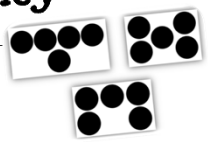
Composing and Decomposing Numbers: Foundation for Fluency



Donna Boucher

MathCoachsCorner.com
Door # 3
Password NCTMAC2015

What is Number Sense?

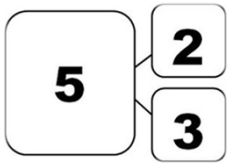
"...a person's general understanding of number and operations along with the ability to use this understanding in flexible ways to make mathematical judgments and to develop useful strategies for solving complex problems" (Burton, 1993; Reys, 1991)

from NCTM's Illuminations website

Composing and Decomposing Numbers: Foundation for Fluency

- "Focusing on a quantity in terms of its parts has important implications for developing number sense." (Van de Walle, 2013, p 139)
- "If basic facts are to be foundational, they must be based on an understanding of the composition and decomposition of numbers. When children know the parts of numbers through 10, they automatically know the basic facts." (Richardson, 2012, p 43)

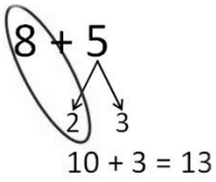
Number Bonds: Fact Families Revisited



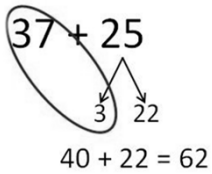
Number bonds emphasize…

- the part/part/whole relationship
- the relationship between addition and subtraction

The Evolution of a Number Bond

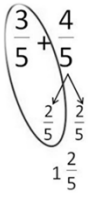


Add and subtract within 20

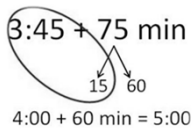


Add and subtract within 100

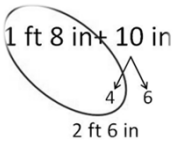
The Evolution of a Number Bond



Fourth Grade
Add fractions



Fourth Grade
Elapsed time

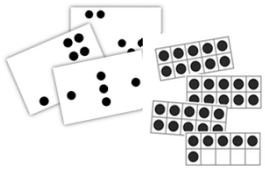


Fifth Grade
Measurement conversions

What is Subitizing?

Talk about it!

Dot Cards



"*Incorporating dot images into classroom number talks provides opportunities to work on counting, seeing numbers in a variety of ways, subitizing, and learning combinations.*"
(Parrish, 2012, p 41)

Door #3

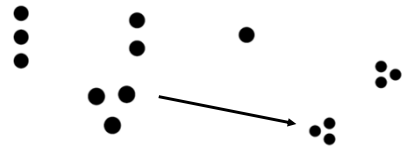
Dot Card Routines

- Develop and practice procedures for dot card routines. Avoid having students shout out answers.
- Be sure to ask not only *what* number they see, but also *how* they see it.
- "Did anyone see it a different way?"

Let's try it!

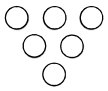
Dot Card Routines

- Start with smaller numbers and build to larger numbers that use combinations of the smaller numbers.



Dot Card Routines

- Connect the visual to the symbolic by writing number sentences for the combinations students see.



3 + 3 = 6

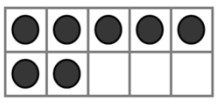
3 + 2 + 1 = 6

4 + 2 = 6

5 + 1 = 6

Dot Card Routines

- 5- and 10-frames anchor to the critical benchmarks of 5 and 10.

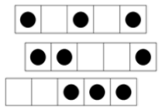
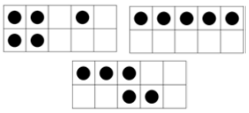


Fast Five

5, 6, 7

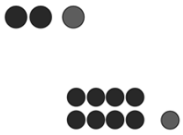
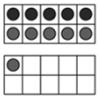
Dot Card Routines

- The process is the same as with random dot cards, but questioning can include the relationship of the number shown to 5 or 10.

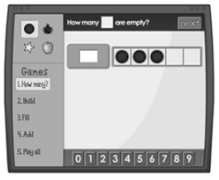
Dot Card Routines

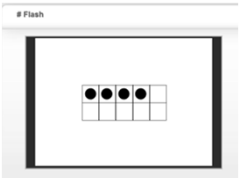
- Use two colors to support composing/decomposing skills and development of basic facts.

Dot Card Interactive Resources

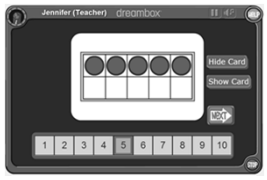
- NCTM Illuminations, five- and ten-frame tools
- Fuel the Brain, # Flash





Dot Card Interactive Resources

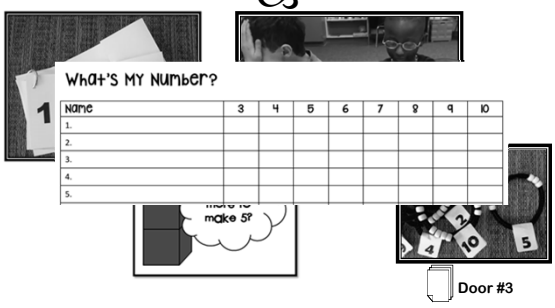
- DreamBox, Numbers to 10 on the Ten-Frame



Differentiating— What's My Number?

- Building a number (composing) and breaking a number apart (decomposing)
- Use the "hiding assessment" to determine each child's number
- Students should master the combinations for one number before moving on to the next
- Independent practice, partner work, and small-group instruction are all based on each student's number
- Ongoing…as in ALL YEAR LONG

Differentiating— What's My Number?



Number Bracelets

Use chenille stems (cut off about 2") and pony beads to make bracelets. Use a single color for the beads. Use mailing labels for the number tag. Put the number tag over the twisted ends.

Door #3

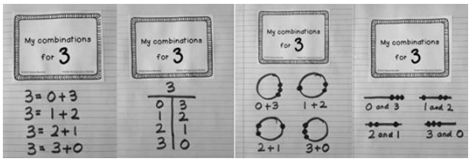
Number Bracelet Routines

- Students manipulate the beads and make all the combinations for a given target number.

Let's try it!

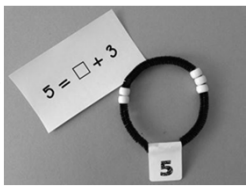
Number Bracelet Routines

- Students can record their number combinations in a math journal to connect the concrete with the abstract (symbolic).



Number Bracelet Routines

- Partner activity–one partner hides some beads and the other partner has to figure out how many are hidden.
- Number bracelets are great for the "hiding assessment".



Rekenreks

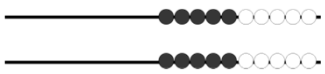
Rekenrek translates loosely to calculation rack or arithmetic rack, and it was designed by a Dutch Mathematician. The rekenrek is a great visual model for developing a strong sense of 5 and 10, and it supports a strategy-based approach for learning calculations.

Rekenreks

- Cut foam sheets into 4 x 6 rectangles
- Cut 2" off the ends of the chenille stems
- Poke the ends of the chenille stems into left side of the foam rectangle, about an inch apart
- Thread 5 red beads and 5 white beads on each stem
- Poke the other ends of the stems through the foam and twist the ends together on the back

Rekenrek Routines

- Introduce the rekenrek and allow students to make observations.
- Teach the conventions of starting with the beads on the right and move beads in groups, rather than one by one.



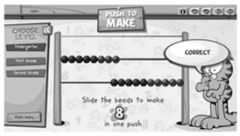
Rekenrek Routines

- Quick Flash
- Make 5–top row only; top and bottom
- Make 10–tip row only; top and bottom
- Build a Number–partners
- Numbers from 11-20–how many tens and ones?

"Use the top row to show me 3 with one move."

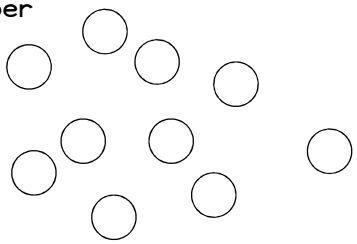
Rekenrek Interactive Resources

- Professor Garfield, What Do I See and Push to Make
- DreamBox, Numbers to 10 on the Math Rack

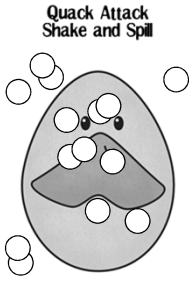


Shake and Spill

Differentiate by changing the target number



Shake and Spill



3 on the duck and 4 off the duck.
3 and 4 make 7.

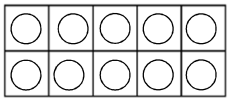
5 on the duck and 2 off the duck.
5 and 2 make 7.

Door #3

How Many to Make Ten?

- Materials: blank ten-frame, two-color counters, 10-sided die (0-9)
- Roll the die and put that number of counters on the ten-frame using one color
- Use the other color to complete the ten-frame
- State the number sentence or combination

6 and 4 make 10
OR
6 + 4 = 10
OR
10 = 6 + 4



Door #3

Roll and Cover

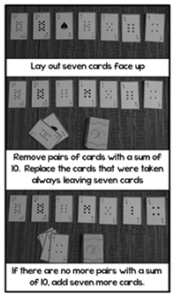
- Materials: game board, two-color counters, 10-sided dice (0-9)
- Roll the dice and determine the number needed to make 10; cover that number on the board
- Players take turns rolling and covering numbers until all numbers are covered

1	2	○	○	○
6	7	8	9	10

Door #3

Seven on Top

- Lay out seven cards face up
- Remove pairs of cards with a sum of 10
- Replace cards, always leaving seven
- If there are no pairs for ten in the seven cards showing, lay down another seven cards on top of the others
- Variations:
  - ➔ Show cards one at a time and have students tell you the number that makes ten
  - ➔ Remove some cards and play looking for combinations of other numbers



Mathemagician Make Ten

- Remove the face cards and Jokers from a standard deck of playing cards; aces are ones
- One player chooses a card from the deck and places it face down off to the side
- Place all other cards face up in rows and columns on the table
- Taking turns, players take pairs of cards that combine to make 10 off the table while stating the fact; 10s can be taken off the table, and the player would say 10 + 0
- At the end of the game, one card will be left on the table; its pair is the one hidden off to the side! Note: if no cards are left on the table at the end of the game, the hidden card is a 10! ☺

Let's try it!

References

- Van de Walle, John A. (2013). *Elementary and Middle School Mathematics: Teaching Developmentally*. Boston: Pearson Education.
- Baroody, A.J. (1987). *Children's mathematical thinking: A developmental framework for preschool, primary, and special education teachers*. New York: Teachers College Press.
- Parrish, Sherry. (2010). *Number Talks: Helping Children Build Mental Math and Computation Strategies, Grades K-5*. Sausalito, CA: Math Solutions.
- Richardson, Kathy. (2012). *How Children Learn Number Concepts: A Guide to the Critical Learning Phases*. Bellingham, WA: Math Perspectives.
- The Math Learning Center. (2008). *Using the Rekenrek as a Visual Model for Strategic Reasoning in Mathematics*. Salem, OR: Authors.

Online Resources

- NCTM Illuminations
  http://illuminations.nctm.org/ActivityDetail.aspx?ID=74, five-frame tool
  http://illuminations.nctm.org/ActivityDetail.aspx?ID=75, ten-frame tool
- Fuel the Brain, Interactives, # Flash
  http://www.fuelthebrain.com/Interactives/app.php?ID=29
- DreamBox Teacher Tools, http://www.dreambox.com/teachertools
- Professor Garfield
  http://www.professorgarfield.org/yourfuture/math.html
- DreamBox Teacher Tools, http://www.dreambox.com/teachertools