Different to achieve certain goals relative to learning and teaching!

Write an equation that shows the relationship between feet and yards.

Let $f =$ the number of feet
Let $y =$ the number of yards
Syntax (words and their order) is emphasized rather than semantics (meanings).

**NOT GOOD**

**Math Makes Sense!!**

enVisionMATH
A Research-Based Program

**SESSION GOALS**

- Effective Curriculum (International Studies)
- Effective Content Development
  - Develop the Concept
  - Solving Word Problems
International Research
Effective Curriculum

- **Focus** (Not a “mile wide.”)
- **Depth** (Not an “inch deep.”)
- **Coherence** (More than a collection of activities)

enVisionMATH - NOT a Mile Wide

“All CA nothing but the CA, so help me Arnold!”

Grade-Level Organization
Focus & Depth

20 Topics Grades 1-5
16 Topics Grade K
Customized Sequence Possible

**EACH TOPIC**
Focuses on One Strand
A Few Related Standards
“A curriculum is more than a collection of activities: it must be coherent.”

---

Coherent Mathematics Content
- Skills-Development Skeleton – CA Standards
- Concept-Development Skeleton – 20 Big Ideas & related Essential Understandings. (UbD)

---

Big Ideas & Essential Understandings

“We understand something if we see how it is related or connected to other things we know.”

Big Idea & Essential Understandings

4 as a Factor

Objective
Students will use known facts and doubles to find products with 4 as a factor.

Essential Understanding
Basic multiplication facts with 4 as a factor can be found by breaking apart the unknown fact into known facts. The answers to the known facts are added to get the final product.
Many teachers obviously would like their students to understand the mathematics they study but, when asked to specify the goal for a particular lesson, most U.S. teachers … talked about skill proficiency; few mentioned understanding. (TIMSS, Hiebert and Stigler, 2000)

Teachers cannot teach big ideas and essential understandings unless they know what big ideas and essential understandings to teach.
Research Effective Teachers

- Have their own mathematics content knowledge anchored on big ideas.
- Use big ideas as the glue for teaching, learning, and assessment (connections).


Are you emphasizing
Skills
AND
Ideas/Understandings?

Research-Based Program

- Effective Content Development
  - Develop the Concept
Research Fact: Effective Curriculum & Instruction

Understanding and skill are best developed through a balance between student-student interactive learning and the teacher providing information at the right time and in the right way.

A New Vision for Basal Programs

<table>
<thead>
<tr>
<th>Site for Learning</th>
<th>Type of Learning Emphasized</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Conceptual Understanding, Reasoning, Problem Solving</td>
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<tr>
<td>Interactive Learning Activities Outside of a Textbook</td>
<td>enVisionMATH</td>
</tr>
<tr>
<td>Textbook with Teacher Directed Lessons</td>
<td>enVisionMATH</td>
</tr>
</tbody>
</table>

enVisionMATH Four-Phase Instructional Model

1) Daily Mixed Review
2) Develop the Concept: Interactive Learning
3) Develop the Concept: Visual Learning
4) Close/Assess - Diagnosis/Intervention
Develop the Concept: Interactive Learning

**Problem-Based Interactive Learning**

Research shows that understanding develops during the process of solving problems in which important math concepts and skills are embedded (Lester & Charles, 2003).

Research Fact

“...if we want students to understand mathematics, it is more helpful to think of understanding as something that results from solving problems, rather than something we teach directly.” (Hiebert et al, 1997, p. 25)
All activities are NOT problem-based interactive learning experiences.

- Totally or mostly teacher directed
- Low cognitive demand
- Too brief – no think time

LONGER activities like this are NOT going to provide better conceptual development!

Non-Problem-Based Activity

Problem-Based Interactive Learning

Phase 1: Solving and Discussing a Problem
- Teacher poses the problem,
- Students work together; teacher facilitates,
- Students share their thinking and work.

Phase 2: Making the Important Math Explicit
- Teacher-Directed Instruction
- “Classroom Conversation”

10 to 20 minutes
Problem-Based Interactive Learning Benefits

- Concepts and skills make sense.
- Concepts and skills are remembered.
- Concepts and skills are more effectively used in problem-solving situations.
- Learning gaps and misconceptions are confronted.

Making the Transition to PBIL

Goals first 3 months:
- Establish a positive environment
- Become a facilitator rather than a director
- Promote student learning independence

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Develop the Concept:
Problem-Based Interactive Learning

Introduce new ideas by giving kids a chance to think (John Van de Walle).
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Four-Phase Instructional Model
1) Daily Mixed Review
2) Develop the Concept: Interactive Learning
3) Develop the Concept: Visual Learning
4) Close/Assess - Diagnosis/Intervention

Visual Learning Bridge
Visual Learning Animation
“Word Problems”

Biggest “leap” in teaching problem solving since 1985!

Why focus on word problems?

• Mathematical literacy.

• About 50% of the state assessment items are word problems.

Why focus on word problems?

• Test data show that performance solving word problems is low for too many students.

• Teachers report that teaching word problems remains as one of their most challenging and frustrating tasks.
Developing students’ abilities to solve word problem is critical for algebra readiness.

Carrie has 135 U.S. stamps. She has 3 times as many foreign stamps as U.S. stamps. How many stamps does she have all together?

Problem solving is NOT a skill.

Successful problem solvers are those most capable of using “quantitative reasoning.”
Quantitative Reasoning

Understanding the quantities involved and how they are related, independent of the specific numbers.

Research Fact

- Training children in the process of using diagrams to solve problems results in more improved problem-solving performance than training students in any other strategy.

(Yancey, Thompson, and Yancey, 2003)

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“Bar Diagrams”
**Concrete** (real-world situation)

**Bar Diagram** (visual representation)

**Abstract** (number sentence)

---

**Carrie has 135 U.S. stamps. She has 3 times as many foreign stamps as U.S. stamps. How many stamps does she have all together?**

- U.S. stamps: $135$
- Foreign: $3 \times 135 = 405$

Total stamps: $(3 \times 135) + 135 = 470$

---

**Rick has 147 apples. He ate 28. How many apples does Rick still have to eat?**

- Total apples: $147$
- Apples eaten: $28$

Remaining apples: $147 - 28 = 119$

---
Tom has 4 boxes of projector pens. There are 5 pens in each box. How many in all?

Joining Equal Groups: Total Amount Unknown

4 x 5 = ?

Pam had 5 bags and put the same number of apples in each bag. She ended up with 45 apples in bags. How many did she put in each bag?

5 x ? = 45

45 ÷ 5 = ?

Byron has 45 pigeons. He keeps them in 5 pens with the same number of pigeons in each. How many pigeons are in each pen?

45 ÷ 5 = ?
A total of 108 children signed up for soccer. How many 18-person teams can be made?

\[ 108 \div 18 = ? \]

**A Developmentally Powerful Sequence from Grade K-6**

Focus 1: Number meanings & relationships

**Bar Diagrams**
Bar Diagrams

Focus 2: Operation meanings & relationships

Bar Diagrams

Focus 3: Representing & solving word problems

enVisionMATH
A Research-Based Program

SESSION GOALS

- Effective Curriculum (International Studies)
- Effective Content Development
  - Develop the Concept
  - Solving Word Problems
**Success Starts with YOU**

We must **believe** that ALL students can understand mathematics, develop computational fluency, and become successful problem solvers.