Goal of Our Session

To provide examples of strategies for guiding and assessing the development of elementary mathematics specialists in mathematics content and pedagogy.

Who We Are

- San Diego State University Professional Development Collaborative (PDC)
- Supported from 2000-2010 by a $9.4M grant from Qualcomm to prepare elementary math specialists.

Guiding and Assessing Teacher Knowledge Through “Try-it-on” Tasks

- Teachers try tasks in PD and discuss math content of the task as well as implementation
- Teachers “try-on” task with their students and bring student work to subsequent PD sessions or post results online for analysis with colleagues
- Teacher sharing informs PD leaders

Types of “Try-it-on’s”

- Quick surveys
  - Equality Survey (Grades 3–5)
- Short-term problems
  - Proportional Reasoning Task (Grades 6–8)
- Long-term tasks
  - Fair-Sharing Task (Grades 2–7)
  - Triangle Task (Grades K–3)

Equality Survey – Grades 3-5

8 + 4 = [ ] + 5

- “Most said it means to find the answer.”
- “Many students were shocked to see this, and I know it was part of the 4th grade curriculum.”
- “I had a lot of students go OOOOOHHH, that’s right.”

Guiding and Assessing During the Equality Survey

- Participants quickly assess and understand more deeply their own students’ thinking about this idea.
- PD leaders are informed about teachers’ focus on student thinking.
- We validated research findings on this topic with local data.

Proportional Reasoning Task – Grades 6–8

- Proportional reasoning:
  
  **Punch Problem**: If a gallon of punch will serve 12 people, how much punch would you prepare for a party at which you will have 50 guests? (Lamon, 2006, p. 111)

- Most students did not use a proportion to solve this, though the procedure had been “taught”.

Guiding and Assessing During the Proportional Reasoning Task

- Teachers conjectured that even though their students could solve a proportion, they may not be reasoning proportionally.
- Another teacher commented that it might be more important for students to know how to reason proportionally than to know how to set up and solve proportions.
- Task results validated the PD leaders’ earlier decision to spend more time on this topic.

Introduction to Fair-Sharing Task Grades 2–7

- Purpose of task for participants:
  - To assess students’ understanding of fractions related to “fair-share” division.
  - To consider number choices that drive student thinking.
- Purpose of task for PD leaders:
  - To assess and develop participants’
    - understanding of “fair-share” division
    - thinking about number choices
    - understanding of children’s thinking.

Guiding and Assessing Cycle

<table>
<thead>
<tr>
<th>In PD Session</th>
<th>Solve problem, analyze, plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>In their Classroom</td>
<td>Implement, assess, analyze</td>
</tr>
<tr>
<td>In PD Session</td>
<td>Share, analyze, revise</td>
</tr>
<tr>
<td>In their Classroom</td>
<td>Implement, assess, analyze</td>
</tr>
</tbody>
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Fair-Sharing Task – Grades 2–7

- In PD, teachers try-on the problem:
  - **There are ___ cookies on a plate. There are ___ children who need to share the cookies so that each person gets an equal amount. How much does each child get if they want to eat all of the cookies?**
  - Possible number choices (7,2); (7,3); (13,3); (14,3); (22,8)
- Analyze their own strategies using Empson’s classification of solution strategies.
- Analyze a selected set of student strategies.
Solution Strategies Example

<table>
<thead>
<tr>
<th>Intermediate Strategies</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>d) Coordinating shares with single units</td>
<td>Child partitions each shared unit into enough pieces for all sharers. (This is a useful, all-purpose strategy, within the zone of understanding of many first and second graders.)</td>
<td>6 children sharing 4 candy bars</td>
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</tbody>
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Fair-Sharing Task

In grade-level PD groups, teachers:
- discuss possible strategies students in their own class might use.
- make plans to implement fair-sharing task in their own classrooms

In their classrooms, teachers:
- implement the fair-sharing task with students.
- analyze student work
  - preliminary sort using Empson’s solution strategies.
  - make notes about students’ responses.

Fair-Sharing Task

In the next face-to-face session, teachers meet in grade-level groups with student work to discuss strategies they noticed in the student work.

Based on the students’ strategies, teachers:
- discuss next steps, including possible modification of contexts and number choices, and strategies they might highlight from students’ work;
- collaboratively develop new problems; and
- individually summarize their classroom experience in writing.

Fair-Sharing Task

Teachers try-on their new problems with students

On their own, teachers:
- re-analyze student work using Empson’s solution strategies;
- re-evaluate students’ progress based on observations and student data; and
- continue the guiding and assessing cycle with ongoing discussion of student development.

Fair-Sharing Task

Clarissa
- 2nd grade teacher
- Fourth year teaching
- Student: Melina
- Program improvement school – year four

Student Work Sample - Melina

7 cookies shared by 4 children.
Clarissa’s Initial Analysis for Melina

Melina C

Analysis: In both assessments, Melina first gave the whole, one to each child. She decided to “check” the leftover centers into pairs and doesn’t recognize them as fractional units of a whole. She considers the fourth as “pens.” However, when she was asked to find 4 children, Melina decided to “check” the leftover centers into halves. When it was 7 centers and 4 children, she “checks” the leftover centers into thirds.

Next steps for Melina will be to explore and discuss the meaning of her repeating errors and what each pen represents (part of the whole cake). If new problems to scaffold: (Hence) 6 (Fourths):

9 centers/6 kids

Possible Next Steps for Melina

Guiding and Assessing During the Fair-Sharing Tasks

- In the case of Clarissa, the goal was to:
  - Assist the teacher in determining the appropriateness of number choices for her students;
  - Consider the role of number choices in moving students to use a new strategy;
  - Determine next-steps for instruction based on strategies students use.

Triangle Task Grades K-3

- In PD Session:
  - Teachers work through task, read “Tricky Triangles” article, and discuss implementation
- In their Classroom:
  - Implement triangle task with students
- In PD Session:
  - Share and analyze student results, collaboratively plan specific next step activities such as using a triangle/not a triangle card sorting
- In their Classroom:
  - Conduct activities designed in PD with students; then re-administer the triangle task.
- In PD Session:
  - Analyze changes in student learning

The Triangle Task Highlighted the Importance of…

- Using a variety of triangles;
- Using non-examples in concept development;
- Determining next steps;
- Addressing student and teacher misconceptions;
- Developing appropriate activities, then reassessing; and
- Paying attention to children’s thinking in the development of next steps.
Teachers Comments About Using Try-It-Ons

- By seeing what my students understand about fractions, I learn how I can improve my teaching to provide students with more than what the text and modules provide . . .
- Are concrete items that further my students’ math thinking . . .
- How to use children’s work to develop new activities and choosing work to demonstrate more sophisticated strategies . . .
- Learned what I can improve and what is working. I also learned so much about how my students think and what they need from me . . .

What We’ve Learned

- Try-it-on strategies:
  - Increase teachers’ mathematics content knowledge;
  - Enhance math pedagogy;
  - Positively impacts classroom practice;
  - Improve student achievement.

Questions/Discussion

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Slides and samples available:
- www.sdsu-pdc.org
Click on “Presentations”