Teaching for Conceptual Understanding: Exciting Mathematics

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What does BIG mean?

...It’s a difficult concept!
What is a Concept? (Big Idea)

Operation Meaning and Relationships

There are multiple interpretations for addition, subtraction, multiplication, and division of rational numbers, and each operation is related to other operations.
What is understanding?

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

How are Connections Made?

NOT in a Linear Fashion

In a Web or Net of Ideas
How Many Snaps?
How would you solve this?

\[ \frac{1}{2} \times \frac{2}{3} = \]
A Problem Posed...

- 23 CDs on EACH shelf
- 3 shelves
- How many IN ALL?

$3 \times 20 = 60$

$3 \times 3 = 9$

$60 + 9 = 69$
Adding It Up (National Research Council, 2001)

Procedural Fluency
Conceptual Understanding
Strategic Competence
Reasoning Adaptations
Productive Dispositions
Throughout mathematics in Kindergarten-Grade 2, students develop numerical fluency with **conceptual understanding** and computational accuracy. Students in Kindergarten-Grade 2 use basic number sense to compose and decompose numbers **in order to solve problems** requiring precision, estimation, and **reasonableness**.

.............TEKS
Students with Conceptual Understanding...

know more than isolated facts and methods,
know why a mathematical idea is important and the kinds of contexts in which it is useful,
are able to learn new ideas by connecting them to ideas they already know, and
are able to remember or retain ideas....

Adding It Up, pg. 118
How is Conceptual Understanding Taught and Learned?

• Emphasis on BOTH IDEAS and skills (Texas Essential KNOWLEDGE and Skills).
• Problem-Based Interactive Learning
• Emphasis on Connections
Understanding Quantity
Making Language Connections

Act It Out!
Talk It Out!
Draw It Out!

University of Houston
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COLLABORATION
FOR LEARNING & LEADING

Educational Video Series
Example: Pattern Count

One, Two, Three, Four, FIVE
Six, Seven, Eight, Nine, TEN
Eleven, Twelve, Thirteen, Fourteen, FIFTEEN
Sixteen, Seventeen, Eighteen, Nineteen
TWENTY

“That’s just how it is when you count by fives!”
What’s Your Answer?

7
8
7 and one half
7 r 4
4 Problems

ONE: Mrs. Sanchez needed to pack 60 books. Each box holds 8 books. How many boxes does she need?

TWO: There are 60 cookies. Eight boys want to share them equally. How many cookies should each of them get?

THREE: 60 divided by 8

FOUR: There are 60 students on a field trip. Each minivan holds 8 students. How many minivans are full?
Third Grade Quilt Problem
Measuring with Kindergartners
Mathematicians make meaning in their world by setting up quantifiable and spatial relationships, by noticing patterns and transformations, by proving them as generalizations, and by searching for elegant solutions. They construct new mathematics to solve real problems or to explain or prove interesting patterns, relationships or puzzles in mathematics itself.

… Fosnet and Dolk, 2001
“You always have lots of problems teacher! Come by any time and we will help!”

... Houston 1st Grader