



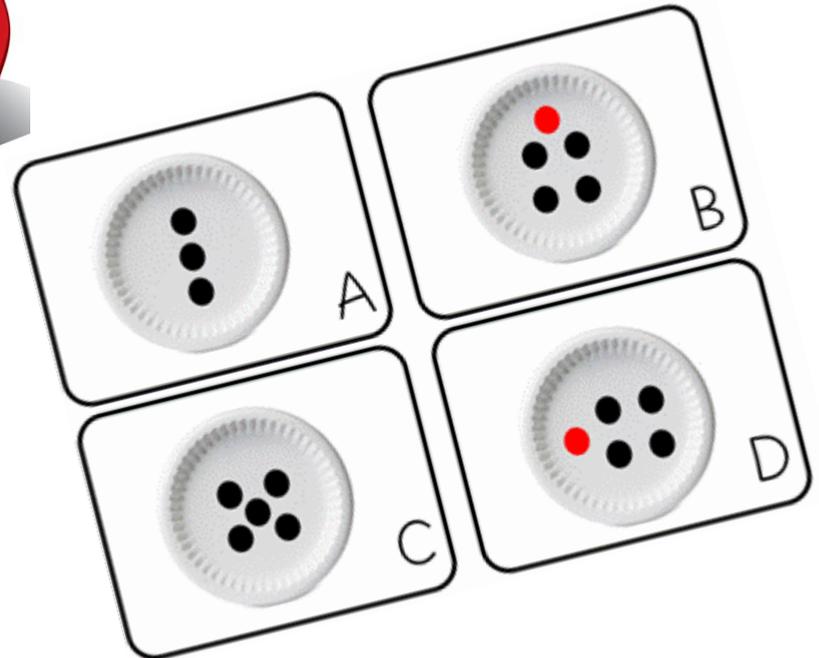
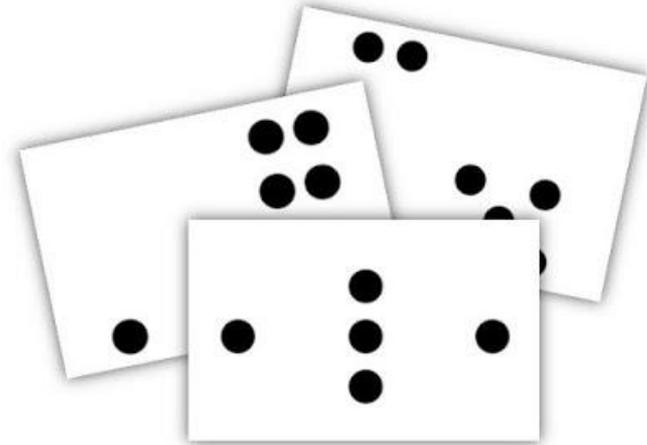
IV. Representations for Part-Part-Whole

Guiding Questions

- What representations can be used to help students develop strong part-part-whole ideas?
- What are the benefits and limitations of these representations?

Dot Representations

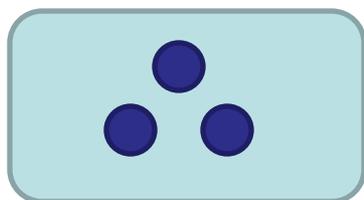
- Dot cards
- Dot plates
- Dominoes
- Dice



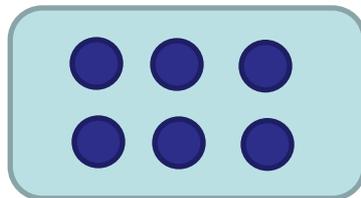


Subitizing

- Perceptual subitizing – recognizing small quantities without counting



- Conceptual subitizing – recognizing patterns and groups to help determine a quantity





Subitizing

“Children use counting and patterning abilities to develop conceptual subitizing.

This more advanced ability to group and quantify sets quickly in turn supports their development of number sense and arithmetic abilities.”

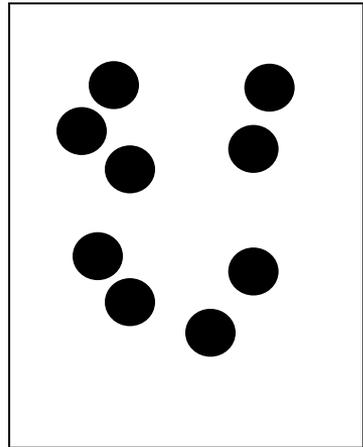
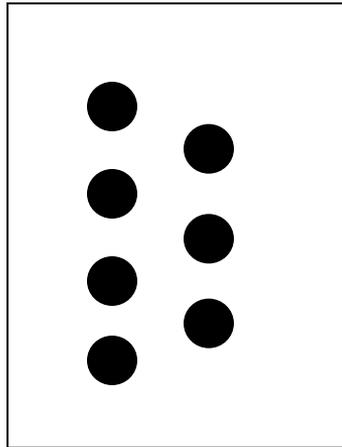
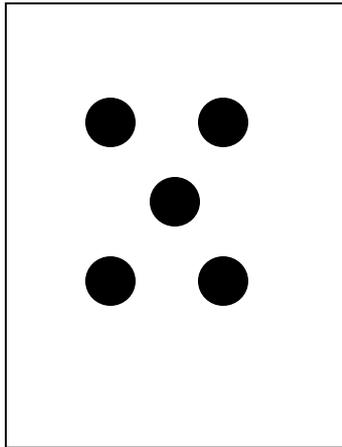
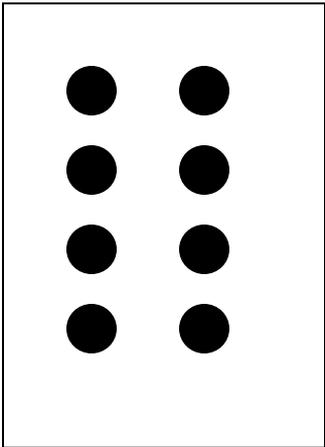


Subitizing

Questions to ask children when using Dot Representations

1. How many dots did you see?
2. How did you see it?
3. What did the pattern look like?
4. Did you see any parts that you know?

Subitizing - Let's Try Some Examples



Using Dot Representations

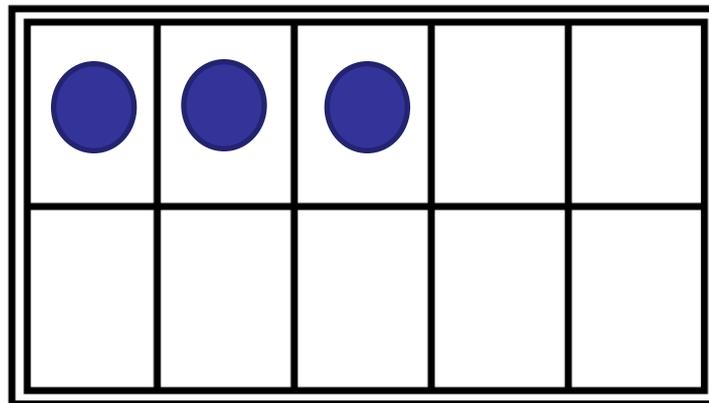
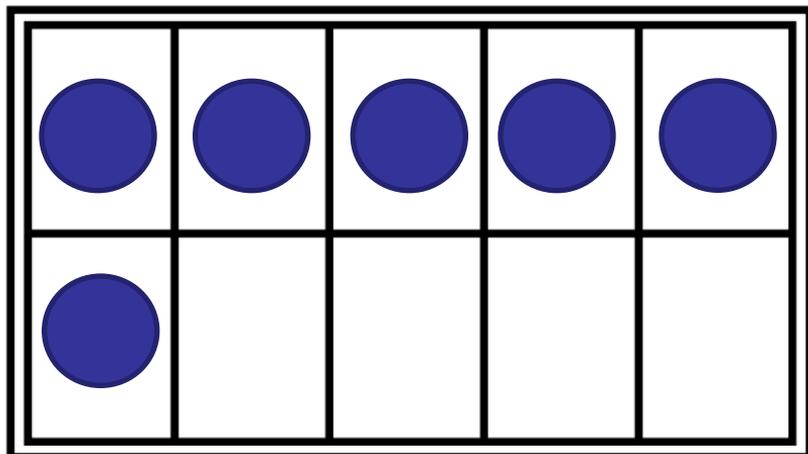
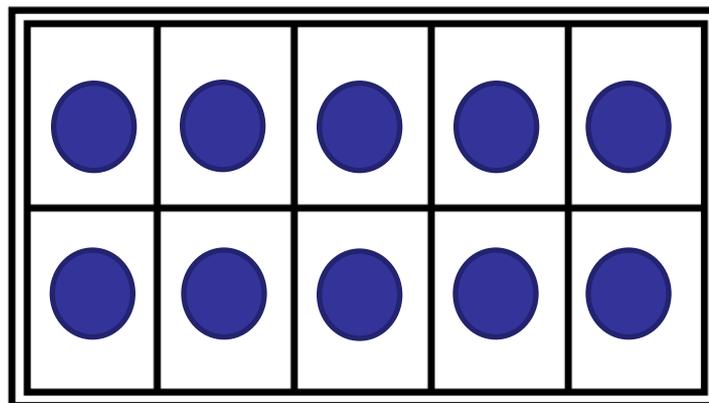
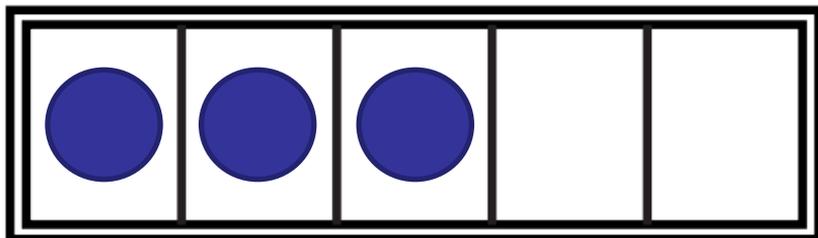
After working with the previous dot cards, discuss the following:

What are the benefits and limitations of using dot representations?



Five-Frames and Ten-Frames

How do these representations help anchor numbers to 5 and 10?





Ten Frames – Number Talk



VIDEO

Kindergarten Class

How is the ten-frame helping students?

What questions is the teacher asking to help students focus on parts within a quantity?

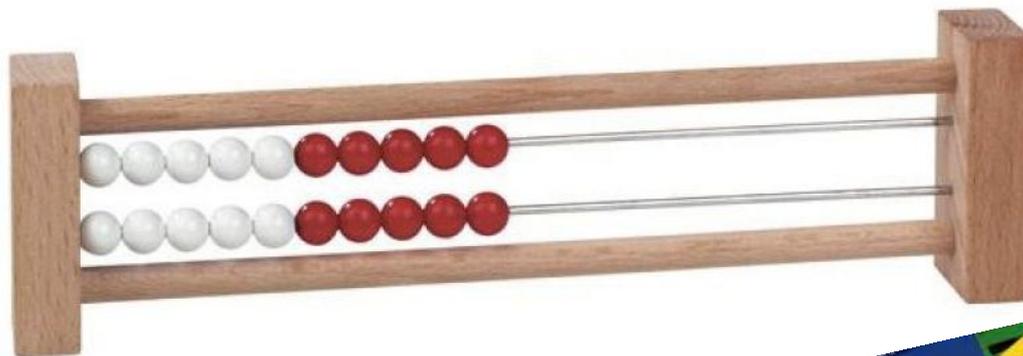
Using Five- and Ten-Frames

In small group or whole group, discuss the following:

What are the benefits and limitations of five- and ten-frames?



Rekenreks



How is this representation similar to the other representations explored? How is it different?

Rekenreks

Let's make a rekenrek!

You need:

- A piece of cardboard
- Two pipe cleaners
- 10 red beads
- 10 black beads



Rekenrek



VIDEO

How is this number talk different from the previous number talk?

How does the teacher honor and value various strategies while encouraging part-part-whole thinking?

What are the benefits and limitations of rekenreks?



Rekenrek

Your turn!!!!

1. Choose one person to be the teacher. Everyone else turns back to numbers below.
2. Teacher uses rekenrek to show the combinations below. After each combination, ask...

How many beads did you see?

How did you know there were ___ beads?

6 on the top, 6 on the bottom

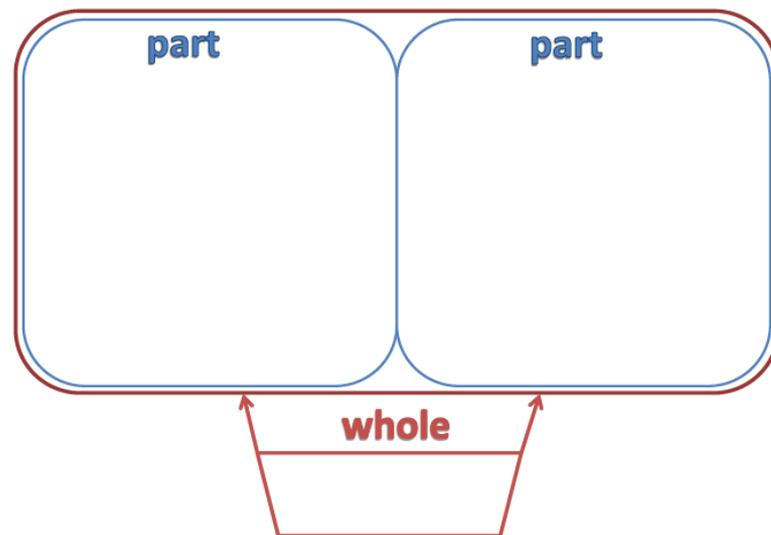
6 on the top, 7 on the bottom

6 on the top, 5 on the bottom



Part-Part-Whole Mat

Use the mat and some counters to model the problems.



- 1. Sam had 6 red balls and 5 blue balls. How many balls did Sam have?**
- 2. Sam had 12 stickers. Four of his stickers were torn. How many were not torn?**
- 3. Sam had 14 goldfish. He gave some to Mary. Now he has 7. How many goldfish did he give to Mary?**

Part-Part- Whole Mat

How does modeling problems using a Part-Part-Whole mat help students?

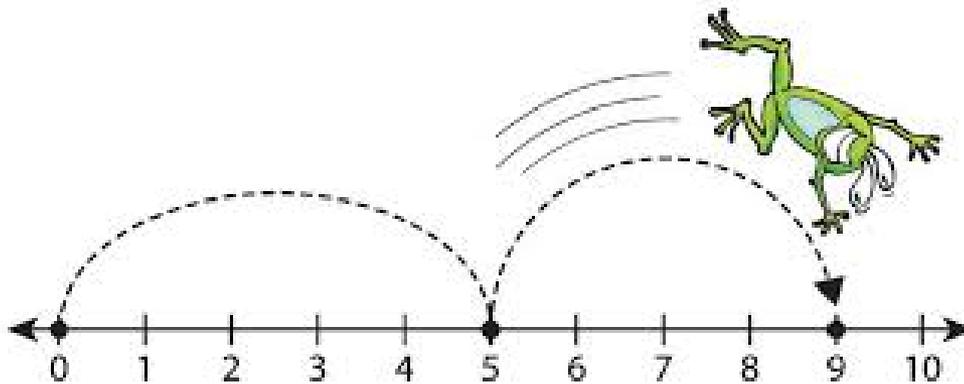
What are the benefits and limitations of part-part-whole mats?

Number Lines

Number Path – discrete counting model



Number Line – length or distance model





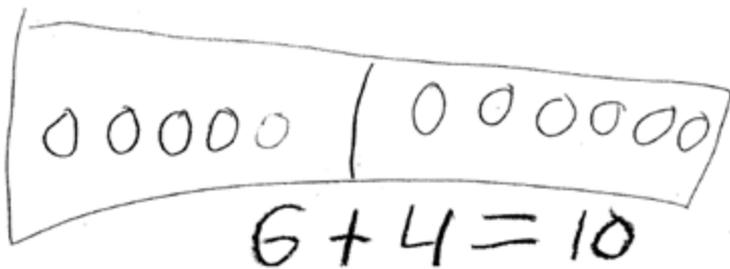
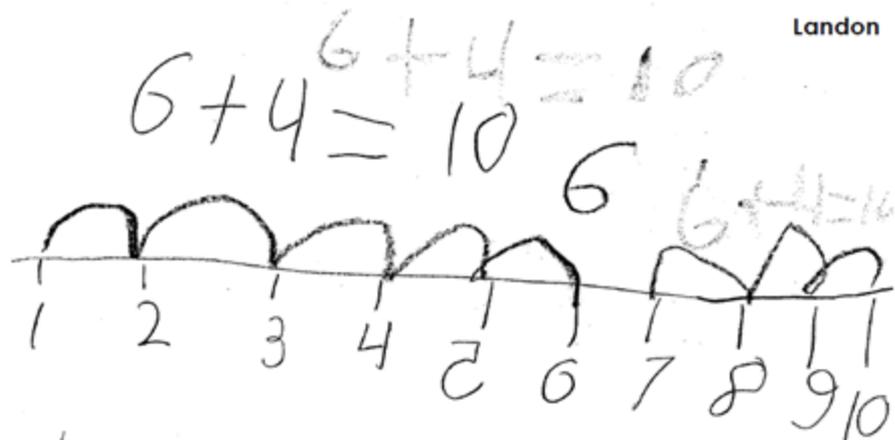
Challenges or Limitations with Number Lines

Young children try to use a number line as a counting model –

- They count the numbers or tic marks, not the segments
- They don't start from 0, because they typically begin counting from one



Can you identify the misconception?



then you 6 cocey
 AND reaches the h you 4
 L A N D O ^{nHW} MemeyAre
 you 10 cocey. (Vther



Number Lines

- Number Lines are not recommended as a representation at K and 1 because of the conceptual difficulties they present
- Introduce at grade 2 with an emphasis on ‘hops’ or lengths, but be cognizant of the difficulties young children have with number lines.



Open Number Lines

- What is an open number line?
- How do you introduce open number lines?
- Going back to the student work, which students used open number lines while solving the problem?

What are the benefits and limitations of number lines?



Representations

“Representations do not “show” the mathematics to the students. Rather the students need to work with representations extensively in many contexts as well as move between representations in order to understand how they can use a representation to model mathematical ideas and relationships.”



Role of the Teacher

- **Create** a learning environment that encourages and supports the use of multiple representations
- **Model** the use of a variety of representations
- **Orchestrate** discussions where students share their representations and thinking
- **Support** students in making connections among multiple representations, to other math content and to real world contexts

Van de Walle, J.A., Karp, K.S., Lovin, L.H. & Bay-Williams, J.M. (2014). *Teaching Student-Centered Mathematics: Developmentally Appropriate Instruction for Grades 3-5* (2nd ed.). (Vol. II). Pearson.



Role of the Student

- ***Create and use*** representations to organize, record, and communicate mathematical ideas
- ***Select, apply, and translate*** among mathematical representations to solve problems
- ***Use representations to model and interpret*** physical, social, and mathematical phenomena

Van de Walle, J.A., Karp, K.S., Lovin, L.H. & Bay-Williams, J.M. (2013). *Teaching Student-Centered Mathematics: Developmentally Appropriate Instruction for Grades 3-5* (2nd ed.). (Vol. II). Pearson.

Students must be **actively engaged** in **developing, interpreting, and critiquing** a variety of representations.

This type of work will lead to better understanding and effective, appropriate use of representation as a mathematical tool.

National Council of Teachers of Mathematics. (2000)
Principles and Standards for School Mathematics. (p. 206). Reston, VA.



"Students representational competence can be developed through instruction. Marshall, Superfine, and Canty (2010, p. 40) suggest three specific strategies:

1. Encourage purposeful selection of representations.
2. Engage in dialogue about explicit connections among representations.
3. Alternate the direction of the connections made among representations."