

How Does *NUMBER SENSE* Begin?

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3-5 Breakout Session, *Children as Mathematicians* PD Institute

Omaha, Nebraska

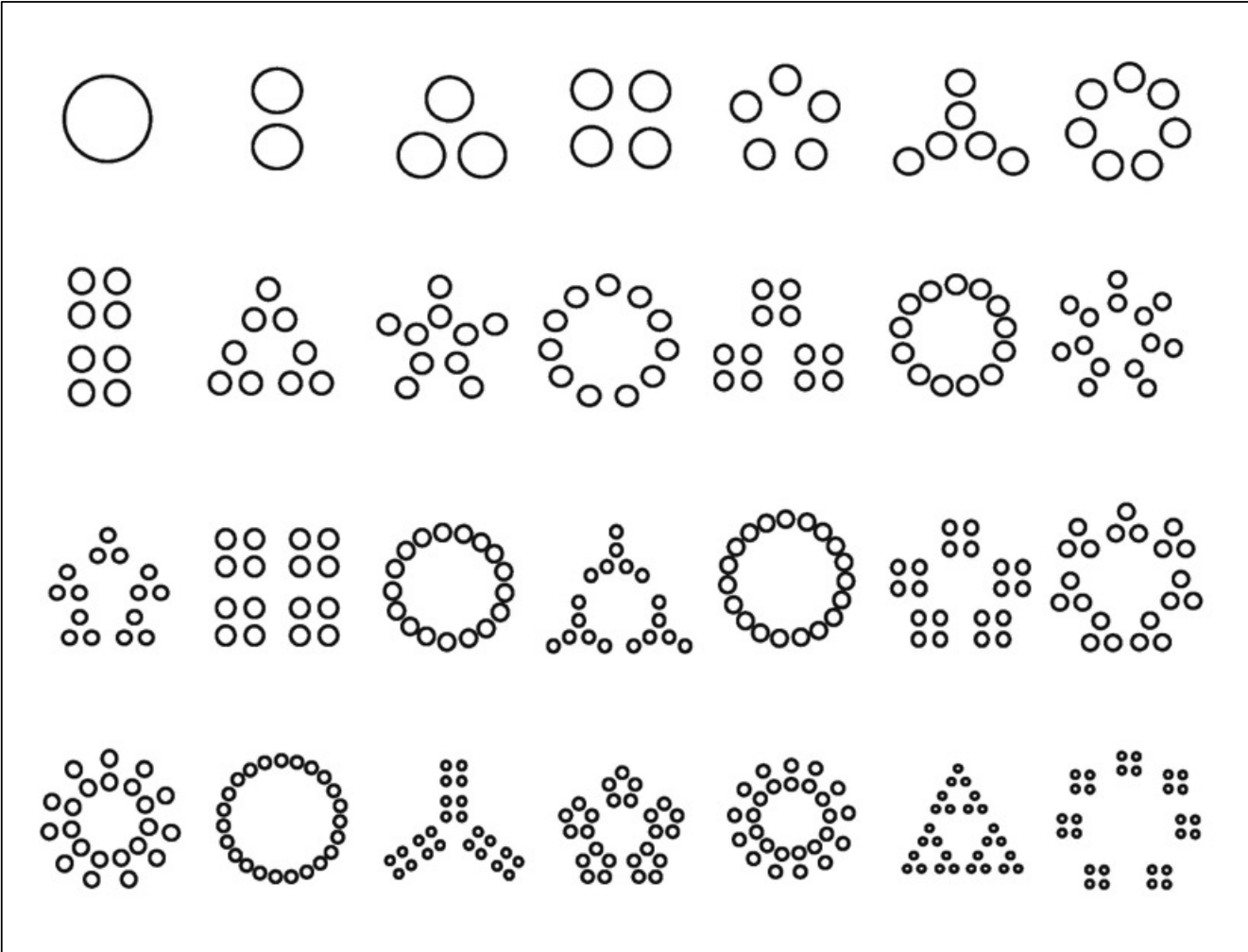
January 25 & 27, 2018

Meeting, Greeting, & Sharing

- Introduce yourself to your partner.
- Share with each other what it means to have strong number sense.



What do you notice?



What do you see?

Visual Number Patterns for Adults

- Look at the sheet with dots - *What do you notice?*
Highlight with colors, if desired.
- Work with elbow partner to find things that look alike, that seem to belong to the same “family.”
- As a table group, sort the cards by “family.”

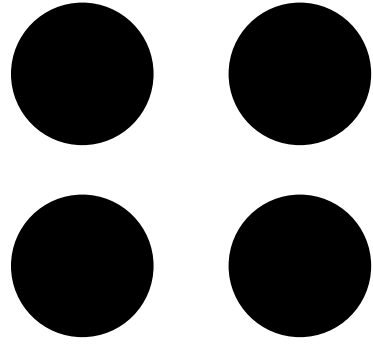
What makes these a set?

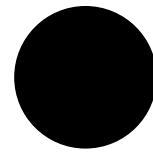
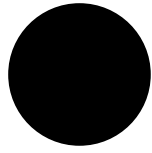
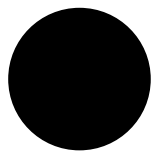
What attribute(s) did you use to sort the cards?

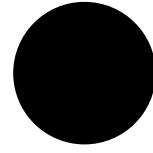
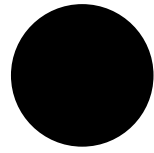
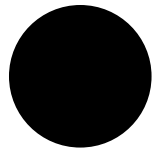
What relationships do you notice?

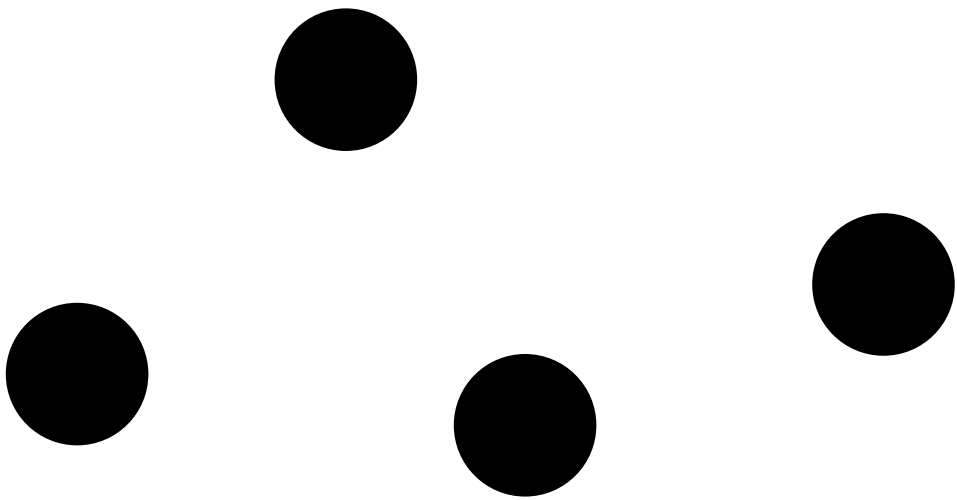
What can you see quickly?

Some dots will flash on the screen *briefly* –
try to see how many without counting.









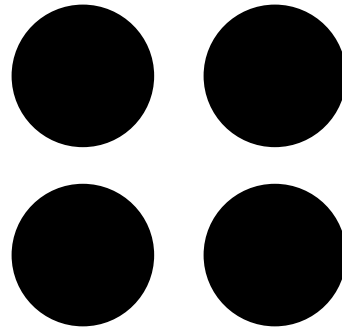
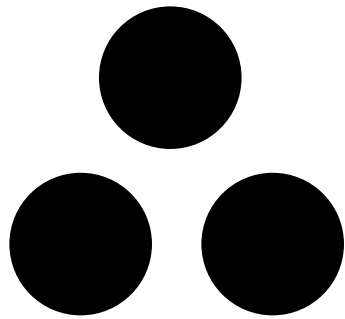
Perceptual Subitizing

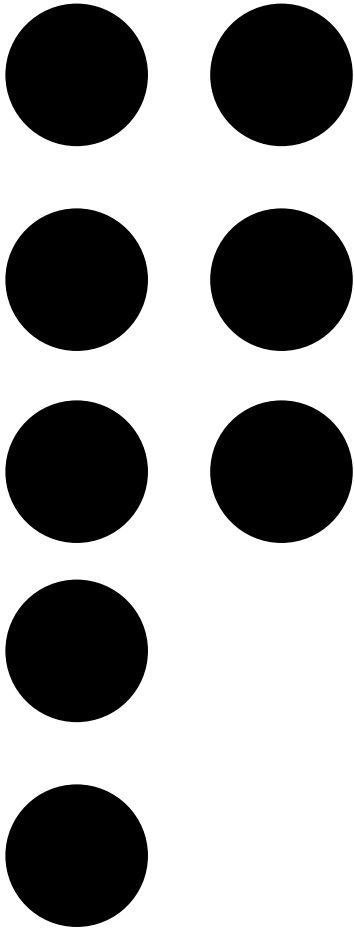
- You perceive the three or four dots intuitively & simultaneously.
- You “just know.”

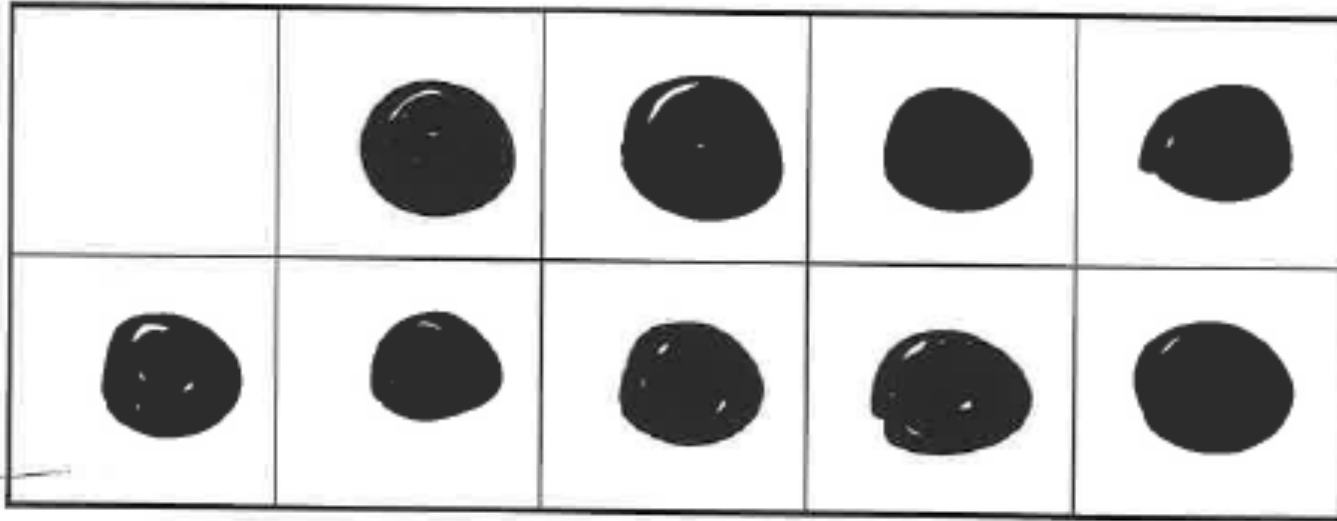
A Big Idea

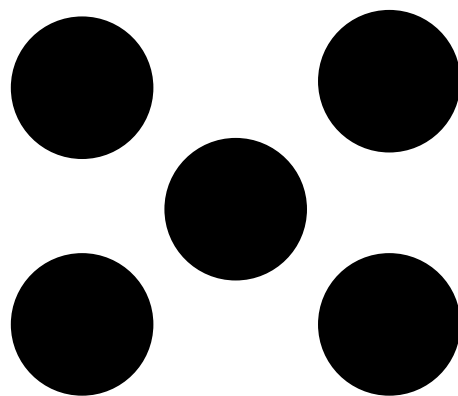
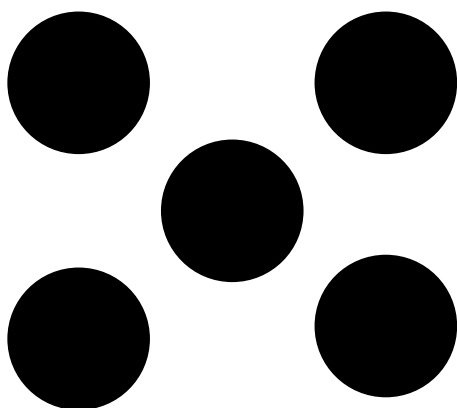
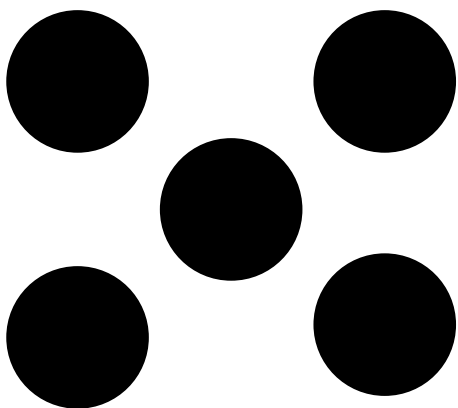
The quantity of a small set
can be intuitively perceived without
counting.











Let's try some more “quick looks” ...

















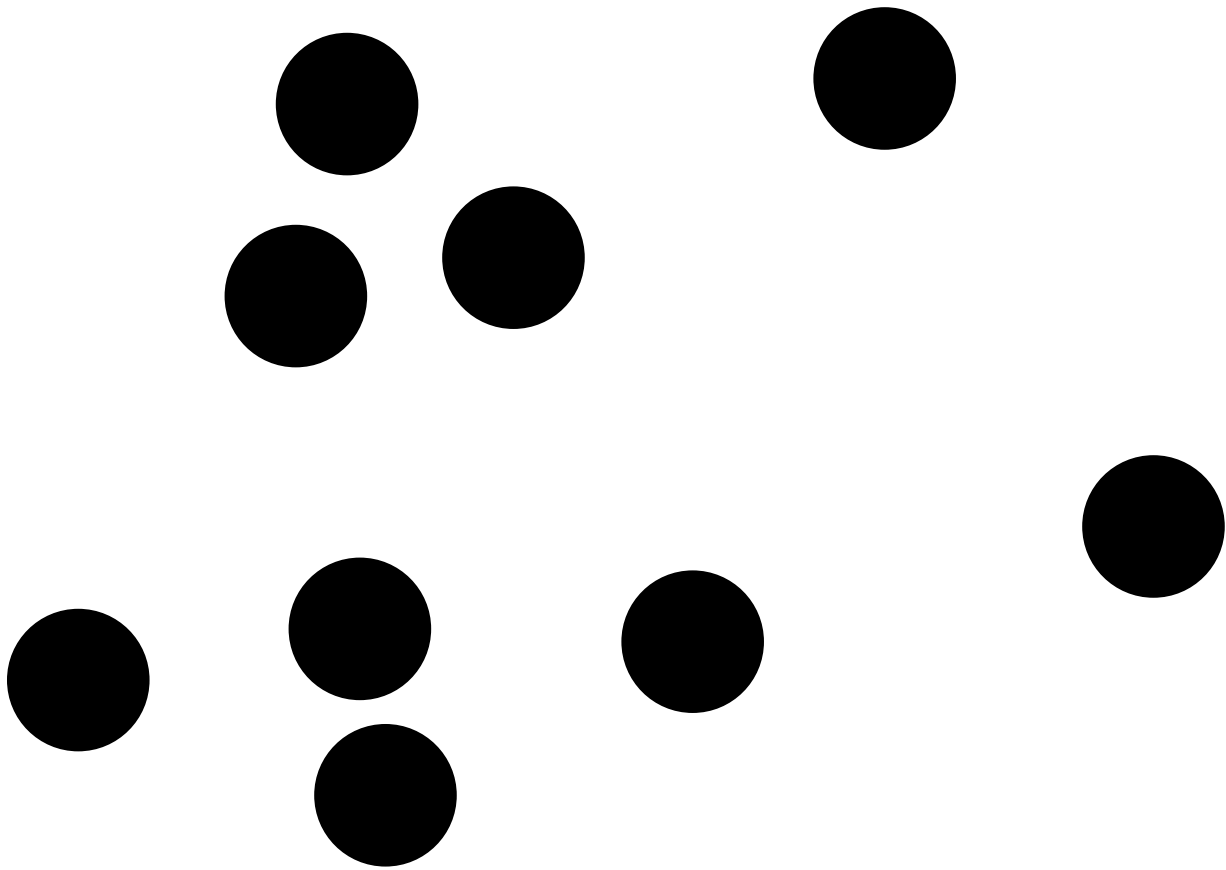






Conceptual Subitizing

- You perceive the parts and put together the whole
- All of this happens quickly and often is not conscious—it is still subitizing

A Big Idea

**Quantity is an attribute
of a set of objects.**

A Big Idea:

Quantity is an **attribute** of a set of objects.

A Collection Can Have Many Attributes

- Red color is an attribute
- Round shape is an attribute
- Sweet smell is an attribute
- Quantity is another attribute:
there are **THREE** roses in this collection.

Roses



A Big Idea:

Quantity is an **attribute** of a set of objects.

3 elephants
might seem
obviously
bigger when
compared to
3 mice ...



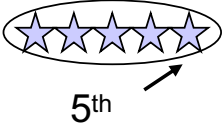

... if you used the attribute of **size**,
but, for the attribute of **number/ numerosity**, they are identical.

A Big Idea:

Quantity is an **attribute** of a set of objects.

- We call this ***numerosity*** - the “threeness” of 3.
- Numerosity exists apart from number words and written symbols. Words and symbols vary from language to language - numerosity does not.
 - *What other ways can we say 3?*
- Humans are biologically programmed to automatically perceive the numerosity of small sets. (*subitizing*)

Big Ideas of Number Sense

Topic	Big Ideas	Examples
<p>Uses of Number</p> 	<ul style="list-style-type: none"> Numbers are used many ways, some more mathematical than others. 	<ul style="list-style-type: none"> Tommy has 5 books. (cardinal) Ava is fifth in line today. (ordinal) Numbers on basketball jerseys, home addresses, telephone numbers (nominal) Let's meet at 5 pm on December 5. (referential)
<p>Numerosity</p> 	<ul style="list-style-type: none"> Quantity is an attribute of a set of objects and we use numbers to name specific quantities. The quantity of a small collection can be intuitively perceived without counting. 	<ul style="list-style-type: none"> 5 mice and 5 elephants are alike in quantity, though different in other ways. Children just "see" three objects and know it's 3.

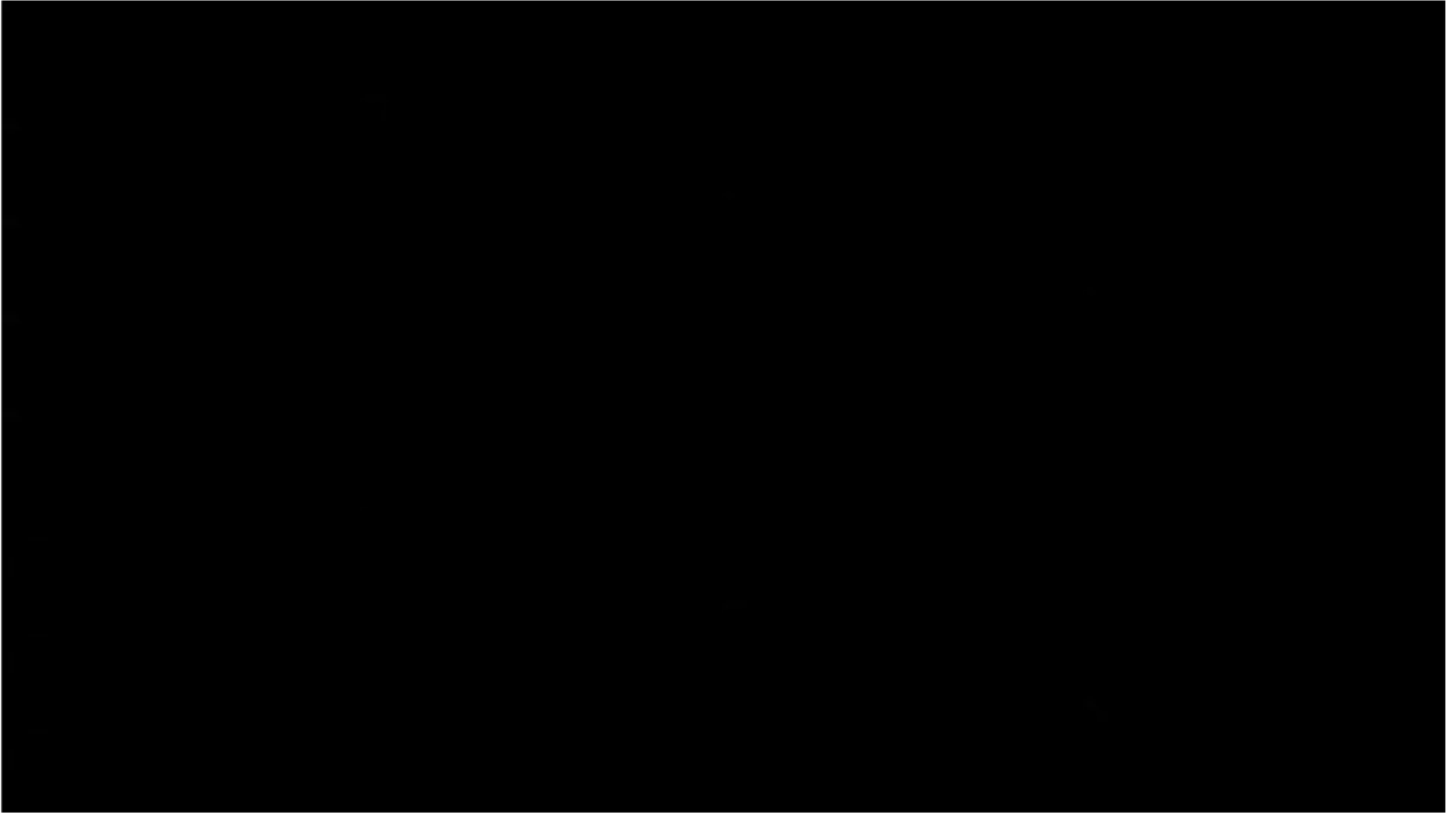
Video Analysis: Focus on the Child

- 1st clip: preschooler is comparing quantities of blocks
- 2nd clip: preschooler using chips to match quantity of dots on a card
- When watching these clips, consider:
 - *What does this child seem to understand about quantity and number?*
 - *What does this child say or do that is evidence of thinking?*

Video – Focus on Child: Comparing_Quantity-EMTR005

Comparing Quantity

Video – Focus on Child: Matching_Quantity-EMTR004



How do children develop the idea of quantity as an attribute?

- Older infants often learn signs/words for “more” and “all gone” before other ideas.
- Toddlers can tell that a pile of 5 is more than a pile of 2, even before they know any number names.
- Preschoolers are building a firm sense of the numerosity of 3, 4 & 5.
- Kindergarteners solidify number combinations to 10.

What is Number Sense?

“ ...good intuition about numbers and their relationships. It develops gradually as a result of exploring numbers, visualizing them in a variety of contexts, and relating them in ways that are not limited by traditional algorithms.”

(Howden)

What is Number Sense?

“ ...good intuition about numbers and their **relationships**. It **develops gradually** as a result of **exploring numbers**, **visualizing** them in a **variety of contexts**, and **relating** them in ways that are not limited by traditional algorithms.” (Howden)

Implications for Teaching & Learning

- Subitizing is foundational.
 - Subitizing relies on visual patterns.
 - Not all arrangements of a number are equally easy to “see.”
 - How is subitizing different than counting?
 - Quantify small sets with number, without enumerating.
 - Subitizing builds an understanding of cardinality.
 - When quantifying a set, state the name of the object in addition to the number name *“It’s 3”, “Yes, it’s 3 cups.”*
 - Expect children to subitize small sets; avoid “counting to be sure.”

Implications for Teaching & Learning

- Children learn about quantity even without exact numbers.
 - “Which pile has more?”
 - “Put one napkin on each plate.”
- Smaller numbers are foundational
 - With infants and toddlers, talk about “1” and “2” and “1 more” and “2 more”
 - With preschoolers, spend a lot of time exploring “3” and “4” and “5”
- Fingers are great tools for understanding small numbers, then building to 5 & 10.
- Children need **repeated exposure** to amounts in order to associate number name and quantity.
- Provide authentic opportunities for children to count

Use those fingers!



The five-ness of the fingers on one hand & the ten-ness of the fingers on two hands.

Composing & de-composing numbers with different arrangements of fingers.



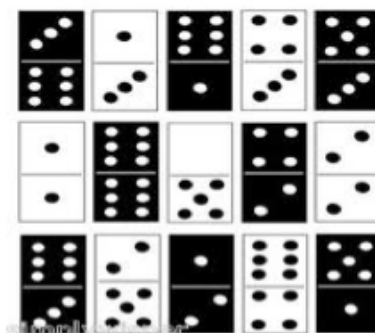
Using fingers with **songs and chants** to reinforce learning of number word list.



Materials to build visual number sense



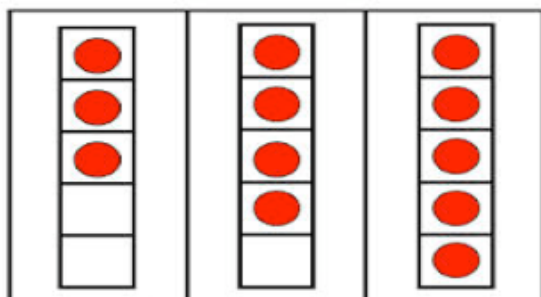
Dice



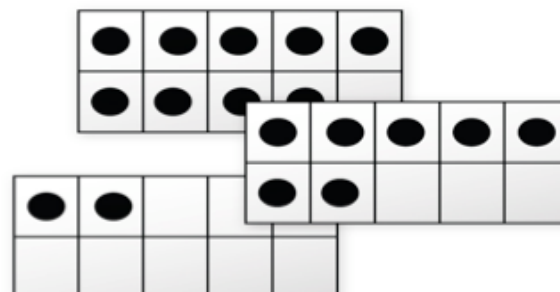
Dominoes



Dot Cards



Five Frames



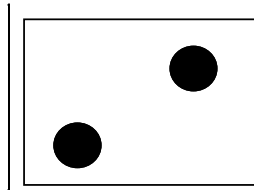
Ten Frames

How can we use quantity cards to build visual number sense?

- “Quick looks” to transition children
- “Quick looks” in small groups or games that use subitizing

Quantity Card dismissal

If you show a card with this quantity on it . . .

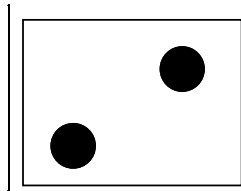


You might prompt ...

- Show me with your fingers how many dots you see ...
- Can you show me how many dots you see using 2 hands?

Quantity Card dismissal

Using the same card:



You might prompt ...

Use your fingers to show me one more than this many dots.

Use your fingers to show me one less than this many dots.

Let's try it!

Subitizing Matching Game

- Each table has 10 cards – place them face up. Take turns finding two cards that have the same quantity (even though the arrangement might be different)
- Teacher can comment, “you have 2 dots and 2 lines, but they are both 2 objects.”

Stop & Reflect

