

Integer Instruction That Works

Best Practices for Instruction of Integers
for All Students Including LEP Learners

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U.S. Department of Education • Teacher to Teacher Initiative • Supporting Success



Outcomes

- Discuss relevant research
- Identify and practice best practices for integers:
 - Manipulatives
 - Models
 - Graphic organizers
- Review informal assessment
- Discuss ways to implement new ideas when you return to your school



Relevant Research

- Direct instruction
 - Carefully sequenced
 - Variety of problem types
 - Worked examples
- Constructivism
 - Prior knowledge
 - Attention and memory limits
 - Inefficiency

Grover Whitehurst, Education Summit, Papers and Presentations, Mathematics and Science Initiative, Washington D.C., 2004, <http://www.ed.gov/rschstat/research/progs/mathscience/whitehurst.html> (Accessed May 9, 2005).



Relevant Research

Types of instruction and their effects on learning

- Verbal: Immediate .74/after 1 year .64
- Visual: Immediate .90/after 1 year .74
- Dramatic: Immediate 1.12/after 1 year .80

Robert Marzano, Deborah Pickering and Jane Pollock, *Classroom Instruction That Works*, (Alexandria, Va.: Association for Supervision and Curriculum Development, 2001).



Identifying Best Practices for Classroom Environment

Classroom organization

- Student/teacher relationships
- Safe and secure
- Risk taking
- User friendly
- Respect
- Responsibility

Gordon Cawelti, *Handbook of Research on Improving Student Achievement*, (Arlington, Va.: Educational Research Service, Alliance for Curriculum Reform, 1995).



Identifying Best Practices for Questioning

- Question formats
- Frequency and response time
- Non-verbal responses
- Exposure to peer language (LEP)
- HOTS (Higher Order Thinking Skills):
 - Knowledge and comprehension level
 - Application and analysis level
 - Synthesis and evaluation level

John Sutton and Alice Krueger, *EDthoughts: What we know about mathematics teaching and learning*, (Aurora, Ill.: Mid-Continent Research for Education and Learning, 2002).



Bloom's Taxonomy

Identifying Best Practices for Mathematics Instruction

- Algorithms without understanding
 - Errors practiced and hard to break
 - Extensive practice time
 - Limited retention
- Algorithms with understanding
 - Conceptual development
 - Reduction in practice time
 - Extended retention and application

Deborah Ball, Secretary's Summit on Mathematics, Washington D.C., 2003,
<http://www.ed.gov/rschstat/research/progs/mathscience/ball.html> (Accessed Nov. 12, 2006).



Best Practices for All Learners Including LEP Students

Nonlinguistic representations

- Graphic organizers to represent knowledge
- Making physical models
- Generate mental pictures
- Symbolic representations
- Total physical response

Jane Hill and Kathleen Flynn, *Classroom Instruction That Works With English Language Learners*, (Alexandria, Va.: Association for Supervision and Curriculum Development, 2006)



Best Practices of Vocabulary Instruction

Adapting the keep-delete-substitute strategy to the stages of language acquisition

1. Keep important information
2. Delete trivial material that is unnecessary to understanding
3. Delete redundant material
4. Substitute subordinate terms for more specific terms

Jane Hill and Kathleen Flynn, *Classroom Instruction That Works With English Language Learners*, (Alexandria, Va.: Association for Supervision and Curriculum Development, 2006)



Practice Problems for Keep-Delete-Substitute Strategy

- Absolute value of an integer is its distance from zero on a number line.
- On a number line, the integer farther to the right is the greater integer.
- To add integers with the same sign, add their absolute values. The sum has the same sign as the integers.
- To add integers with different signs, find the difference of their absolute values. The sum has the sign of the integer with the greater absolute value.



Integers Overview

- Vocabulary
- Absolute value/opposites/ordering
- Adding integers
- Subtracting integers
- Multiplying and dividing integers
- Integers with order of operations
- Non-traditional review



Tools for Implementing Best Practices

Graphic organizers

- Compare/contrast
- Venn diagram
- Frayer model
- Combination note making

Robert Marzano, Barbara Gaddy and Ceri Dean, *What Works in Classroom Instruction*, (Aurora, Ill.: Mid-continent Research for Education and Learning, 2000).

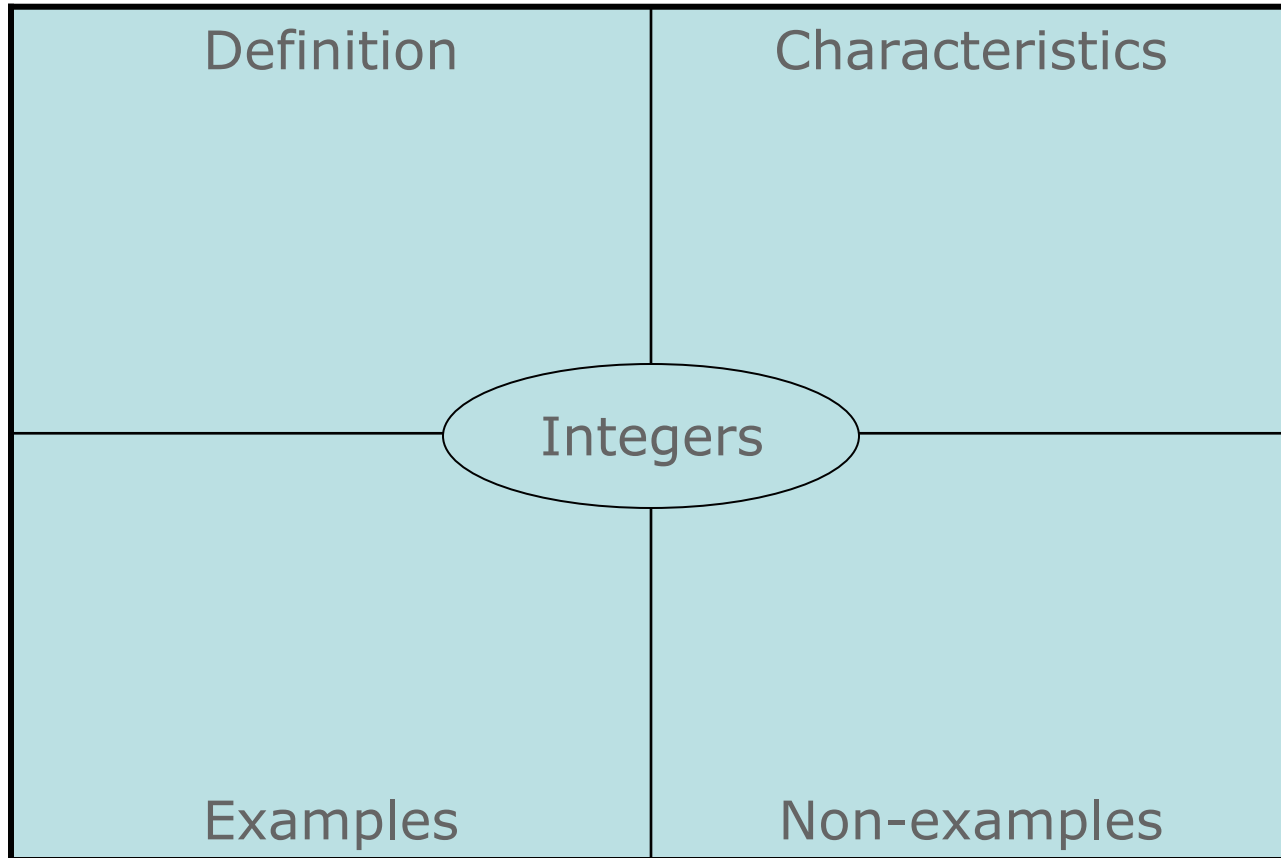


Vocabulary: Tier One Words Scaffolding Language

- Integers
- Opposites
- Positive
- Negative
- Value
- Absolute value
- Combine
- Cancel



Frayer Model

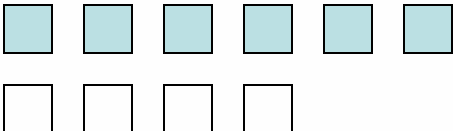
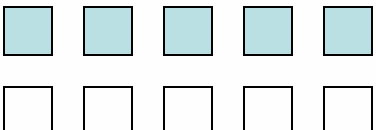
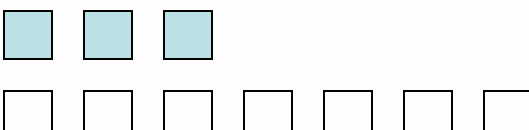
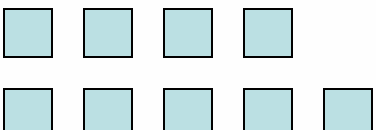


Preparing to Operate With Integers

- Absolute value
 - Purpose for learning
 - Language barriers
- Opposites
 - Multiple opposites
 - Multiplication and division
- Ordering
 - Number line remains best practice
 - Ideas for implementation



Adding Integers: Manipulatives

- $-6 + 4$ 
- $-5 + 5$ 
- $-3 + 7$ 
- $-4 + -5$ 



Adding Integers: Models

- $-6 + 4$ $- \ - \ - \ - \ - \ -$
 $+ \ + \ + \ +$
- $-5 + 5$ $- \ - \ - \ - \ -$
 $+ \ + \ + \ + \ +$
- $-3 + 7$ $- \ - \ -$
 $+ \ + \ + \ + \ + \ + \ +$
- $-4 + -5$ $- \ - \ - \ -$
 $- \ - \ - \ - \ -$



Combination Note Making

Informal outline	Graphic representations
Summary	



Subtracting Integers: Manipulatives (Adding Zeros)

• $9 - 4$ □ □ □ □ □ □ □ □ □

• $3 - 7$ □ □ □ □ □ □ □
 □ □ □ □

• $4 - -5$ □ □ □ □ □ □ □ □ □
 □ □ □ □ □

• $-6 - 4$ □ □ □ □ □ □ □ □ □ □
 □ □ □ □

• $-5 - -5$ □ □ □ □ □



Subtracting Integers: Manipulatives (Rewriting)

• $9 - 4$

$9 + -4$

• $3 - 7$

$3 + -7$

• $4 - -5$

$4 + 5$

• $-6 - 4$

$-6 + -4$

• $-5 - -5$

$-5 + 5$



Subtracting Integers: Models

- $9 - 4$ + + + + + + + + +
 $9 + -4$ - - - -
- $3 - 7$ + + +
 $3 + -7$ - - - - - - -
- $4 - -5$ + + + +
 $4 + 5$ + + + + +
- $-6 - 4$ - - - - - -
 $-6 + -4$ - - - -
- $-5 - -5$ - - - - -
 $-5 + 5$ + + + + +



Multiplying and Dividing Integers

- $9 \cdot 4$
- $-6 \cdot 4$
- $8 \cdot -9$
- $-5 \cdot -5$
- $\frac{-45}{9}$
- $\frac{-60}{-6}$



Reviewing With Informal Assessment

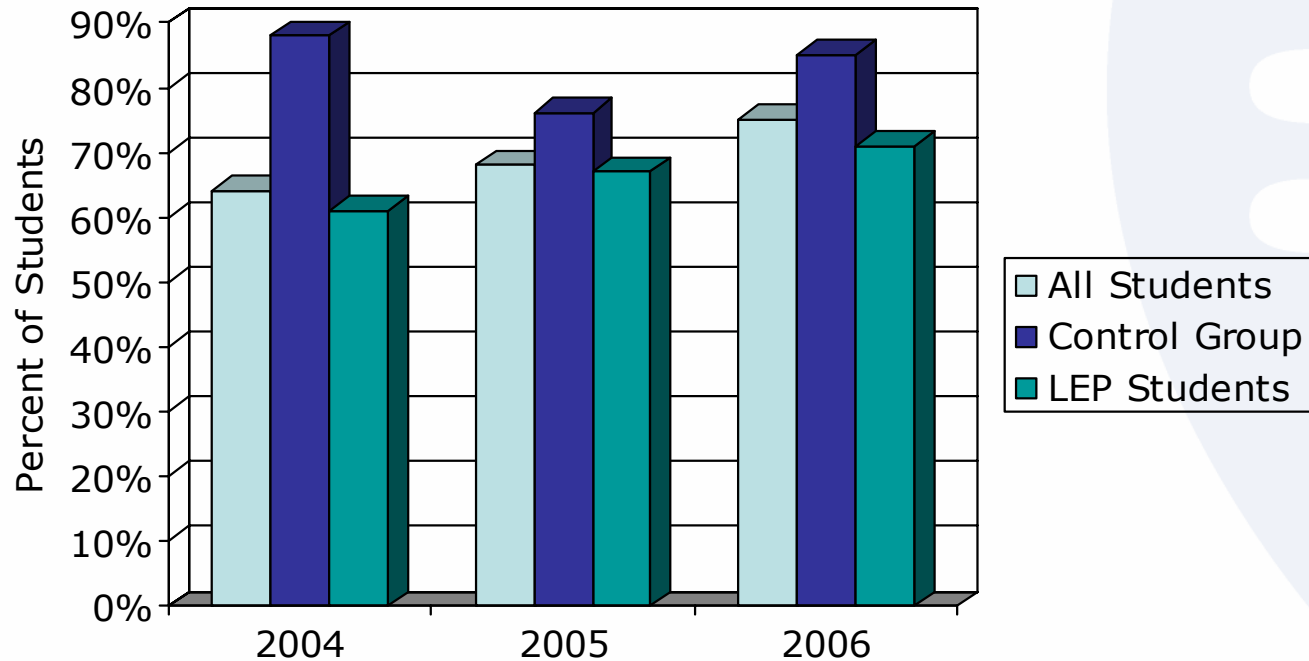
- Jeopardy?
- Football
- Bingo
- I have, who has



CRT Data

Solve problems using the four basic operations with integers

Percent of Students Scoring Proficient or Advanced



Thoughts to Carry

- Relevant research
- Best practices of mathematics
- Adapting to ALL students
- Moving from concrete to abstract learners
 - Manipulatives to models
- Graphic organizers
- If research suggests that students must practice a new concept 24 times for mastery, how can you ensure you will provide the time needed?



Contact

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Reflective Questions for Implementation

- What vocabulary is essential to pre-teach students?
- How will you do this? When?
- What graphic organizers will I use this year?
- How will I model them? When?

