



## Early Steps Count: Connecting Arithmetic to Algebra

Linda Plattner  
Video Note-taking Guide

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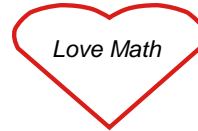
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### Objectives



- Deepen your understanding of basic math
- Become more reflective about the way basic math is taught
- Strengthen understanding of relationship between algebra and arithmetic



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### Teaching Subtraction



- How are all of these problems similar?
- How would you explain these problems if you were teaching second grade?

62	53	72	91
<u>-49</u>	<u>-26</u>	<u>-16</u>	<u>-79</u>

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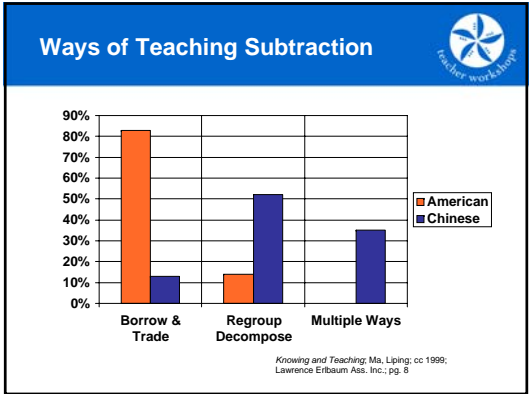
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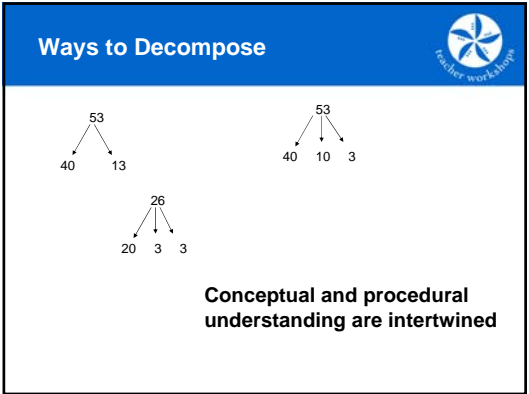
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- ### Ties Between Arithmetic and Algebra
- **Fundamental processes of arithmetic basis for algebra**
  - **Making generalizations and recognizing relationships among concept and procedure – computations become easier**
  - **Same hierarchy of justification**
    - Appeal to authority
    - Justification by example
    - Generalizable arguments

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## Practice in Decomposing



How can you decompose these numbers to complete the problem?

62

-49

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## How Would You Teach?



■ **Most American teachers said they would use manipulatives in ways that paralleled their understanding**

- Develop a concrete idea of subtraction
- Build understanding of 1 ten = 10 ones
- One teacher wanted to build the idea of equivalent exchanges, which is equal to the Chinese idea of decomposing numbers

Knowing and Teaching, Ms. Liping, cc 1999, Lawrence Erlbaum Ass., Inc., pg. 26

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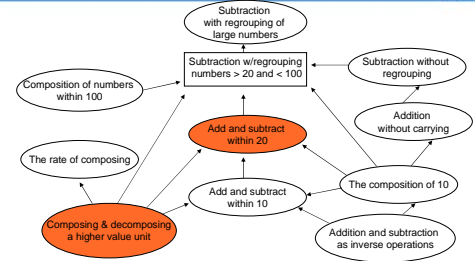
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## Knowledge Packet: Subtraction with Regrouping



Knowing and Teaching, Ms. Liping, cc 1999, Lawrence Erlbaum Ass., Inc., pg. 19

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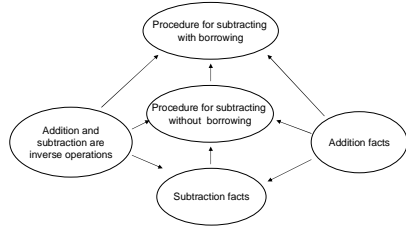
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## Knowledge Packet for "Borrow and Trade" Approach




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## Multidigit Multiplication: Dealing with Student Mistakes



What do you do, when you get this:

$$\begin{array}{r} 123 \\ *456 \\ \hline 738 \\ 615 \\ \hline 1,845 \end{array}$$

Instead of this?

$$\begin{array}{r} 123 \\ * 456 \\ \hline 738 \\ 615 \\ \hline 492 \\ 56,088 \end{array}$$


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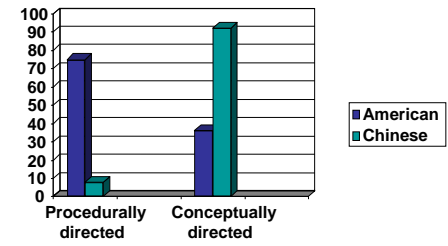
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## Teaching Strategies




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### Mr. Chen's Approach



$$\begin{array}{r} 123 \\ * 456 \\ \hline 492 \\ 738 \\ \hline 615 \\ \hline 56,088 \end{array}$$

Challenge: Find other ways to align the problem so that it is correct.

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### Division of Fractions



$$1 \frac{3}{4} \div \frac{1}{2}$$

People solve this problem in different ways. How do you solve it? Can you solve it in more than one way?

Imagine you are teaching fractions. What is a story you would make up to fit with this problem?

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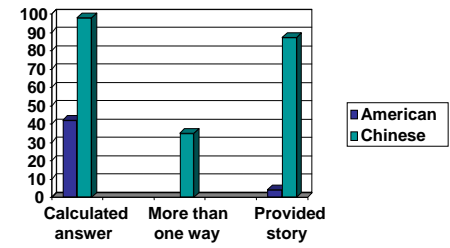
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### Teacher's Knowledge of Division by Fractions



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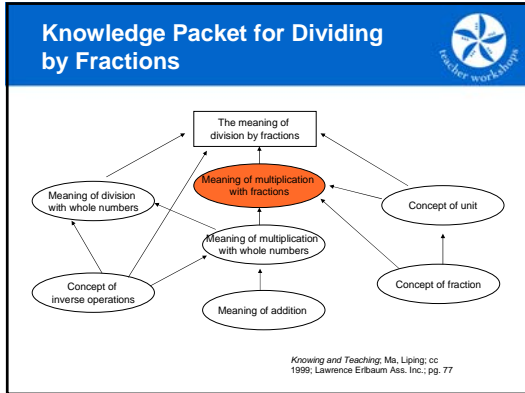
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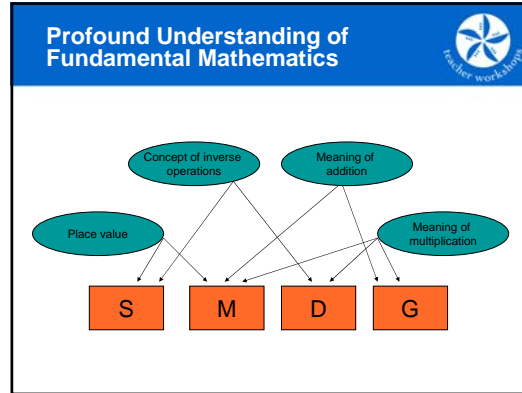
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### Research: What the Number-Proficient Child Brings

- **A clear understanding:**
  - Of the fundamental properties of numbers
  - That an = sign represents a relationship of equality
  - That operations represent relationships
  - Of inverse operations

Adapted from *Adding it up: Helping children learn mathematics*; national Research Council, 2001

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## Final Points



- Americans talk about basic math; Chinese talk about fundamental mathematics
- How children are taught elementary mathematics sets them up for success or failure in algebra
- The knowledge gap between American and Chinese teachers parallels the learning gap between American and Chinese children

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## Extension



- Work with a group of teachers to evaluate the new algorithm for Division
  - Is this approach more procedural or conceptual?
  - Which algebraic concepts does it support?
  - How could it be enhanced to better support algebraic thinking?
  - Would you use this approach? Why or why not?
- Take one lesson from your text, identify the core math that is being taught and identify the algebraic concepts that could be strengthened/included. If possible, discuss with grade-level group

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## Resources



- Carpenter, Thomas, et al.(2003). *Thinking mathematically*. Heimann, Portsmouth, NH 03801-3912.
- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, and B. Findell (Eds.) Washington, DC: National Academy Press.

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