

Deepening Teacher Content Knowledge

- Research has shown that content-focused professional development is related to changes in teaching practice and positive results in student achievement
- What does it mean to have professional development that is “content-focused”?

Facets of Teacher Content Knowledge

- Disciplinary content knowledge (DCK)
- Pedagogical content knowledge (PCK)
- Ways of knowing content (WoK)

I. Disciplinary Content Knowledge

- A. Knowledge of content at the level the students are expected to know it
- B. Knowledge of content beyond what the students are expected to know
 - More advanced concepts
 - Deeper understandings of concepts, and connections among them

II. Pedagogical Content Knowledge

- A. Knowledge of how students think about particular content ideas
 - Initial conceptions
 - Learning difficulties
 - Learning progressions/trajectories

II. Pedagogical Content Knowledge

- B. Knowledge of instructional strategies for teaching particular content ideas
 - Eliciting ideas
 - Challenging student thinking
 - Scaffolding learning while maintaining high cognitive demand
 - Assessing student thinking/understanding

II. Pedagogical Content Knowledge

- C. Knowledge of curriculum regarding particular content ideas
 - How instructional materials develop particular content ideas
 - K-12 articulation of particular content ideas

III. Ways of Knowing Content

- A. How ideas/problems are investigated
 - Hypothesizing, conjecturing
 - Designing/conducting inquiry, problem solving
 - Productive habits of mind

III. Ways of Knowing Content

- B. How knowledge is established in the discipline
 - What counts as evidence
 - The nature of explanation/justification in the discipline
 - The nature of working in the intellectual community of the discipline

What facets of content to choose in content-focused PD

- Most people seem to agree that all of these facets are important for teaching
- With unlimited time and resources, we would likely address them all
- But we don't have unlimited time and resources, so we have to make choices

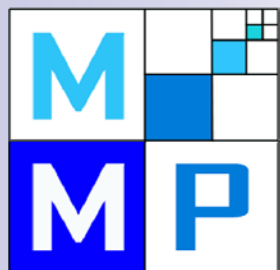
What facets of content to choose in content-focused PD

- For a given group of teachers, people might have different perspectives on:
 - How much emphasis to place on various facets of teacher knowledge
 - Optimal sequencing and connecting of those facets

MSP Example:

Milwaukee Mathematics Partnership

- DeAnn Huinker: Professor of mathematics education, director Center for Mathematics and Science Education Research at the University of Wisconsin-Milwaukee
- Kevin McLeod: research mathematician and Associate Professor in the Department of Mathematical Sciences at the University of Wisconsin-Milwaukee



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Sharing in Leadership for Student Success



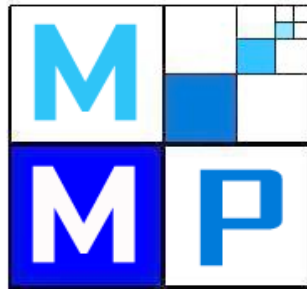
*DeAnn Huinker & Kevin McLeod
University of Wisconsin-Milwaukee
May 24, 2010*



Partnership-Driven Leadership



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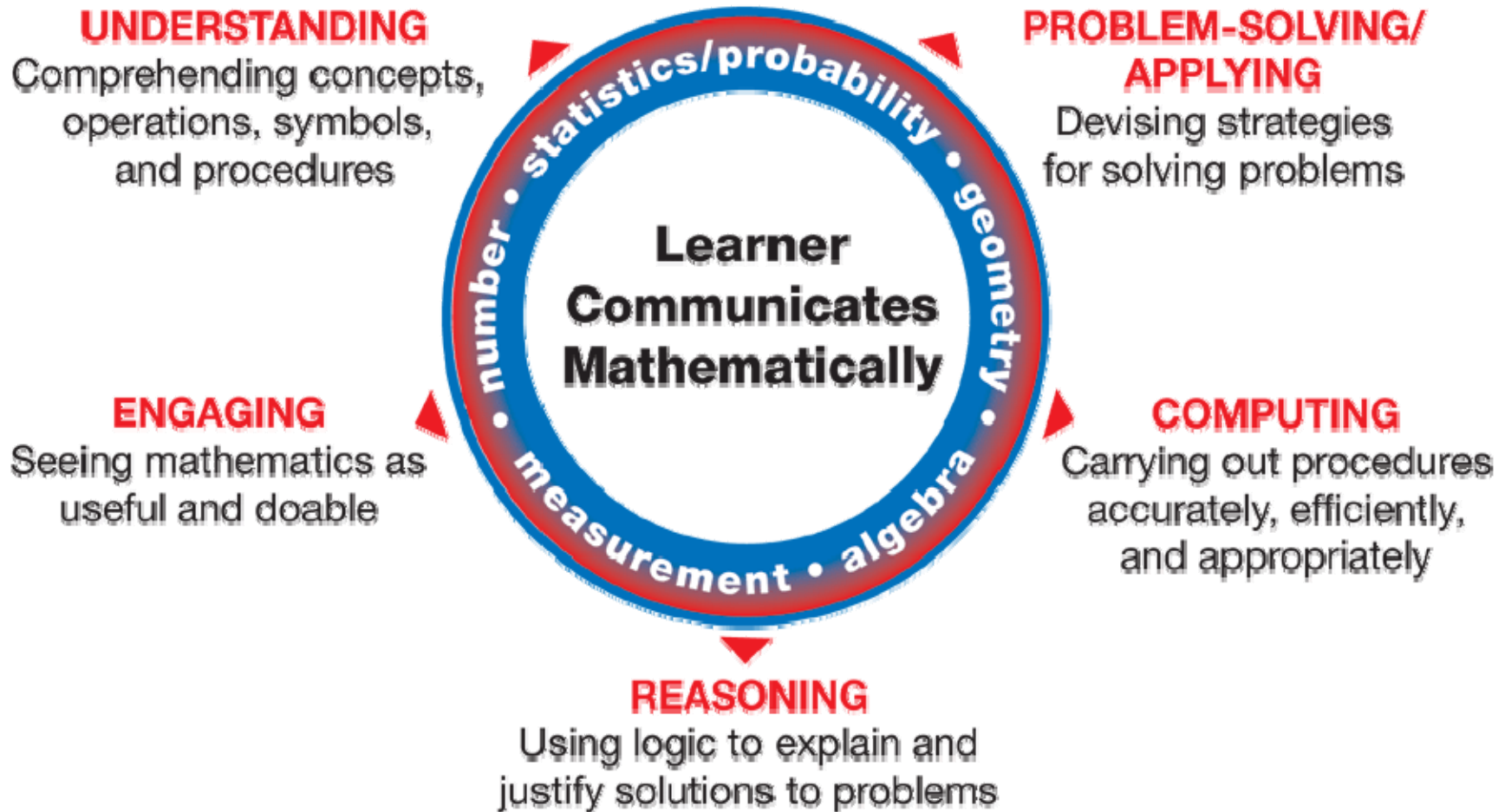
Design Team

Mathematician

**Mathematics
Educator**

Teachers

Mathematics Framework



Mathematics Proficiency For All Students

Content Focus of the Year

Year 1: Mathematical Processes

Year 2: Rational Numbers and Operations

Year 3: Algebraic Relationships

Year 4: Measurement and Geometry

Year 5: Statistics and Probability



“Big Ideas” in Mathematics

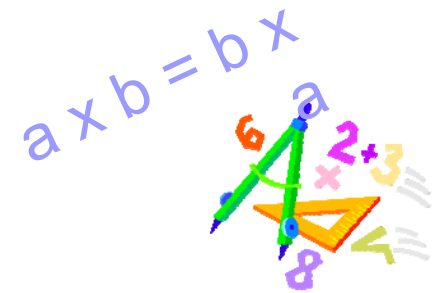
- **Equivalence:** Any number, expression, or equation can be represented in different ways that have the same value.
- **Properties:** For a given set of numbers, there are relationships that are always true, and they are the rules that govern arithmetic and algebra.

Algebraic Relationships

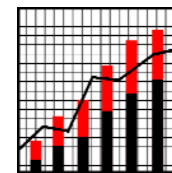
Expressions,
Equations,
and
Inequalities

Sub-skill Areas

Generalized
Properties



Patterns, Relations,
and Functions



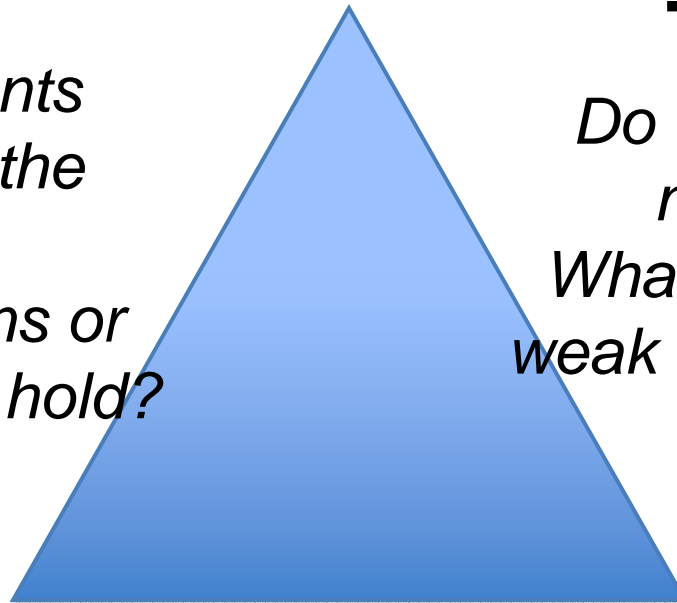
Situating Content in Classroom Practice

Students

*What do my students understand about the mathematics?
What misconceptions or limited ideas do they hold?*

Teachers

*Do I understand the mathematics?
What connections are weak or missing for me?*



Curriculum and Assessments

*What mathematical knowledge is given emphasis in our curriculum materials and classroom assessments?
How is that knowledge presented? How is it assessed?*

Solve, Explain, Justify

$$48 + 24 = \square + 27$$

Solve the following:

$$48 + 24 = \underline{99} + 27$$

$$\begin{array}{r} 48 \\ + 24 \\ \hline 72 \\ + 27 \\ \hline 99 \end{array}$$

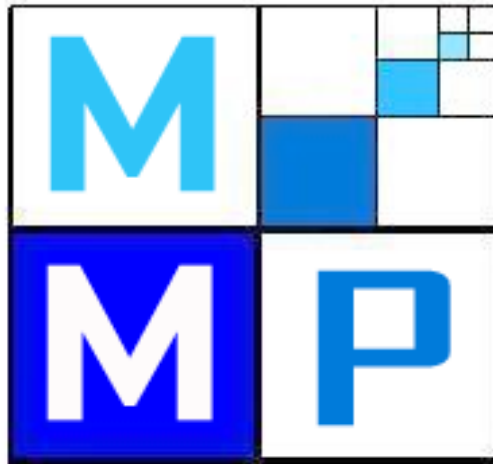
Solve the following:

$$48 + 24 = \underline{45} + 27$$

25, 26, 27

$$\begin{array}{r} 48 \\ - 3 \\ \hline 45 \end{array}$$

Thank you



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Balancing PD Goals

- Depending on a number of factors, other MSPs have made different choices about how much to emphasize the various facets of teacher content knowledge.

Sequencing PD Goals

One line of reasoning:

- Teachers can't teach what they don't know. Therefore, it is important to start with mathematics/science content, and only after teachers themselves have a sufficiently deep understanding of the content, move to considering classroom application.

Sequencing PD Goals

Another line of reasoning:

- Teachers are by their very nature practitioners. Starting with classroom applications, e.g., trying to analyze student work, provides a context for engaging the teachers in learning mathematics/science content.

Sequencing PD Goals

- It is important to note that the available research doesn't help in making this kind of decision.

Sequencing PD Goals

- In making these decisions, PD designers need to consider:
 - The needs of the particular group of teachers in relation to the selected content areas
 - Your views on what knowledge is most important
 - What you have time to do
 - What you know how to do well.

Now it's your turn...

- It is worth the time to come to consensus within a team of PD designers about the balance of teacher content knowledge facets.
- It is also important to share your decisions and the rationale for them with all of the people who will provide PD, as how you facilitate a session depends on having a clear sense of priority goals (e.g., which questions to pursue, and which to downplay/leave until later).

Team Planning Worksheet #1

- Tab 7 in your binder (blue)
- You will have 15 minutes to get started on this discussion.
- You may want to refer to the description of the facets in Tab 2 of your binder.