

The Leadership and Learning Center[®]

Strategies for Teaching Math Facts Rather than Just Assessing Them

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Math Fact Issues

- Instruction Related to Math Facts
- Fluency and Automaticity
- Brain Research - Memory
- Tradition
- Number Sense

Fluency and Automaticity

“Fluency in math is defined as using the math facts that you know to find the math facts that you are not sure of.” (*Balancing Mathematics Instruction* by Christinson, 2013, p.77)

- “Understanding is developed first, with practice for fluency coming later.” (O'Connell, 2011, p.6)
- “A fluency approach to learning basic facts places a focus on developing and using mathematical strategies, with the goal of finding efficient, effective ways to apply known facts to derive unknown facts.” (Christinson, 2013, p.78)

Automaticity means the quick and effortless recall of math facts.

- “No need to count every object. No need to think about related facts. No need to extend patterns.” (O'Connell, 2011, p.3)
- “Automaticity is achieved through brief, frequent, interactive activities that provide students with repeated exposure to math facts.” (O'Connell, 2011, p.6)

“Drill of inefficient methods does not produce mastery.”

- John A. Van De Walle, (2004), p. 157.

Math Fact Simulation

1. _____

6. _____

11. _____

2. _____

7. _____

12. _____

3. _____

8. _____

13. _____

4. _____

9. _____

14. _____

5. _____

10. _____

15. _____

How did this activity make you feel?

How do you think students feel when they take traditional timed tests?

Fluency Expectations in Common Core State Standards

What do you notice about the fluency expectations? How will this impact students?

Kindergarten	Grade 3	Grade 6
<ul style="list-style-type: none"> • K.OA.5-Fluently add and subtract within 5 	<ul style="list-style-type: none"> • 3.OA.7-By the end of Grade 3, know from memory all products of two one- digit numbers 	<ul style="list-style-type: none"> • 6.NS.2-Fluently divide multi-digit numbers using the standard algorithm
<p>Grade 1</p> <ul style="list-style-type: none"> • 1.OA.6-Add and subtract within 20, demonstrating fluency for addition and subtraction within 10 	<p>Grade 4</p> <ul style="list-style-type: none"> • 4.NBT.4-Fluently add and subtract multi-digit whole numbers using the standard algorithm 	
<p>Grade 2</p> <ul style="list-style-type: none"> • 2.OA.2-Fluently add and subtract within 20 using mental strategies. • 2.OA.2-By the end of Grade 2, know from memory all sums of two one-digit numbers 	<p>Grade 5</p> <ul style="list-style-type: none"> • 5.NBT.5-Fluently multiply multi-digit whole numbers using the standard algorithm 	

Examples for Math Facts using CPA (Concrete - Picture - Abstract) Approach

- Ten Frames and Dot Arrangements

Quantity Seen	Math Fact Connected to Visual

- Hierarchical Inclusion

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- Part/Part Whole Relationships

Research on Developing Mastery with Math Facts

- *Counting Strategies*: Direct modeling with objects or verbal counting to determine the answer
- *Reasoning Strategies*: Using strategies to logically determine the answer. This includes reasoning and using known facts.
- *Mastery*: Quick and accurate recall of facts

Source: *Why Can't Johnny remember the basic facts* *Developmental Disabilities Research Reviews* Baroody, Bajwa, and Eiland (2009), p. 90

Big Ideas to Develop Math Fact Strategies

- Our number system is a system of patterns.
- All math facts are conceptually related; you can learn new or unknown facts from those you already know.
- Numbers are flexible. They can be broken apart to more easily perform an operation.
- “Think addition” is the most powerful way to learn subtraction
- “Think multiplication” is the most powerful way to learn division facts

Source: O'Connell, S. & SanGiovanni J. (2011). *Mastering the Basic Math Facts in Addition and Subtraction*. Portsmouth, NH: Heinemann.

Addition Facts Instruction

Reflection: Do you follow a specific progression in teaching/re-teaching addition facts? If so, what is it and why do you use that order?

Focusing on the Big Ideas for Addition and Subtraction Facts

- Addition is a joining or combining process (part-part-whole).
- Addition and subtraction are inverse operations.
- The order of the factors does not change the sum (the commutative property).
- Subtraction is a separation or comparison process.

Source: O'Connell, S. & SanGiovanni J. (2011). *Mastering the Basic Math Facts in Addition and Subtraction*. Portsmouth, NH: Heinemann.

Possible Progression for Addition and Subtraction Facts

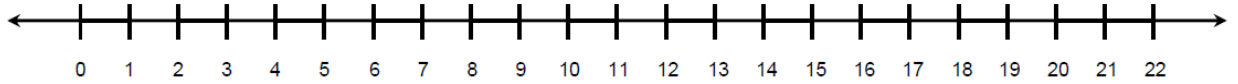
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Using Models to Represent Facts: Addition and Subtraction

- Five Frames and Ten Frames
- Manipulatives
- Number Lines
- Number Charts
- Investigations
- Context Problems
- Draw
- Act Out
- Literature
- Games

More Examples for Math Facts using CPA Approach

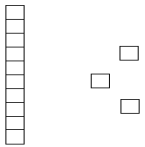
- "I Spy" Dominoes
- Number Line



- Draw a Picture
- "Game" with Number Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

- Linking Cubes

3		$10 + 3 = 13$
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- Act It Out

Notes and Ideas

Resources:

Ainsworth, L. & Christinson, J. R. (2006). *Five Easy Steps to a Balanced Math Program*. Englewood, CO: Lead and Learn Press.

Christinson, J. R. (2013). *Balancing Mathematics Instruction*. Englewood, CO: Lead and Learn Press.

O'Connell, S. & SanGiovanni J. (2011). *Mastering the Basic Math Facts in Addition and Subtraction*. Portsmouth, NH: Heinemann.

O'Connell, S. & SanGiovanni J. (2011). *Mastering the Basic Math Facts in Multiplication and Division*. Portsmouth, NH: Heinemann.

Shumway, J. (2011). *Number Sense Routines: Building Numerical Literacy Every Day in Grades K-3*. Portland, ME: Stenhouse Publishers.

Van de Walle, J. A. (2012). *Elementary and Middle School Mathematics: Teaching Developmentally*. New York, NY: Pearson.