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."

J. Hiebert, Signposts for Teaching Mathematics through Problem Solving In F. Lester & R. Charles, <u>Teaching Mathematics Through</u> <u>Problem Solving</u>, Grades PreK-6. NCTM: Reston, VA, 2003.

How are Connections Made?



How Many Snaps?

How would you solve this?

$\frac{1}{2} \times \frac{2}{3} =$

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| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|--------|--------|---------|-----------|----------|--------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 | | | |

A Problem Posed...

•23 CDs on EACH shelf

•3 shelves





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 College of Education 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



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