

Developing and Assessing Addition Fact Fluency

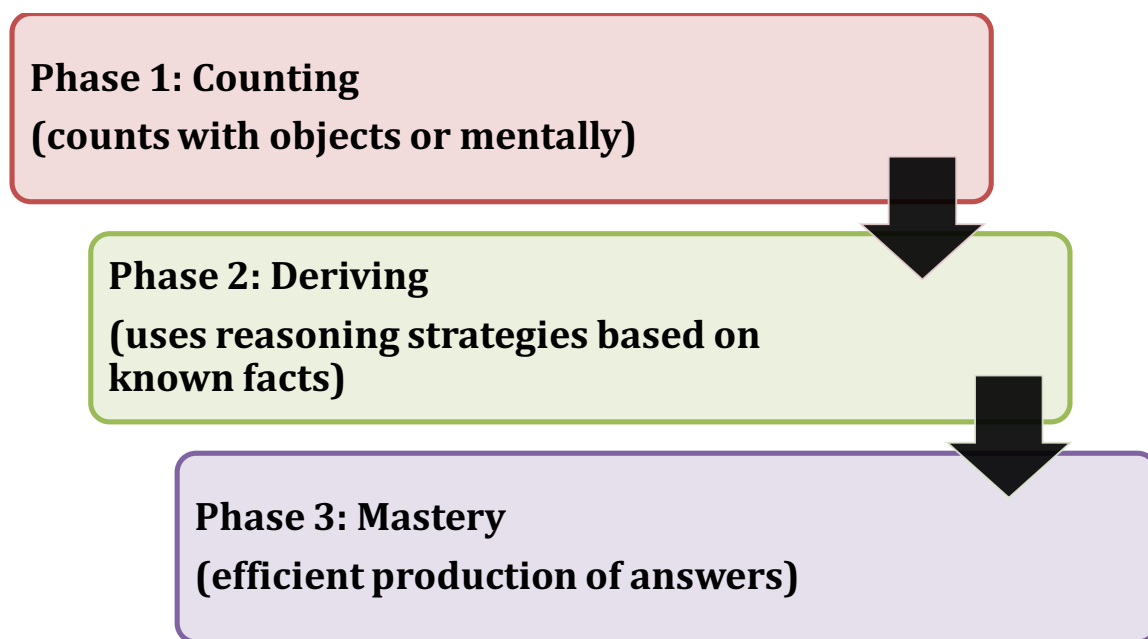
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Procedural Fluency is skill in carrying out procedures **flexibly, **accurately**, **efficiently** and **appropriately**.**
(CCSSO, 2010, NCTM, 2014, NRC, 2001)

Phases of Basic Fact Mastery (Baroody, 2006)



Indicators for each phase for the example $5 + 7 = ?$

Phase 1: The child uses fingers to help keep track of his counts as he either counts all or counts on to find the sum.

Phase 2: The child uses a known fact such as $5 + 5$ and thinks “ $5 + 5 = 10$ and 2 more will make 12. So $5 + 7 = 12$.”

Phase 3: The child answers “12” with little/no hesitation.

Developmental Sequence for Addition Fact Strategies

Foundational Facts	
Sums within 5 (1 + 4, 2 + 2, etc.)	Work with Foundational Facts begins in Kindergarten, with a focus on mastery in First Grade. Derived Fact Strategies (see below) are a focus of First and Second Grades.
One/two more (+ 1 or 2)	
10 + (10 + 7 = 17, etc.)	
Doubles (2 + 2, 6 + 6, etc.)	
Combinations of 10 (3 + 7, 8 + 2, etc.)	
Derived Fact Strategies	
Near Doubles (6 + 7, 8 + 7, etc.)	Start with a nearby known double and add or subtract 1 or 2 from it to derive the unknown fact. <i>Ex: I don't know 6 + 7, so I think 6 + 6 = 12 and add 1 more to get 13.</i>
Making Ten (8 + 3, 9 + 5, etc.)	Decompose one addend in order to form a combination of 10 with the other addend and then add the remaining number. <i>Ex: I don't know 9 + 5, so I think 9 + 1 = 10 and 4 more is 14.</i>
Making Fives (6 + 7, 5 + 8, etc.)	Decompose one or both addend to five and some extras; combine fives to make 10; add on the extras. <i>Ex: 6 is 5 + 1 and 7 is 5 + 2 more; so the sum is 10 + 3, which is 13.</i>

Doubles Bingo

Materials: Playing cards with numbers 0–10 (Ace = 1, Jack = 0, other face cards removed); Counters or bingo chips; Doubles Bingo Board.

Players: Whole Class

How to Play:

1. Post the following doubles sums: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20.
2. Ask each student to fill in a Doubles Bingo Card using numbers from this list. [Note: numbers can be repeated, and not all numbers have to be used.]
3. To begin play, draw a card and say the number. Students use that number, double it, and find that sum on their board. For example, if a 4 is drawn, they find an 8 on their board and cover it.
4. Only one space can be covered each turn, and a bingo chip cannot be moved after it has been placed.
5. Players that get four-in-a-row (horizontally, diagonally, vertically) say 'bingo.'

Possible Adaptions: Rather than Doubles do One More, One Less, Two More, or Two Less (changing the list of possible sums); Focus on derived facts, creating notecards with up to 16 facts you wish to practice (e.g., $7 + 8 = ?$ or $17 - 8 = ?$) (changing the list of possible sums); Reverse so that students record expressions on their Bingo Board (e.g., $12 - 3$), and you draw sums/differences between 0 and 20.

Doubles Bingo Board

Fishing for 10

(adapted from *Everyday Mathematics 4, 2016*)

Materials: Ten frame cards or deck of cards with numbers 0–10 (Ace = 1, Jack = 0, remove other face cards),

Players: 2–4 Players

How to Play:

1. This is played like the card game “Go Fish,” only instead of looking for matching cards, a match is a combination of ten.
2. Deal 5 cards to each player.
3. Take turns. On a player's turn, they ask for a card that will make a ten for one of their cards. For example, if they have a 4, they ask one of the other players, “Do you have a 6?”
 - If the person asked has the card, they give it to the player and that player makes a match.
 - If the person asked does not have the card, they say ‘Go Fish.’ The player then draws a card from the deck.
4. Repeat the process for the next player.
5. Play until all cards are used.
6. Optional: Players record number sentences for each of the distinct pairs they got.

Salute!

Materials: Deck of ten frame cards, numeral cards, or playing cards with numbers 0–10 (Ace = 1, Jack = 0; remove other face cards).

Players: Groups of 3

How to Play:

1. Determine which of the three will be the leader for the first draw. This player takes the deck (face down) and hands each of the other two players a card.
2. Without looking at the card they were handed, each player places their card on their forehead facing outward (so the others can see it).
3. The leader says the sum of the two cards.
4. The other two players determine the value of the card on their forehead, based on hearing the sum and seeing one addend.
5. Both players share how they determined their number.
6. Rotate so that one of the players is now the leader.
7. Continue until deck is gone.

Possible Adaptations: Use only certain cards (e.g., only numbers 1 through 5); Include a third player so that the leader finds the sum of all three cards and the players must find the difference between that sum and the sum of the other two player's cards; Score points by having the player who was fastest keep the cards.

**Facts Assessment: 1st grade journal responses to
“If your friend didn’t know the answer to $4 + 5$, how could he figure it out?”**

I would tell my friend to use a double plus 1. $4 + 4 = 8$ so count 1 up. now you get your answer

I would tell my friend to take away one number from ten. And that is nine. I know that five plus five equals ten.

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I would tell my friend to take 5 and count 4 in your hand

I would tell my friend to start with 5 then add 2 then one more 2 and then you have 9.

Additional Resources for Developing and Assessing Basic Fact Fluency

Please see additional ideas for games and assessment tools in the following articles and their related More4U sections:

Kling, Gina and Jennifer M. Bay-Williams (2015). Three Steps to Mastering Multiplication Facts. *Teaching Children Mathematics*, 21(9), 548-559.

Contains a summary of multiplication fact strategies as well as directions for a variety of multiplication facts games.

Bay-Williams, Jennifer M. & Gina Kling (2015). Developing Fact Fluency. Turn Off Timers, Turn Up Formative Assessment. In NCTM *Annual Perspectives in Mathematics Education (APME) 2015: Assessment to enhance learning and teaching*. Chris Suurtamm, (Ed.) National Council of Teachers of Mathematics, Reston, VA.

Contains examples of different types of fact assessments that can be used across the three phases of fact mastery.

Bay-Williams, Jennifer M. and Gina Kling (2014). Enriching Addition and Subtraction Fact Mastery through Games. *Teaching Children Mathematics* 21(4): 238-247.

Contains game directions in the main article as well as detail on how to use the games to help children progress through the three phases of fact mastery.

Kling, Gina and Jennifer M. Bay-Williams (2014). Assessing Basic Fact Fluency. *Teaching Children Mathematics* 20(8): 488-497.

Contains examples of different types of fact assessments that can be used to more accurately capture the four components of fluency.

Kling, Gina (2011). Fluency with Basic Addition. *Teaching Children Mathematics* 18(2): 80-88.

Contains a summary of basic addition strategies as well as game directions, including games focused on developing foundational fact fluency.

You are welcome to contact us with any questions or ideas you have related to basic fact fluency. Thank you for all you do to support fact fluency and student confidence in mathematics! ☺