Number Routines in K - 3

Presented by Jen Barker
Port Hardy, BC
November 23rd, 2018

A little about Me…

- I am a Numeracy Helping Teacher in Surrey
- 20th year of teaching
- Mom to M&M, aged 15 and 13
- Twitter: @BarkerJbarker
- www.meaningfulmathmoments.com
- Email: barker_jennifer@surreyschools.ca
- Believe Math should be meaningful, authentic, engaging and build conceptual understanding

Learning Intentions

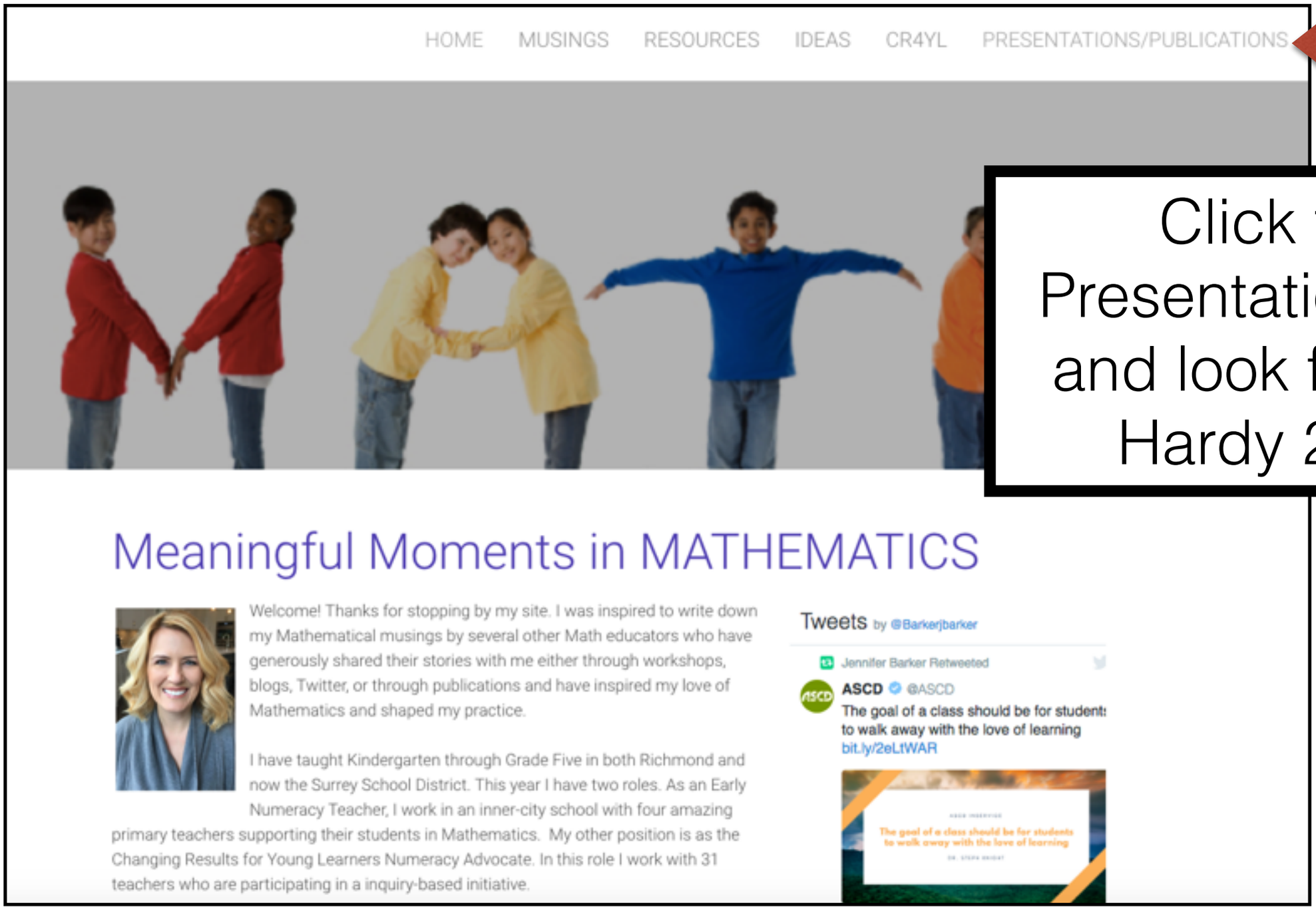
- I understand how using 5 - 10 minute daily Number Routines can develop my students' number sense, computational fluency and spatial sense.

- I understand how using Number Routines helps to build a Mathematical Community and encourages my students to share and communicate their thinking.

- I have one or two Number Routines that I feel comfortable exploring with my class and I understand how to differentiate these to meet the needs of my students.

Where can you find the PPT?

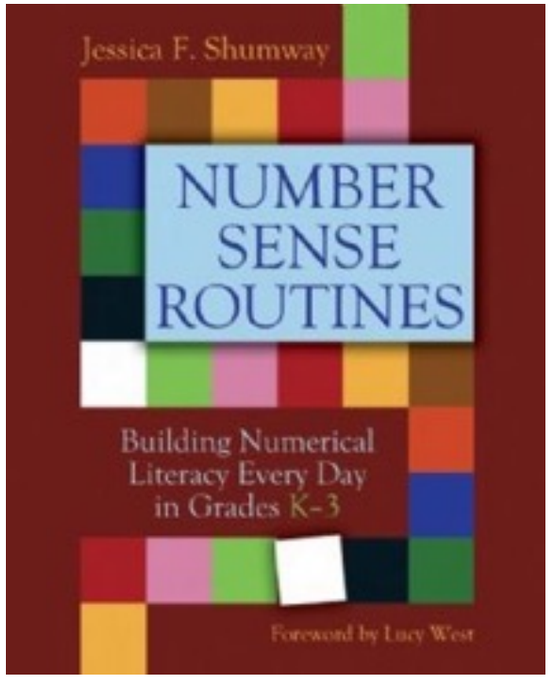
www.meaningfulmathmoments.com

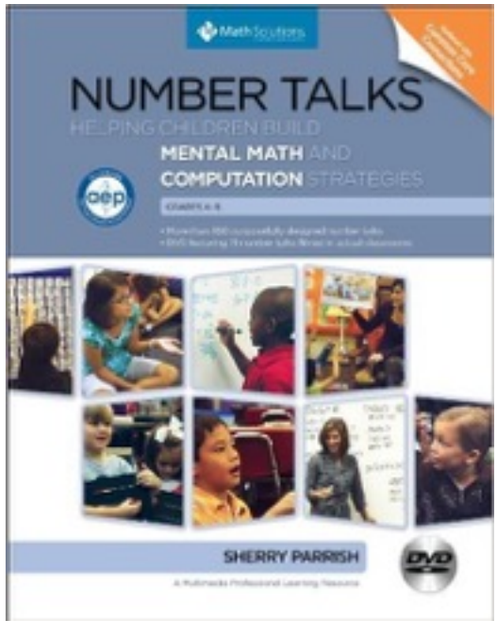


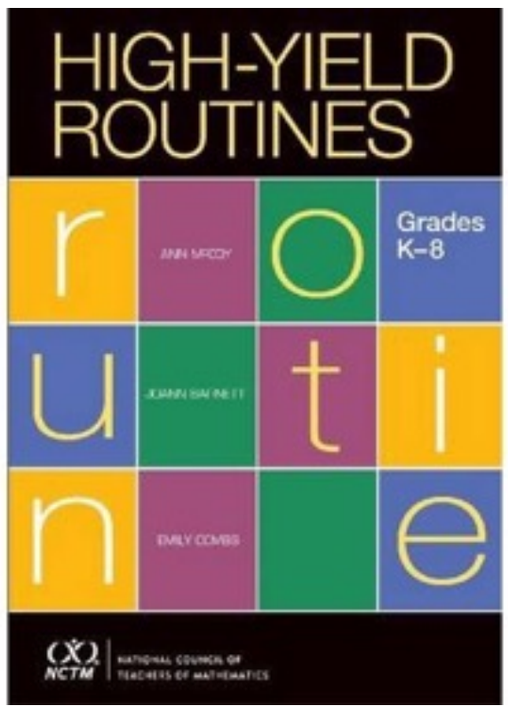
Click the Presentations tab and look for Port Hardy 2018

What are Number Routines?

- Collection of quick, low-prep 5 to 10 minute activities.
- They focus on the big ideas in Mathematics.
- They serve to reteach, reinforce, and enrich.
- Can be used as warm ups, mini lesson, with the whole class or in small groups.





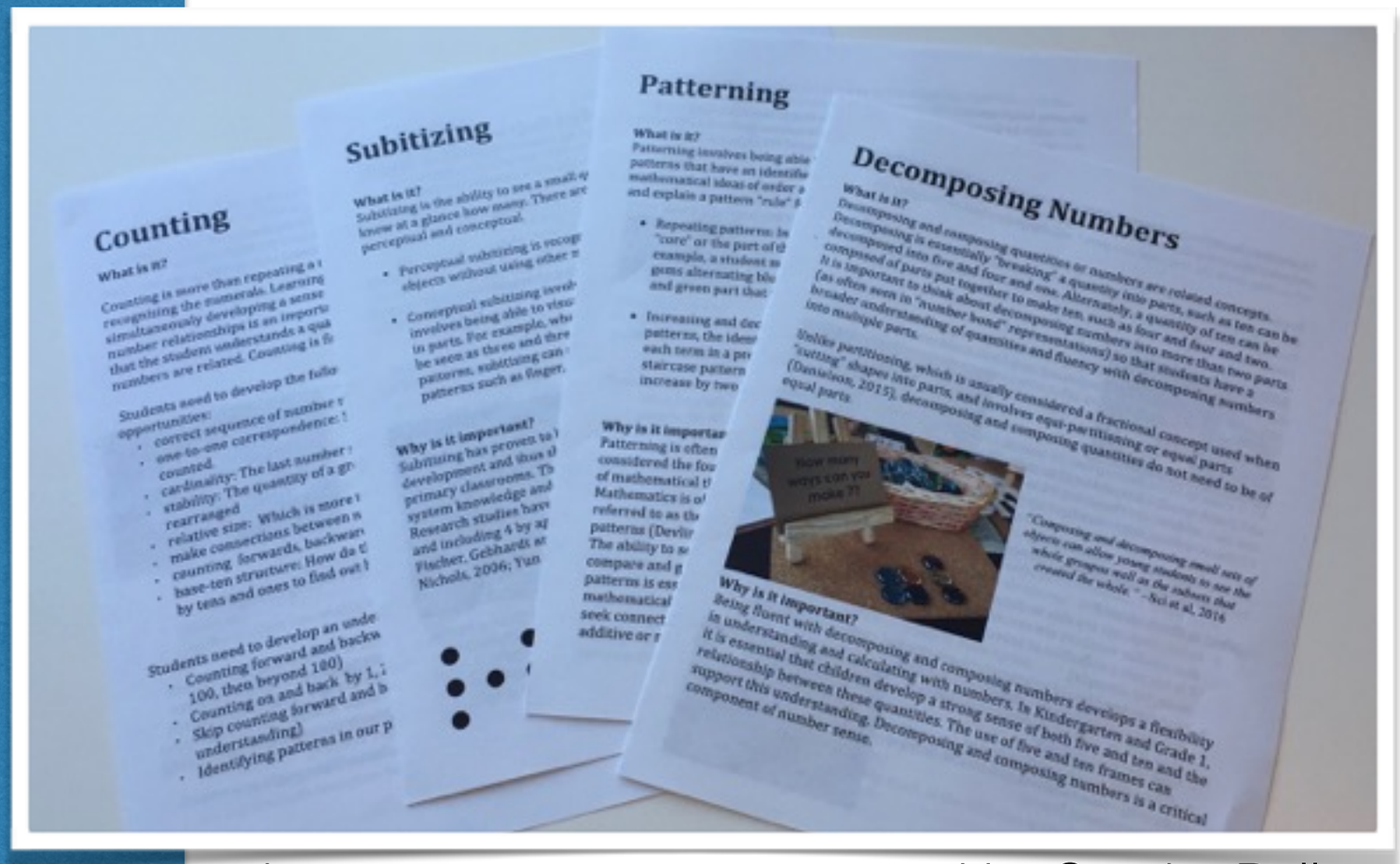


Why use Number Routines?

- Builds a Math community where students feel safe to take risks and can learn from one and other
- Provides daily number sense experiences
- Fosters discussion about numbers and their relationships
- Responsive to students' understandings
- Allows for spiralling through concepts and helps students make connections to the big ideas in mathematics
- Emphasizes the core and curricular competencies in relation to mathematical content.

What are the BIG ideas in Number for Primary Students?

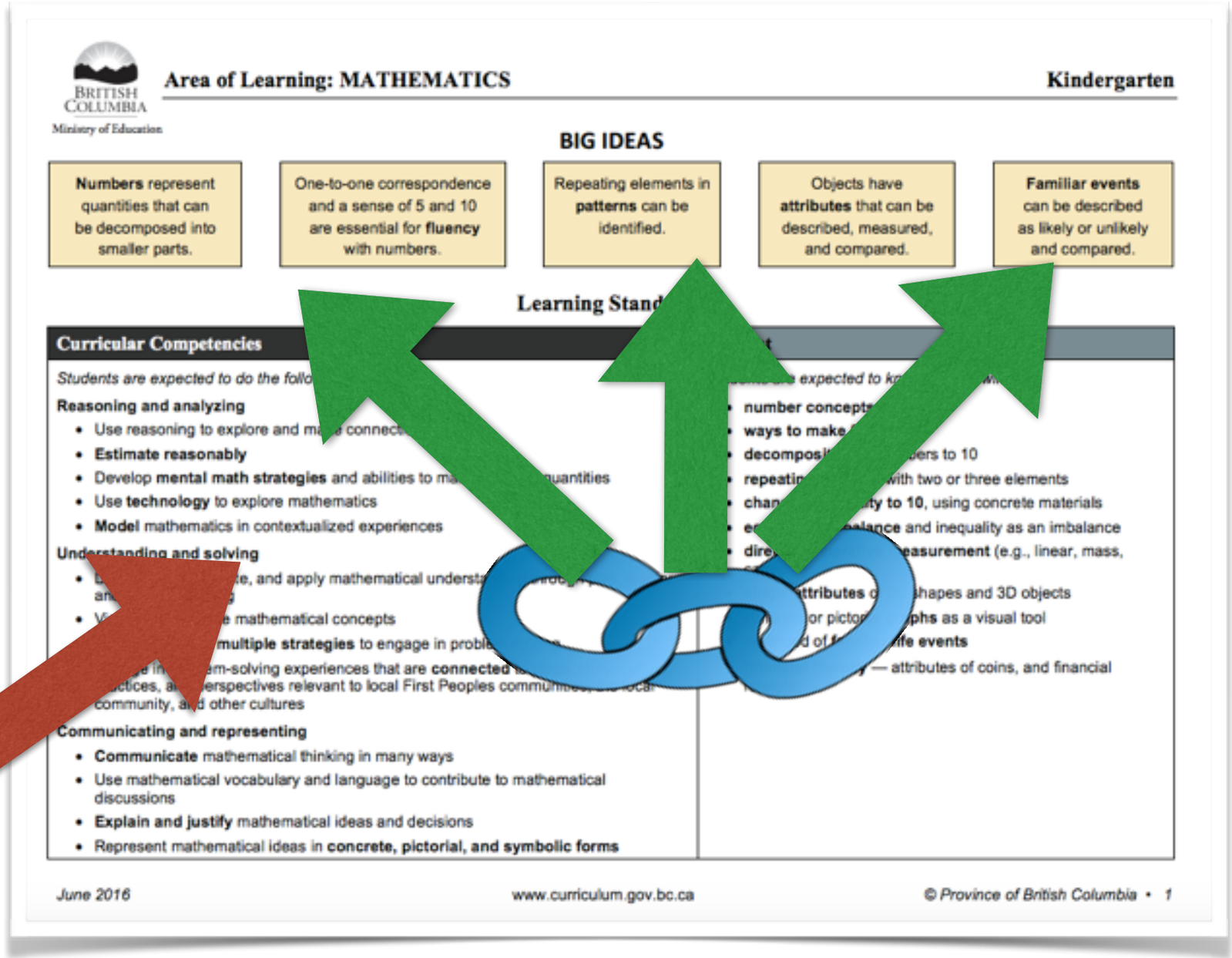
- Subitizing
- Counting
- Place Value
- Decomposing
- Patterning
- Spatial Awareness



These one pagers were created by Sandra Ball and Janice Novakowski.
They can be found at http://janicenovkam.typepad.com/reggioinspired_mathematic/instructional-resources.html

How does this relate to the revised Curriculum?

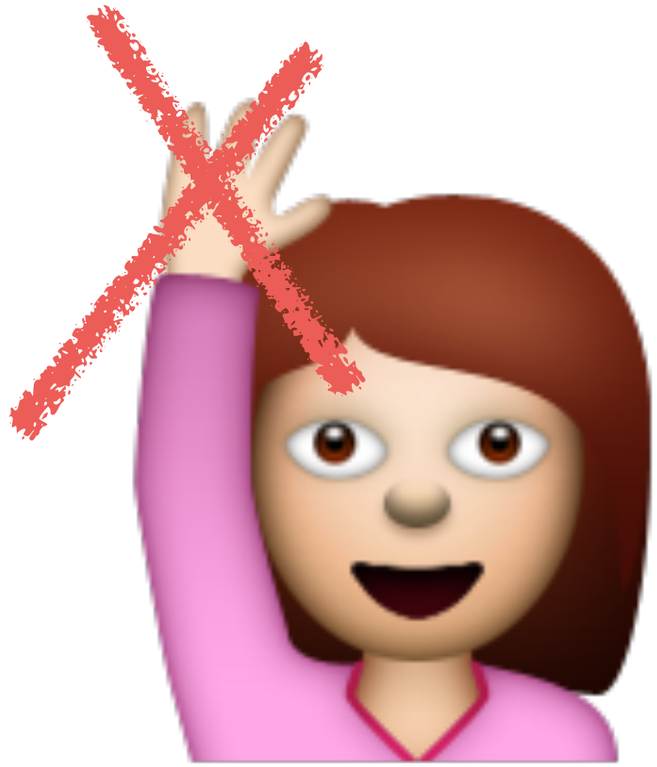
The mathematical discussions embedded in the routines foster the curricular competencies in relation to the content.



What Curricular Competencies are fostered?

- **Reasoning and Analyzing** through estimating and developing mental math strategies and abilities to make sense of quantities
- **Understanding and Solving** through using multiple strategies
- **Communicating and Representing** their thinking not only orally but through concrete materials, pictorial representations, and symbolically
- **Connecting and Reflecting** through visualizing and describing mathematical concepts, connecting mathematical concepts, and sharing and reflecting upon their thinking

Thinking time is needed



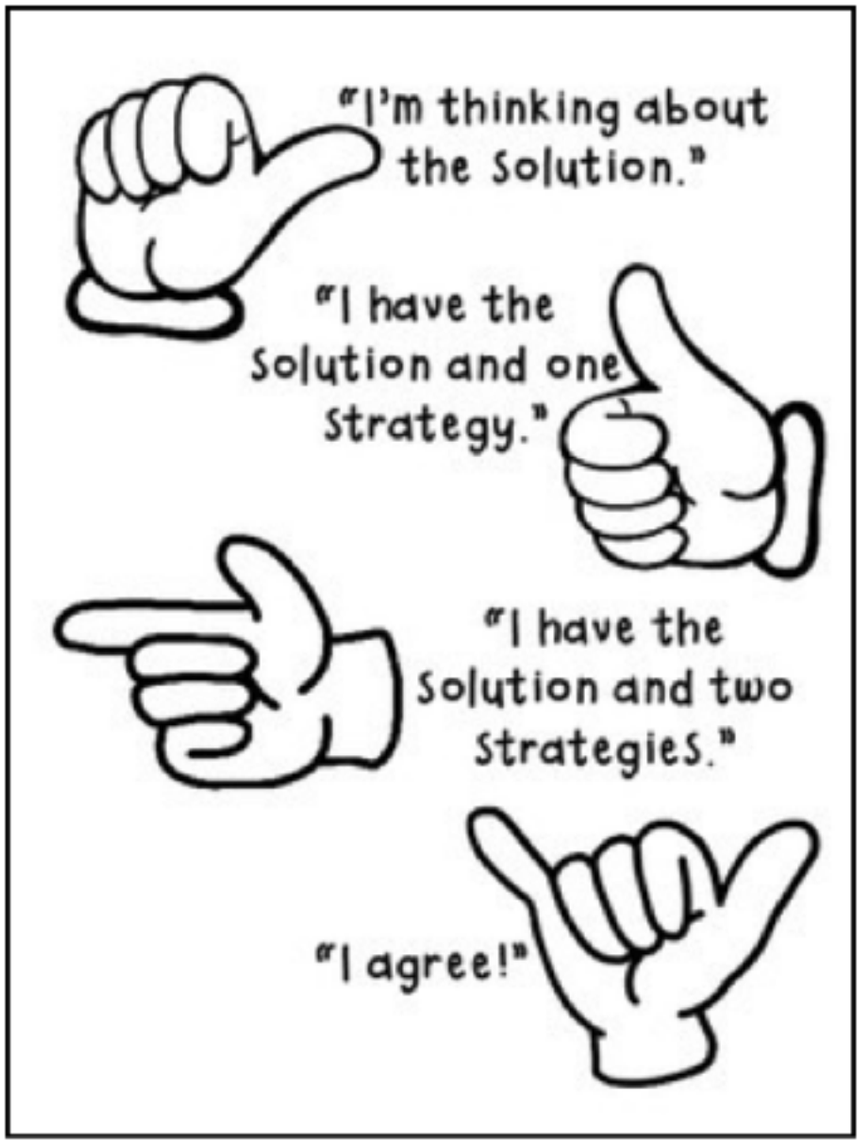
NO HANDS UP

SECRET SIGNALS

Hold up one thumb if you have one way to find the answer.

Hold up another finger if you another way…

Thinking Thumbs

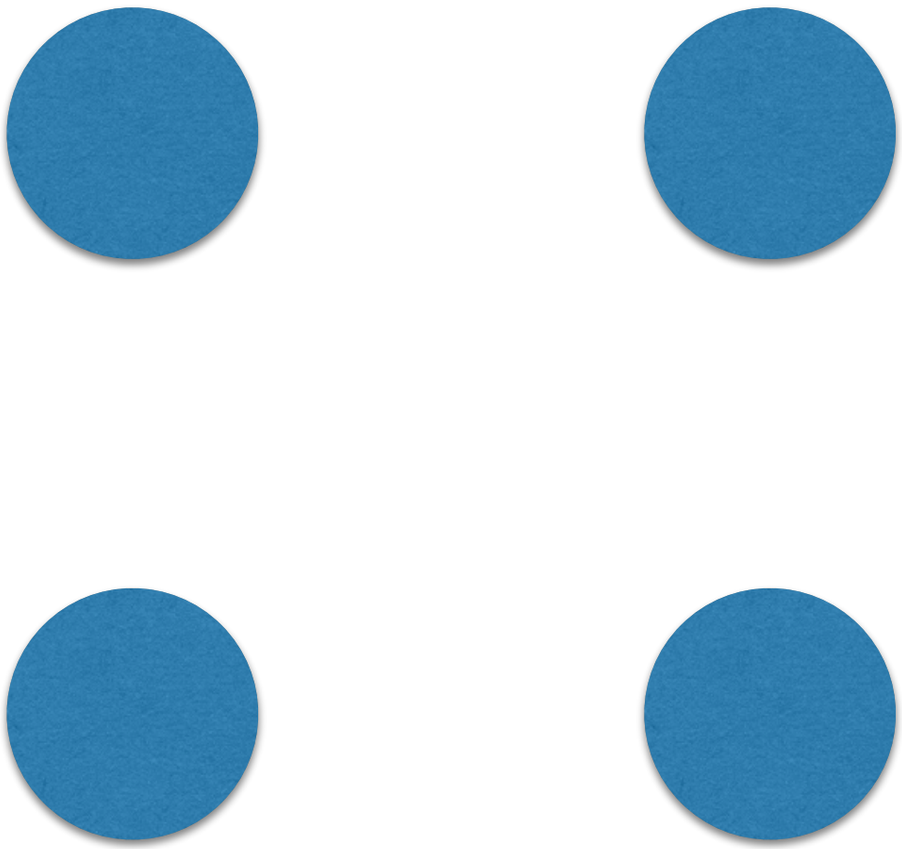


SUBITIZING

It is the ability to instantly see how many!

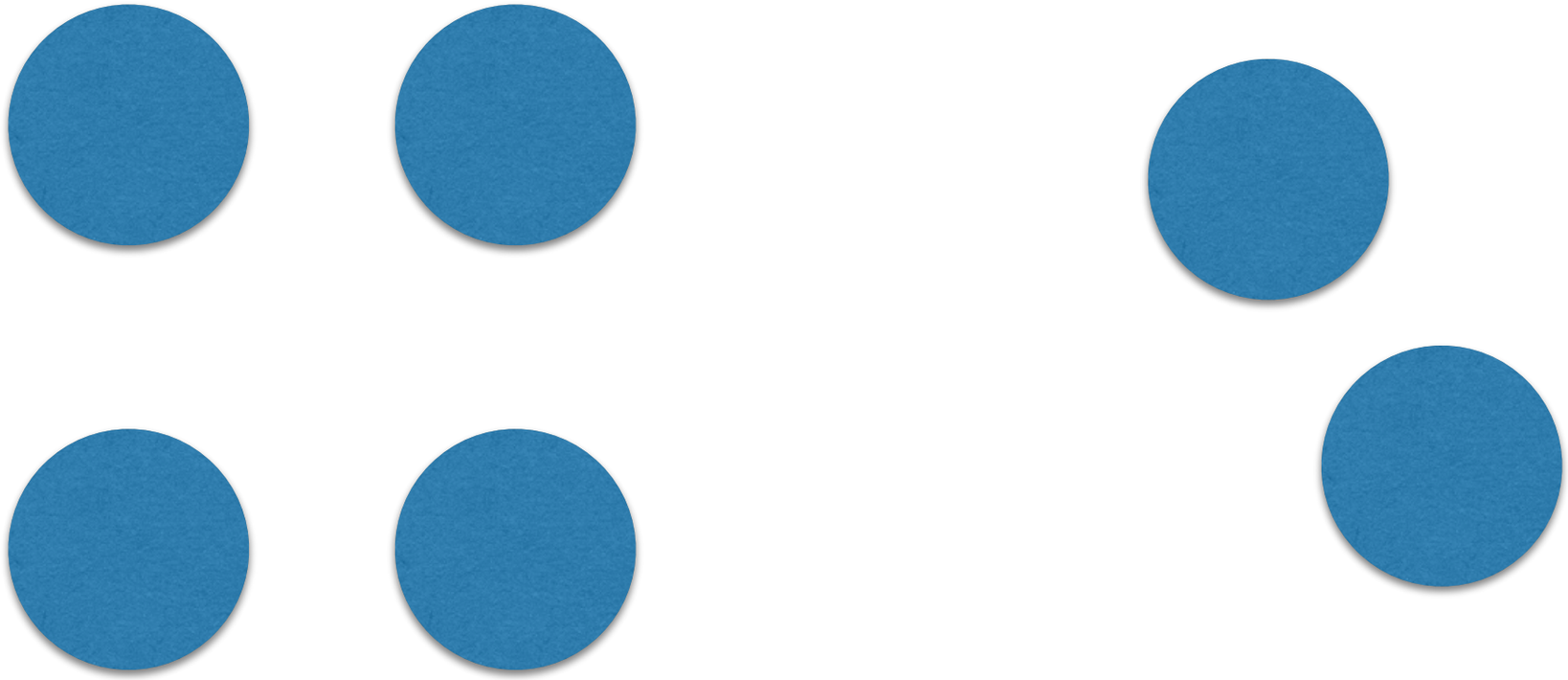
It is important because students need to develop:

- ability to move beyond counting to see spatial patterns
- seeing groups/sets of #'s
- using benchmarks of five and ten
- develop part-part whole understanding



How many?

How did you see them?



How many?

How did you see them?

Quick Images

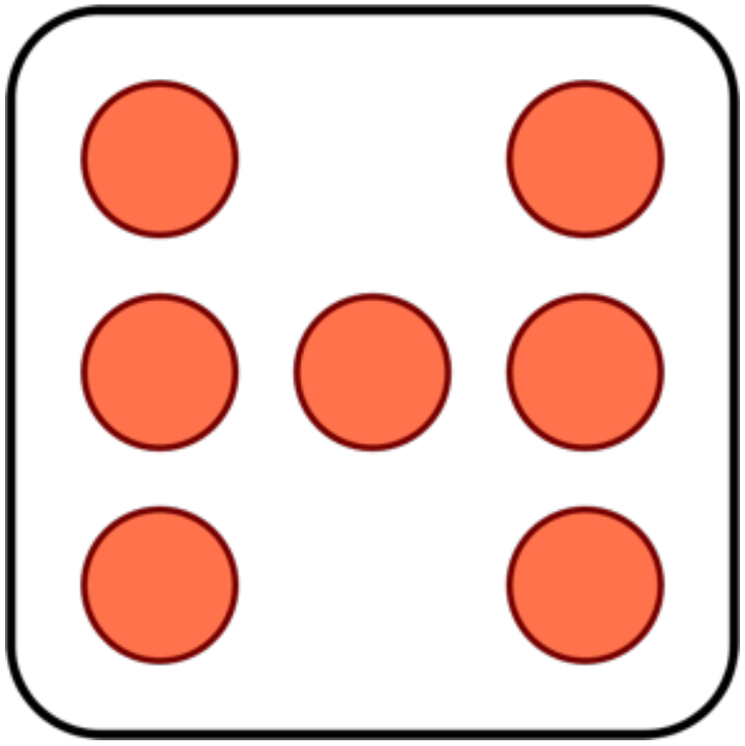
Learning Intentions:

- Subtilizing (Perceptual and Conceptual)
- Visualization
- Decomposing and Recomposing
- Mental Math Strategies

<u>Perceptual Subtizing</u>
Taking a “mental picture” and quickly being able to know how many are there.

<u>Conceptual Subitizing</u>
Seeing quantities in groups (e.g., I see 3 and 3 and know it is 6)

Dot Cards



Flash and Say

Flash and Show

Give SILENT thumbs up!

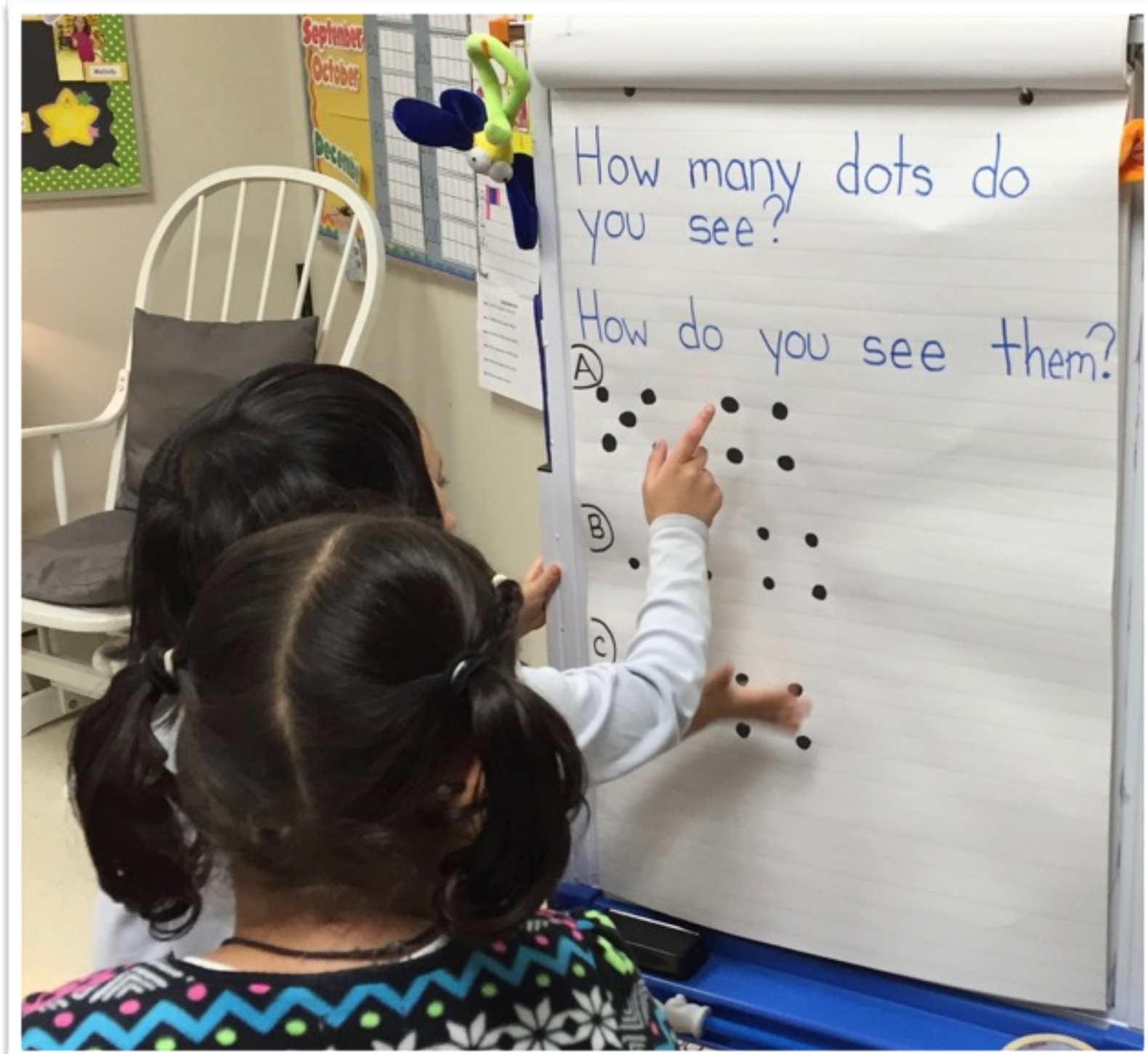
“How many do you see?”

“How did you know so quickly?”

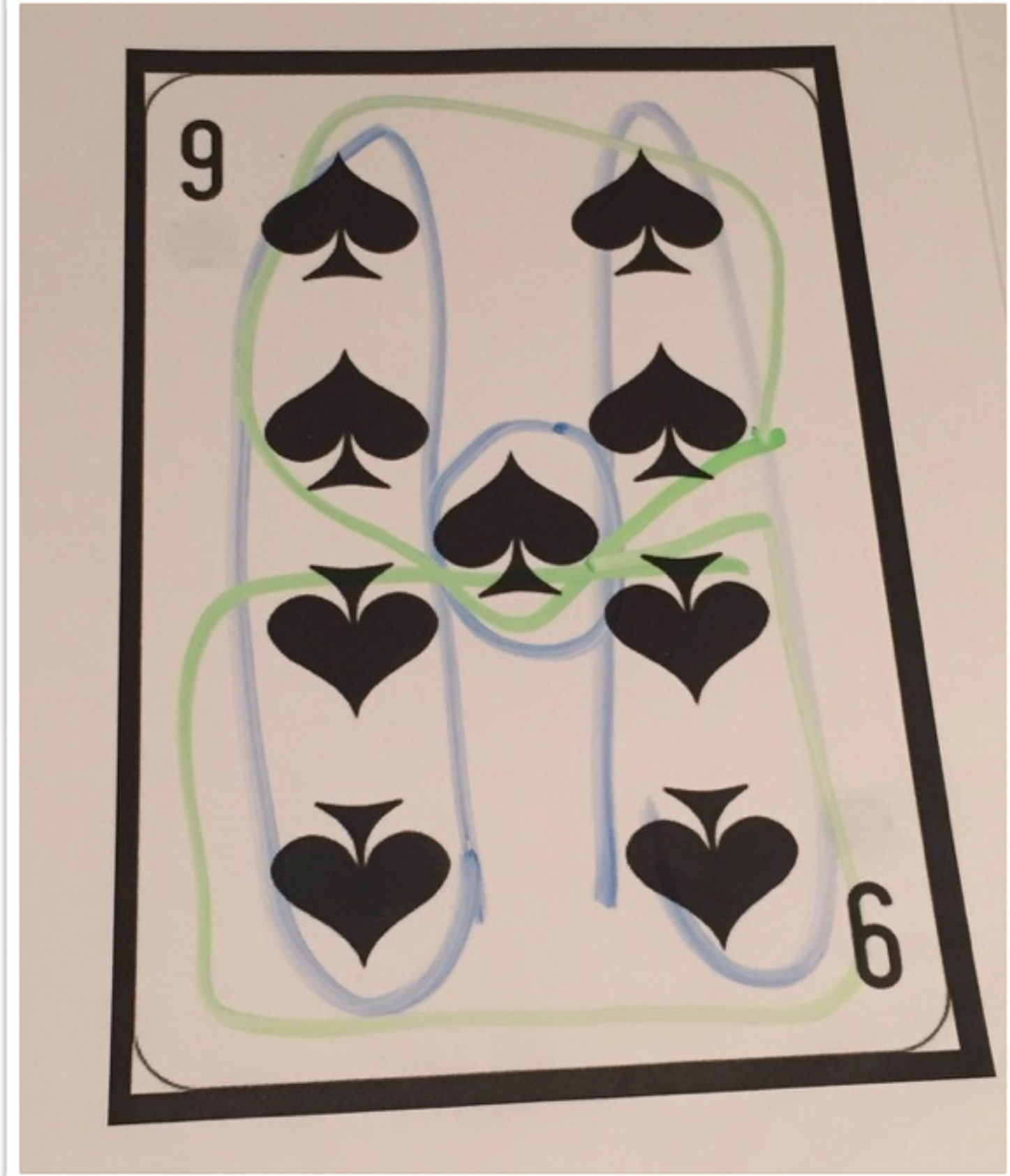
“How did you see them?”

Pie Plates/ Paper Plates

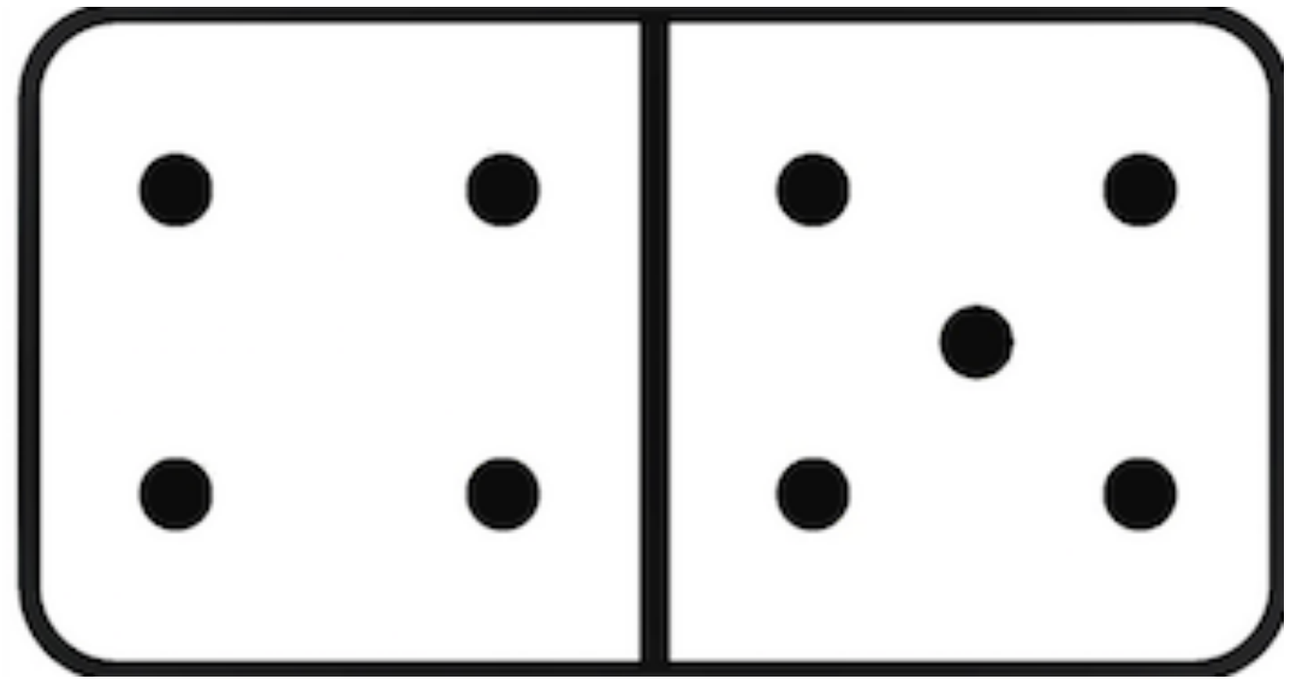
Chart Paper


September
October
How many dots do you see?
How do you see them?
A
B
C

Playing Cards


9
6

Dominoes



How many do you see?
How do you see them?

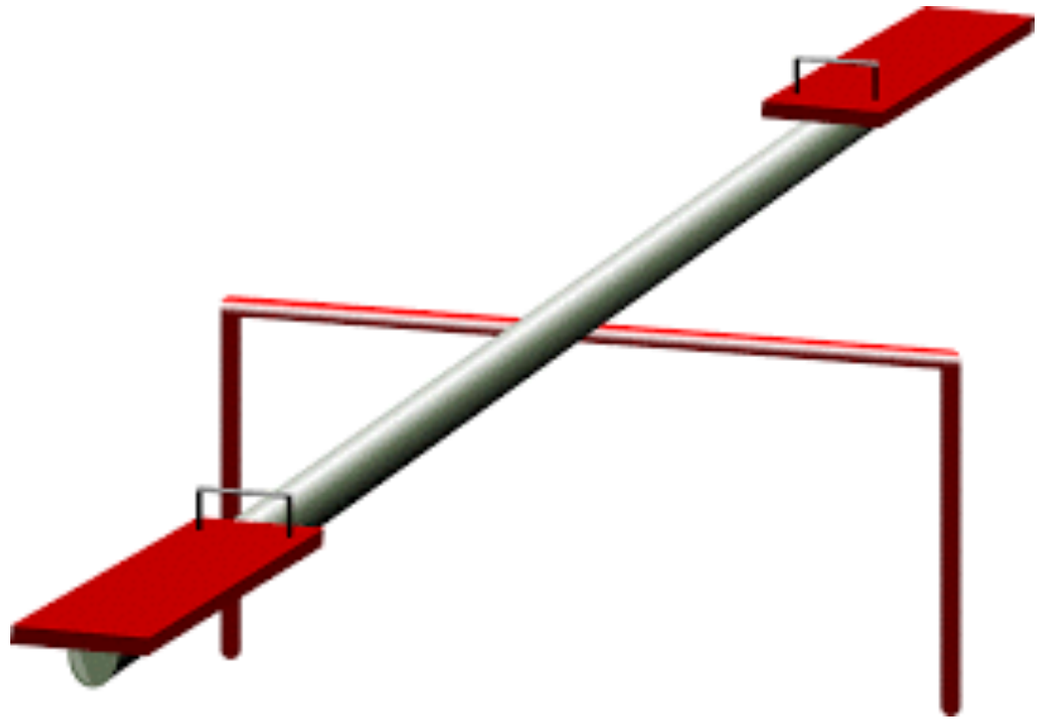
Teeter Totter

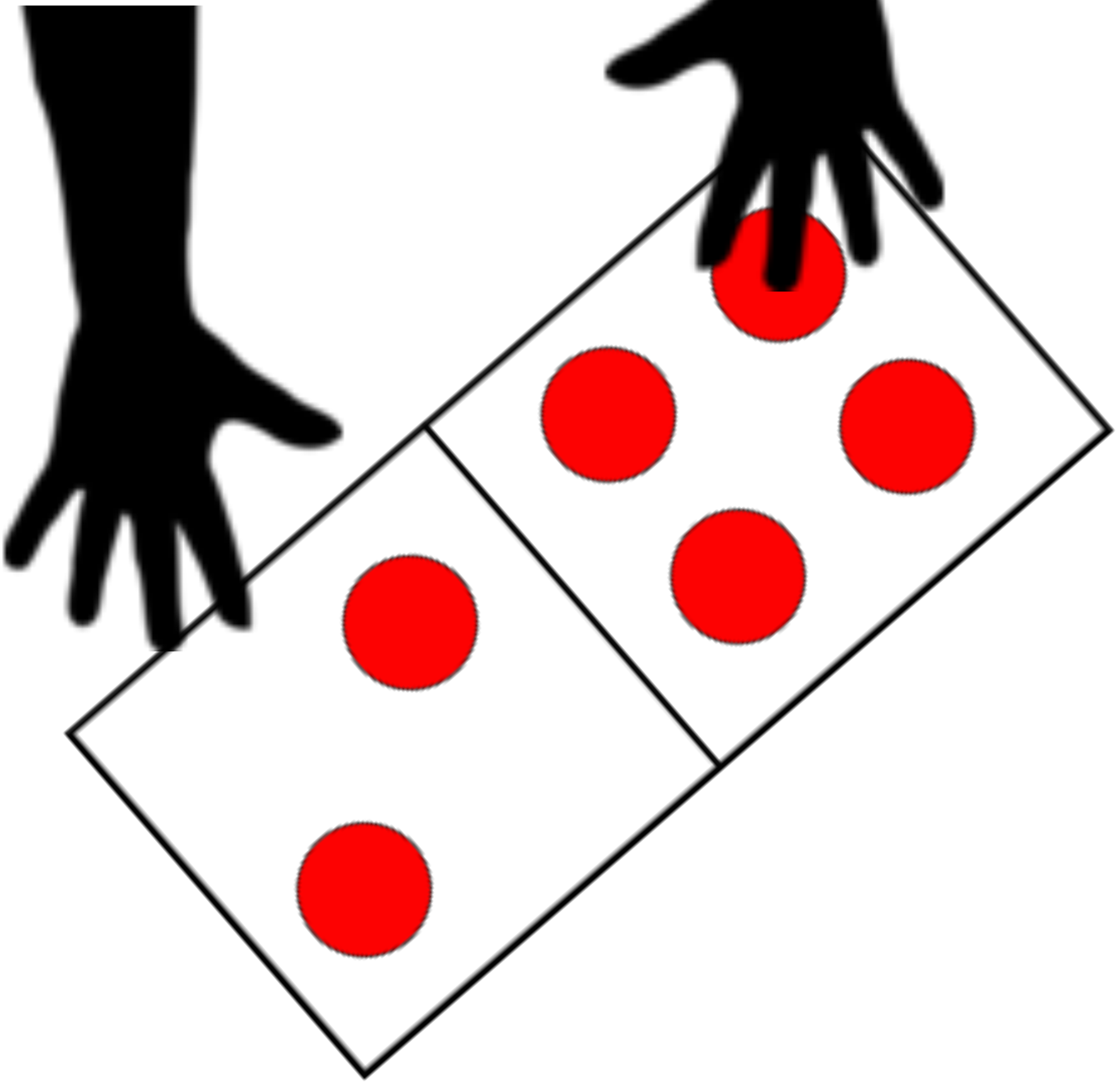
Learning Intentions:

- Subtilizing (Perceptual and Conceptual)
- Visualization
- Magnitude (more or less)

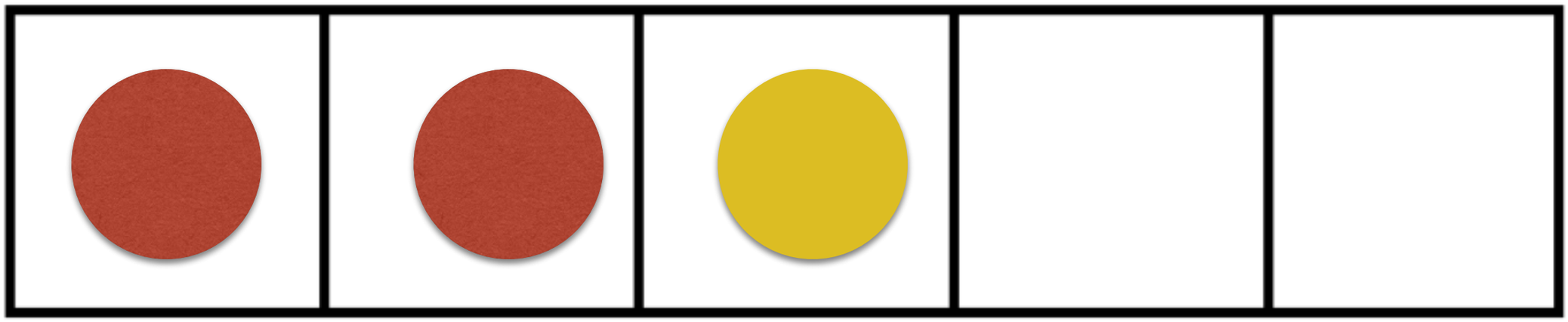
Items you could use:

- Any of the quick image items





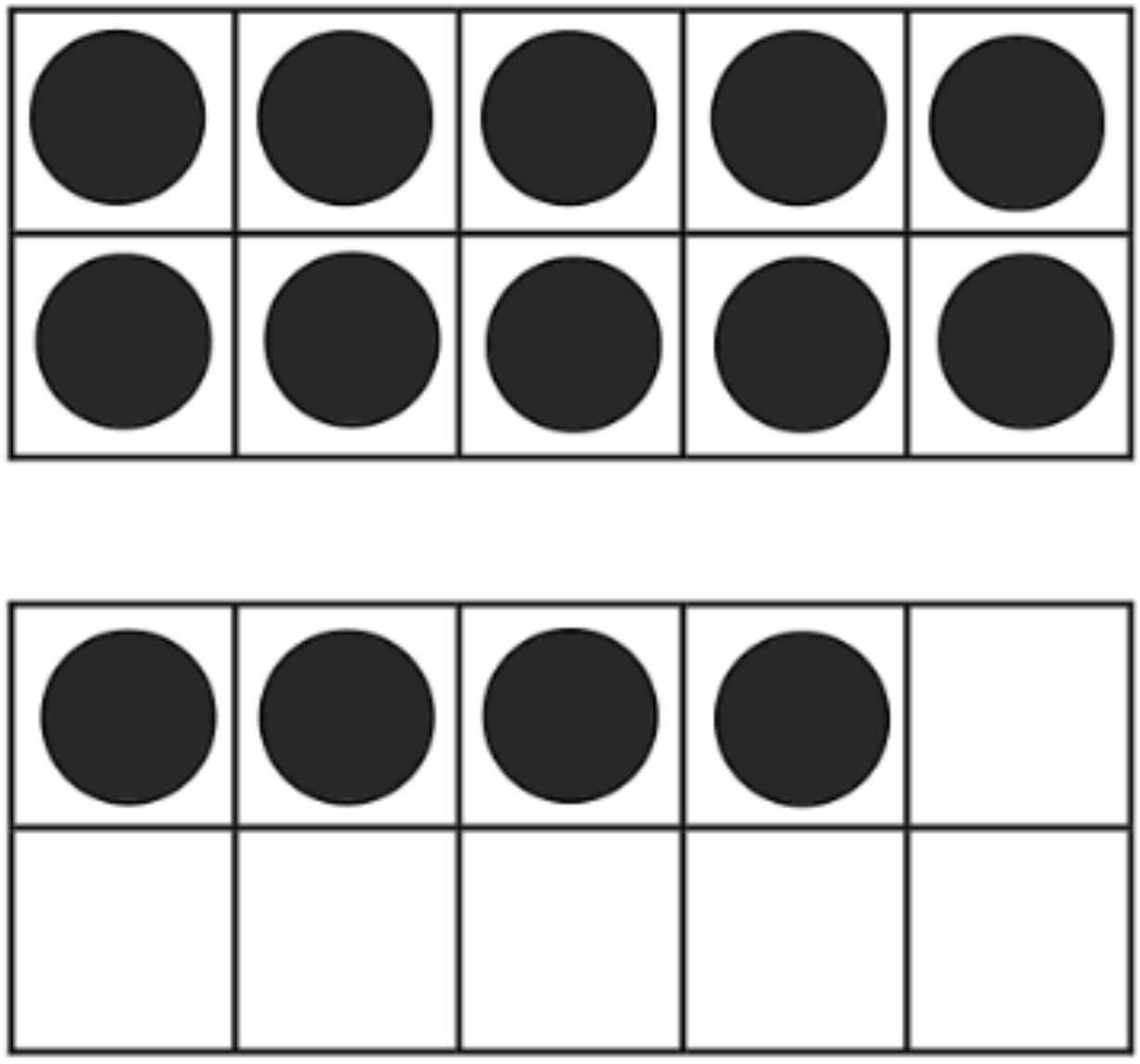
Five and Ten Frames



How many?

How did you see them?

Double Ten Frames



Video Example
www.mathsolutions.com/NTWNC21

What questions does the teacher use to build understanding about decomposing and composing numbers?

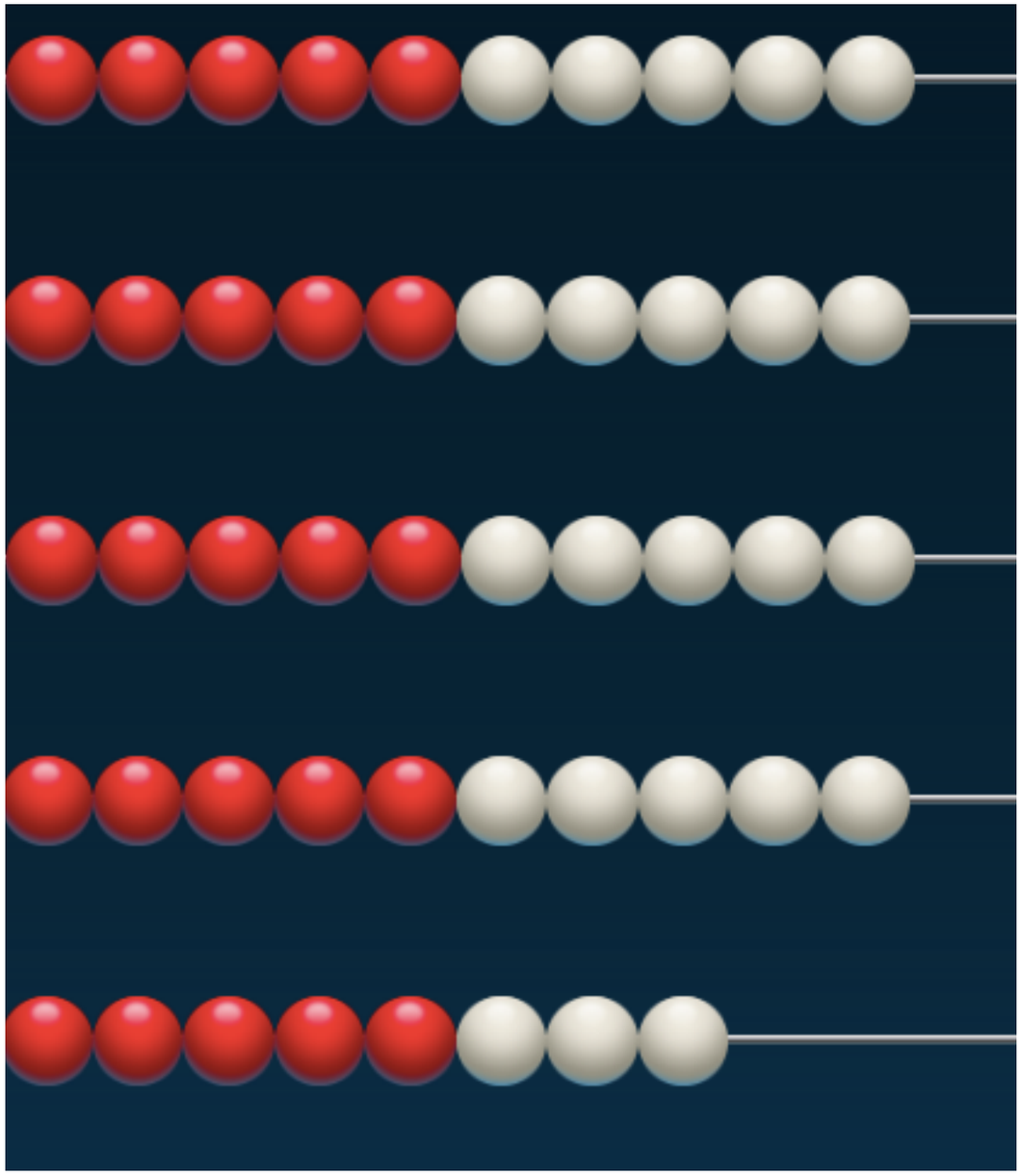
What strategies are the students using?

Rekenrek or Math Rack

There is 8!

I know it is 8 because I see

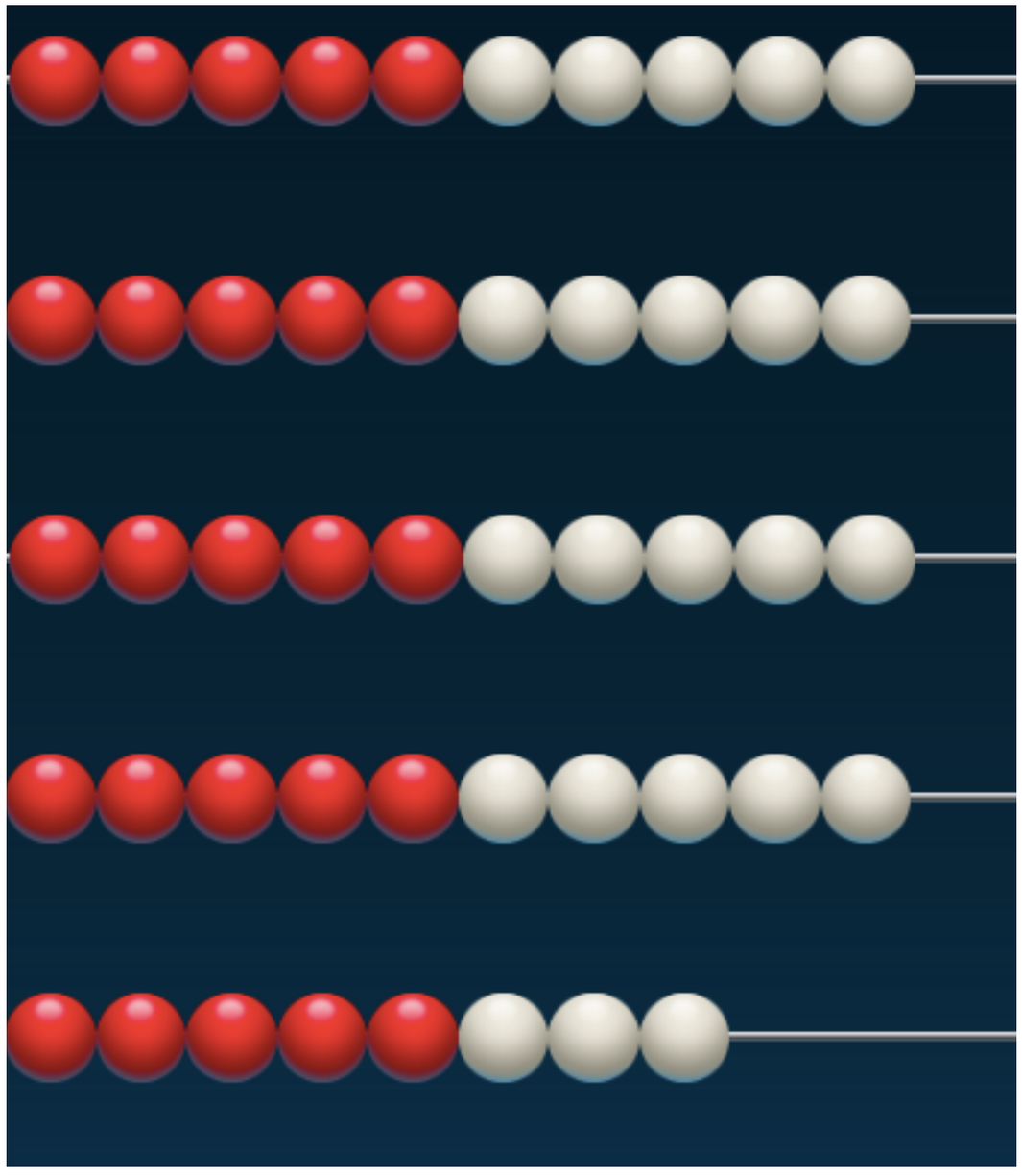
5 and 3



https://www.mathlearningcenter.org/resources/apps

How many?

How did you see them?



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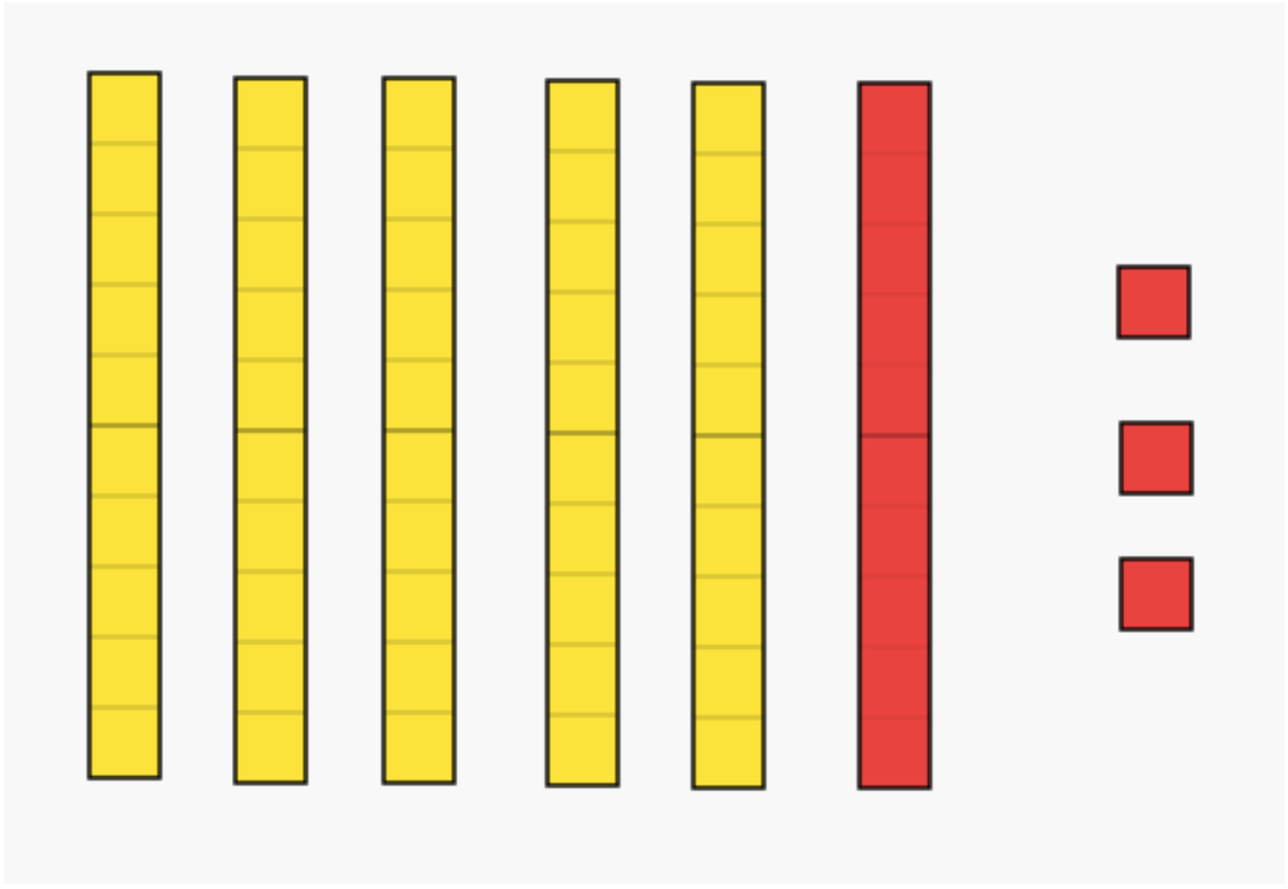
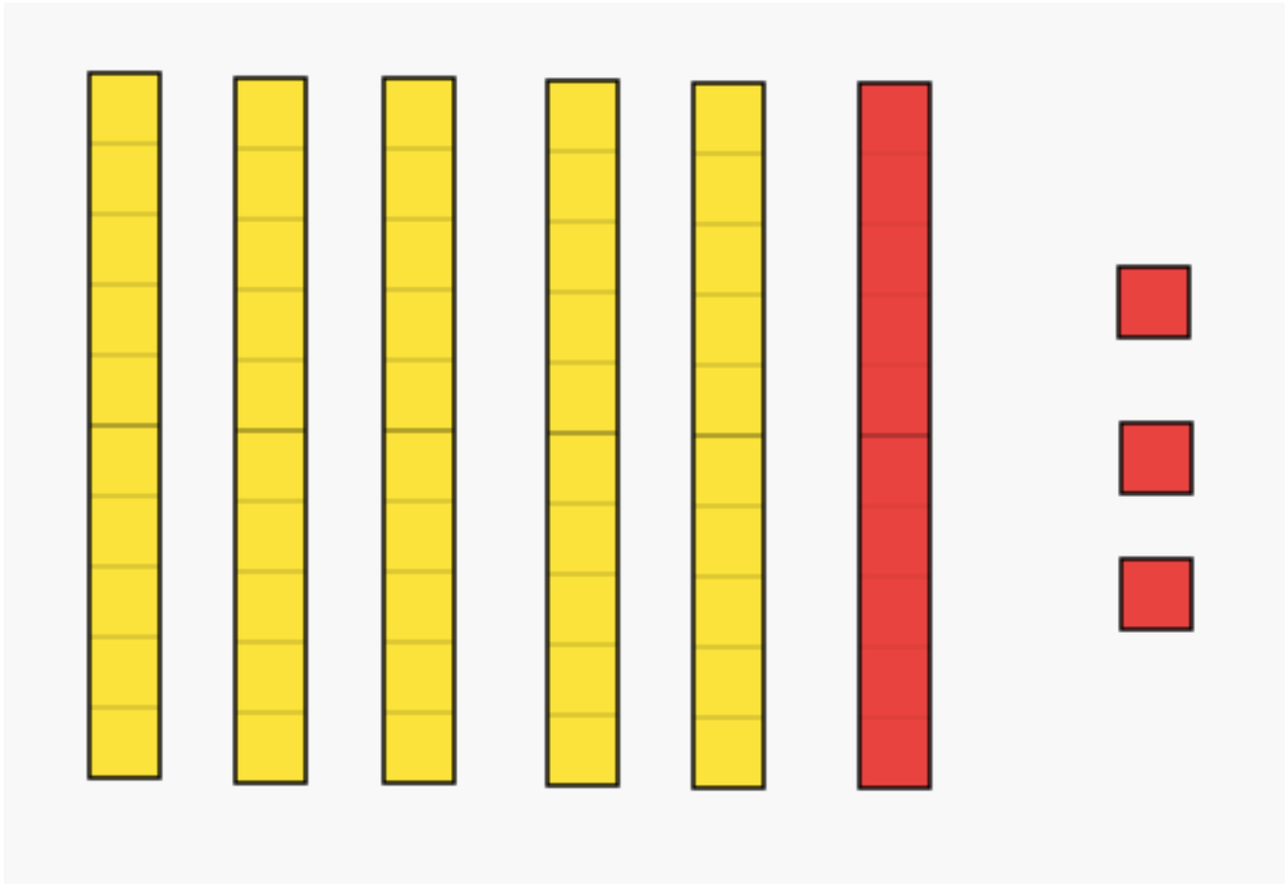


https://www.mathlearningcenter.org/resources/apps

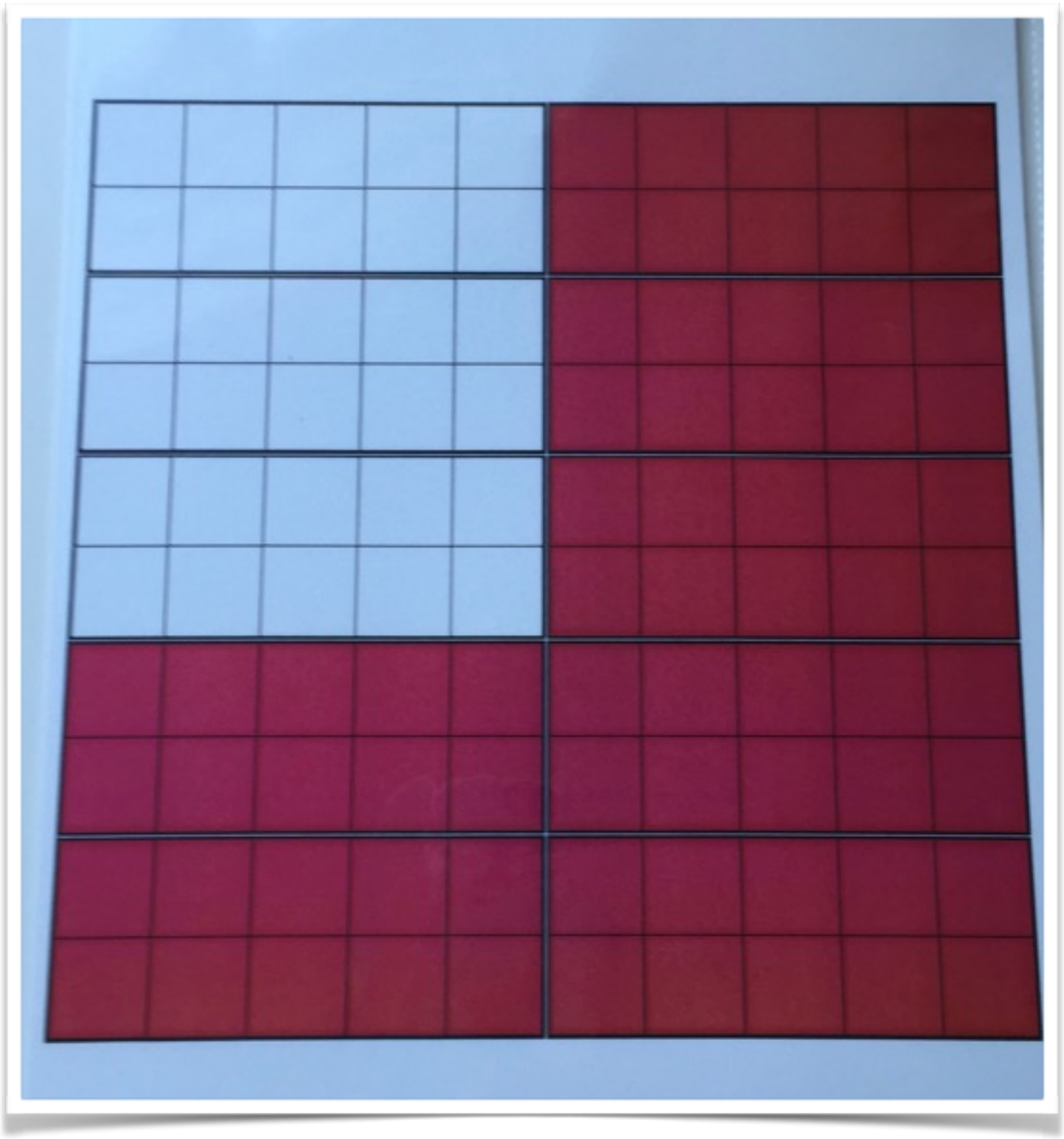
How many?

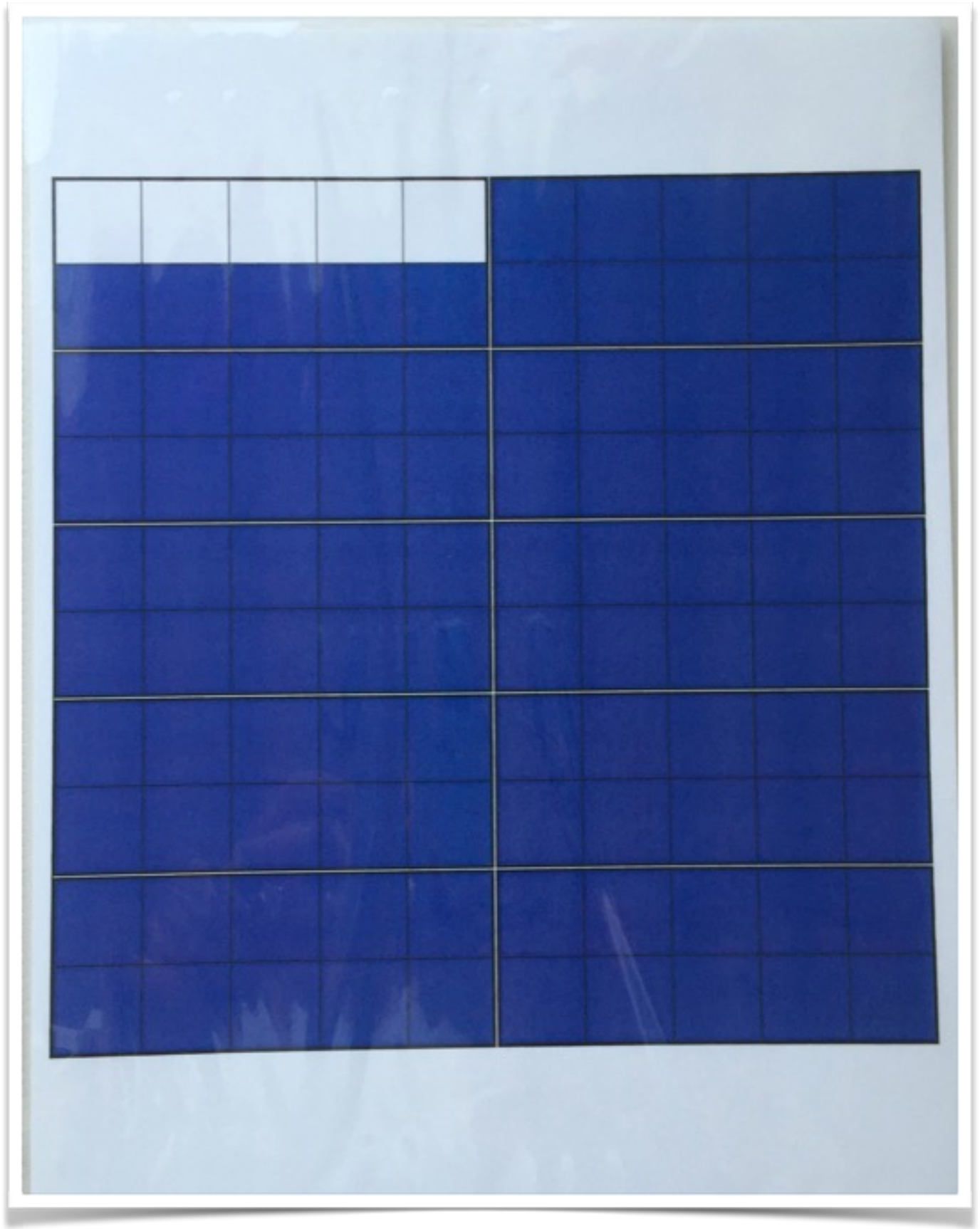
How did you see them?

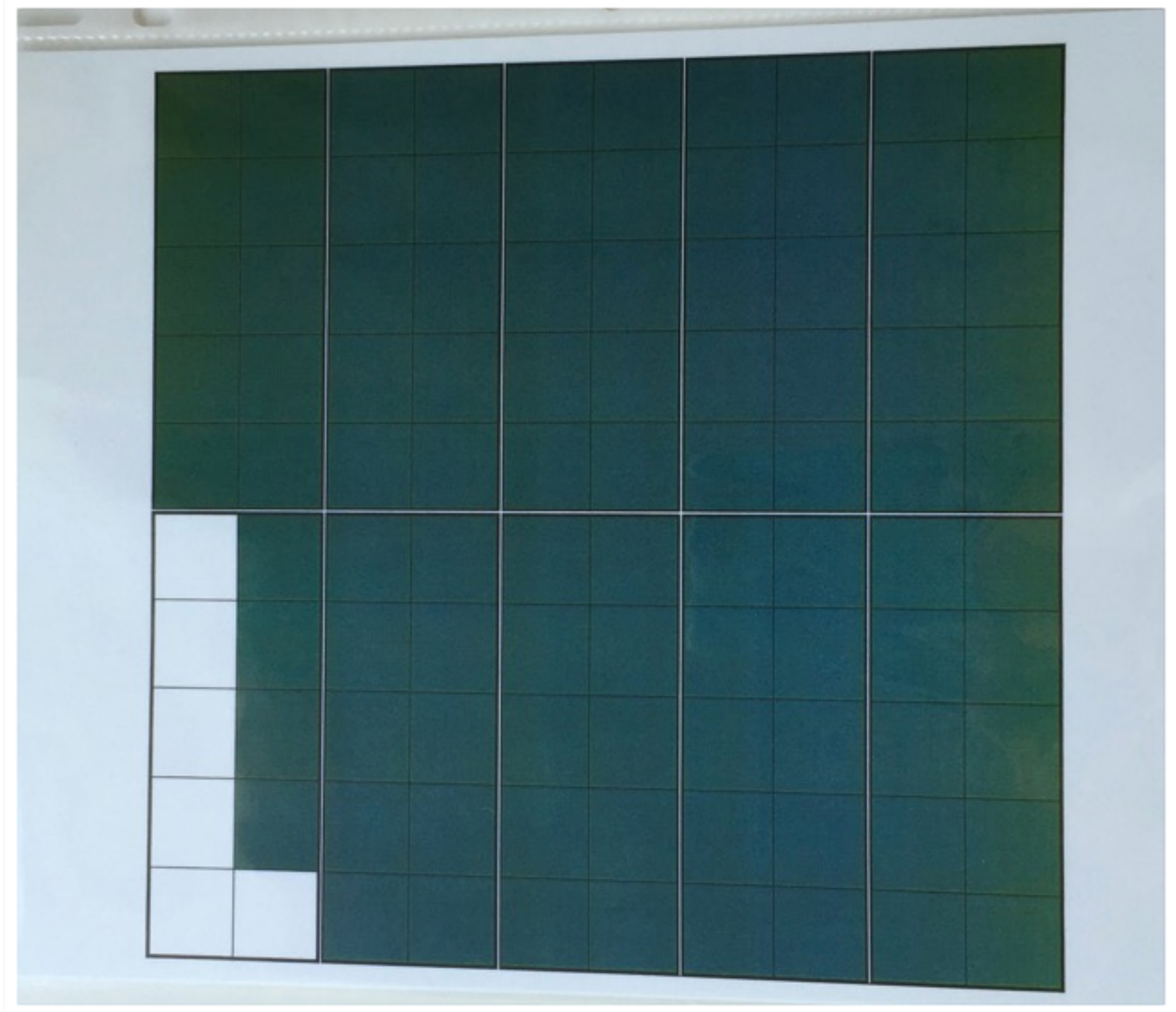


https://www.mathlearningcenter.org/resources/apps

Hundreds Boards







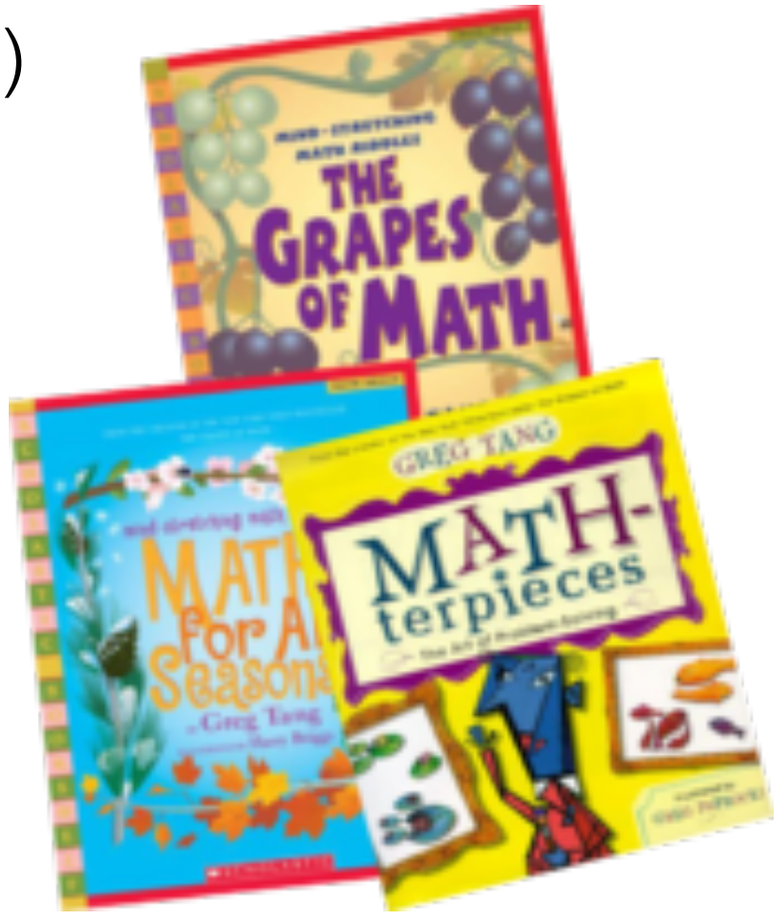
Guiding questions…

- How many do you see?
- How do you see them?
- Does anyone see them a different way?
- Explain your thinking.

Picture of the Day

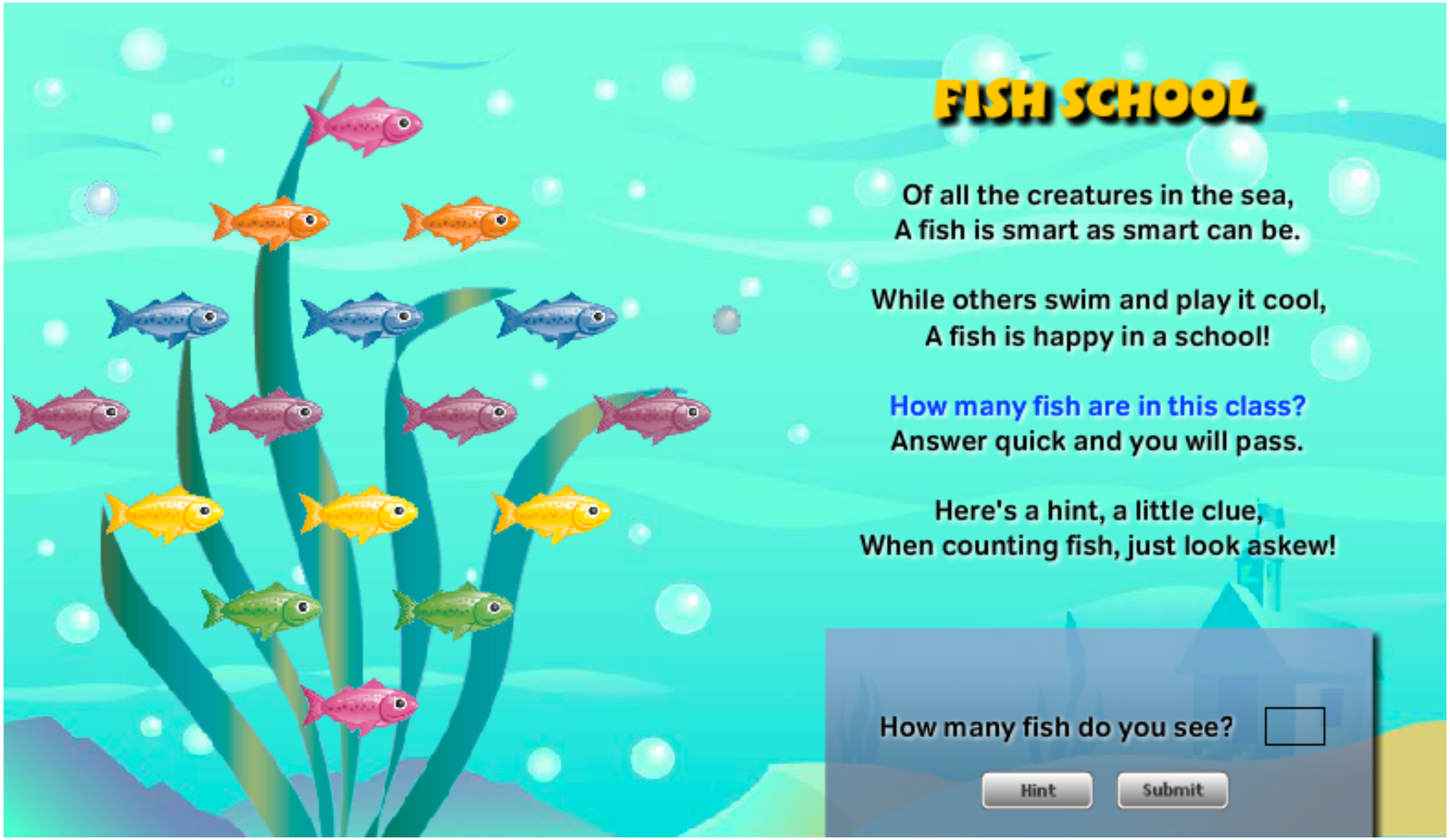
Learning Intentions:

- Subtilizing (Perceptual and Conceptual)
- Visualization
- Decomposing and Recomposing
- Mental Math Strategies



Items you could use:

- Greg Tang books
- Photos of real life items


FISH SCHOOL
Of all the creatures in the sea,
A fish is smart as smart can be.
While others swim and play it cool,
A fish is happy in a school!
How many fish are in this class?
Answer quick and you will pass.
Here's a hint, a little clue,
When counting fish, just look askew!
How many fish do you see?
Hint
Submit

“How many do you see?”

“How did you know so quickly?”

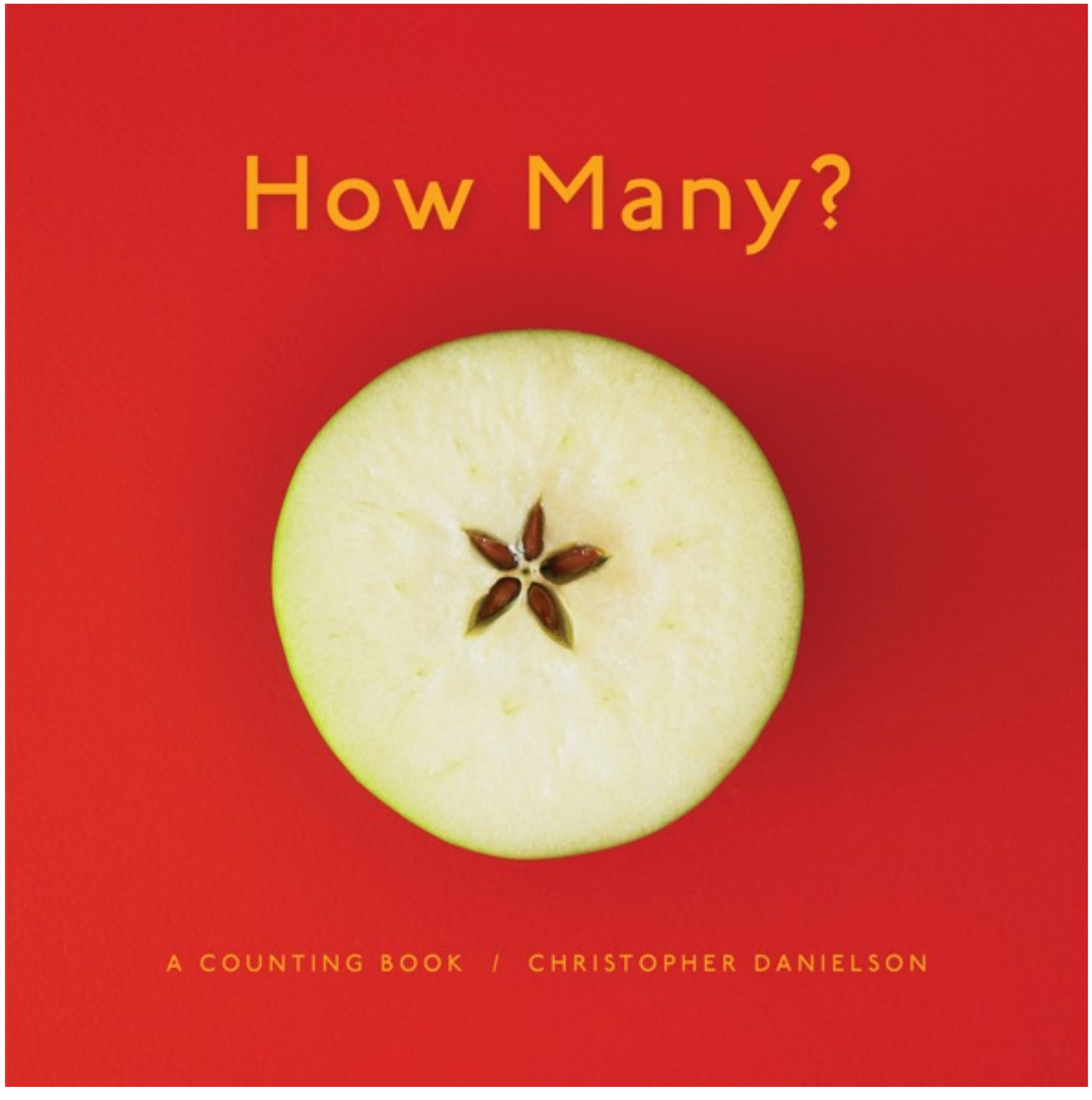
“How did you see them?”

“How many do you see?”

“How did you know so quickly?”

“How did you see them?”

How Many?



Turn and talk to a partner about what you see!

COUNTING

It is the ability to find out how many!

It is important because students need to develop:

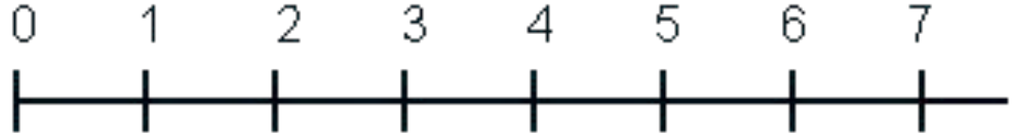
- Correct sequence of number names
- One-to-one correspondence
- Cardinality
- Relative size
- Counting forward and backwards, starting at any point
- Skip counting
- Place Value
- Estimation skills

Choral Counting

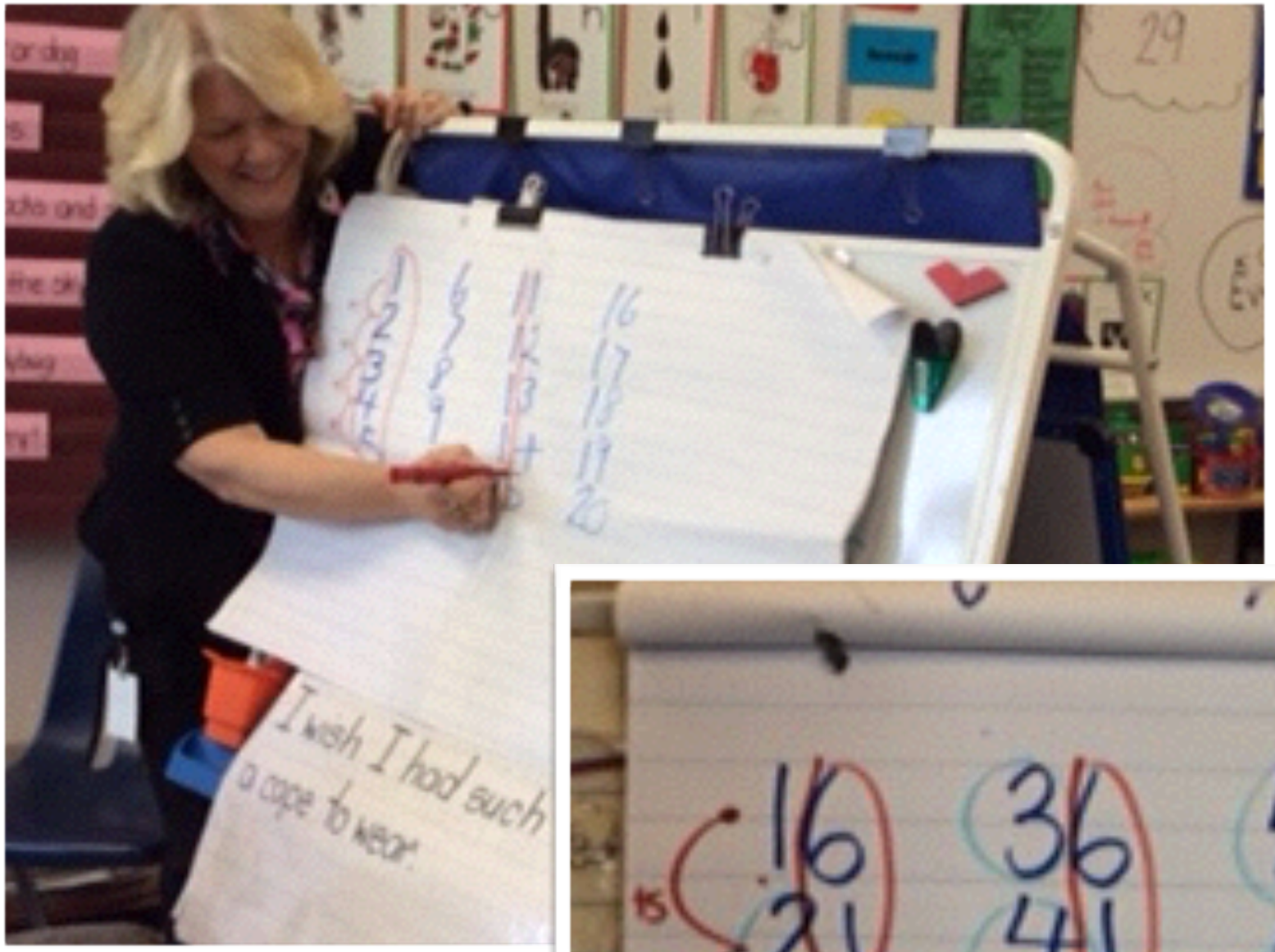
Note: The main benefit of this routine is that children can hear and participate in a counting sequence without being put on the spot.

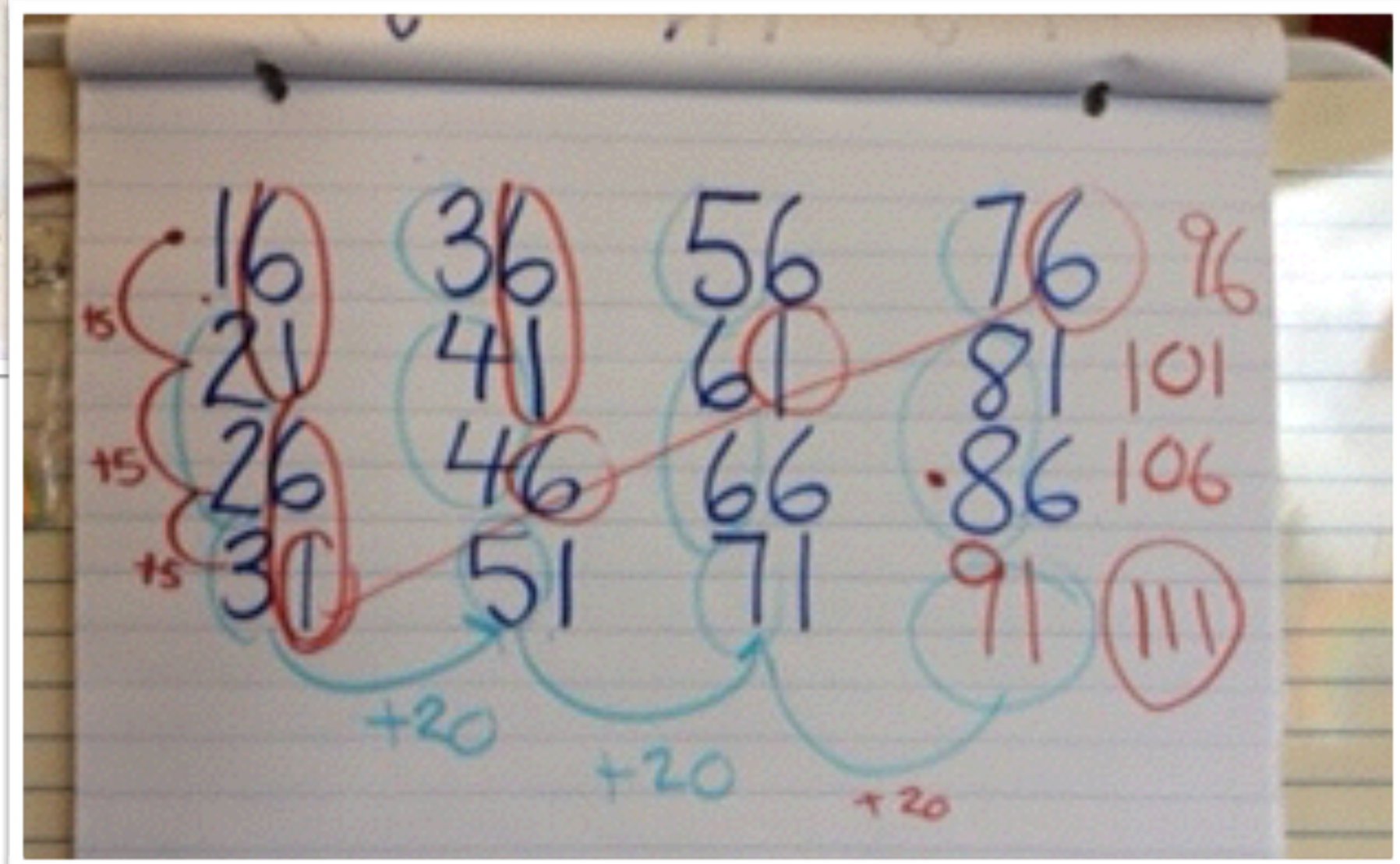
Learning Intentions:

- Counting forwards and backwards
- Skip counting
- Magnitude of numbers
- Make connections between number names, quantitates, and symbols
- one-to-one or one-to-many correspondence
- cardinality



1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

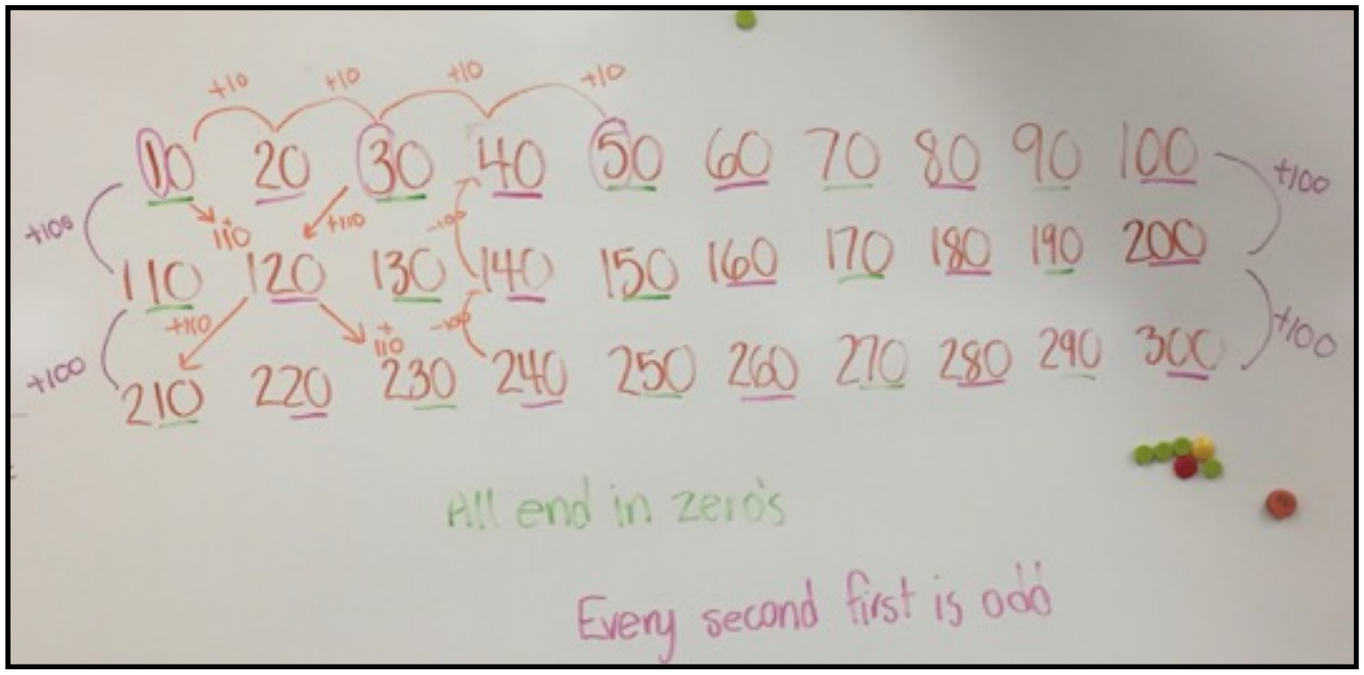

I wish I had such a cape to wear


16
21
26
31
36
41
46
51
56
61
66
71
76
81
86
91
96
101
106
111
15
15
15
+20
+20
+20

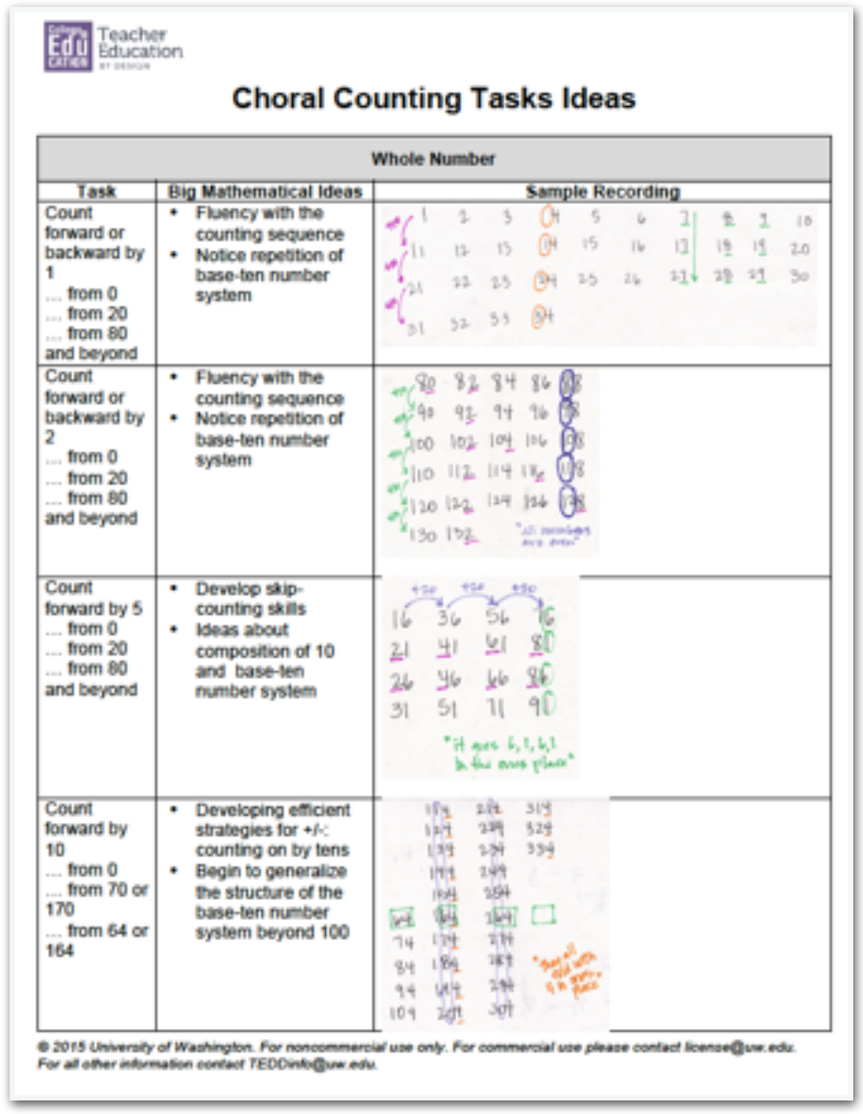
Video from tedd.org

How is this similar or different from choral counting you have done with your students?

Take an index card and create a Choral Count appropriate for your class.



For more info: www.tedd.org



Teacher Education

Choral Counting Tasks Ideas

Whole Number		
Task	**Big Mathematical Ideas**	**Sample Recording**
Count forward or backward by 1 … from 0 … from 20 … from 80 and beyond	• Fluency with the counting sequence • Notice repetition of base-ten number system	
Count forward or backward by 2 … from 0 … from 20 … from 80 and beyond	• Fluency with the counting sequence • Notice repetition of base-ten number system	
Count forward by 5 … from 0 … from 20 … from 80 and beyond	• Develop skip-counting skills • Ideas about composition of 10 and base-ten number system	
Count forward by 10 … from 0 … from 70 or 170 … from 64 or 164	• Developing efficient strategies for +/-: counting on by tens • Begin to generalize the structure of the base-ten number system beyond 100	

Try different representations of the count (e.g, in a number grid, in a vertical or horizontal list, or along a number line).
Which representation do you prefer and why?

Guiding questions…

- Which three numbers do you think will come next?
- How do you know?
- What number goes here?
- If we continue, will we say the number _____?

Kinaesthetic Movement

- when counting by 1’s, have students move one cube into their pile each time they count. This reinforces 1-to-1

- when counting by 5’s have them show five fingers

- when counting by 10’s have them stretch out all ten fingers when they say the number, then make a fist before stretching fingers out to say the next numbers.

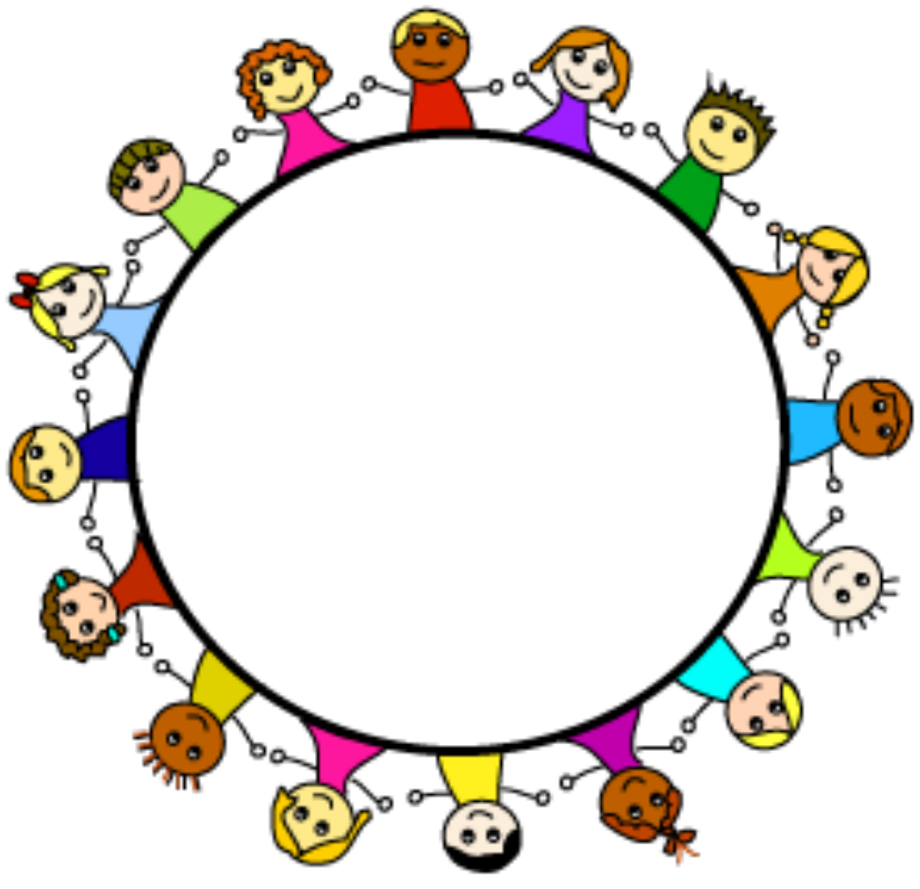
Start and Stop Counting

- Can be done chorally or in count around the circle
- Students start at a specified number and stop at another determined number
- Use number lines and/or number grids to assist students

Counting Around The Circle

Learning Intentions:

- Counting forwards and backwards
- Skip counting
- Magnitude of numbers
- Make connections between number names, quantities, and symbols



Reminders:

1. Everyone needs to listen to each person. We cannot be talking to each other. We need quiet to hear each person talking.
2. Give everyone time to think. Calling out the answer turns our friends' brains off.

To scaffold the activity, consider recording the numbers on the board while students count aloud.

And if it is too difficult - move to a choral count aloud.

Differentiation:

- Prior to counting ask some **ESTIMATION** questions

"If we count by one's starting at Megan, and go all the way around the circle, what number do you think Michael will say?"

"Why did you choose ___ as an estimation?"

"Why didn't anyone choose ____ as an estimation?"

Count Around the Circle: Knock-down

Teacher picks a “Knock-Down” number (e.g.10)

Everyone in the circle stand ups. The first student says “1”, next one says “2”, continuing until someone says “10”

The student who says “10” turns to the person beside them and uses pretend fists to “Knock-Down” them down. Play keeps going until only one person is standing!

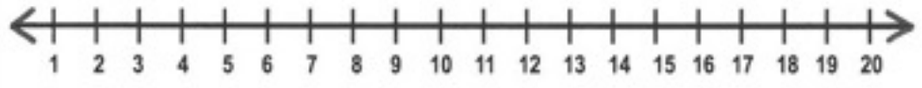
Number Lines

Learning Intentions:

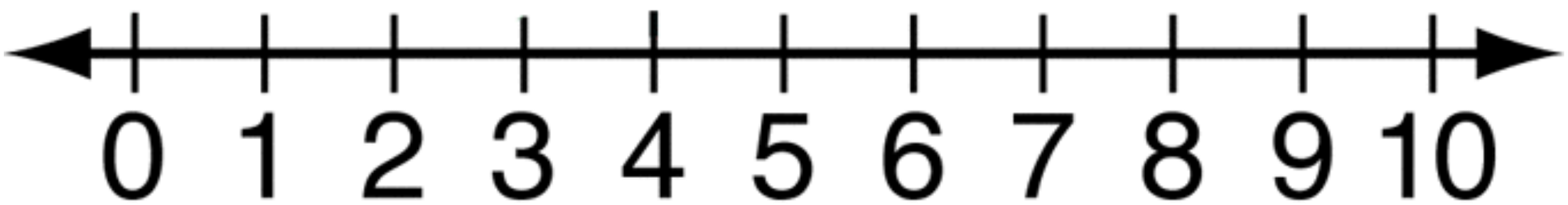
- Visualization
- Spatial Sense of Quantities and Magnitude
- Relationships Among Numbers
- Computational Fluency
- Mental Math Strategies

Items you could use:

- White boards
- Calendar numbers and Edging at Home Depot
- Clothesline Number Lines



Guess My Number!



Too Small

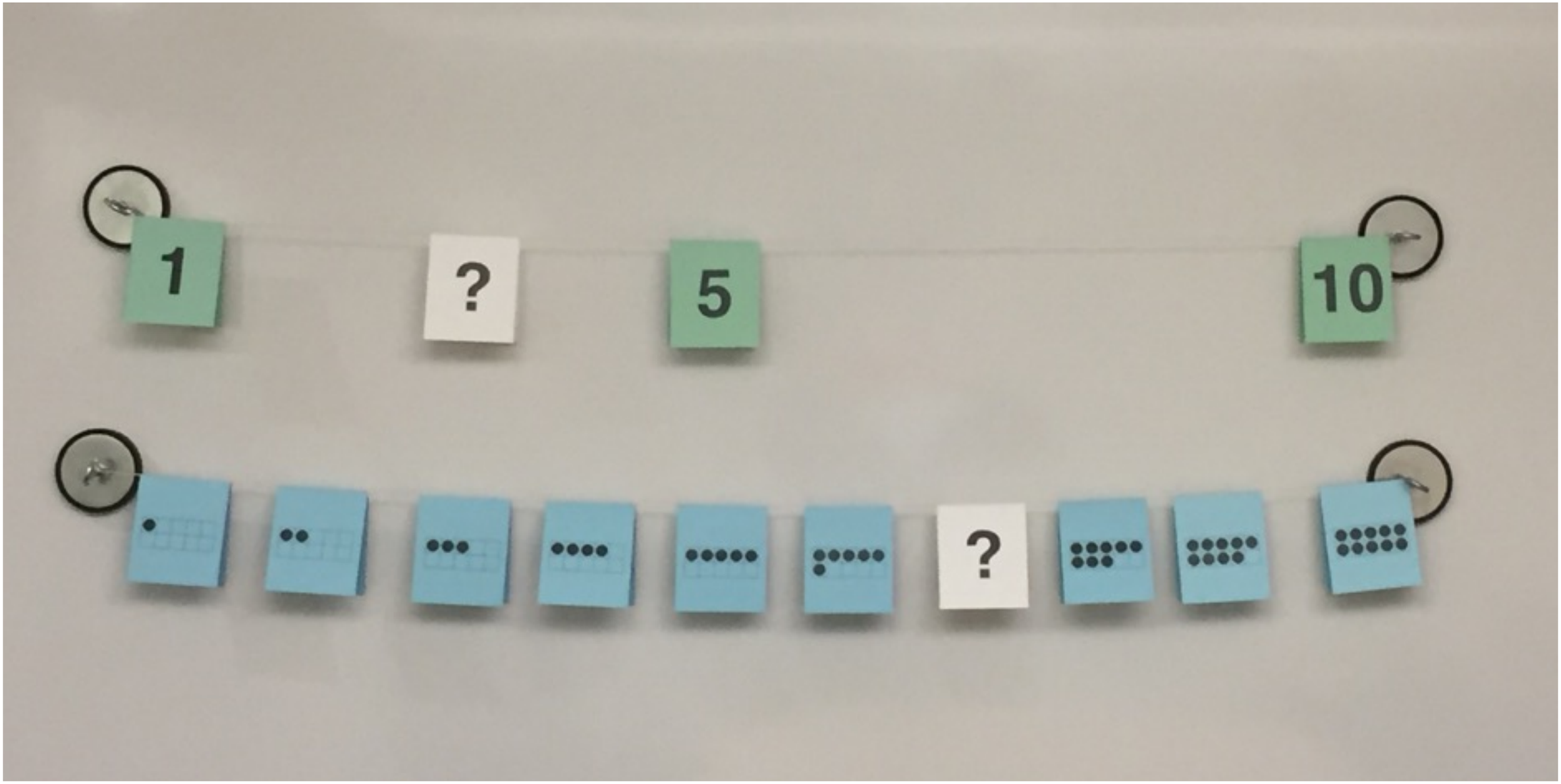
Too BIG

Where would 13 be located?

Explain your thinking!

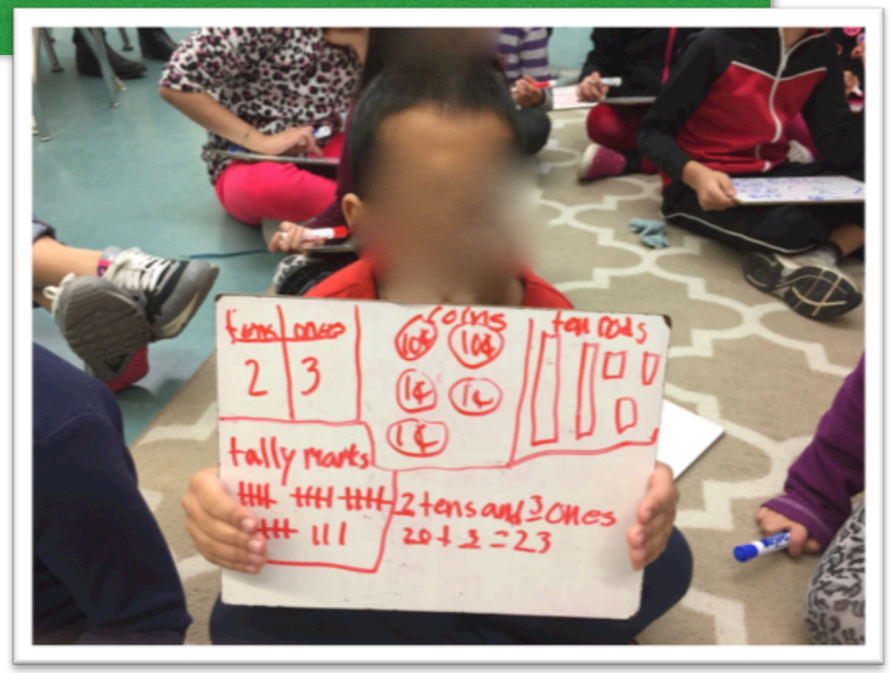
Working with the Clothesline

- Build the line
- What are my mystery numbers?
- Can you fix the line?
- Parallel lines - multiple representations



Multiple representations of quantities

Today's Number

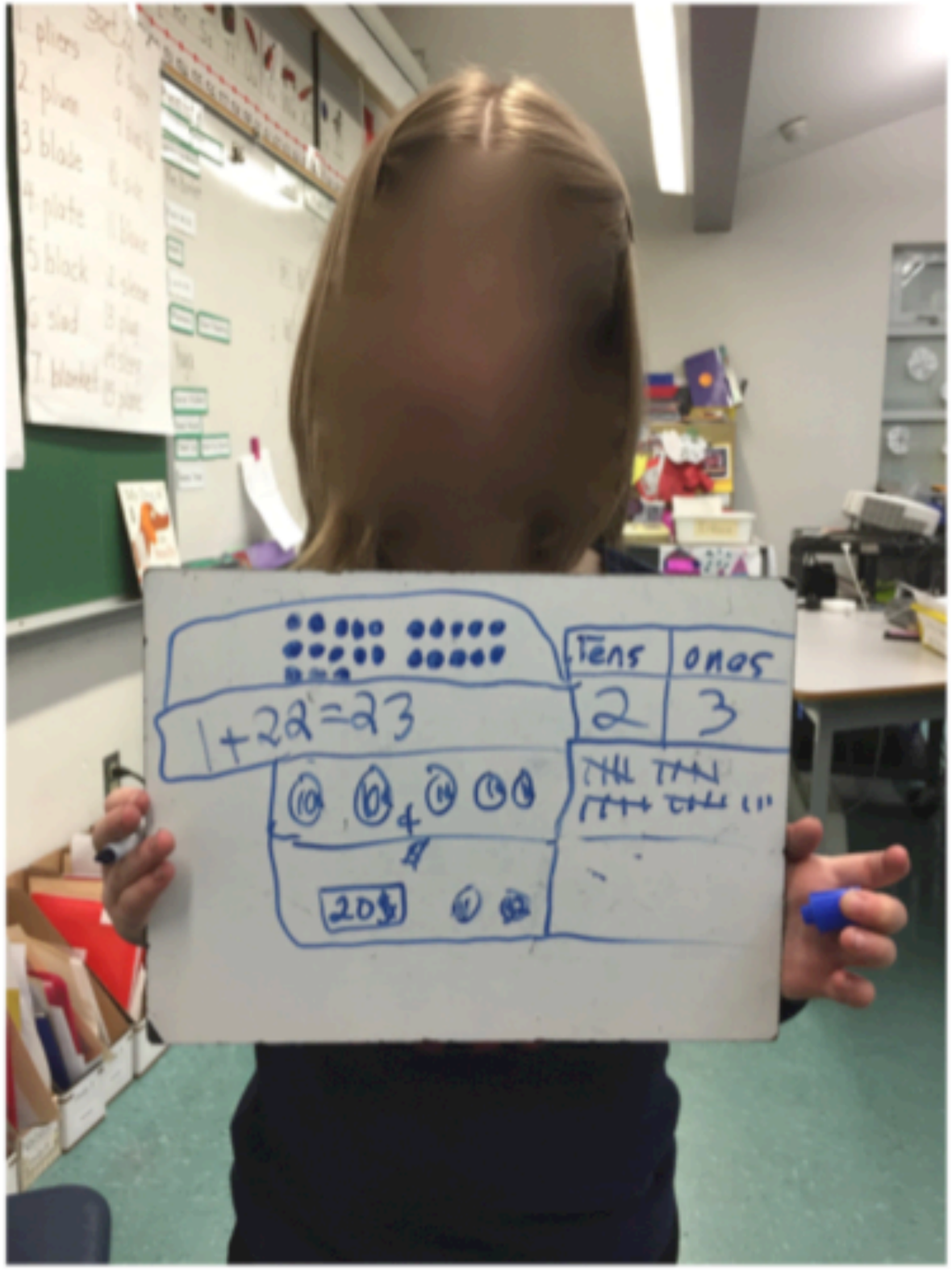


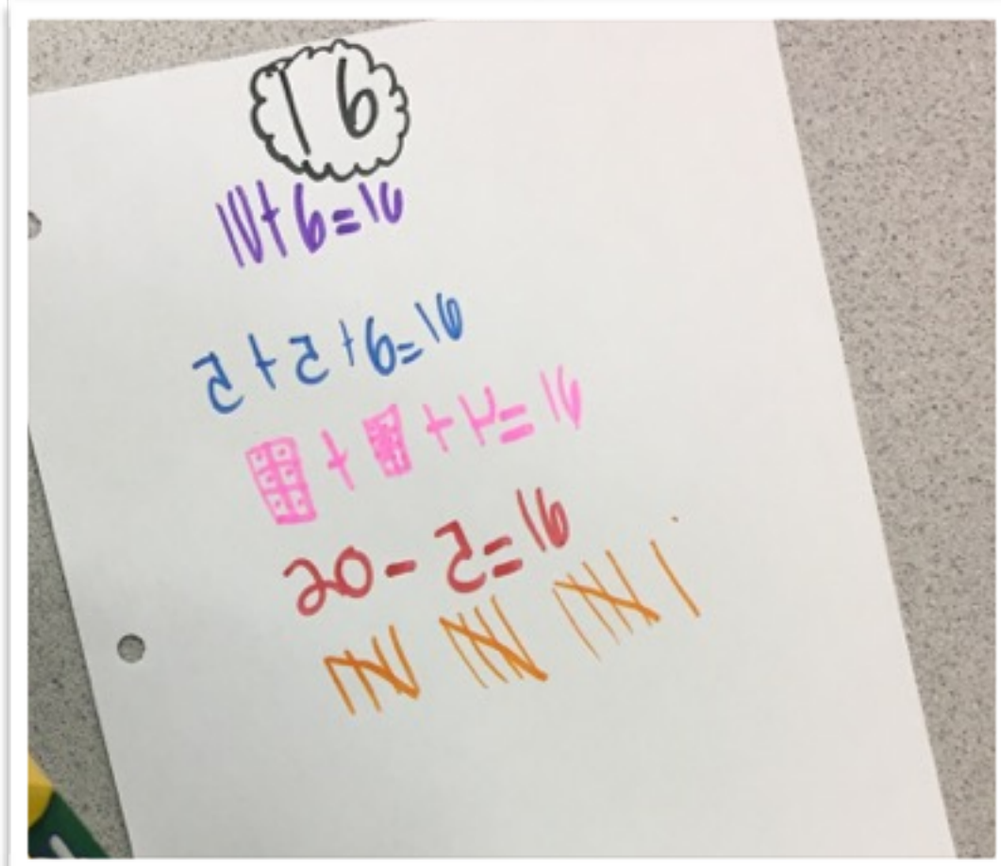
Learning Intentions:

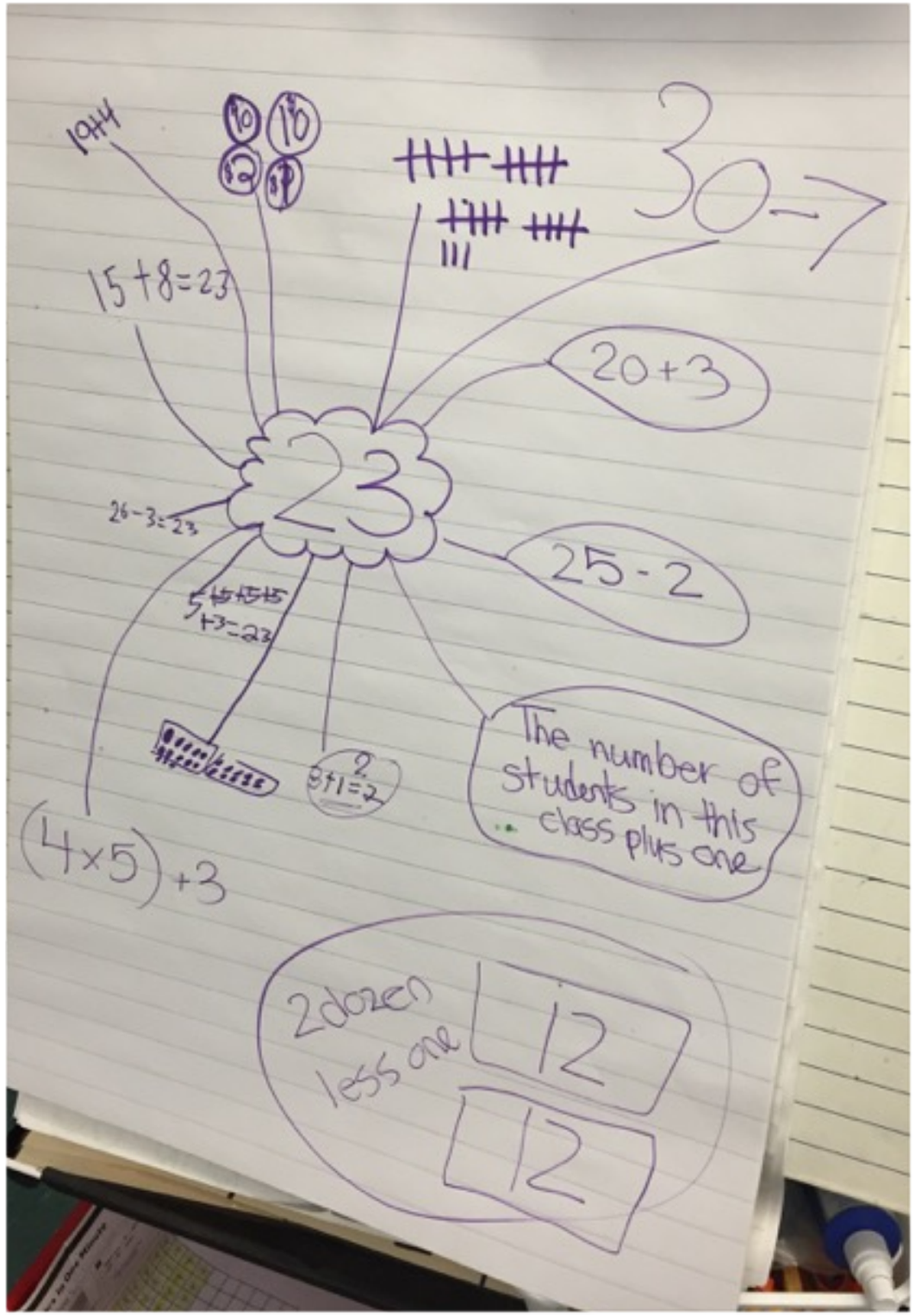
- Subtilizing (Perceptual and Conceptual)
- Visualization
- Decomposing and Recomposing
- Mental Math Strategies

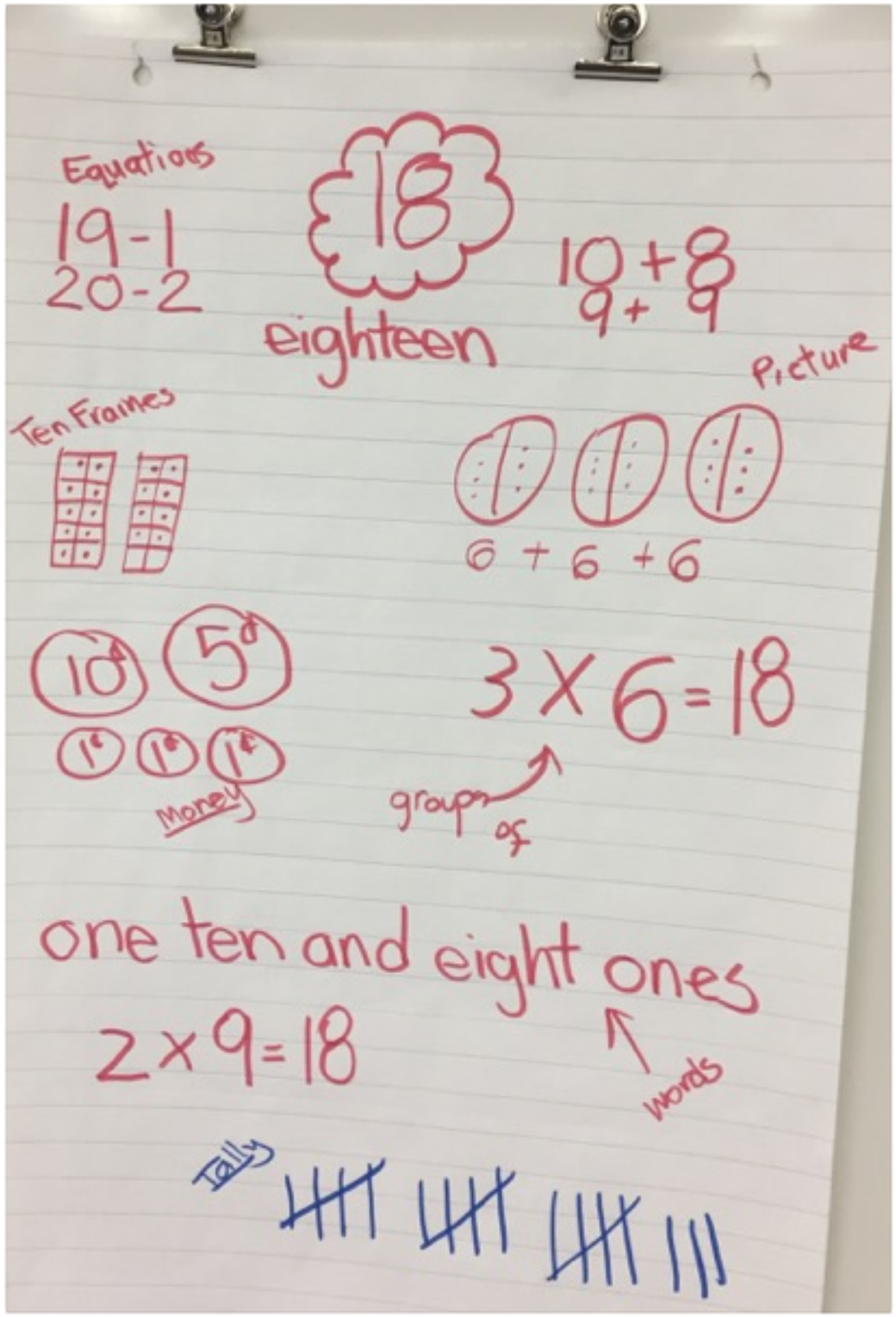
Highlight important math concepts, such as:

- breaking numbers apart into tens and ones
- using patterns
- using the Commutative Property
- using two or more addends
- using repeated groups


Tens
ones
1+22=23
2
3
20$


16
9+7=16
9+2+5=16
20-2=16


19+4
15+8=23
30-7
20+3
23
25-2
26-3=23
5+5+5+5+3=23
8+1=2
The number of students in this class plus one
(4×5)+3
2 dozen less one
12
12


Equations
19-1
20-2
18
eighteen
10+8
9+9
Ten Frames
Picture
6+6+6
10
5
1
1
1
Money
3×6=18
groups of
one ten and eight ones
2×9=18
words
Tally

Questions and Statements for Today's Number

- When is ____ big?
- When is ____ small?
- When is ___ a lot?
- When is ___ very little?

Which One Doesn't Belong?

Learning Intentions:

- Understanding attributes
- Encourages Mathematical language
- Spatial Awareness
- Reasoning
- Explain and Justify

Items you could use:

- Letters
- Numbers
- Money
- Graphs

basketball

cannot eat this

sphere

rectangular prism

square

brownie

cookie

Colourful

Pink

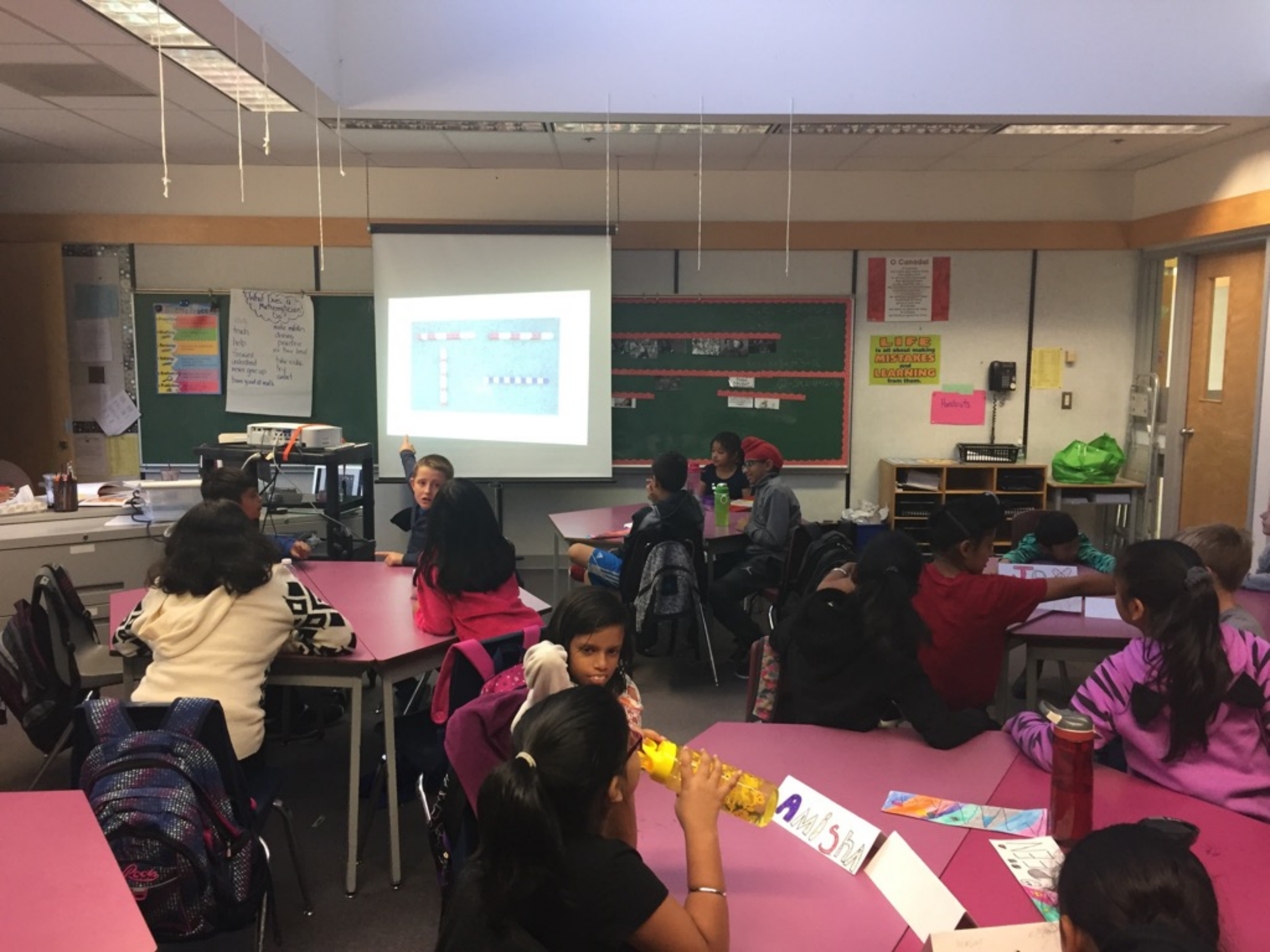
red

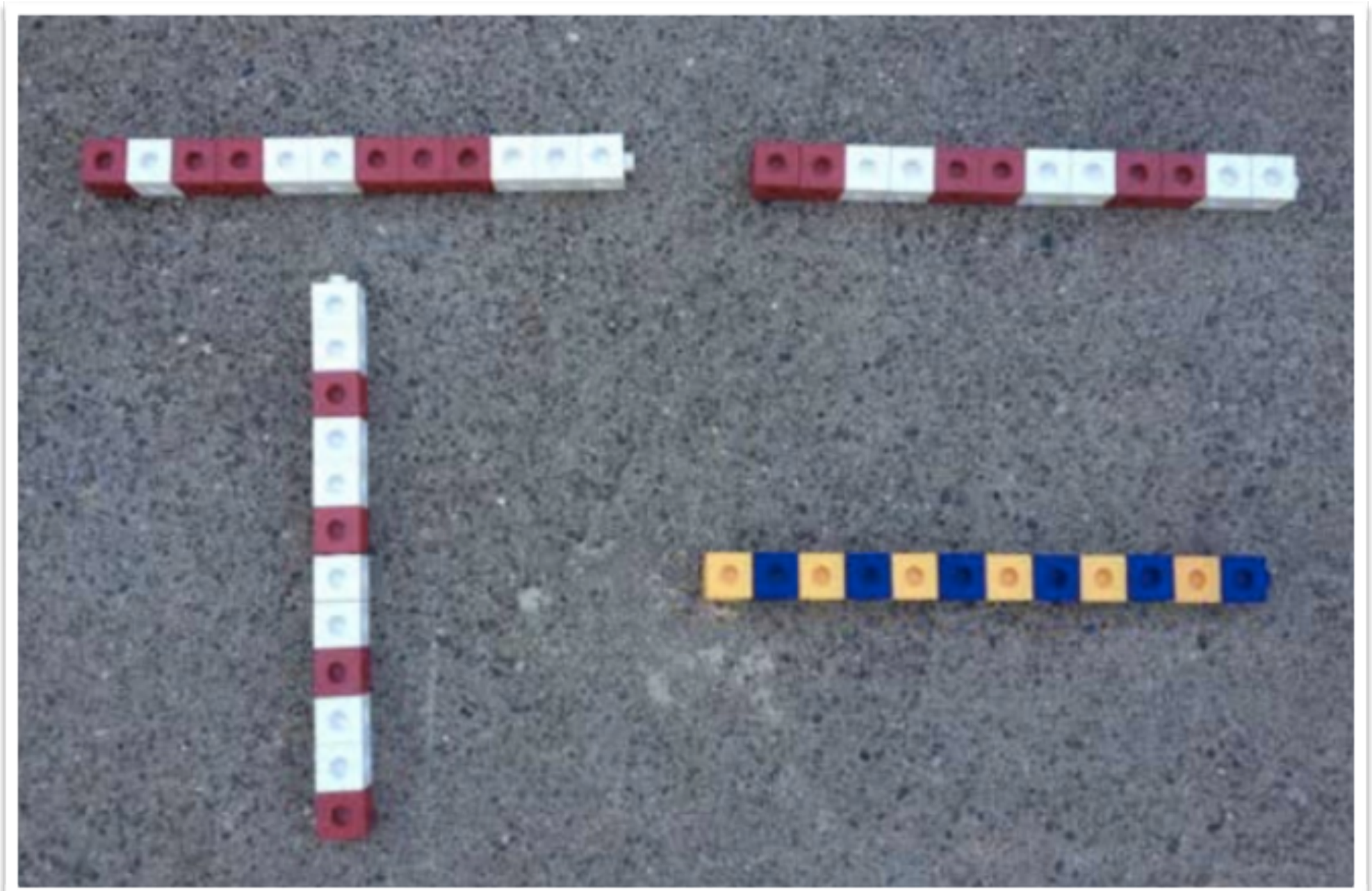
yellow

cylinder

cake

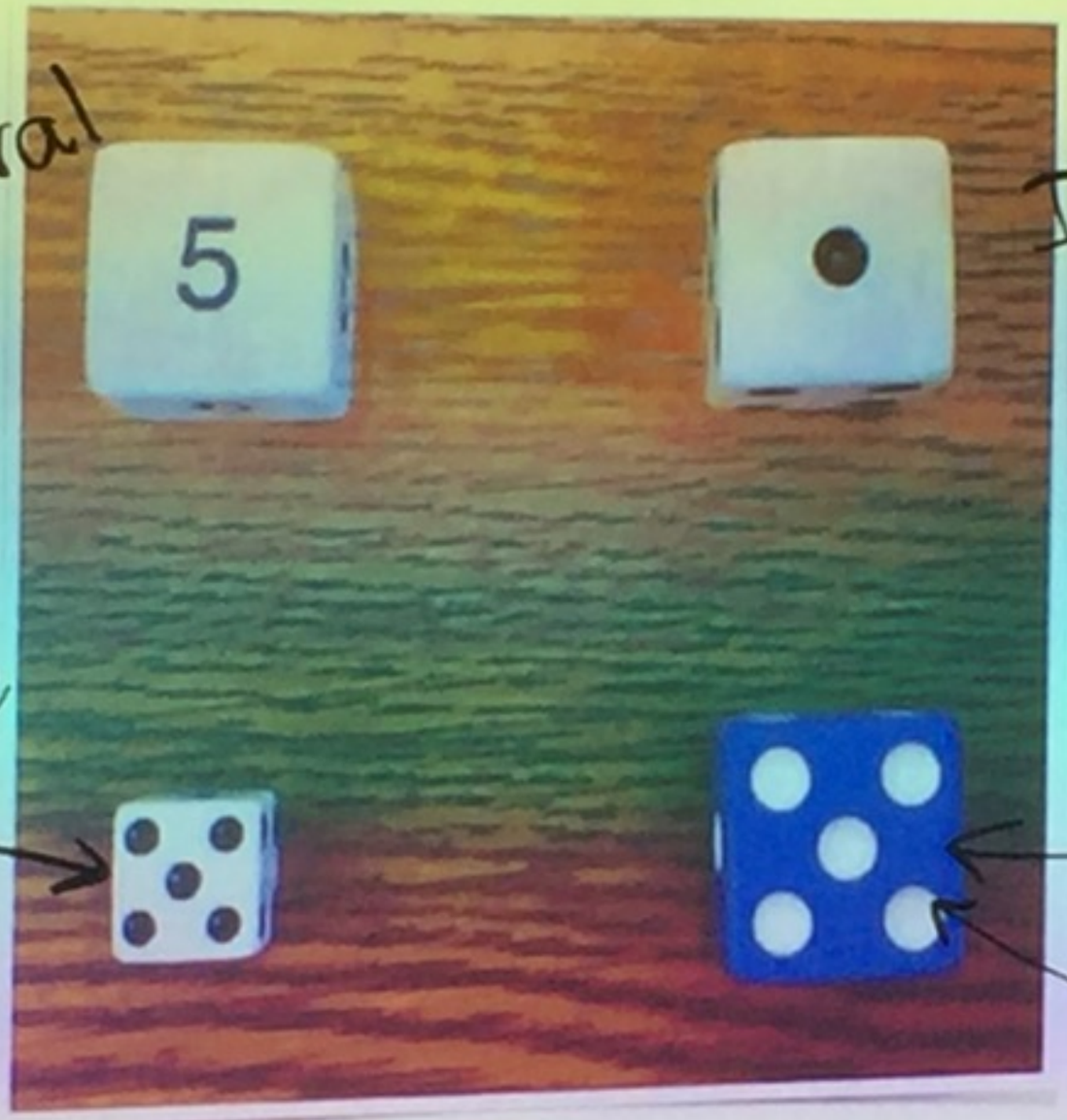
writing


LIFE
is all about making
MISTAKES
and
LEARNING
from them.
AMISHA




5

A numeral #



It is not a 5 - it's a one

Smaller in size

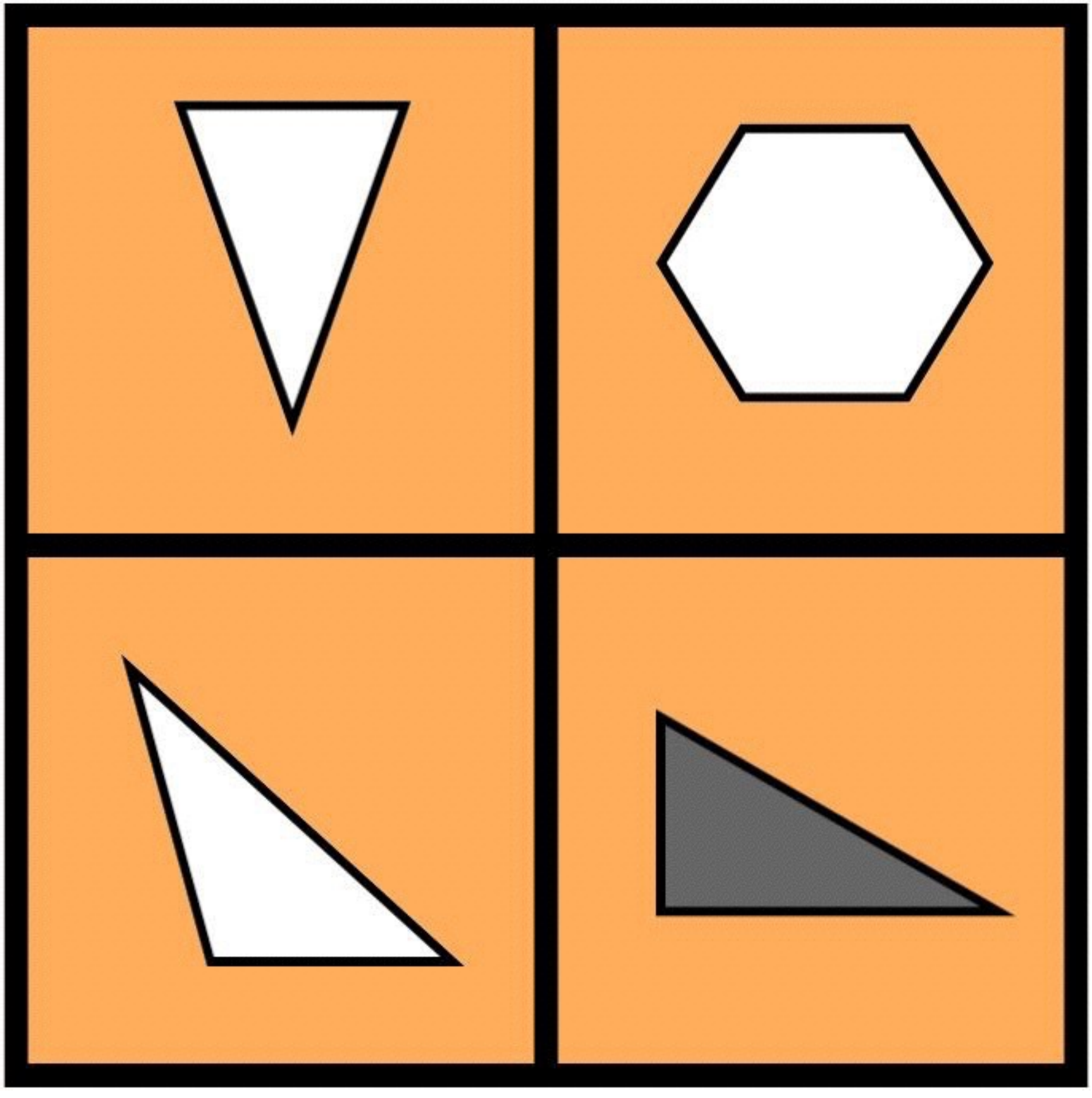
It's blue

White dots / symbols

Sean
Olivia
Stephanie
Yejoon
Sina

Kaine
Hudson
Hadison
Amiik
Serena

$8+6$	$7+7$
$8+7$	$5+9$



Guiding questions…

- What do you notice?
- What makes all the the items alike?
- What makes them different?
- Which one doesn’t belong?
- Can you share your reasoning to justify your answer?

DECOMPOSING

It is the ability to “break” quantities into parts.

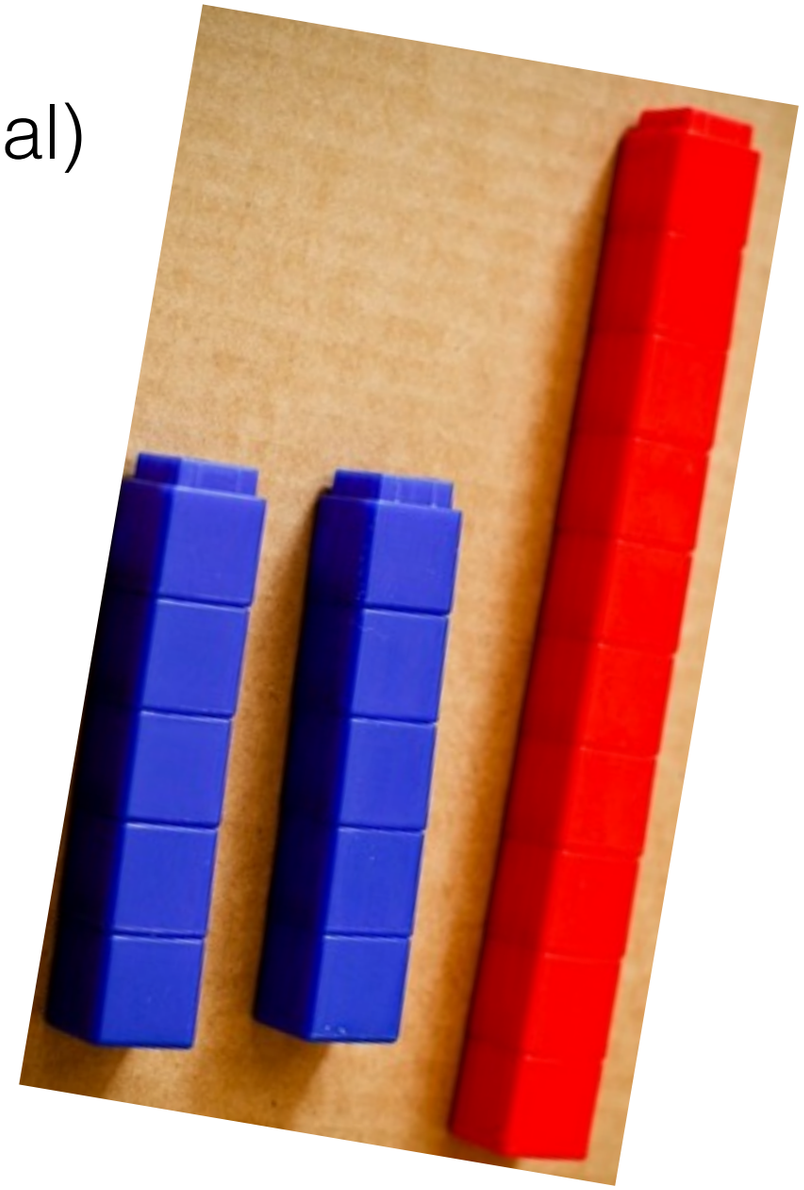
It is important because students need to develop:

- a strong sense of both five and ten and the relationship between these quantities
- flexibility with numbers
- mental math strategies to add, subtract, multiply and divide such as making a friendly ten, adding tens and adding ones.

Snap or 10 Wands

Learning Intentions:

- Subtilizing (Perceptual and Conceptual)
- Decomposing and Recomposing
- Combinations to 10
- Commutative Property
- Place Value



Items you could use:

- Towers of 10 unifix cubes or any number

Hold the train behind your back

“1, 2, 3, Snap” and break train in two

Keep one part hidden

Show the other part to the class

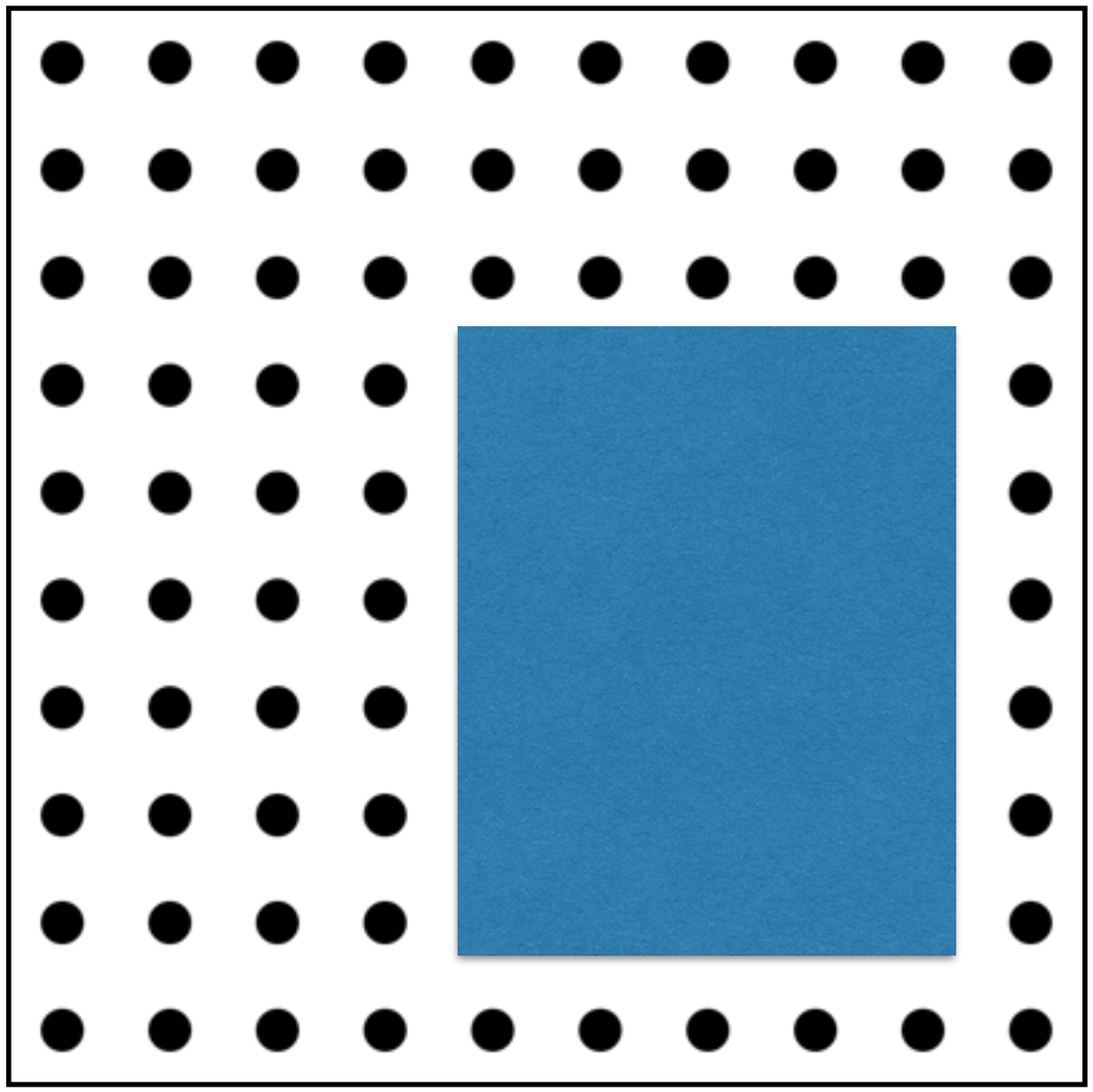
“How many am I hiding?”

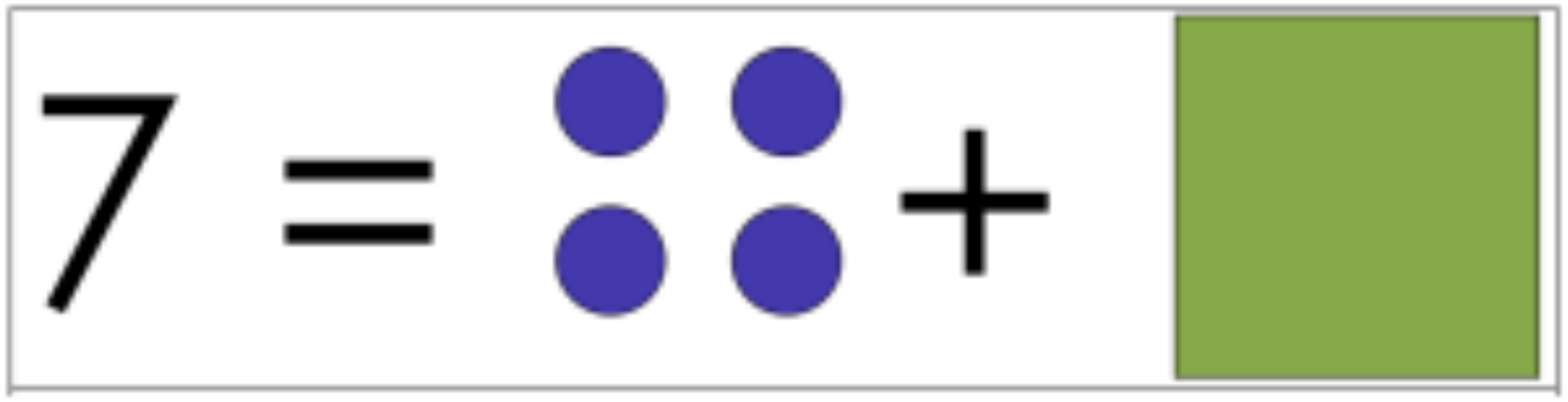
“How do you know?”

Missing Part Cards

Learning Intentions:

- Subtilizing
- Decomposing Numbers
- Computational Fluency
- Commutative Property
- Place Value
- Mental Math
- Introduction to Algebraic thinking

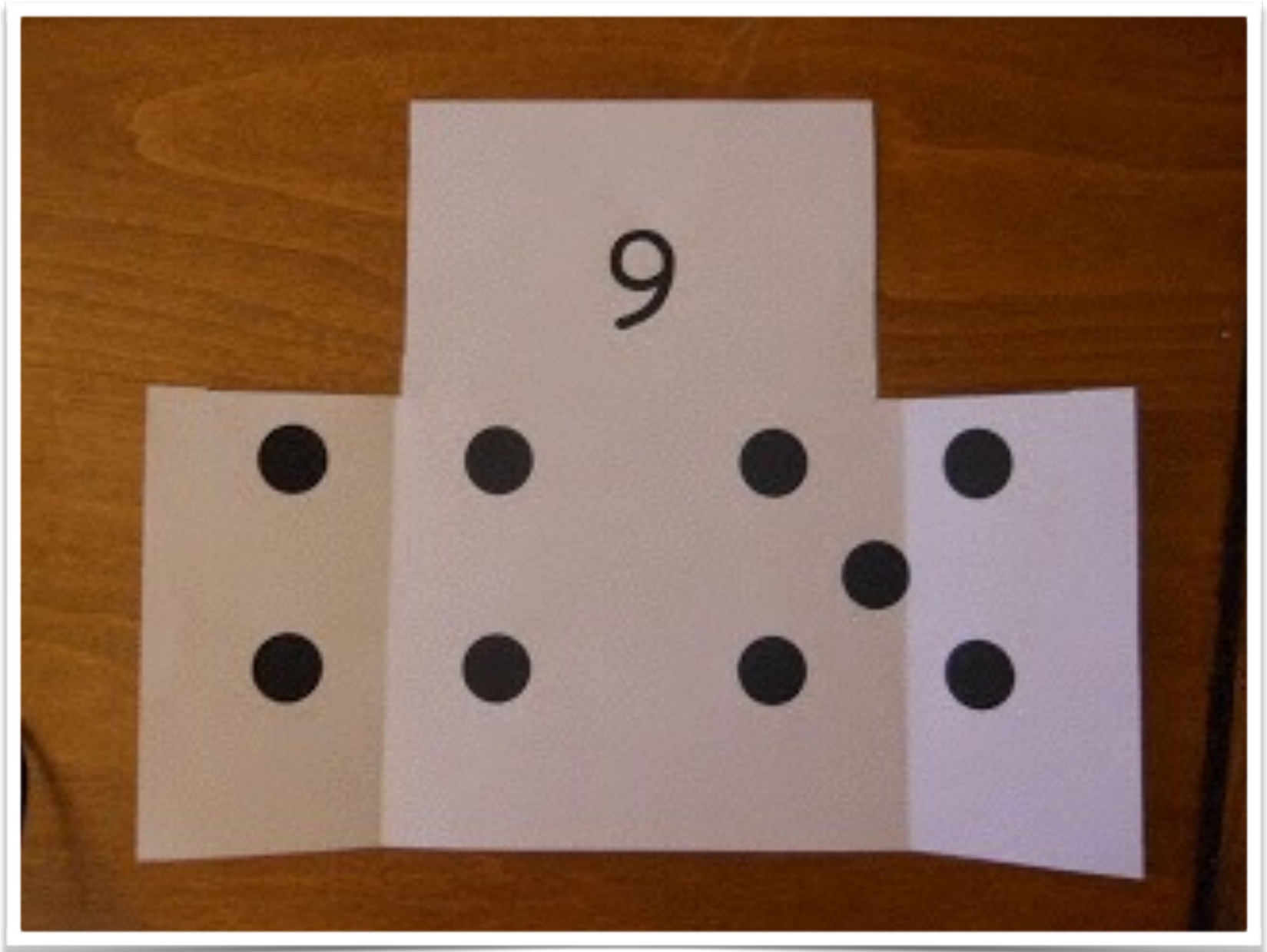




- This idea comes from Carole Fullerton and can be downloaded from her website.

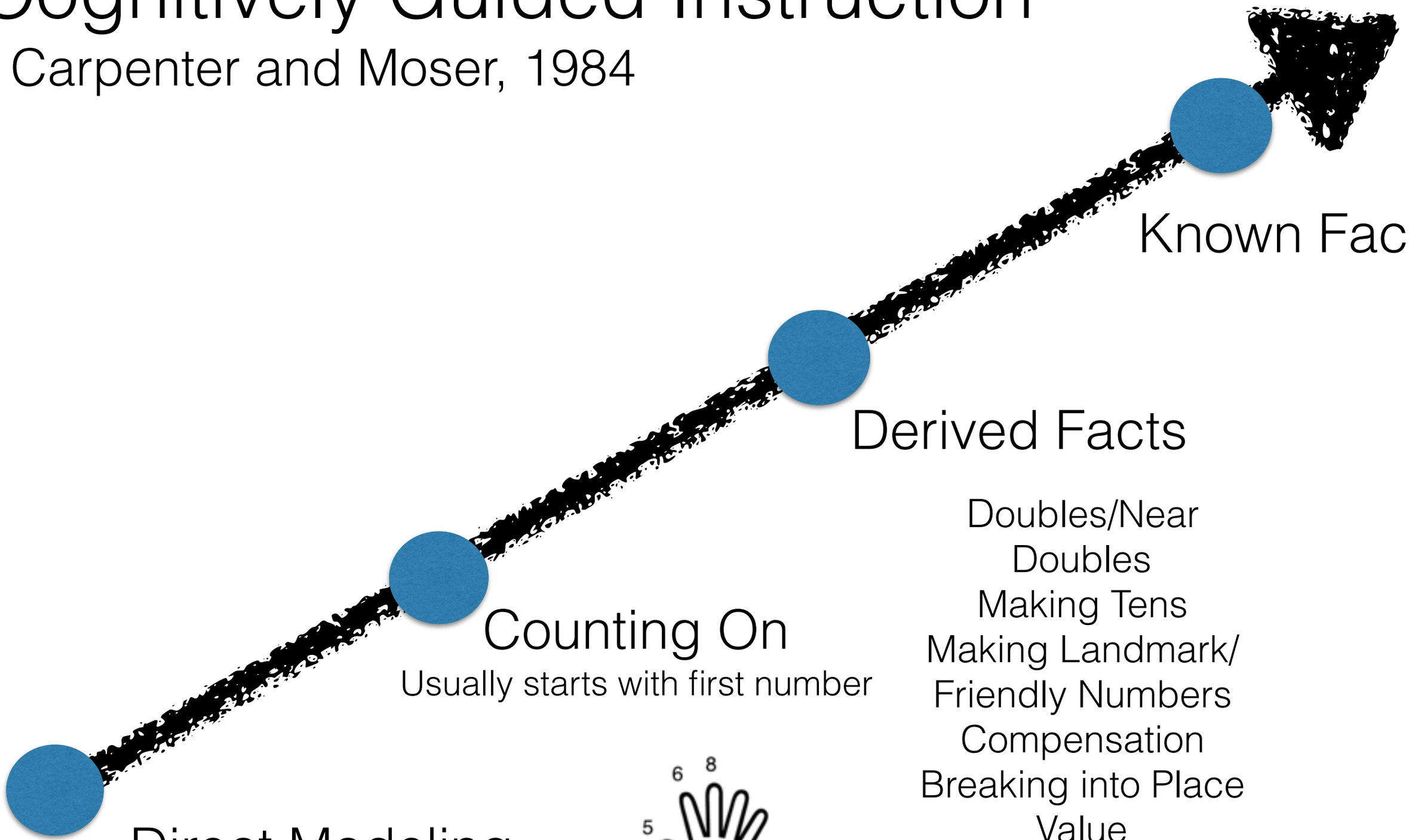
- Show the card and read it aloud with the students
- “Seven is the same as 4 and _____”
- “What do you think is missing?”
- “How do you know?”

Part Part Whole Cards



Cognitively Guided Instruction

- Carpenter and Moser, 1984



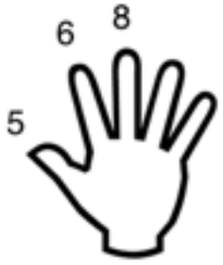
Known Facts

Derived Facts

Doubles/Near Doubles
Making Tens
Making Landmark/ Friendly Numbers
Compensation
Breaking into Place Value
Adding up in Chunks

Counting On

Usually starts with first number



4 + 3 =

Direct Modeling

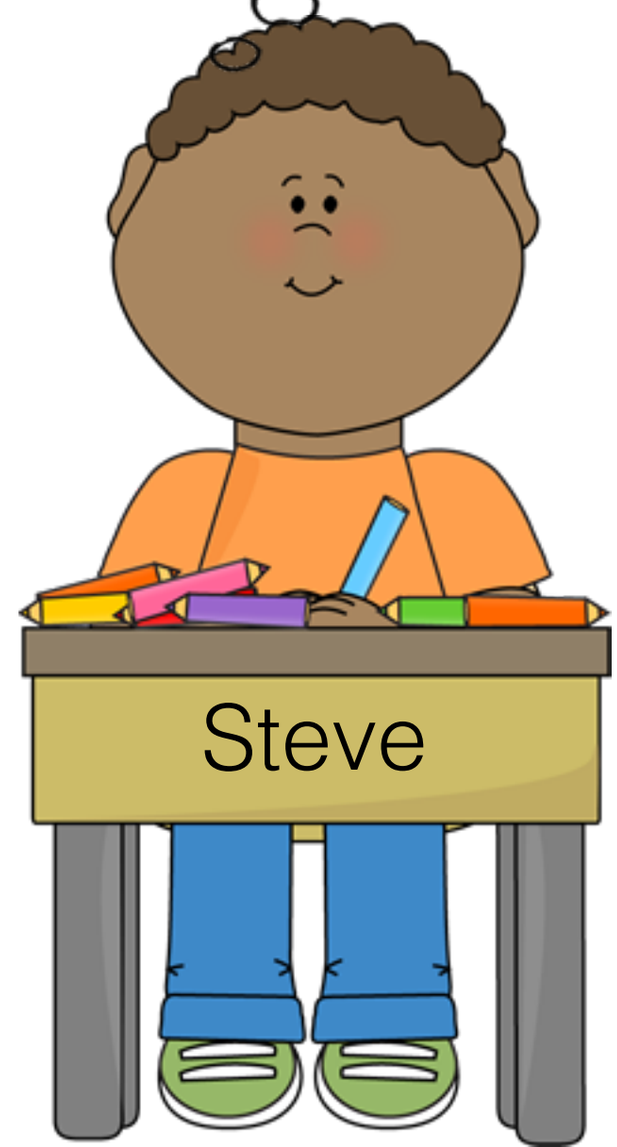
Counts everything

Three Scenarios

7 + 8 =

I don't know.
I will skip it!

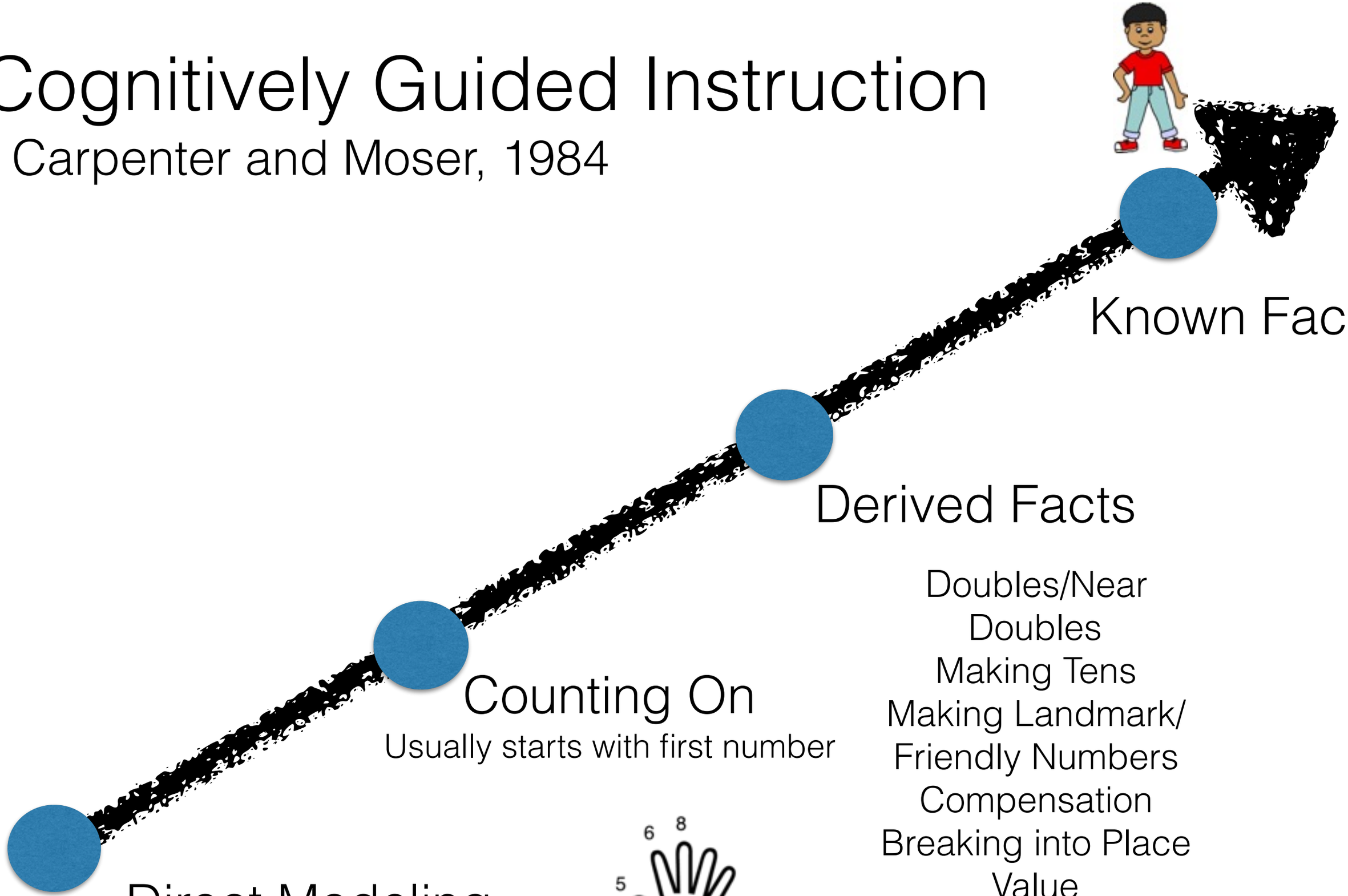
I don't know. I will count on from 7. Hmm is it 15? I better recount.



I don't know. But I do know 7 + 7 is 14 and one more, well that is 15!

Cognitively Guided Instruction

- Carpenter and Moser, 1984



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Doubles/Near Doubles
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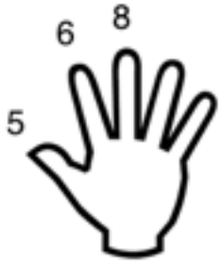

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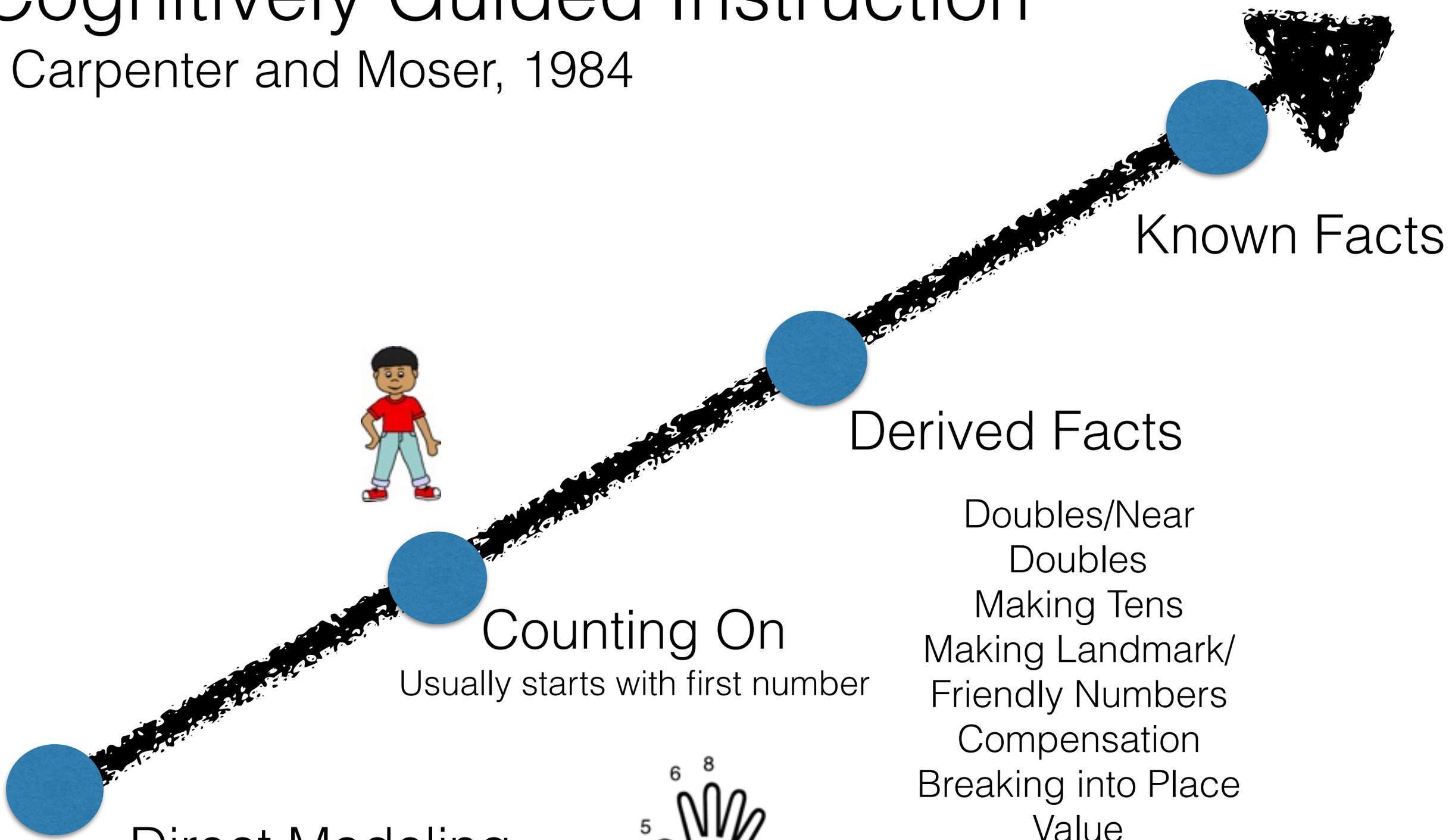


Known Facts

Derived Facts

Doubles/Near Doubles
Making Tens
Making Landmark/ Friendly Numbers
Compensation
Breaking into Place Value
Adding up in Chunks

Counting On

Usually starts with first number

4 + 3 =

Direct Modeling

Counts everything

Number Talks

Learning Intentions:

- develop multiple strategies for Decomposing (Mental Math)
- developing flexibility through use of multiple strategies
- Computational Fluency
- Place Value

10 - 15 minutes focussed on one question (Number Talk) or a “string” of questions (Number Strings)

$3 + 5 + 7 =$

$8 + 2 =$

$8 + 3 + 2 =$

$18 + 3 + 2 =$

Number Talks

Potential Addition Strategies:

- Count All
- Count On
- Plus one/plus two
- Doubles/Near Doubles
- Partners for Tens
- Bridging through ten (starting with adding nine, then eight)
- Making Landmark or Friendly Numbers
- Compensation
- Breaking Each Number into its Place Value

Potential Subtraction Strategies:

- Removal or Counting back
- Adding Up

We do not “teach” the strategies.

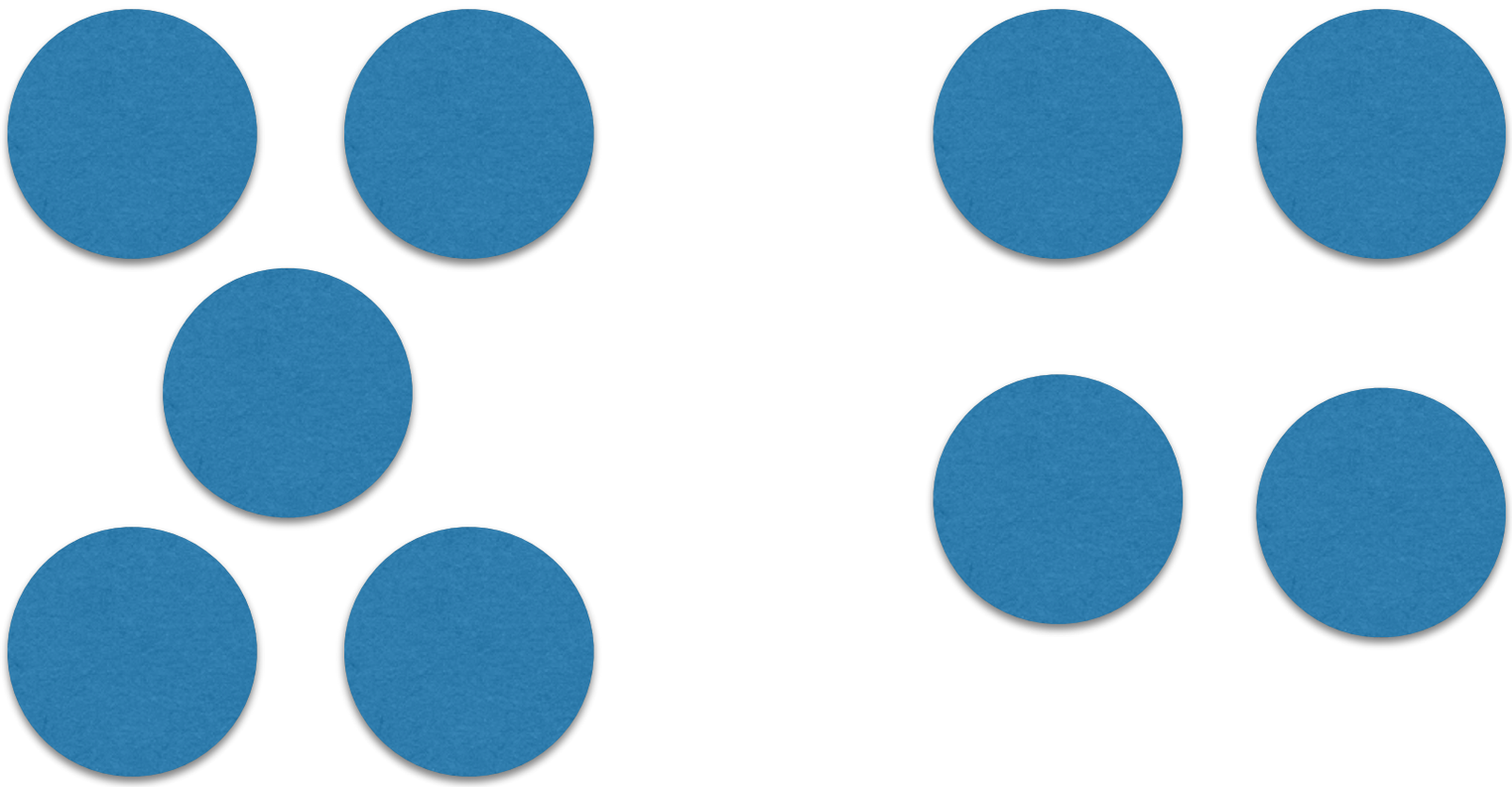
Instead we **INTENTIONALLY pose questions** that would encourage a strategy.

After students have share their thinking around the strategy and students have heard this many time, ask the students **“What we could call the strategy?”**

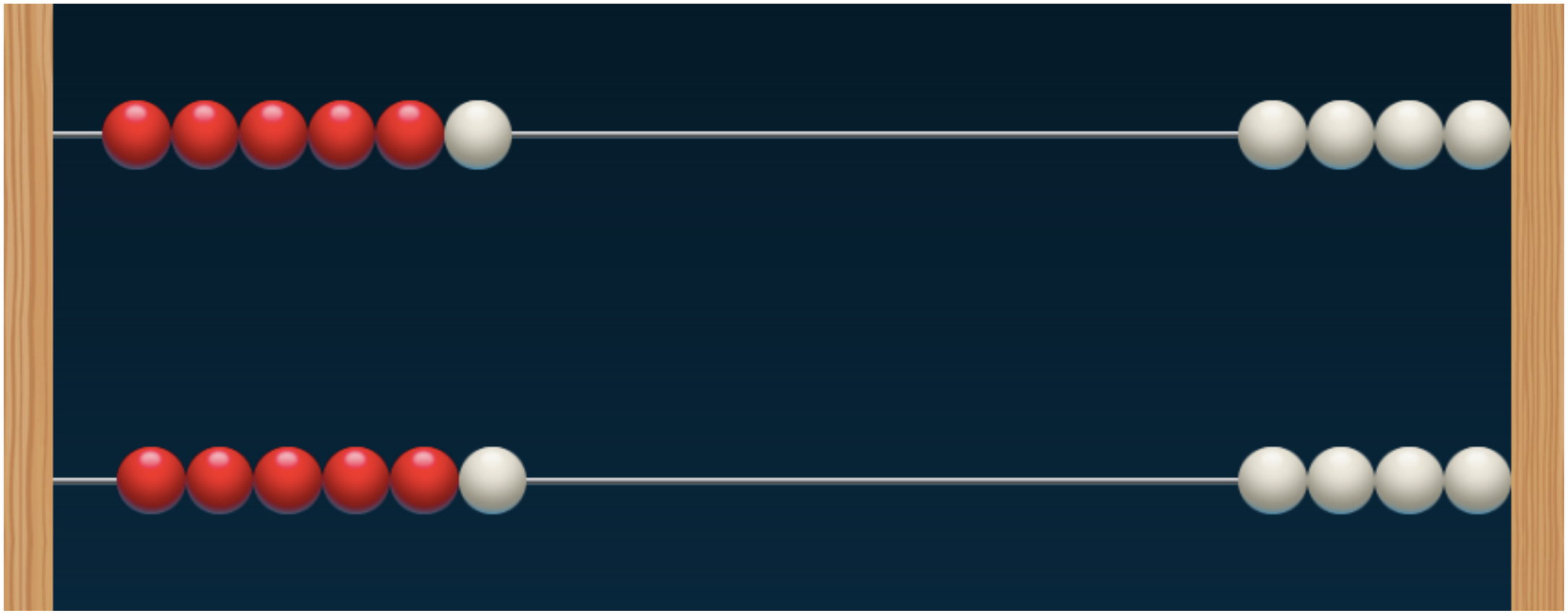
Name it and build a class anchor chart.

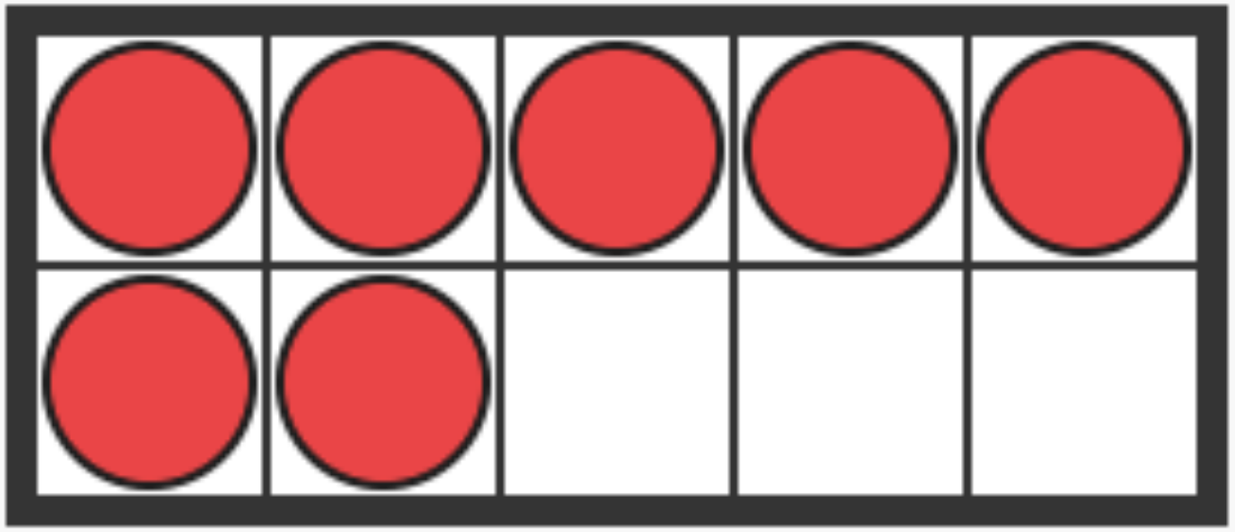
Sample Discussion Prompts

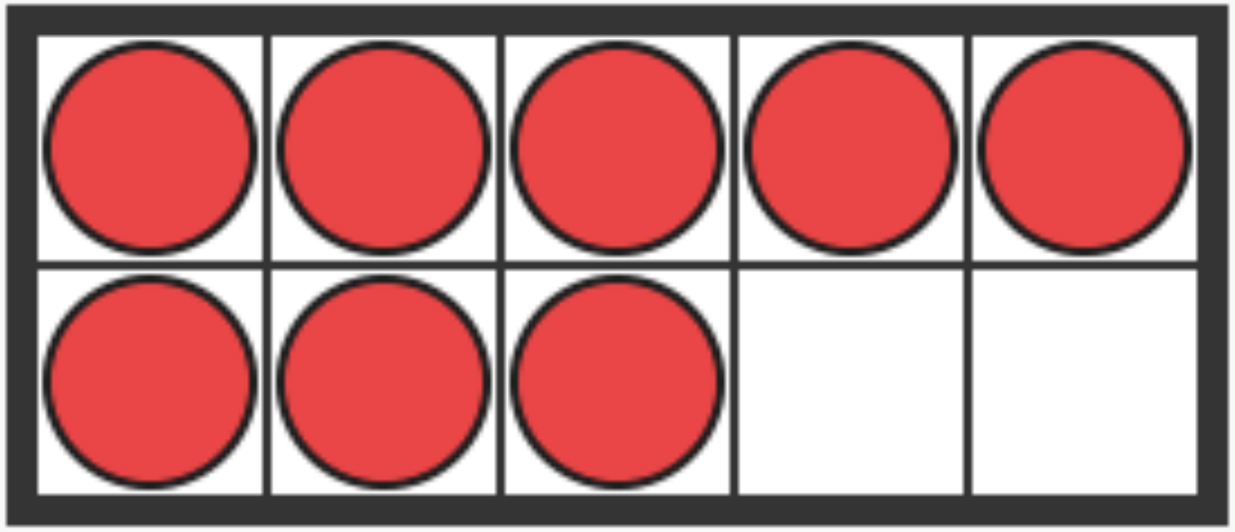
- I agree with _____ because _____.
- I do not understand _____. Can you explain this again?
- I disagree with _____ because _____.
- How did you decide to _____?



$$7 + 4 =$$







$$2 + 2 =$$

$$2 + 3 =$$

$$3 + 3 =$$

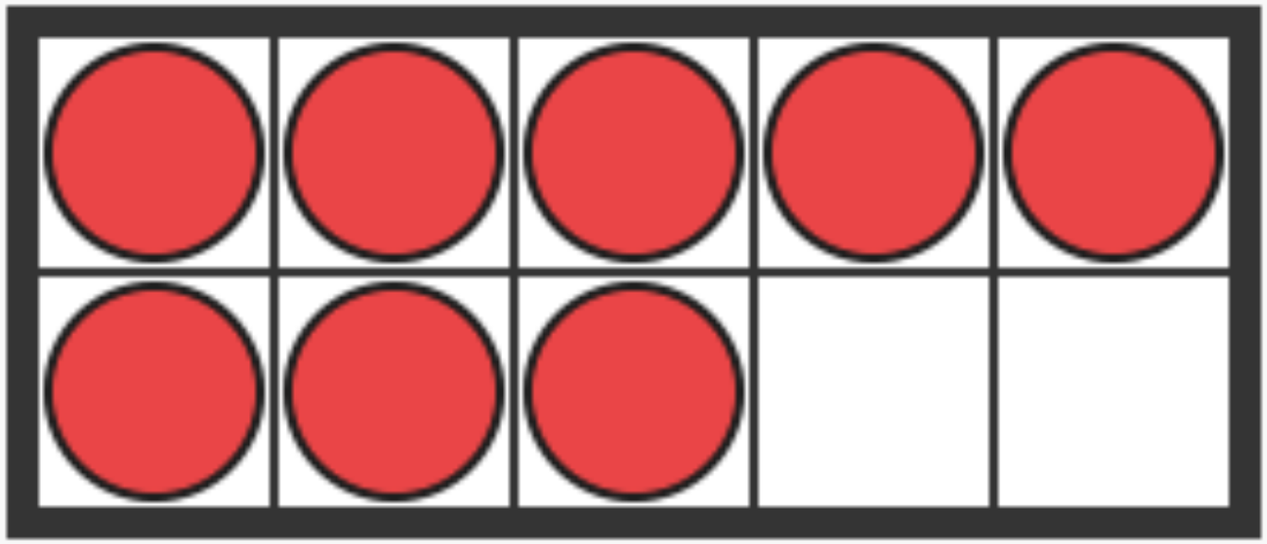
$$3 + 4 =$$

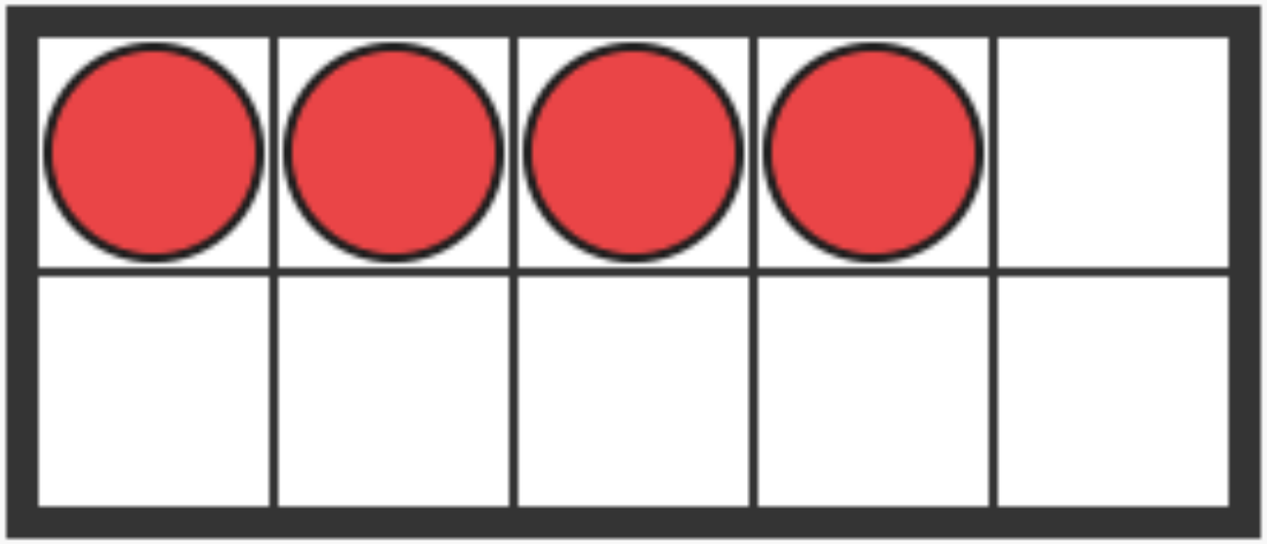
$$15 + 15 =$$

$$15 + 16 =$$

$$14 + 14 =$$

$$14 + 15 =$$





$$9 + 1 =$$

$$9 + 3 + 1 =$$

$$9 + 5 + 1 =$$

$$10 + 20 =$$

$$11 + 22 =$$

$$14 + 23 =$$

$$15 + 21 =$$

$$5 + 5 =$$

$$4 + 6 =$$

$$6 + 6 =$$

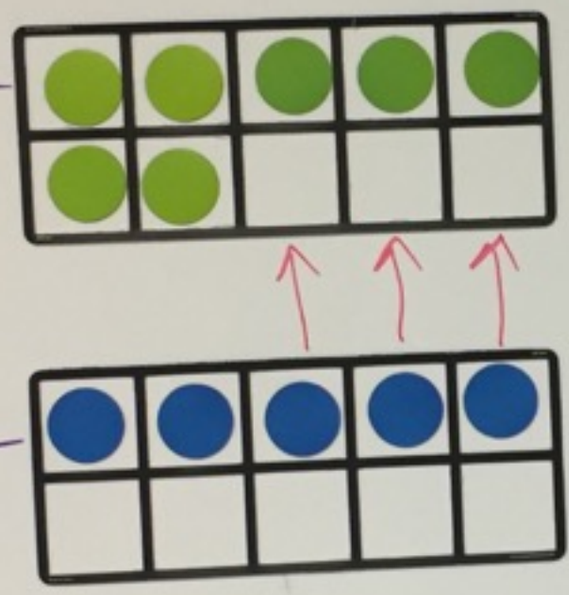
$$5 + 7 =$$

7 + 5 =

3 2

10 + 2 = 12

5:39
from
with
have
what
were



5 + 5

10 + 2 = 12

7 +

Counted on

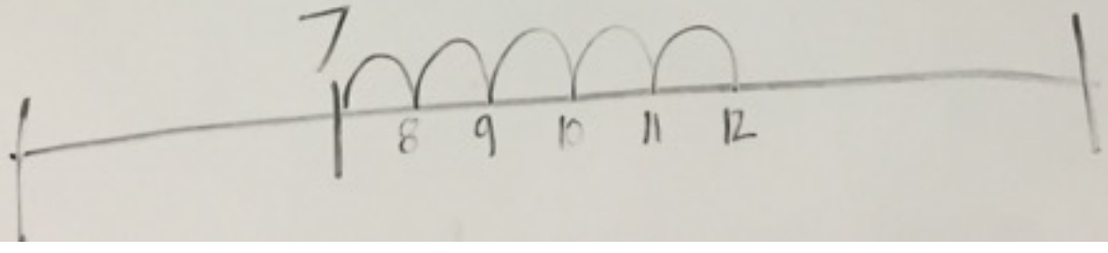
9 10 11 12

8

5 + 7

5 2

10 + 2 = 12



12 - 2 =

12 - 5 =

15 - 5 =

15 - 6 =

26 - 10 =

20 - 16 =

30 - 10 =

30 - 12 =

15 - 9 =

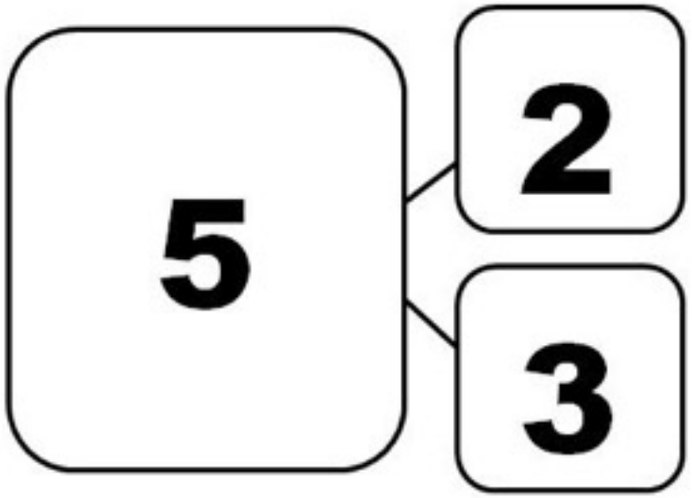
17 - 9 =

14 - 9 =

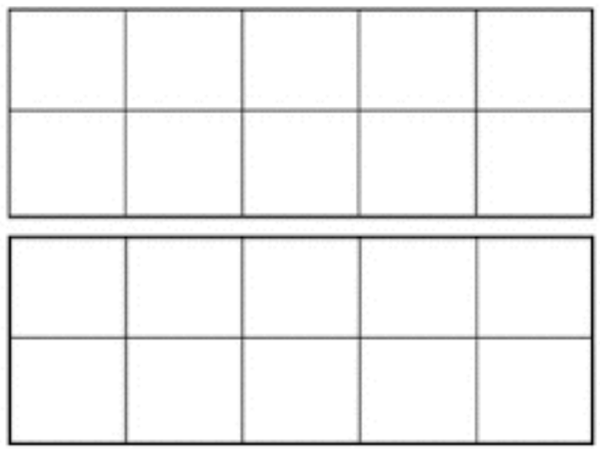
16 - 9 =

Math Solutions.

Visual tools/models are especially helpful when discussing and modelling student strategies in addition and subtraction!



Number Bonds



Ten Frames

INTENTIONALLY using models to represent your students' thinking!

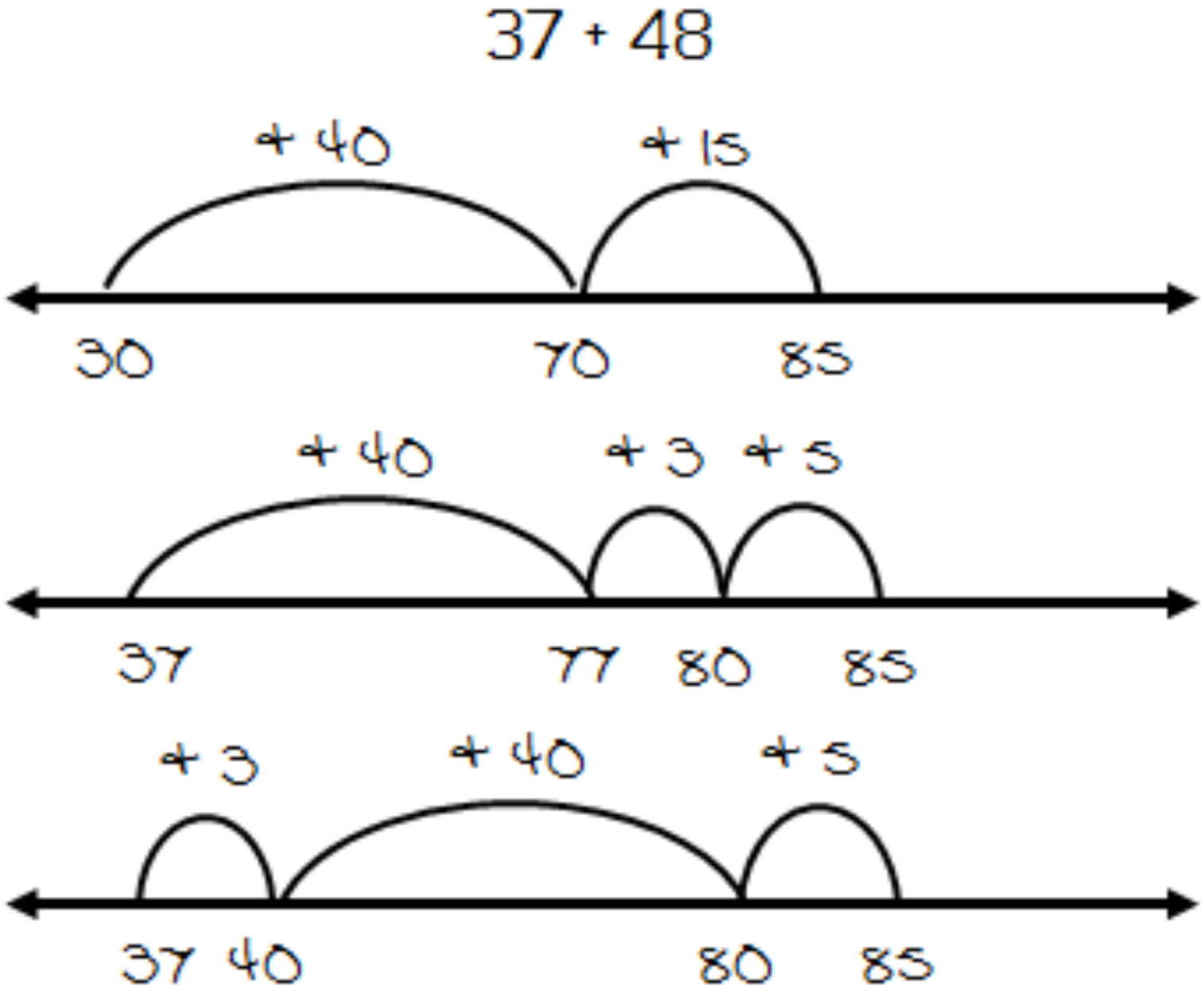
56 + 30 =

How would you represent their thinking?

I started at 56 and added 10 to get 66 and 10 more to 76 and 10 more to get 86.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Open Number Lines



Let's give it a go!

Addition Strategies

- Count All
- Count On
- Doubles/Near Doubles
- Making Tens
- Making Landmark or Friendly Numbers
- Compensation
- Breaking Each Number into its Place Value

1. Pick a strategy you would like to highlight in a number talk.

2. Anticipate and record potential student responses.

3. How will you represent their thinking - which models will you use?

Estimation Clipboard
STRAWBERRIES

Created by Jen Barker
Inspired by Steve Wyborney's work

How many strawberries are in the container?

The Reveal


15


15


The Reveal


15


25


15


25


The Reveal


15


25


39


15


25


39


The Reveal


15


25


39


30

Estimation Clipboard Pom Poms

Created by Jen Barker
Inspired by Steve Wyborney's work

How many pom poms are in the glass jar?

The Reveal

5

5

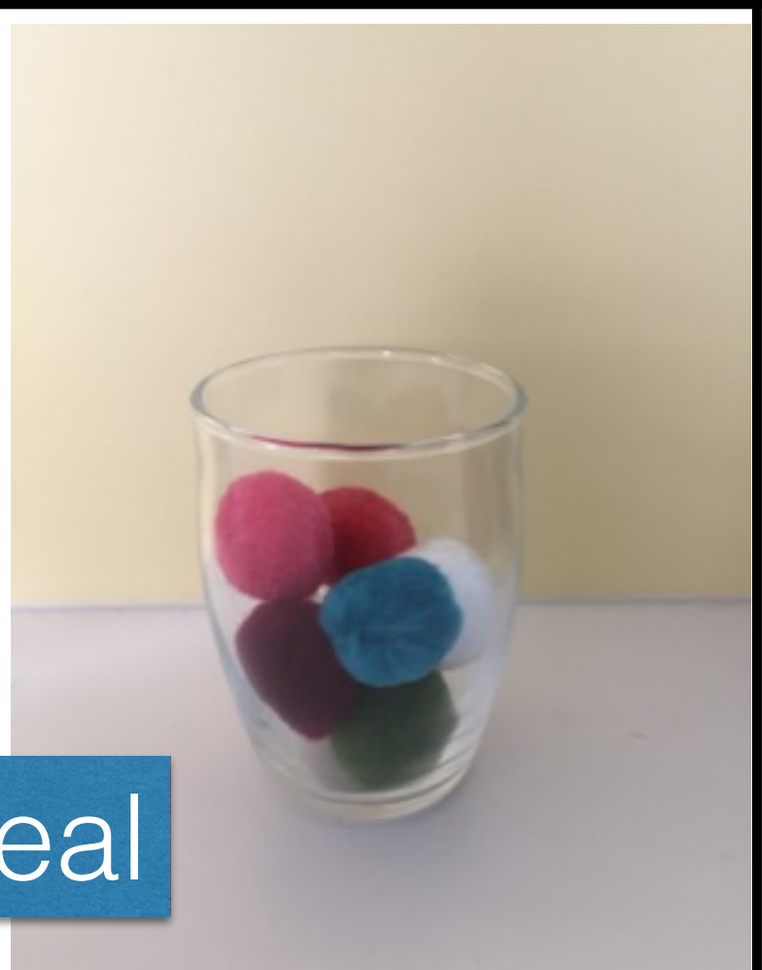
The Reveal

5

11

5

11



The Reveal

5

11

7

5

11

7

The Reveal

5

11

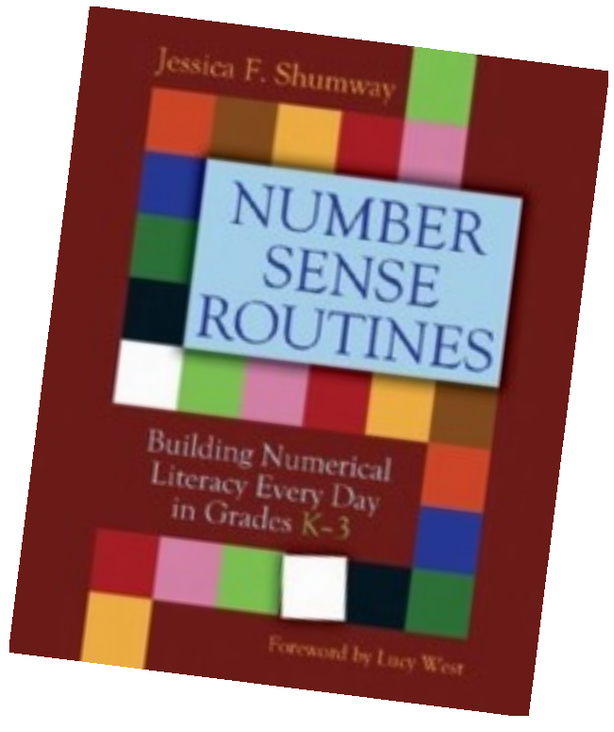
7

14

Teachers can use and encourage Talk Moves

“These number sense routines are not ‘auto pilot’ activities, but opportunities for meaningful practice. You’ll learn when to use a particular routine, how to differentiate, and how to use routines as formative assessment tools.”

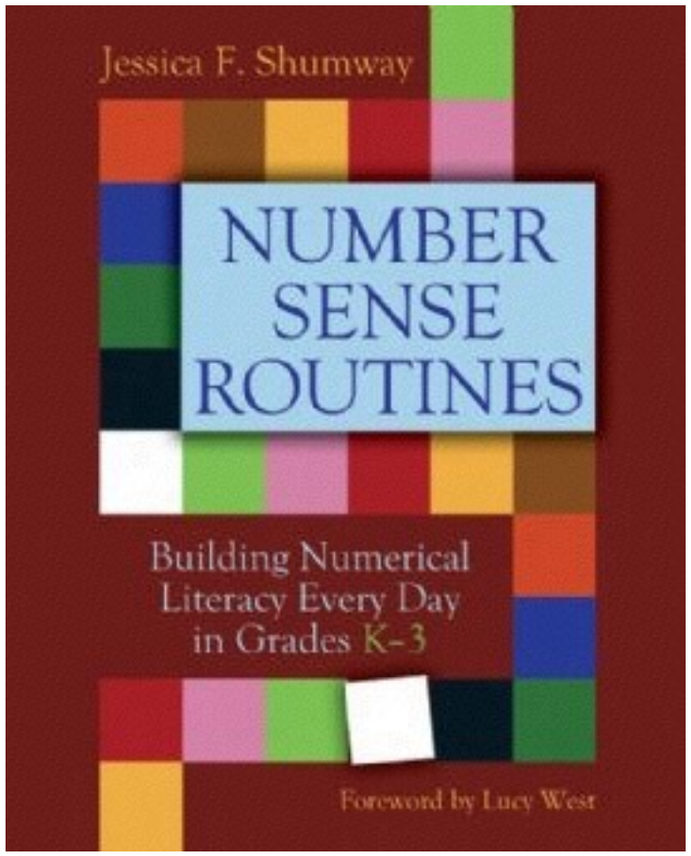
–Jessica Shumway (p.g.14)



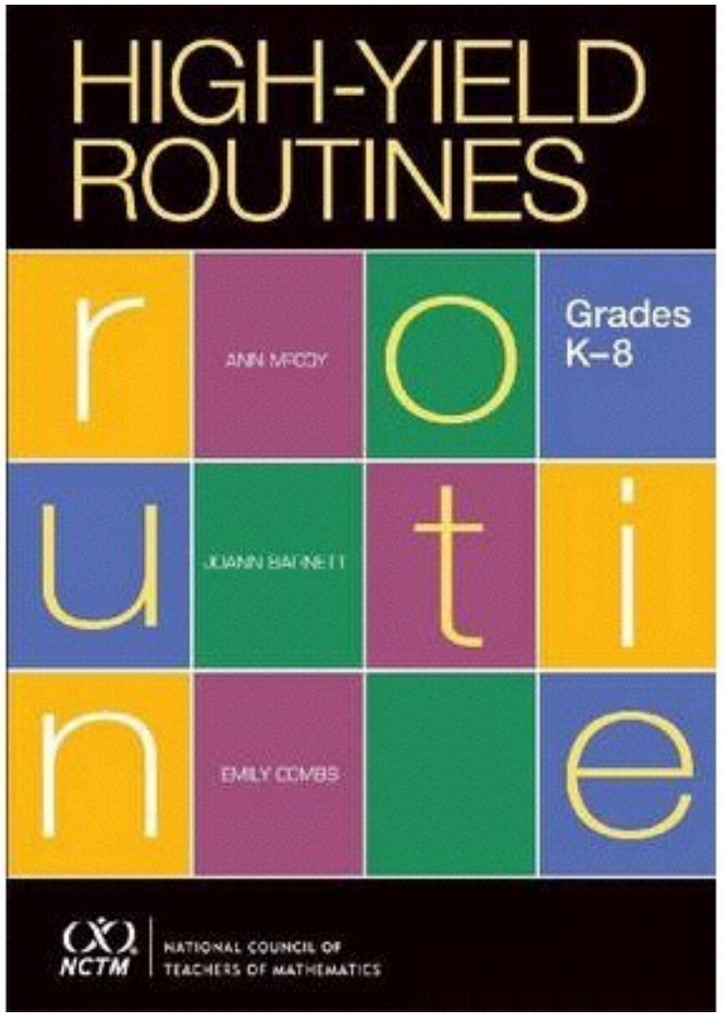
Resources - Websites

- meaningfulmathmoments.com
- Which One Doesn't Belong - wodb.ca
- Various Number Routines - http://visiblethinking.weebly.com/daily-routines.html
- Teacher Education by Design tedd.org
- Sandra Ball - https://startingwiththebeginning.wordpress.com/big-results-in-a-small-amount-of-time/
- Janice Novakowski - http://blogs.sd38.bc.ca/sd38mathandscience/ and http://janicenovkam.typepad.com/reggioinspired_mathematic/instructional-resources.html

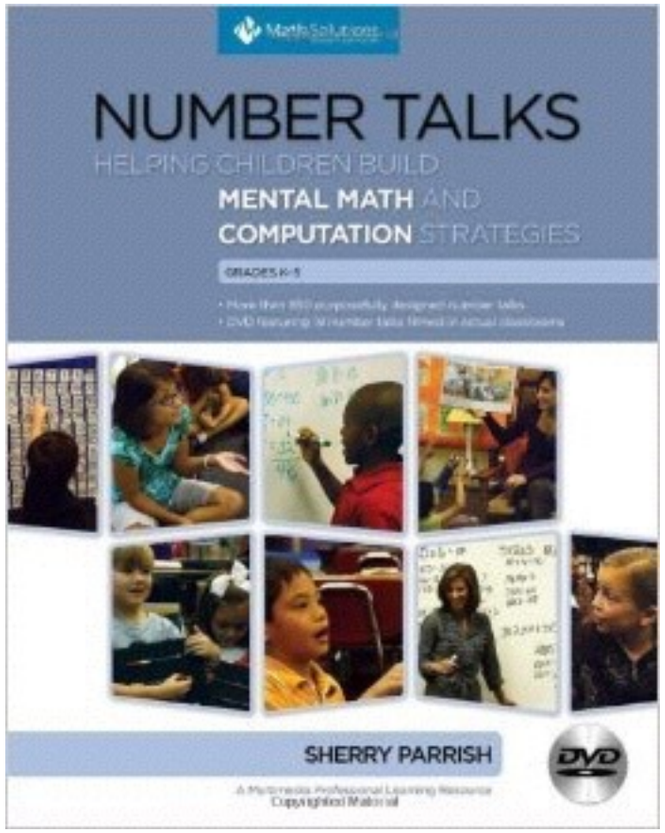
Resources



Jessica Shumway



Ann McCoy, Joann Barnett
Emily Combs



Sherry Parrish

Christopher Danielson

Thanks so much for sharing your time with me!

MATHEMATICS
is not about
numbers, equations,
computations, or
algorithms:
it is about
UNDERSTANDING.

William Paul Thurston