Standards-based Mathematics Instruction in Elementary School

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Algebra Misconception

- Researchers at the University of Wisconsin posed the task: 8+4 = 5 + __
  - 752 students were assessed
  - Students ranged from Grades 1-6
- Only 43 of the 752 students (5.7%) answered correctly
- But the biggest surprise was….

8+4 = __ + 5 (% correct)

Grade	7	12	17	12 and 17	Other	Num. of Students
1	0	79	7	0	14	42
1 and 2	6	54	20	0	20	84
2	6	55	10	14	15	174
3	10	60	20	5	5	208
4	7	9	44	30	11	57
5	7	48	45	0	0	42
6	0	84	14	2	0	145

Algebra Misconception

- No 6th graders answered correctly

Multiplication: Impact of Curriculum

- Comparative study
  - Grade 3 students who had a standards-based curriculum
  - Grade 4 students who had a traditional, skills-based curriculum
- Multiple tasks
  - Basic facts (e.g., 3x4, 5x8, 8x7, 9x6)
  - For each basic fact, students had to…
    - Write a story problem
    - Draw a picture
    - Write an addition number sentence

Multiplication: Impact of Curriculum

	Grade 4: Traditional		Grade 3: Standards-based	
Task	immediate	% correct	immediate	% correct
3x4	100	100	7	100
3x4 – story		10		73
3x4- drawing		20		100
3x4- addition		40		93
5x8	70	100	0	100
5x8- story		20		87
5x8- drawing		40		100
5x8- addition		40		100

Multiplication: Impact of Curriculum

	Grade 4: Traditional		Grade 3: Standards-based	
Task	immediate	% correct	immediate	% correct
8x7	20	70	0	100
8x7 – story		20		93
8x7- drawing		20		100
8x7- addition		30		100
9x6	20	90	0	100
9x6- story		20		100
9x6- drawing		20		100
9x6- addition		40		100

Multiplication: Impact of Curriculum

- Basic facts computation
  - 4th grade, traditional- 53% immediate, 90% correct
  - 3rd grade, standards-based- 2% immediate, 100% correct
- Conceptual questions
  - 4th grade, traditional- 27%
  - 3rd grade, standards-based- 96%

Standards-Based Mathematics Instruction: The Impact

- From a dozen studies that have compared standards-based to traditional instruction…
- Students in standards-based classes perform as well as traditional students on skills, computation
- Students in standards-based classes significantly outperform traditional students on problem solving, multi-step problems and tasks focused on conceptual understanding

Standards-Based Instruction: What is it?

- Worthwhile tasks
- Teachers guide by questioning students during task completion
- Teachers help students connect concepts through discussion and sharing of strategies
- Teachers continuously examine student work to look for misconceptions and error patterns
- Assessment is embedded within tasks

2009 Essential Standards: Data Analysis

- PCAI Model in Grades K-5
  - a)Pose questions, collect data to answer questions, and make decisions using data.
  - b) Organize and represent data using concrete objects, pictures or pictorial graphs, line plots and tallies.
  - c) Describe data in a variety of ways and evaluate how the data help answer the posed question.

2009 Essential Standards: Data Analysis

- What does this look like in:
  - Kindergarten?
  - 2nd grade?
  - 5th grade?

2009 Essential Standards: Problem Solving

- Recognize and apply connections among mathematical ideas.
- Develop fluency in solving single and multi-step problems that arise in mathematics and in other contexts, building mathematical knowledge through problem solving.
- Use reasoning to solve problems.
- Use the language and symbols of mathematics and appropriate technology.
- Create and use representations to organize, record and communicate mathematical ideas.