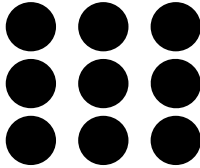# Visualizing Numbers to Ten

Student Probe

Show this dot arrangement to the student:

Only show it for 3 seconds (not long enough for the student to count). If a student can easily tell you it is 9 and can explain how they saw it (example: 3 and 3 and 3 or 6 plus 3), he/she may already be able to subitize. Try a few other random dot cards to 10 to check for sure. (See variations below)

Lesson Description

This lesson is intended to help students recognize quantities to 10 without counting. Dot pattern arrangements, five frames, and 10 frames will be used to develop students' mental mind map for the numbers 1-10.

Rationale

Subitizing helps children develop a mental imagery for numbers and their corresponding symbolic numerals. Subitizing is the first step in helping students construct an abstract sense of number. Subitizing helps students develop various mental pictures of numbers which enables them to "see" quantities as both decomposed parts and as a single unit. When a student has a firm mental picture of a number as a unit and understanding of how numbers can be arranged and broken apart, he or she can begin to develop flexible

At a Glance

<u>What:</u> Subitizing numbers 1-10
Relationships between numbers such as 1 more or 1 less, 2 more or 2 less, anchors to 5, anchors to 10
<u>Standard:</u>
AR.Math.Content.K.CC.B.4
Understand the relationship between numbers and quantities; connect counting to cardinality.
When counting objects:

- Say the numbers in order, pairing each object with only one number and each number with only one object (one-to-one correspondence).
- Understand that the last number said tells the number of objects counted.
- Understand that each successive number refers to a quantity that is one larger.

Note: Students should understand that the number of objects is the same regardless of their arrangement or the order in which they were counted.
<u>Mathematical Practices:</u>
SMP6: Attend to precision.
SMP7: Look for and make use of structure.
<u>Who:</u> Students who can't see a number quantity as a unit but only as collections of "ones".
<u>Grade Level:</u> Kindergarten
<u>Prerequisite Vocabulary:</u> How many?
Number words to 10
<u>Prerequisite Skills:</u>
Rote sequence of counting numbers to 12, one-to-one correspondence, ability to orally match a numeral with a quantity to 10
<u>Delivery Format:</u> Individual, small group
<u>Lesson Length:</u> 15 minutes every day
<u>Materials, Resources, Technology:</u>
Dot Cards 1- 5
Dot Cards 5-10
Five Frame Arrangements and Template
Ten Frame Arrangements and Template
2 color counters or black dots
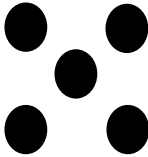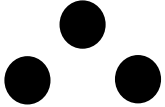Parent Instructions for work at home.
<u>Student Worksheets:</u> Students may use a piece of copy paper for the workspace when building dot arrangements.
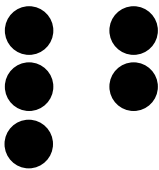
thinking strategies for computing numbers.

Preparation
Prepare a set of dot cards, five frames and ten frames.

Lesson

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
1. Choose a dot card that will challenge but not overwhelm the child. (for example 5) Show the pattern for 2 to 3 seconds and then ask: How many dots did you see? Show it again if necessary but avoid showing it for more than three seconds. You don't want the child to count the dots.	"5" 	Have the child build the arrangement with counters (if using two-colored, make sure the child only uses one side or the other so color does not interfere) OR Have the child draw the arrangement OR Choose a smaller quantity (2-4). For example:
2. Exclaim: How were you able to know that so quickly? You didn't have time to count by ones! (*Do NOT have students prove their answer is correct by having them count by ones. This defeats the purpose of trying to have them see the number a unit.*) Ask: How were the dots arranged? OR What did the dots look like?	I saw "2 on the top, 2 on the bottom, and 1 in the middle" OR "A square with one in the middle" (ask "how many dots mad up the square?") OR "4 and 1"	If a student says I saw it in my head, say "pretend I can't see the dot arrangement, can you explain to me about how I might build it?" You may need to probe a little by saying "What is the shape?" or "Are there some on the top or some on the bottom?"

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
3. Ask: Have you ever seen this pattern anywhere else? (common answers: dice, dominoes, bowling pins, ball field (5 bases))	Dice, dominoes, bowling pins, ball field (5 bases)	Ask probing questions such as: What about games you play? Have you ever seen it there? Help them think about it or show a die or domino with the arrangement.
4. REPEAT with another arrangement for the <u>same</u> quantity and repeat steps above. For example, the quantity of 5.	"5" ● ● ● ● ●	Have the child build the arrangement with counters (if two-colored, make sure the child only uses one side or the other so color does not interfere).
5. Ask: How were the dots arranged? OR What did the dots look like? OR If I closed my eyes, what would I see?	"I saw 3 and 2" OR "I saw 2, 2, and 1: OR "I saw a line of 3 and a line of 2"	If a student says I saw it in my head, say "pretend I can't see the dot arrangement, can you explain to me about how I might build it?" You may need to probe a little by saying "What is the shape?" or "Are there some on the top or some on the bottom?"
6. Put both dot arrangements side by side and compare. Ask: So do you agree this arrangement is 5? (point to one.)	"Yes"	If a student says no, refer back to what was said earlier.
And you also agree this is 5? (Point to the other one.)	"Yes"	Flash the arrangement again so he/she can remember that it is 5.
Ask: How can they both be 5? They don't look the same?	Because they are both 5	
How do you know?	Because 3 and 2 is 5 and 4 and 1 is 5 (or something to that effect).	If student is unable to explain go directly to the next step.

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
7. Tell the students: Please make both arrangements side-by-side. See if you can make one arrangement look like the other one.	The student will rearrange one of the arrangements to look like the other arrangement.	Ask: Could you move some of these dots around to make this dot arrangement look like this one?
Are they both 5?	Yes	Have student count both if necessary.
How do you know?	Because I made they are both 5, they just look different.	
So can they both be 5 even though they don't look the same?	Yes	
8. Continue in this manner until student has mastered all arrangements.	Student confidently names the value and can explain how he/she knows.	

Teacher Notes
Cut-out dot cards and glue to inexpensive paper plates for easy handling when implementing the dot flash. Also sets can be made to send home with students. Include the parent directions linked in the resource section.

Students need **lots** of practice with these patterns. It is helpful to work with one number at a time using different arrangements so students become proficient with all the arrangements for each quantity. Start with the numbers 1-5 using dot card arrangements and five frames. Then move on to 6-10 quantities using dot card arrangements and ten frames. Students must easily articulate the values and arrangements in order to be considered proficient.
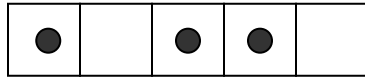
Variations

Five Frames

Materials: five frame arrangements and template
Use the same lesson format as with the dot cards.
Probe: Show a five frame to the student:
Example:

How many dots? (3) How do you know; you didn't have time to count? (I saw one dot and two dots) And what do you know about one and two; how many altogether?) How far from 5? How do you know?
How many spaces? How do you know?
Use the template and have students duplicate the arrangement on their template using black dots or two-color counters.
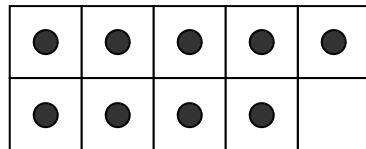
Ten Frames

Materials: Ten frame arrangements and template
Use the same lesson format as with the dot cards.
Probe: Show a ten frame to the student:
Example:

Questions vary:
How many dots? How do you know? How far from 10? How do you know?

1 More/1 Less

Materials: Dot cards
After students become very *fluent* with all the dot pattern arrangements to 10, begin working with the relationships of numbers to 10. Ask students to try to mentally visualize any arrangement of 5. Tell them to close their eyes to visualize the dot arrangement. Ask them to raise their hand when they can "see" it. Ask a student to explain what they are "seeing". Then ask students to mentally take one of the dots away or ask what is one less than 5? Ask: How many do you see now? The student should say "4". Ask, how do you know? Which dot did you mentally take away? Respond by saying "so what you are saying is one less than 5 is 4? Do you agree? Next, begin to flash the dot cards, saying, "now when I flash the dot card I want you to tell me what is one less than the total number of dots you see. Are you ready? Proceed as with the subitizing except that students are now explaining and determining one less.

2 More/2 less

Materials: Dot Cards

This process will be just like 1 more/1 less except instead of choosing 5 to visualize, maybe choose 7 so the arrangement is easy to mentally take away 2

Formative Assessment

Keep track of which numbers students can easily subitize. Continue working with the student using these materials and questions until all quantities and all arrangements of each quantity are mastered.

For the relationships of numbers, listen to students as they explain "how they know". Continue until students are confident and explaining easily.

References

Elementary and Middle School Mathematics, Teaching Developmentally, Fifth Edition, John A. Van De Walle, pp. 119-124.

Coming to Know Number, by Grayson Wheatley, Second Edition, 2010.

An Emerging Model: Three-Tier Mathematics Intervention Model. (2005). Retrieved January 13, 2011, from rti4success: http://www.rti4success.org/images/stories/pdfs/serp-math.dcairppt.pdf

Mathematics Preparation for Algebra. (n.d.). Retrieved January 13, 2011, from Doing What Works: http://dww.ed.gov/practice/?T_ID=20&P_ID=48