantities generated by the child while solving the problem. Teacher may ask the child to compare a quantity to a more familiar quantity or to estimate a quantity before solving for it.</td>
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<td><strong>Encouraging the child to consider other strategies</strong></td>
<td>Teacher encourages the child to generate a strategy (different from what the child has already done) or to compare his or her strategy to another strategy.</td>
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<td><strong>Connecting the child’s thinking to symbolic notation</strong></td>
<td>Teacher writes (or asks the child to write) numerals, expressions, or equations to connect formal notation to the story problem, the child’s strategy, or ideas that arise during problem solving.</td>
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<td><strong>Posing a related problem linked to what the child understands</strong></td>
<td>Teacher poses a similar problem (different numbers or different problem type) to push students thinking or ideas that arise during problem solving.</td>
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Cassie has ___ books. She donated ___ books to Miss Kayla for the school library. How many books does she have left?

(252, 138) (223, 177) (264, 133)
200
200 + 40 = 240
60 - 30 = 30
240 - 100 = 100
4 - 3 = 1
131
41, 42, 43, 44, 45, 46, books
Looking at Student Work

With your group, look at the student work samples and:

• Each person shares one new student strategy until all different strategies have been presented.

• What question(s) might you ask the students if you want to better understand what they were doing?

• Group papers by students you think solved the problem the same way.
## Sorting Student Work
for Addition and Subtraction Problems

<table>
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<tr>
<th>Direct Modeling</th>
<th>Counting</th>
<th>Derived Facts/Grouping/Invented Algorithm</th>
<th>Recall/Standard Algorithm</th>
<th>Invalid Strategy</th>
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Share Out

• Within your group, decide where most of your students fall on the trajectory.

• Decide their next steps. What mathematical connections do you want to make with the class?

• Choose 2-3 students’ strategies that will be shared out and decide in which order they will be presented.

• Be ready to share and justify your thinking.
As we finish...

Take a few minutes and write down the big ideas that you are going to take with you from today.
Thank You!

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