

Balanced Numeracy

Grades K - 3



April 20th, 2018
Prince George, BC
Presented by Jen Barker

Acknowledgement



We gratefully acknowledge we are here today to learn on the unneeded shared traditional territories of the Lheidl T'enneh First Nations.

Learning Intentions



- I understand the key components that comprise a Balanced Numeracy Program, how they fit together (e.g., whole class, small group, and independent practice) and what this could look like in the classroom.
- I understand learning is developmental. I have some ideas I can use to identify what my students know and their next steps.
- I have an emerging understanding of what Balanced Numeracy could look like over a week.
- I am aware of various resources that I can use to support my Balance Numeracy Program (e.g., books, websites)

Balanced Numeracy Network

Balanced numeracy is a framework that incorporates a diverse range of organizational structures, assessments and instructional practices that are intentional and responsive to students and curriculum. Balanced numeracy provides opportunities for students to uncover, construct, and apply mathematical understandings.



<https://sites.google.com/view/bcnumeracynetwork/home>

Balanced Literacy (K to 12)	Balanced Numeracy (K to 12)
<p>Routines:</p> <ul style="list-style-type: none"> • Transitions (Question of the Day; Morning Message, 'soft start', provocations, etc.) <p>Flexible Groupings:</p> <ul style="list-style-type: none"> • Whole class (read aloud, mini-lessons, etc.) • Small groups (mini-lessons, guided reading, literacy centers, Literature Circles, etc.) • Individual (conferences & interviews, authentic practice, student choice) <p>Explicit and Intentional Planning</p> <p>Gradual Release of Responsibility</p> <ul style="list-style-type: none"> • Modelling of reading, writing – 'think aloud' • Shared reading and writing – 'think-pair-share' • Guided reading and writing • Independent and authentic practice in reading, writing, reflecting • Individual choice <p>Reading & Writing Workshop (Structure)</p> <ul style="list-style-type: none"> • Mini lessons • Lots of time reading, writing, thinking • Lots of descriptive, individual feedback <p>Rich Learning Environment</p> <ul style="list-style-type: none"> • Classroom library, literacy centers, read aloud, word wall, anchor charts for routines and criteria • Place-based learning, outdoor learning, First Peoples Principles 	<p>Routines:</p> <ul style="list-style-type: none"> • Daily math investigations • Transitions (provocations, number sense routine, etc.) <p>Flexible Groupings:</p> <ul style="list-style-type: none"> • Whole class (modelling, "Number Talks", mini-lessons, "Math Makes Sense: Explore") • Small group (guided math, mini-lessons, math centers, collaborative tasks and problem solving) • Individual (practice, conferences, interviews) <p>Explicit and Intentional Planning</p> <ul style="list-style-type: none"> • Model – think aloud • Guided small group practice • Independent exploration and practice <p>Math Workshop (Structure)</p> <ul style="list-style-type: none"> • Small group • Conferencing with teacher • Teacher prompting and questioning to encourage further learning <p>Rich Learning Environment</p> <ul style="list-style-type: none"> • Math community, student discourse • Choice, play, inquiry, joy, fun • Access to materials (manipulatives, etc.) • Word wall, anchor charts, visuals • Rich tasks, problem-solving, inquiry • Visual tools (visualize, spatial reasoning)

Using what we knew about Balanced Literacy, we asked ourselves "What does this mean for Numeracy?"

<p>Foundations</p> <ul style="list-style-type: none"> • Reading and writing strategies • Phonological awareness, phonics, sight words, etc. 	<p>Foundations</p> <ul style="list-style-type: none"> • Conceptual connections • Computational fluency • Concrete, pictorial, abstract – at all grade/age levels (connected to formal introduction of a concept) • Common language – vocabulary • Compose and decompose quantities, shapes, and fractions • Strategies that demonstrate flexible thinking
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What key parts are needed?

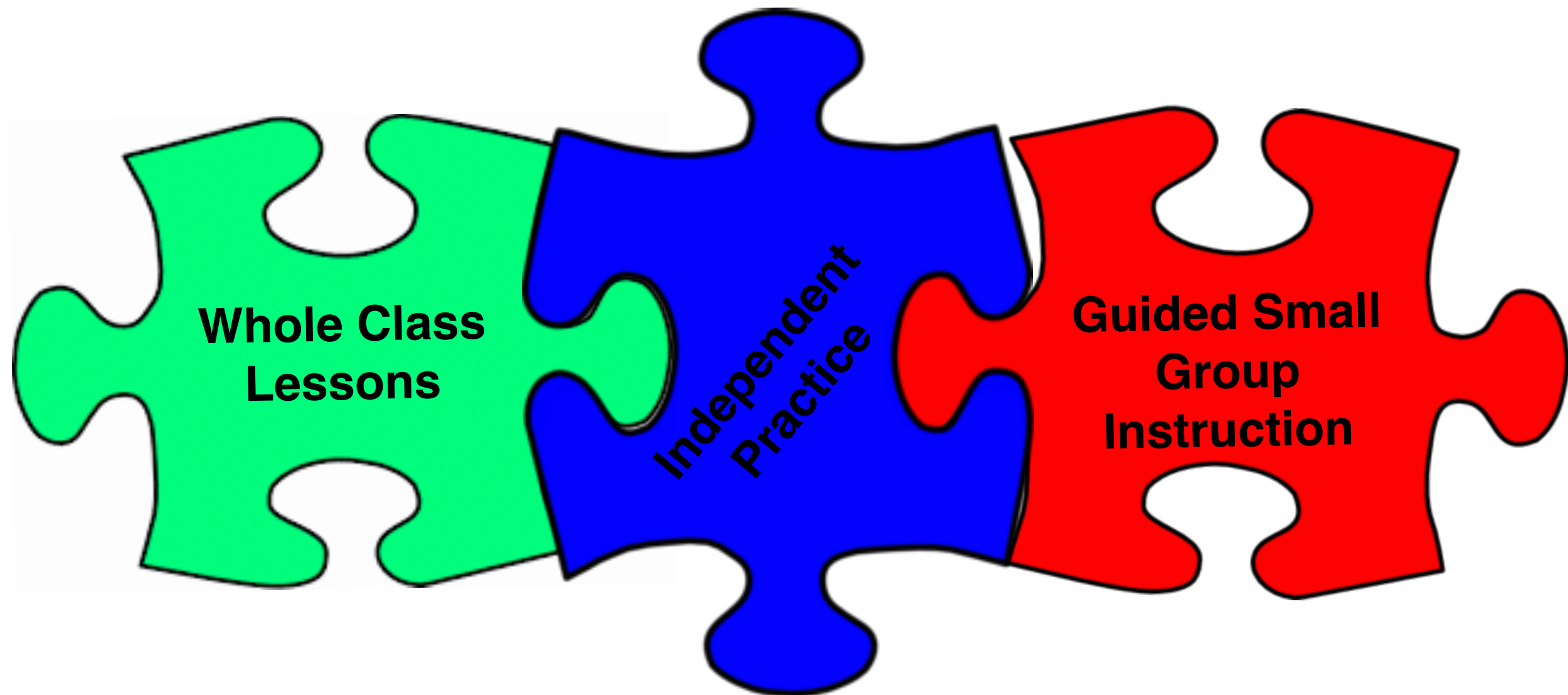
Three interlocking puzzle pieces are shown. The green piece is on the left, the blue piece is in the center, and the red piece is on the right. Each piece has a different shape and color, and they are interlocked with each other.

**Whole Class
Lessons**

**Independent
Practice**

**Guided Small
Group
Instruction**

What key parts are needed?

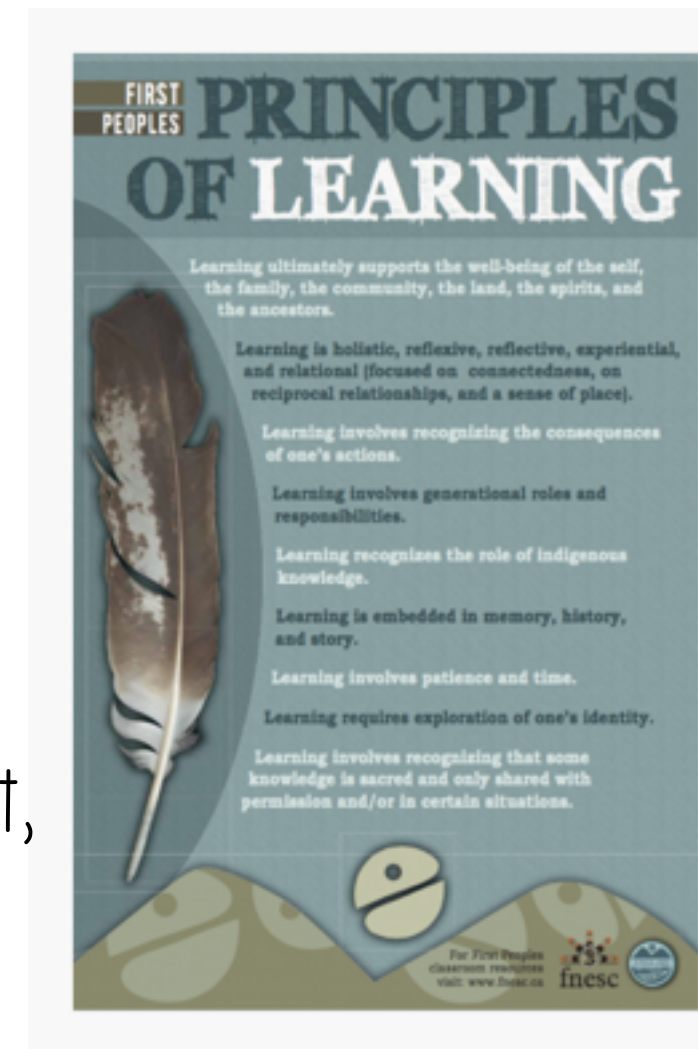


Creating rich math learning contexts involves not only planning the activities that students will complete, but also considering the kinds of interactions, language use, and critical thinking opportunities in which we want our students to engage.

- Cathy Marks Krpan (2018)

What beliefs about children and learning guide our work?

- First Peoples Principles;
- students learn to think like Mathematicians by being immersed in classrooms that foster the “Habits of Minds/Doing” of Mathematics;
- problem solving is fundamental to the study of mathematics;
- an inquiry-based approach includes rich tasks and student problem posing, which nurtures engagement, curiosity and deep understanding, and;
- there is a progression of learning in mathematics.



Whole Class Lessons

Learning opportunities that enhance student understanding of mathematics through whole class instruction.

Guiding Questions:

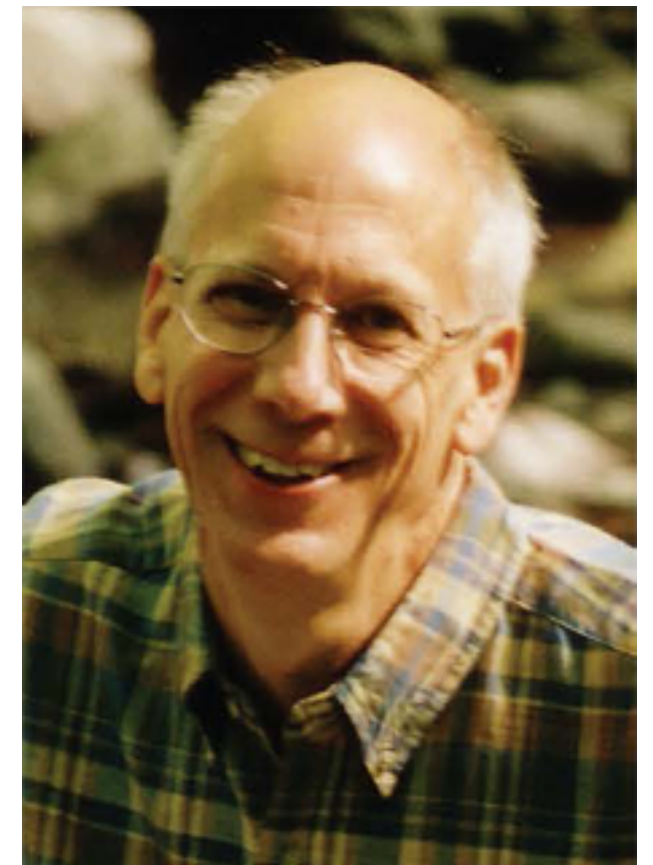
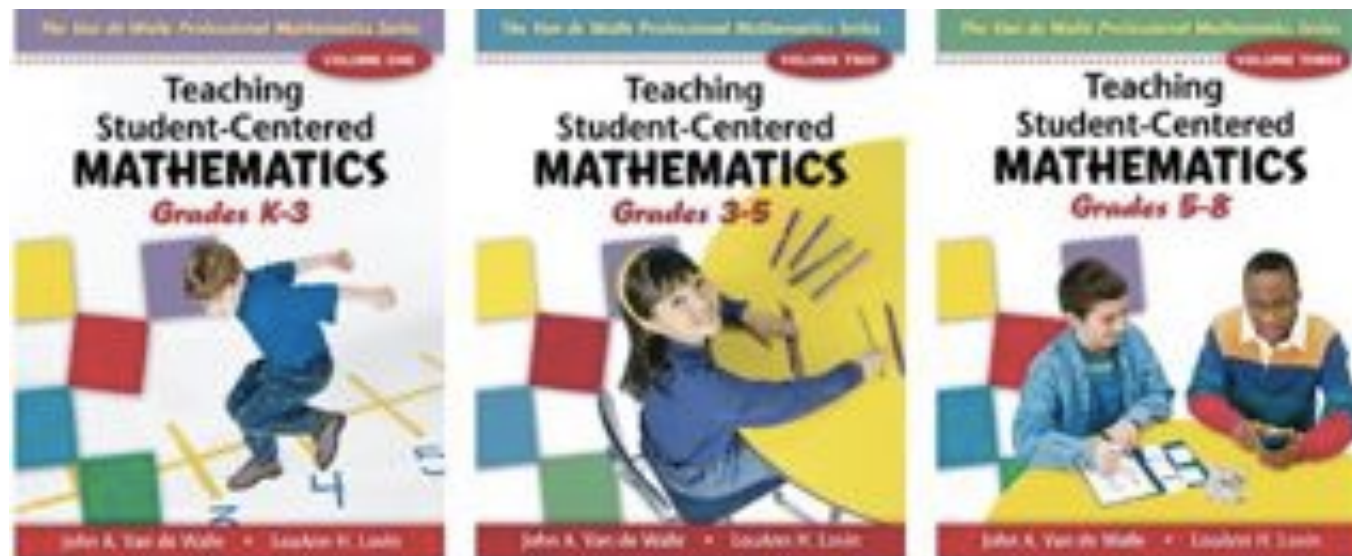
- How can I use Rich Routines to develop a community of learners in which students feel safe to take risks and make mistakes?
How will I use routines to provide opportunities to revisit concepts and model 'thinking aloud'?
- How will I activate prior knowledge?
- How will I find out what my students' know?
- What mathematical vocabulary needs to be introduced?
- Is there any available literature that will help students to make connections and provide visual connections to concepts?
- What learning opportunities can I use that will provide an entry point for ALL students?

Three Part Lesson Format

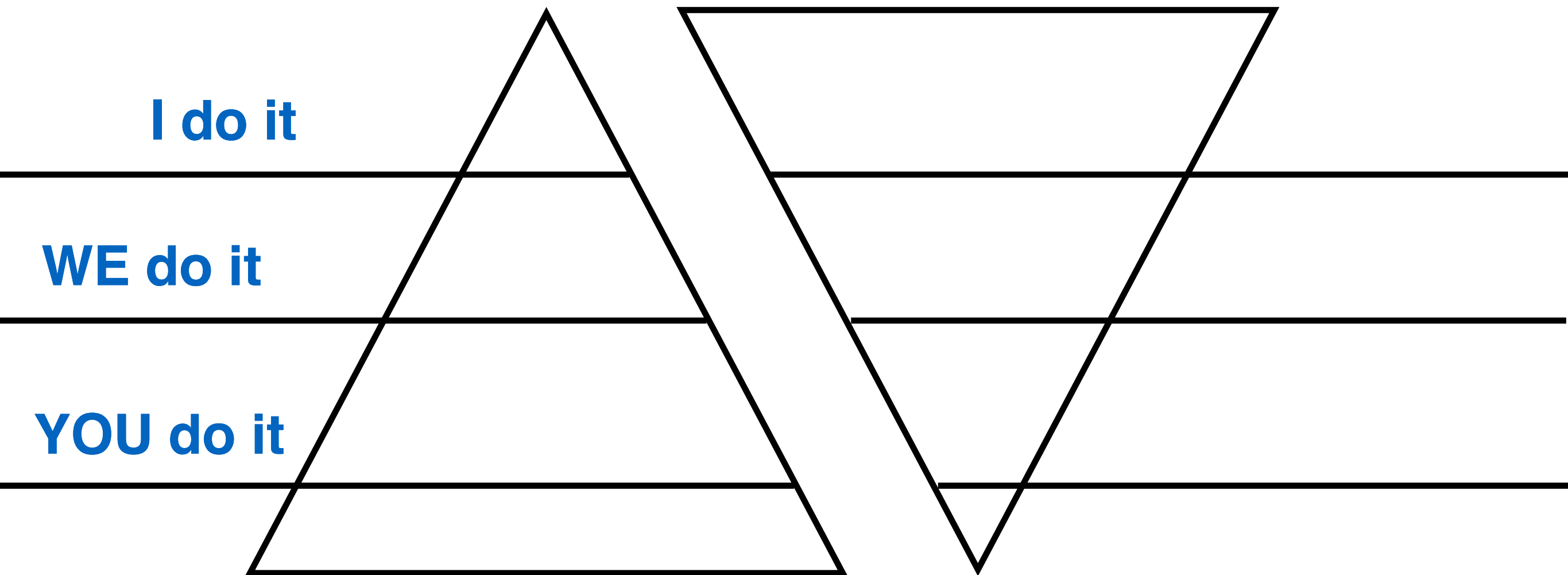
BEFORE: Engage your students with – Activate prior knowledge – Clear learning intentions – Pose the Problem

DURING: Exploration/Conferencing/Formative Assessment

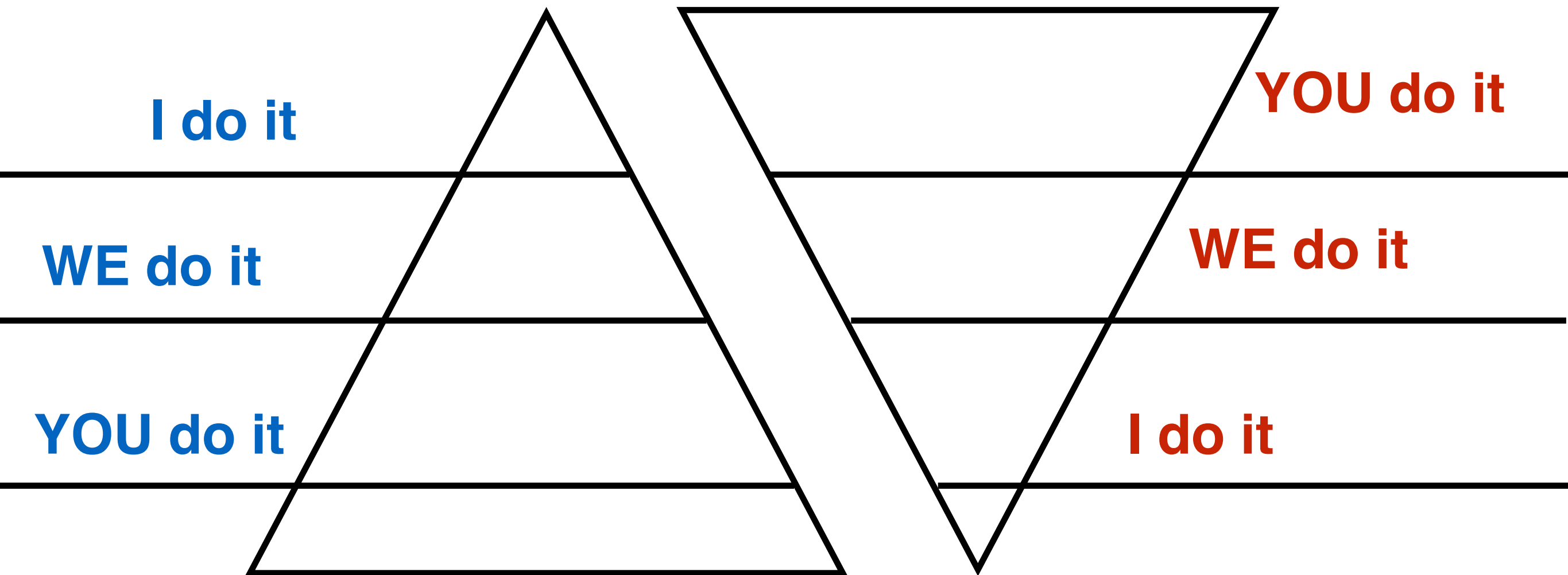
AFTER: Sharing – Connecting and Reflecting



Gradual Release Flipped

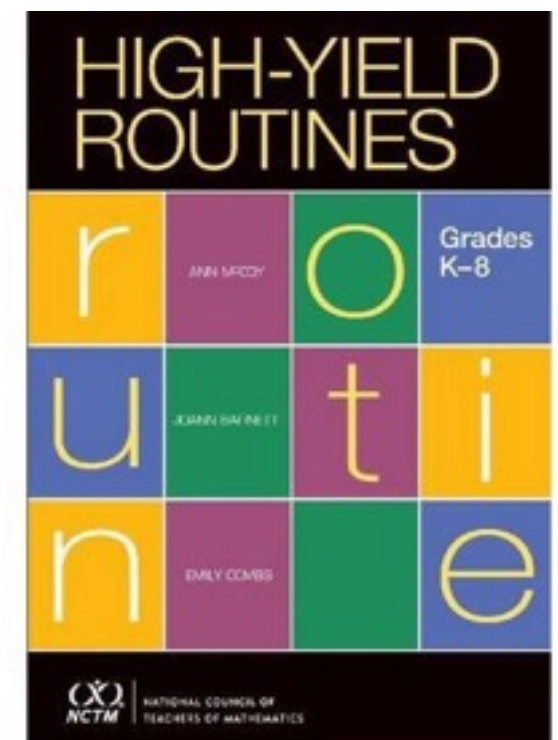
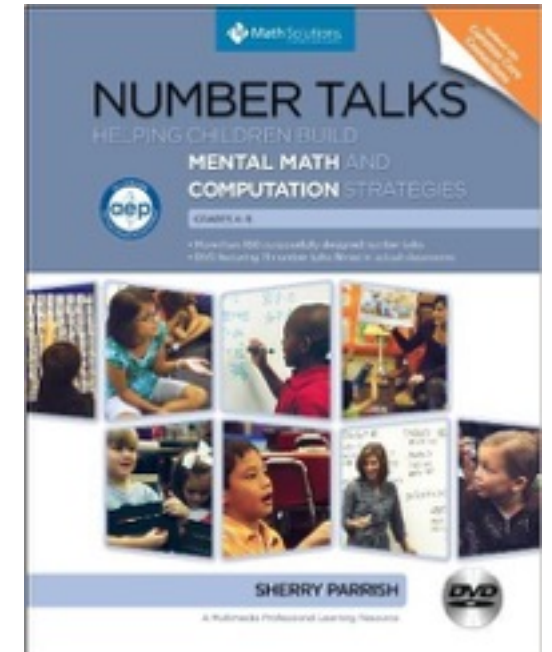
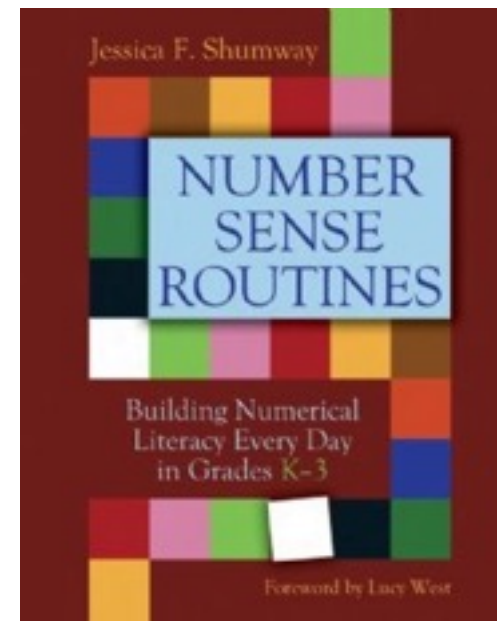


Gradual Release Flipped



What are Mathematical Instructional 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 where students clarify their thinking, consider and test strategies, and build a repertoire of efficient strategies
- 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.

Quick Images

Potential learning intentions:

- Subitizing
- Visualization
- Multiplicative Thinking
- Decomposing and Recomposing
- Mental Math Strategies

Items you could use:

- Ten Frames or Base Ten Blocks
- Greg Tang books
- Shapes
- Pie plates and cookie sheets with magnets

Guiding Questions:

How many do you see?

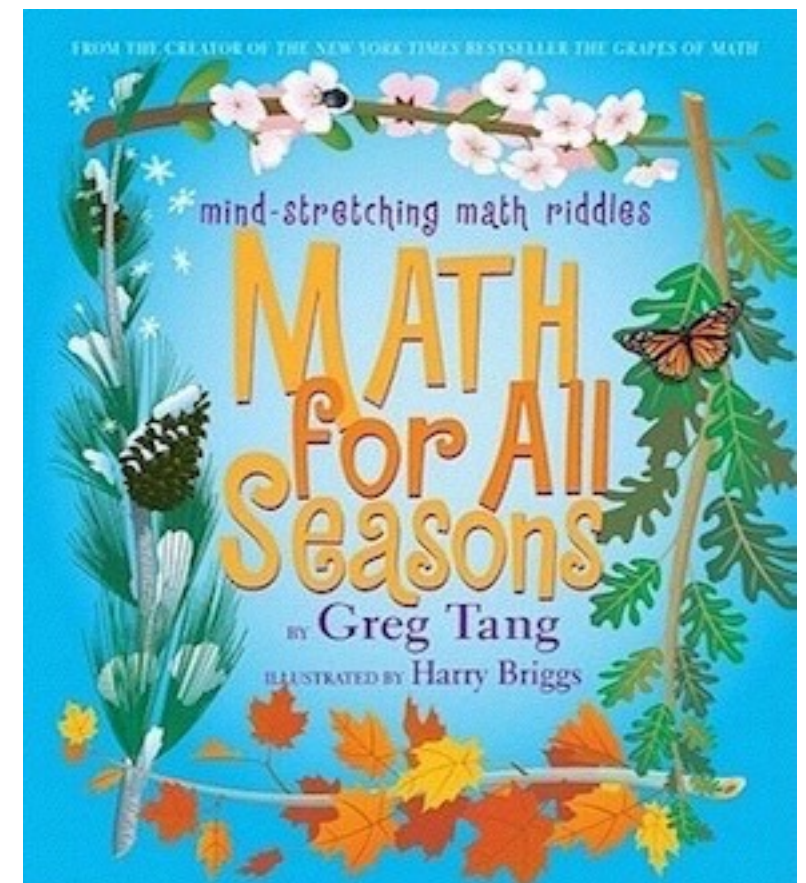
How do you see them?

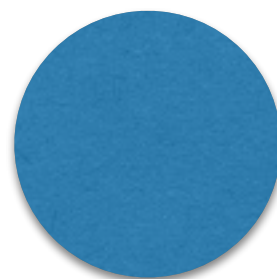
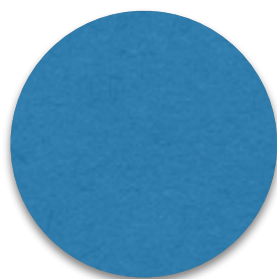
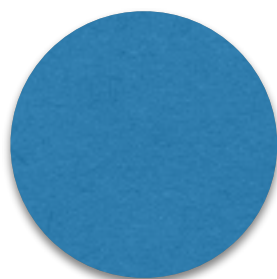
Does anyone see them differently?

Can you draw them?

What equation could describe how you see them?

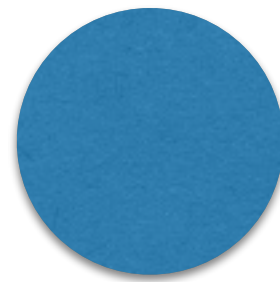
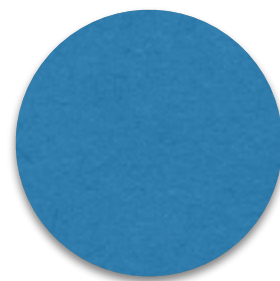
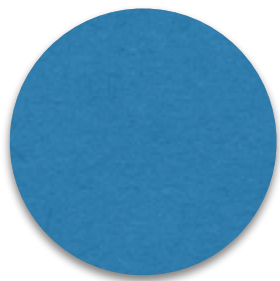
How could you record this using numbers and symbols?





How many?

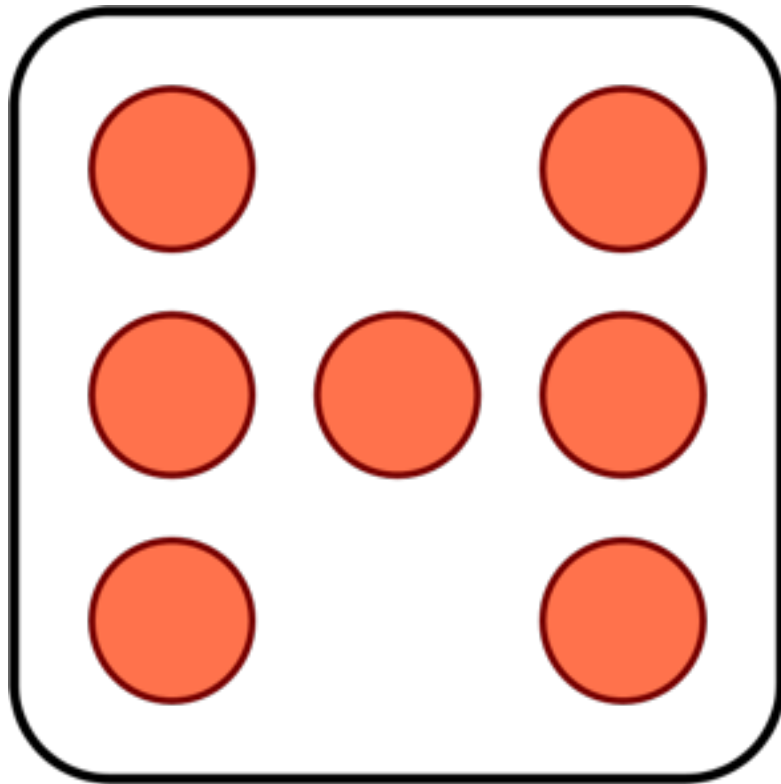
How did you see them?



How many?

How did you see them?

Dot Cards



Flash and Say

Flash and Show

Give SILENT thumbs up!

“How many do you see?”

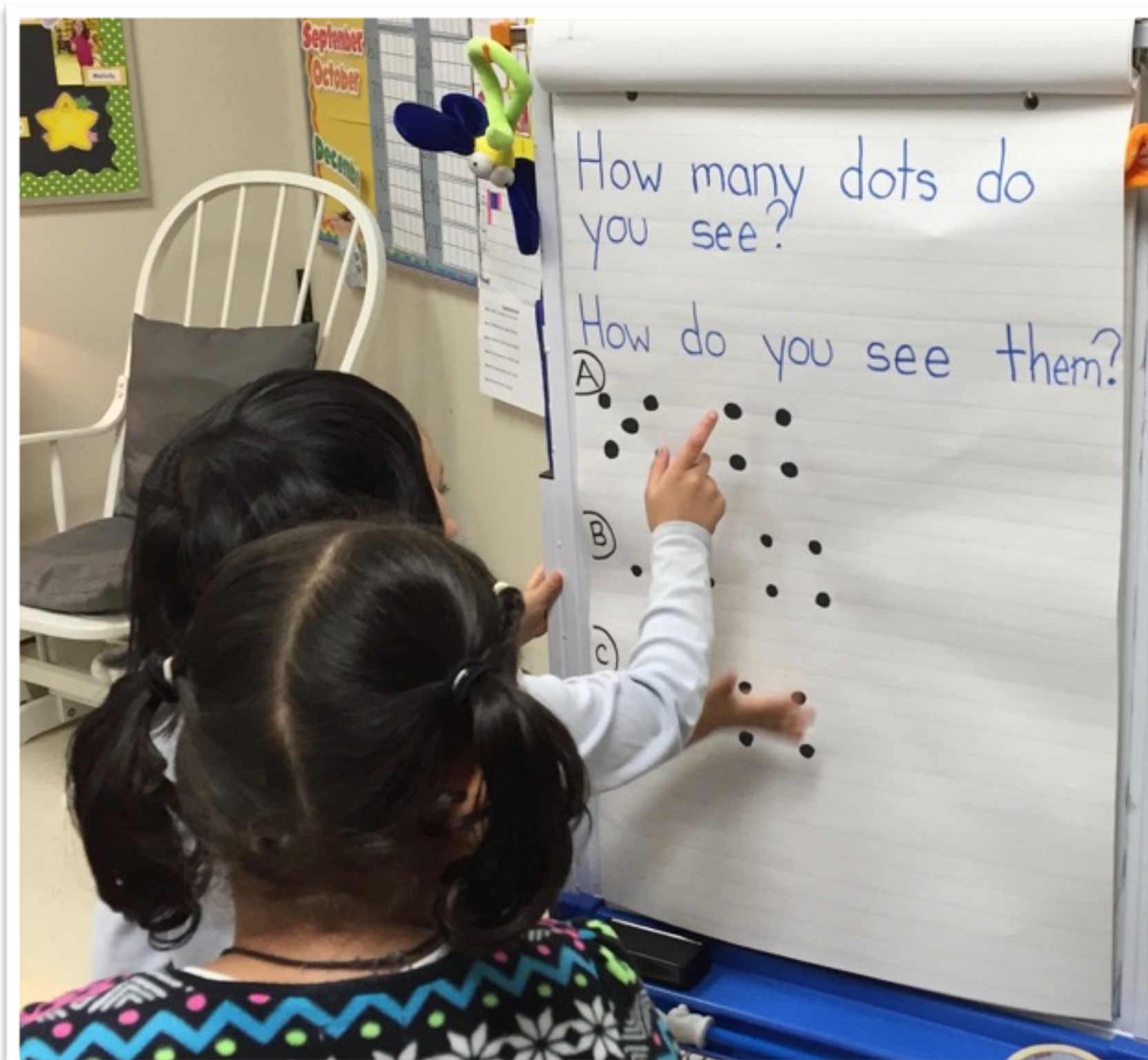
“How did you know so quickly?”

“How did you see them?”

Pie Plates/ Paper Plates

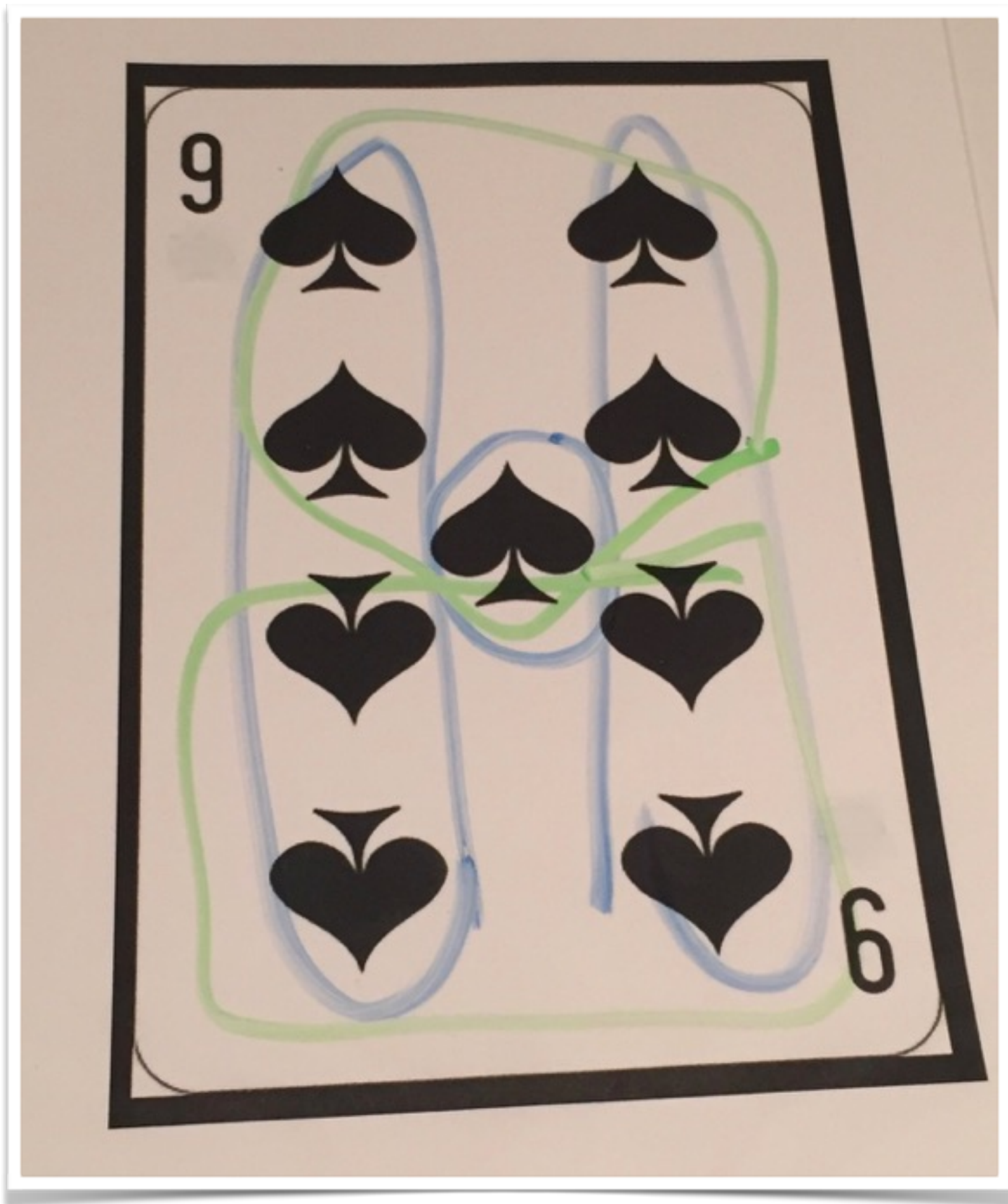


Chart Paper

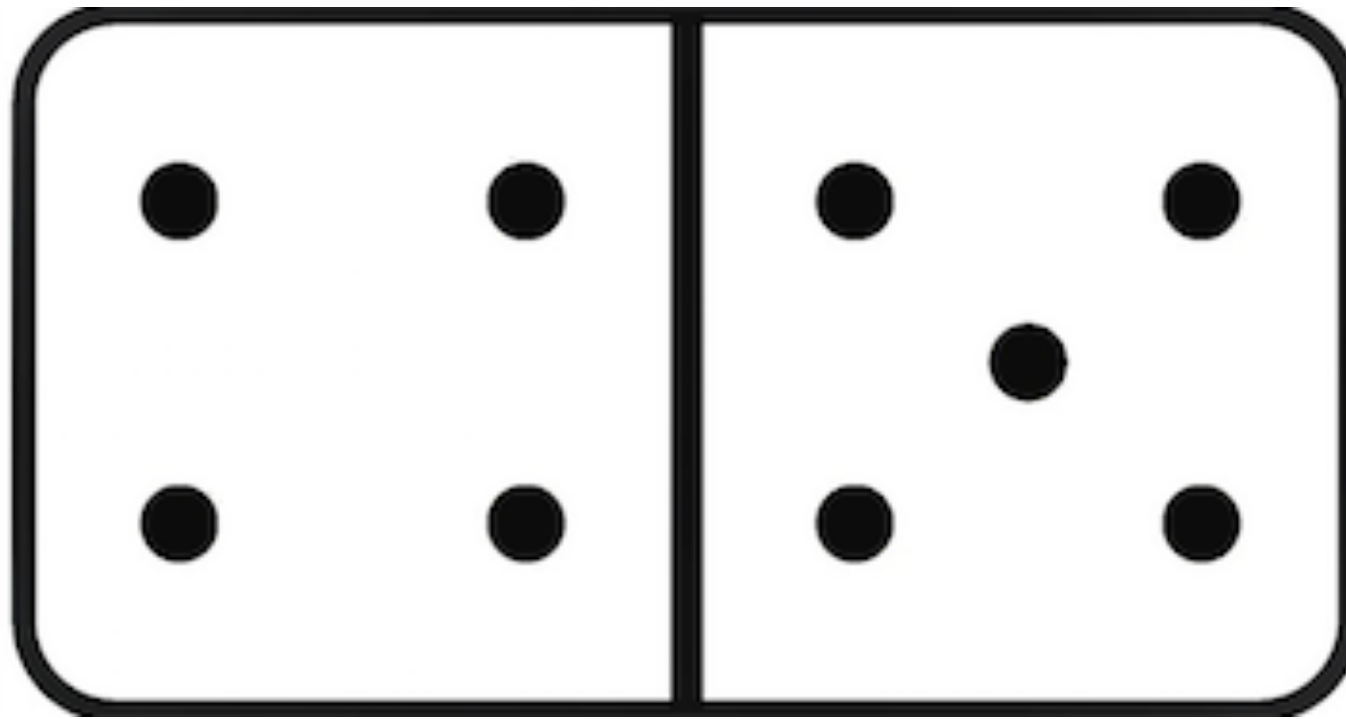


Playing Cards





Dominoes



How many do you see?

How do you see them?

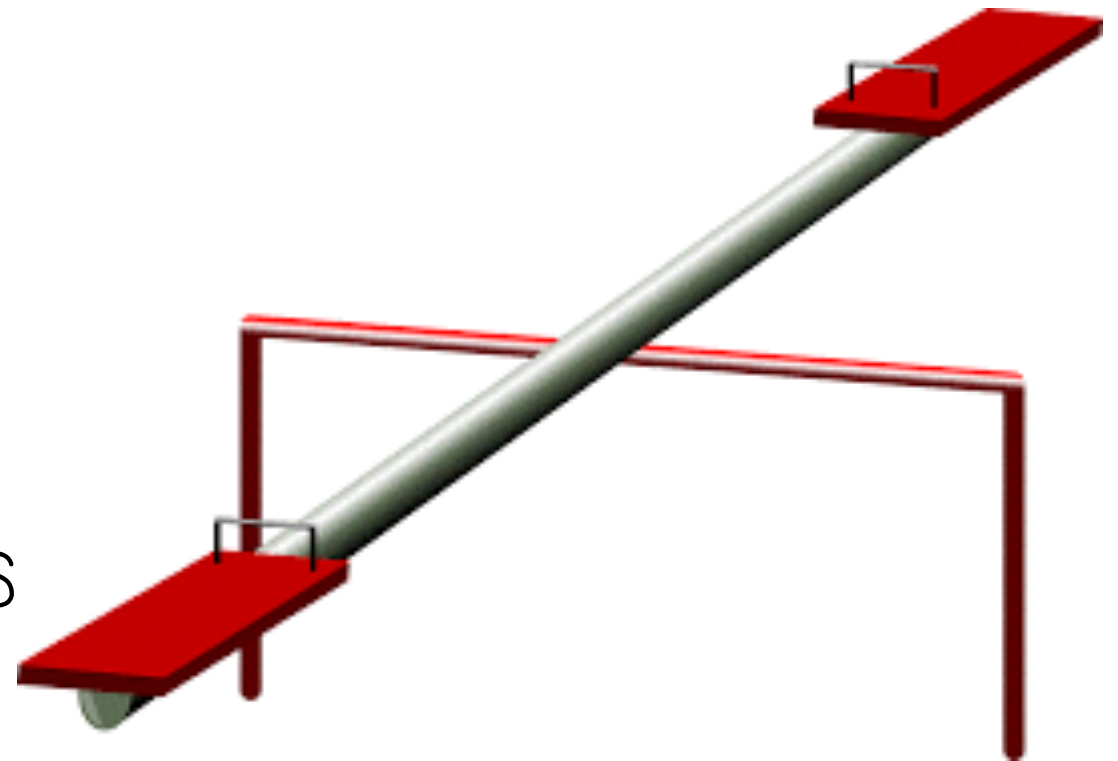
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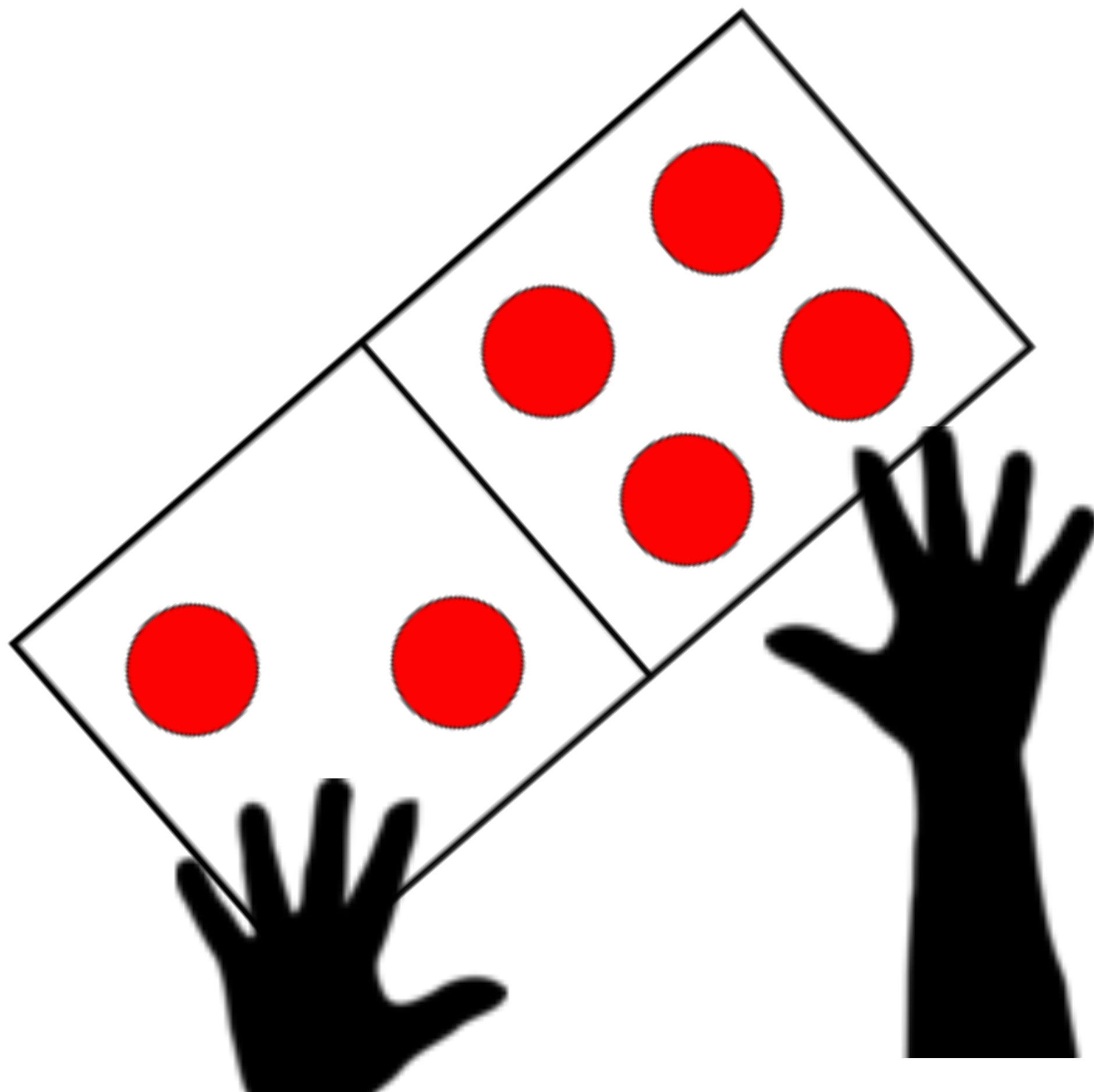
Learning Intentions:

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

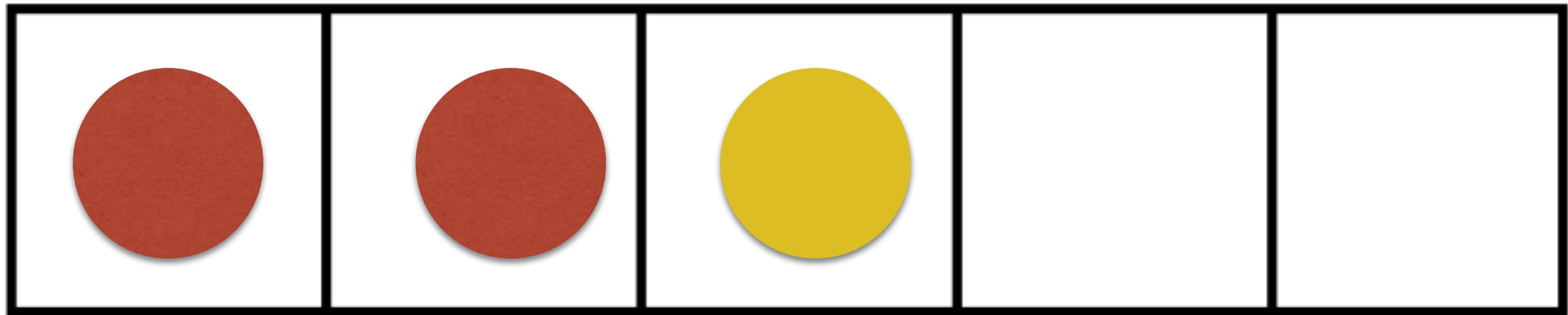
Items you could use:

- Any of the quick image items





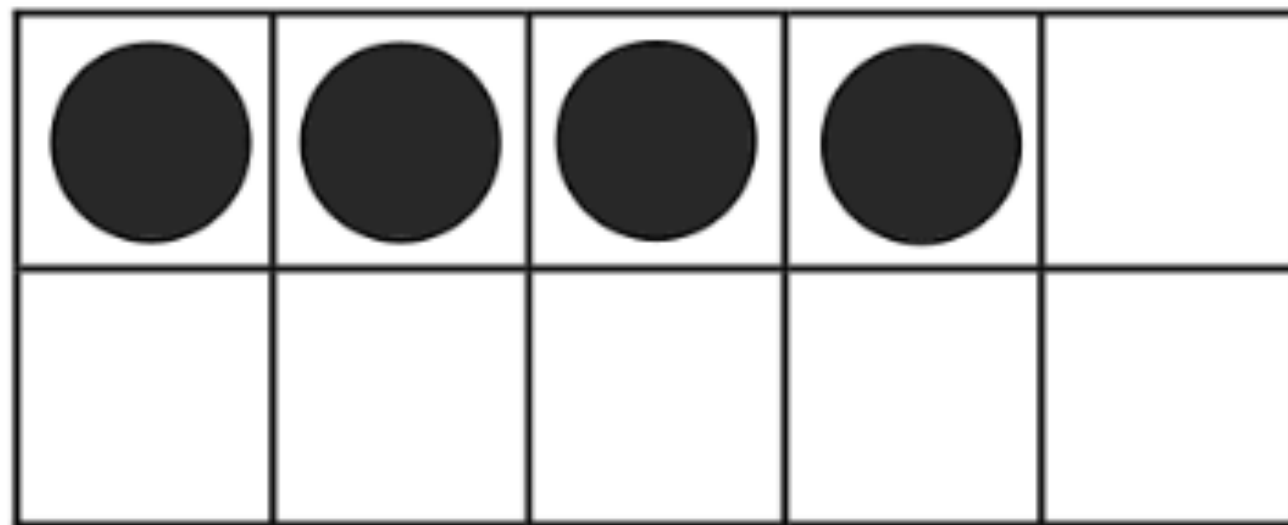
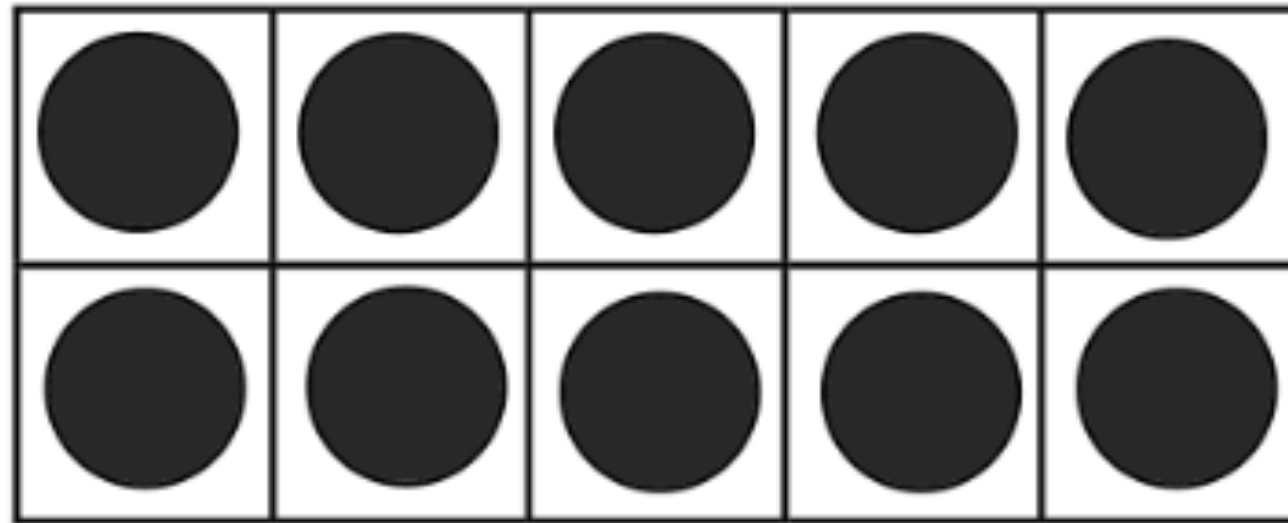
Five and Ten Frames

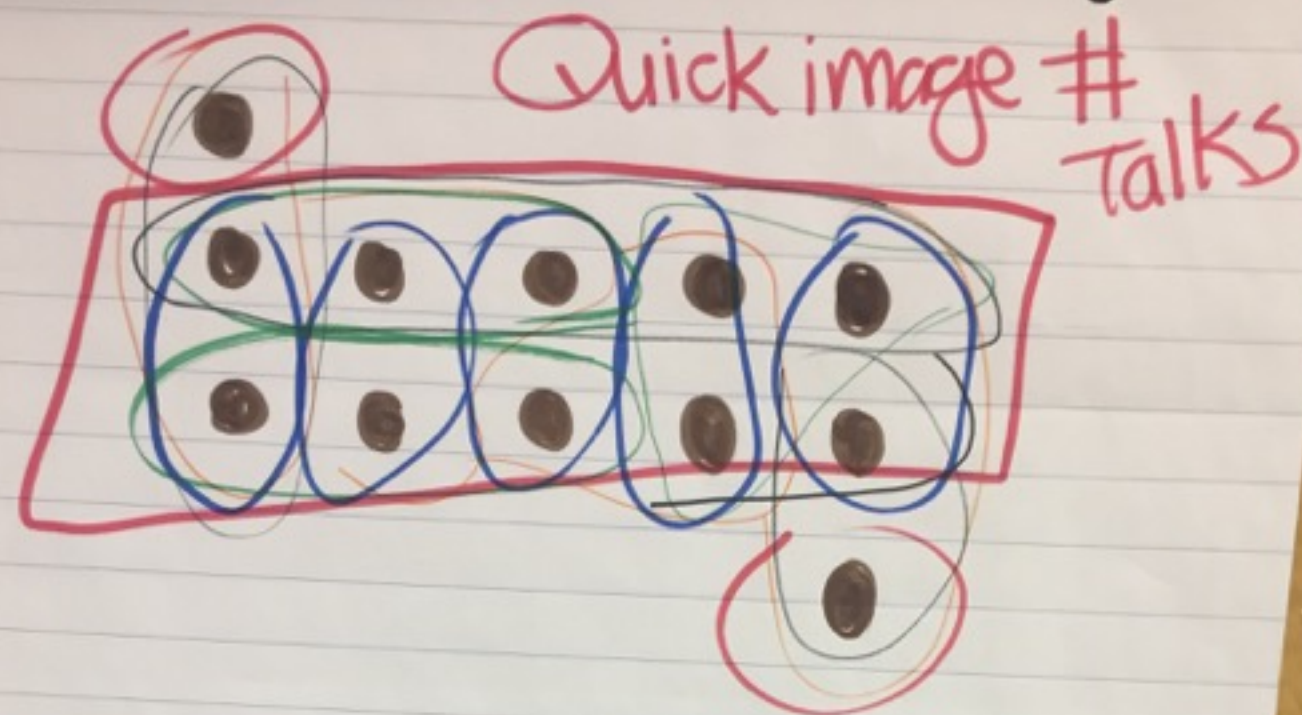


How many?

How did you see them?

Double Ten Frames





$$3 + 3 + 3 + 3 = 12$$

$$4 \times 3 = 12$$

$$2 + 2 + 2 + 2 + 2 + 1 + 1 = 12$$

4 6 8 10 11 12

$$3 + 3 + 3 + 2 + 1 = 12$$

$$5 + 2 + 3 + 2 = 12$$

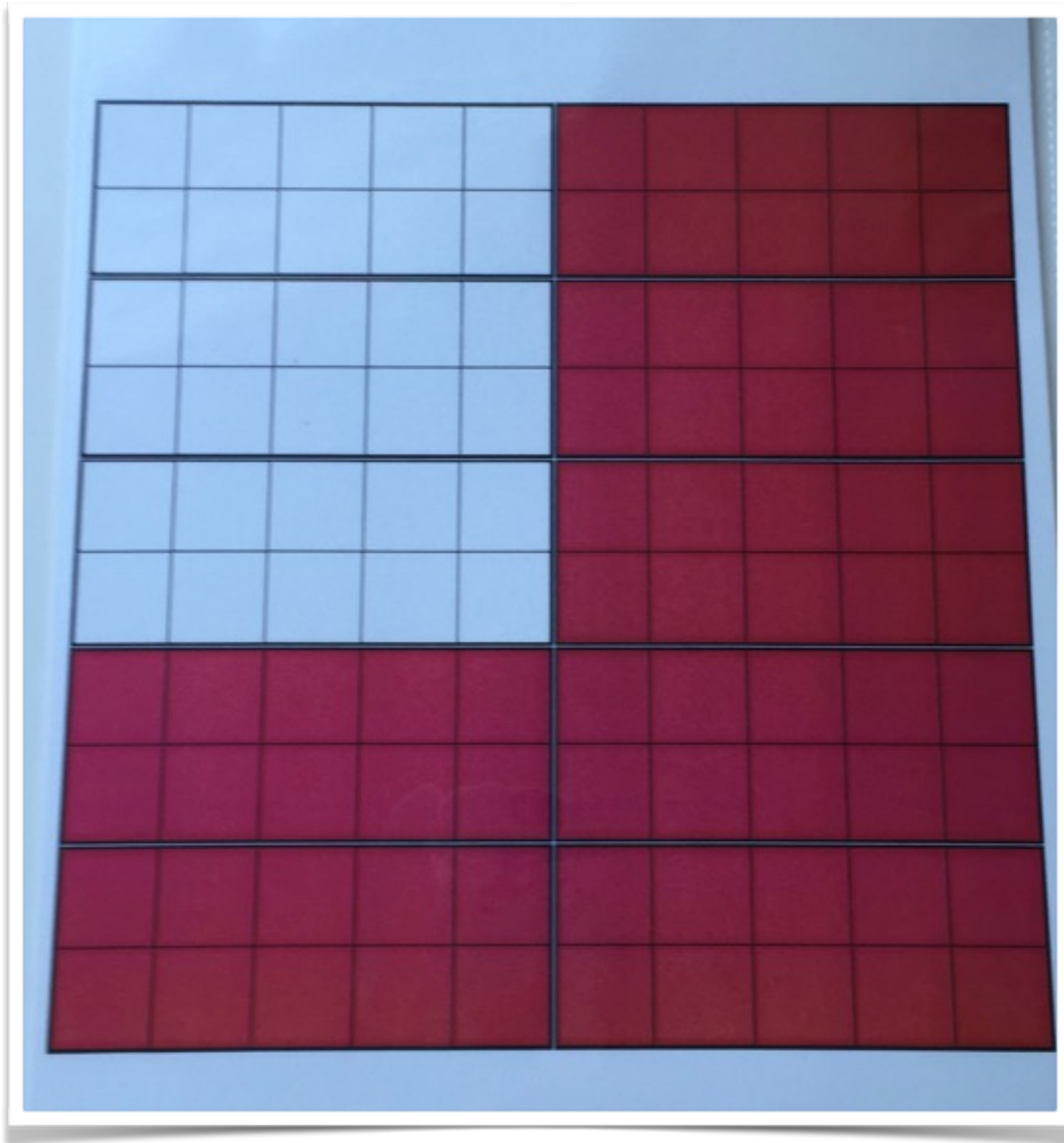
$$10 + 1 + 1 = 12$$

Rekenrek

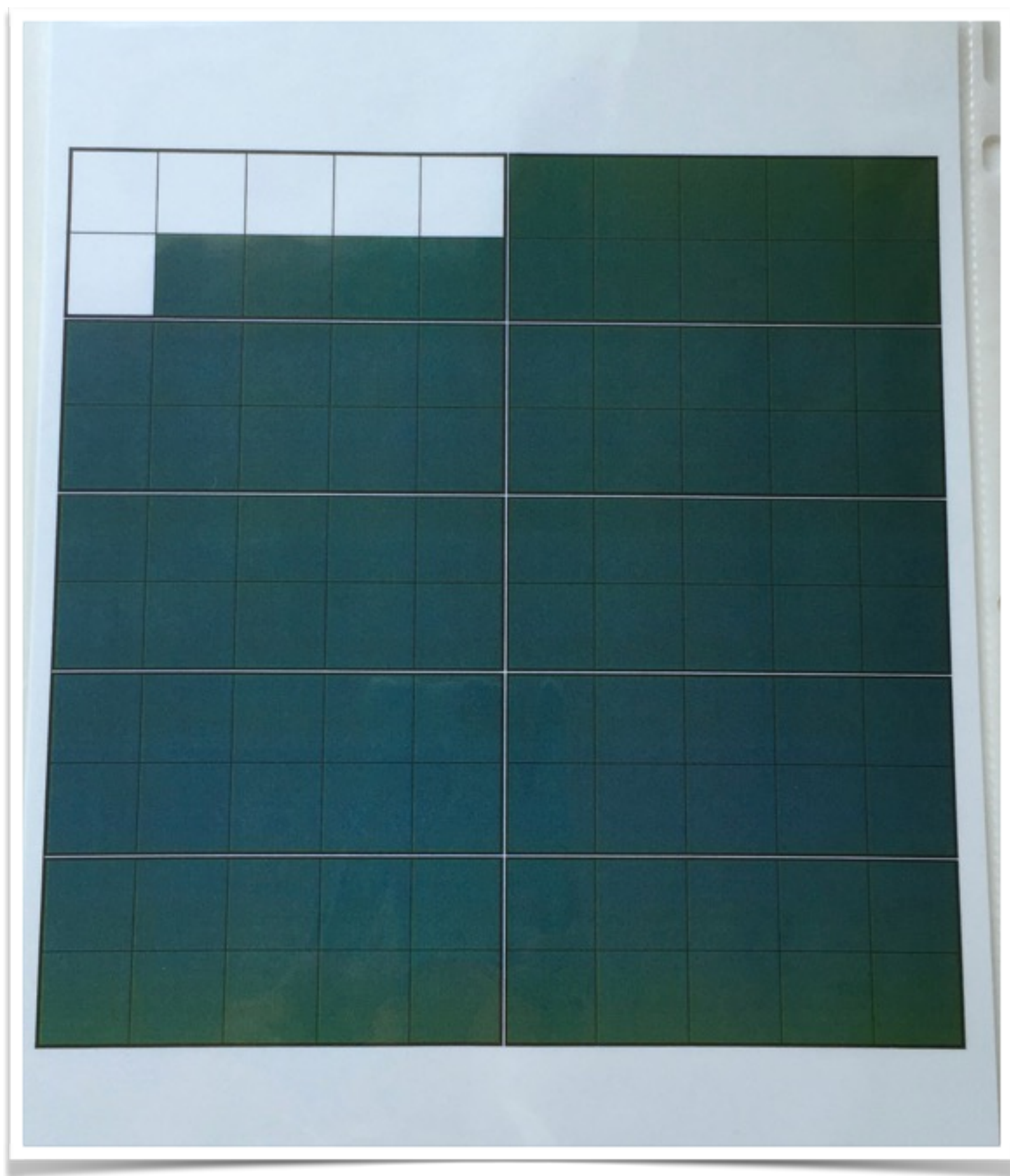


There is 8!
I know it is 8 because I see
5 and 3

Hundreds Boards



[illegible]





“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?”

Clothesline Numberlines

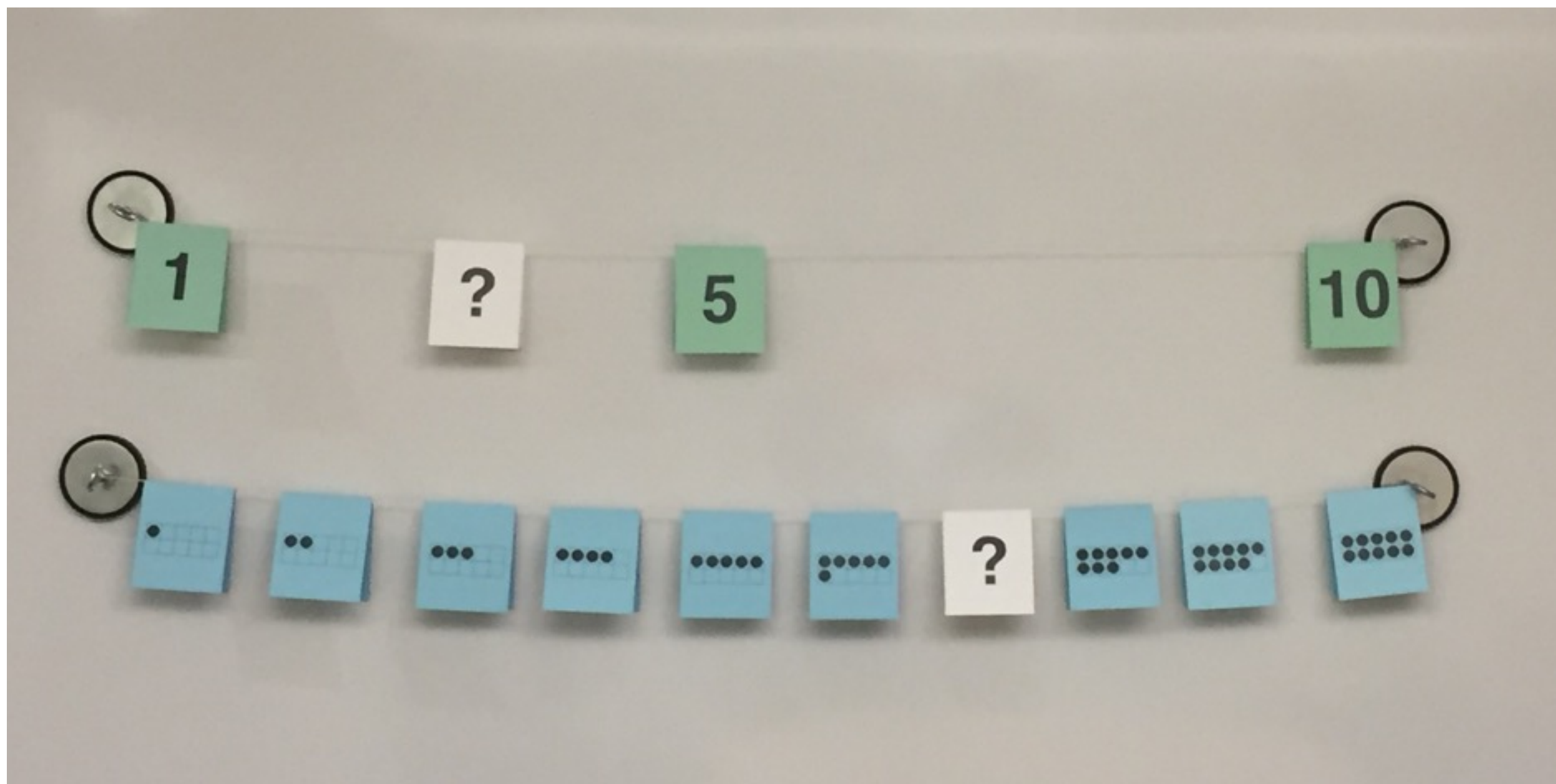
The potential learning intentions:

- comparing and ordering number
- understanding quantity and magnitude
- relationships among numbers
- computational Fluency

Students can engage with number lines by:

- building number lines (using clothesline)
- discussing the missing numbers on a number line
- fixing a mixed up number line
- playing “Guess my Number” with too high and too low clues
- solving equations using the open number line





Multiple representations of quantities

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 or
a “string” of questions

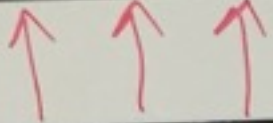
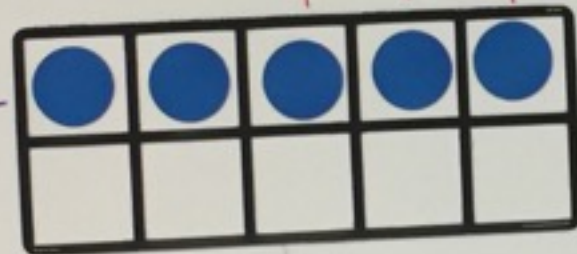
$$18 + 2$$

$$18 + 12$$

$$18 + 6$$

$$18 + 16$$

$$(5 + 5) \\ 10 + 2 = 12$$



$$7 + 5 =$$

3 2

$$10 + 2 = 12$$

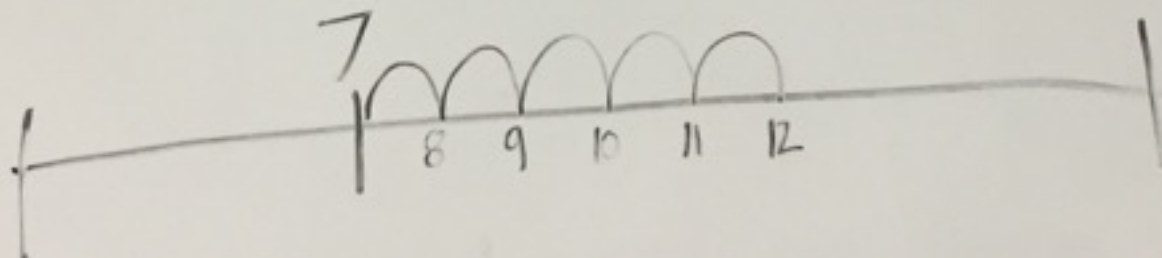
$$7 + 8$$

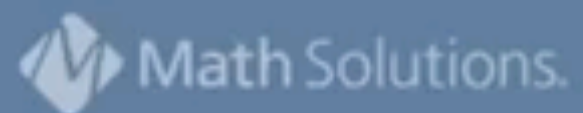
Counted on
9 10 11 12

5:39
from
with
have
what
were

$$5 + 7$$

5 2
 $10 + 2 = 12$





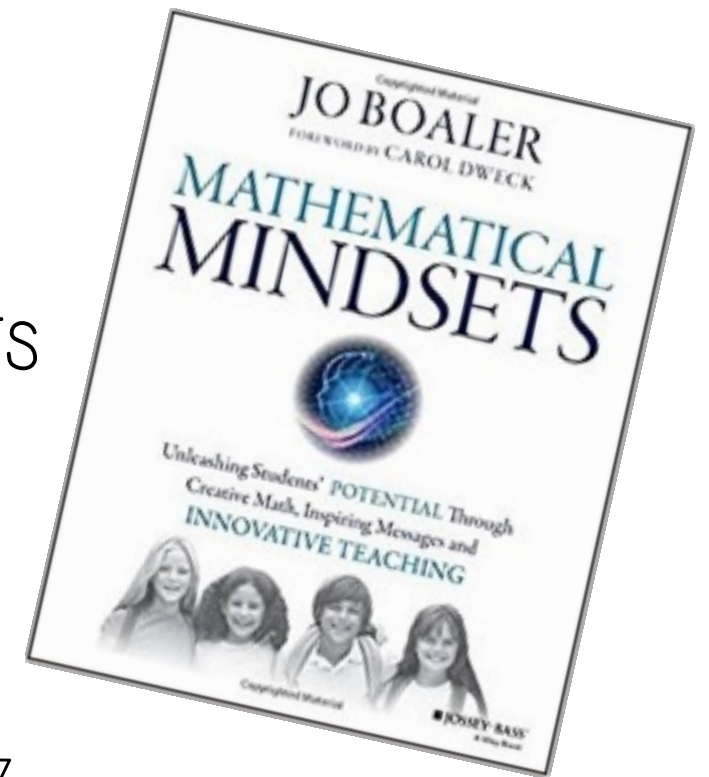
<https://www.youtube.com/watch?v=SPExPgZJy4>

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 _____?

“Teachers are the most important resource for students. They are the ones who can create exciting mathematics environments, give students the positive messages they need, and take any math task and make it one that piques student curiosity and interest.”

– Jo Boaler, Mathematical Mindsets (2016), pg. 57



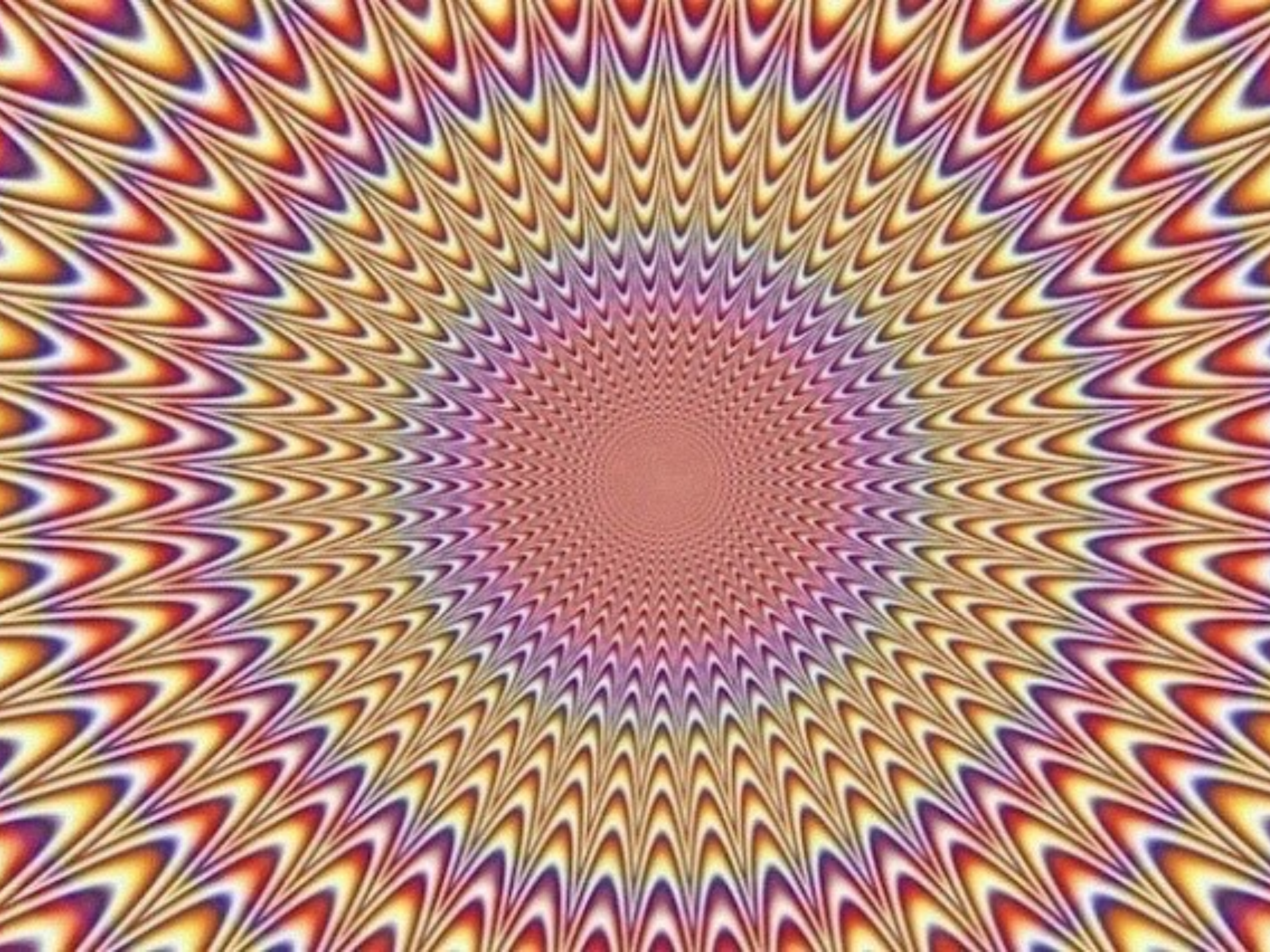
How do we design mathematical learning opportunities where all students feel successful and develop self-efficacy?

Finding Out What Students Know

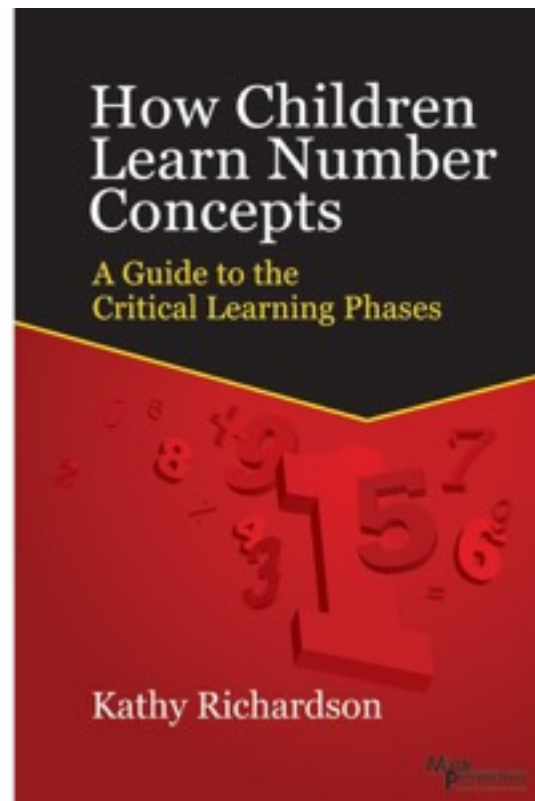
Why is this important?

“When children are taught mathematical concepts and procedures before they reach certain levels of thinking, they do not see the underlying logic of mathematics. All they can do is memorize processes and procedures. It may appear that they know the mathematics, but in reality, this is just an illusion.”

~ Kathy Richardson (2012), How Children Learn Number Concepts, pg. xii



Learning is developmental...



As teachers we MUST know the critical learning phases that build upon on one and other and lead to conceptual understanding.

Developmental progression of Counting pg. 3

THE CRITICAL LEARNING PHASES

Counting Objects

- Counts one item for each number (one-to one correspondence)
- Keeps track of an unorganized pile
- Notices when recounting a group results in a different number
- Is bothered when counting a group results in the same number after some have been added or taken away
- Spontaneously checks by recounting to see if the result is the same
- Knows “how many” after counting
- Counts out a particular quantity
- Reacts to estimate while counting
- Spontaneously adjusts estimate while counting and makes a closer estimate

Knowing One More/One Less

- Knows one more in sequence without counting
- Knows one less in sequence without counting
- Notices if a counting pattern doesn't make sense
(Ex: instead of saying “13, 12, 11,” says “13, 14, 15,” or instead of saying “21, 22, 23”, says “20, 30, 40”)

- Knows one more without counting when numbers are presented out of sequence
- Knows one less without counting when numbers are presented out of sequence

Counting Objects by Groups

- Counts by groups by moving the appropriate group of counters
- Knows quantity stays the same when counted by different-sized groups

Using Symbols

- Uses numerals to describe quantities

Finding Out What Students Know

Activating Prior Knowledge

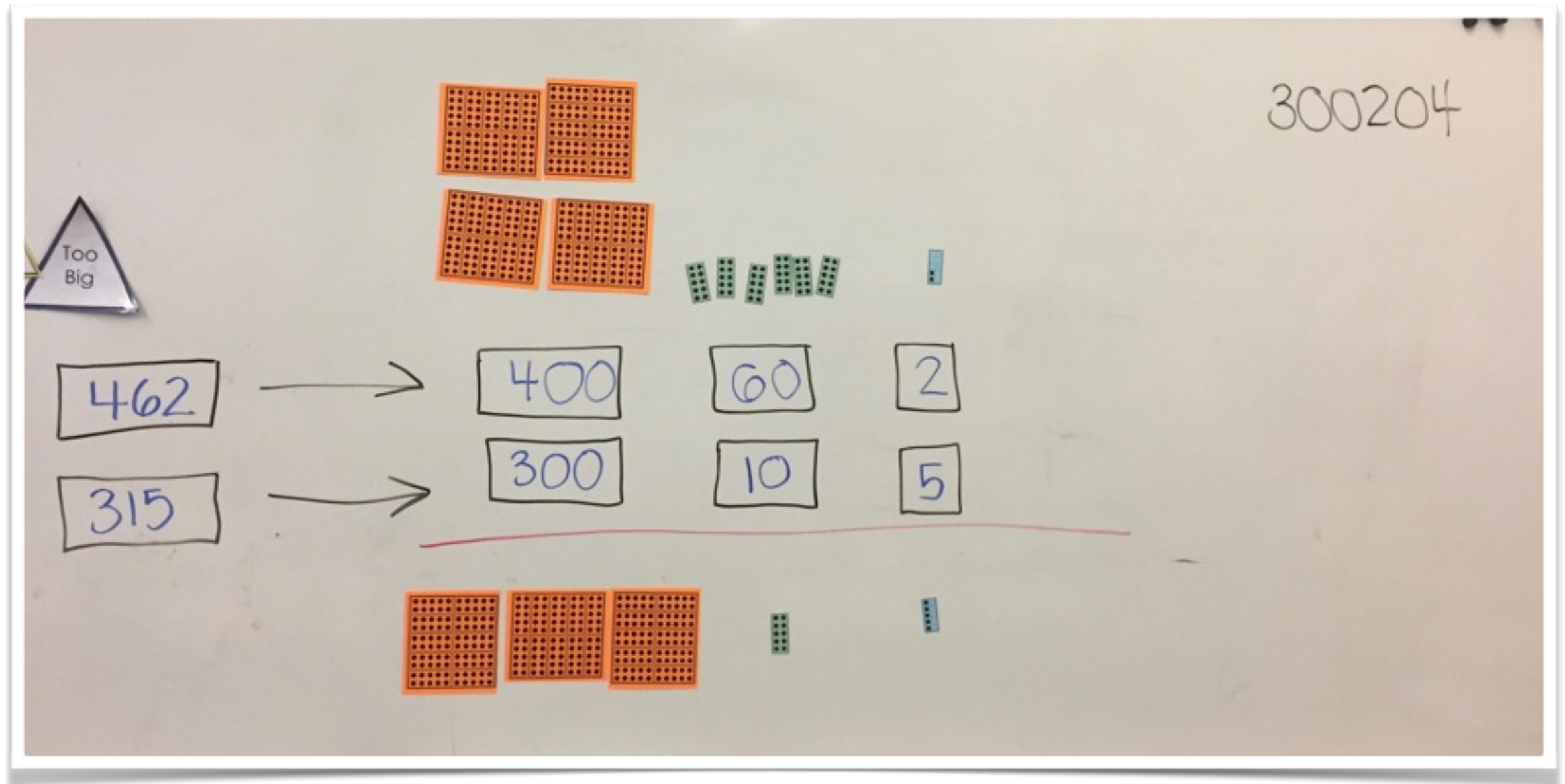
Performance Based Task

Counting Collections

- Present the students with a collection of 7 counters (12, 21, or 32)
- Ask:
 - How many do you think there might be?
 - Would you check and see?
 - How many did you count?
- Say: **Now make a pile of 5 objects (9, 18, or 28)**
- Begin with the collection the student just counted...
 - Add 4 counters (**one at a time**) each time asking 'How many now?'
 - Take away 5 counters (**one at a time**) each time asking 'How many now?'
- Ask:
 - What if we had 6 and we added one more? (17, 39, 68, 109)

Introducing New Concepts

Conceptual Understanding of decomposing and recomposing numbers to "Make Ten"



Introducing Vocabulary

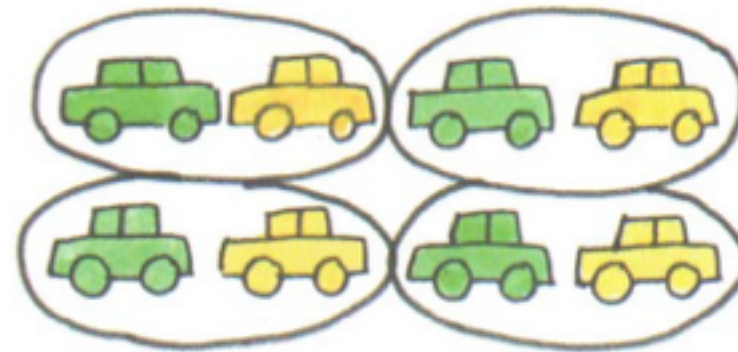
Math Word Walls

attribute

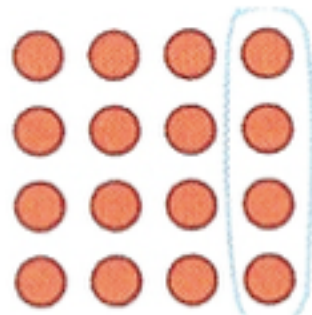


sorted by colour

repeat



column



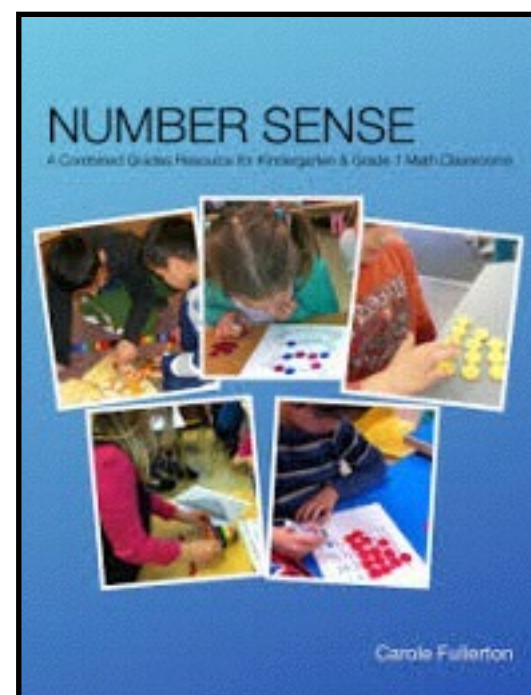
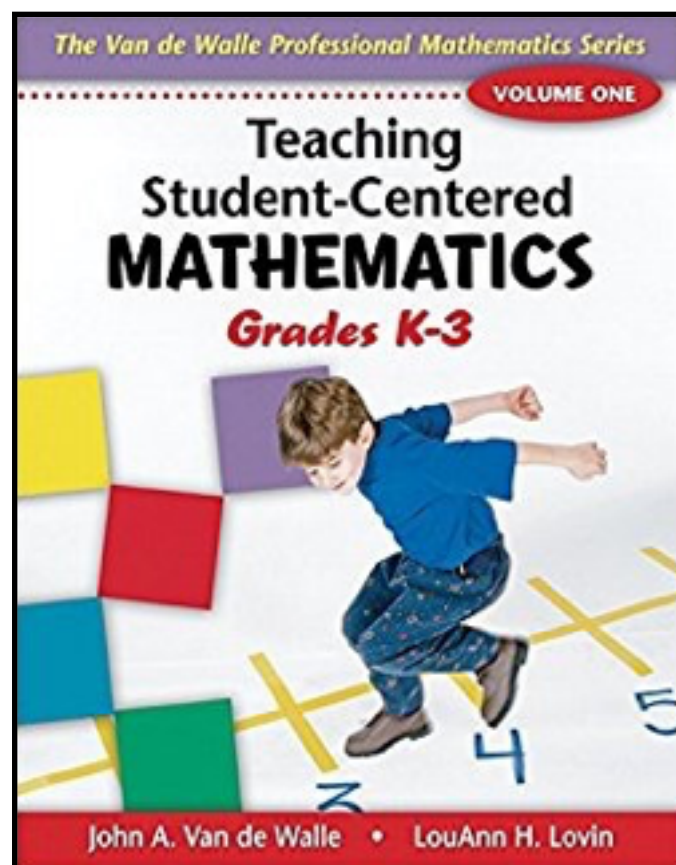
fact family

$$6 + 5 = 11$$

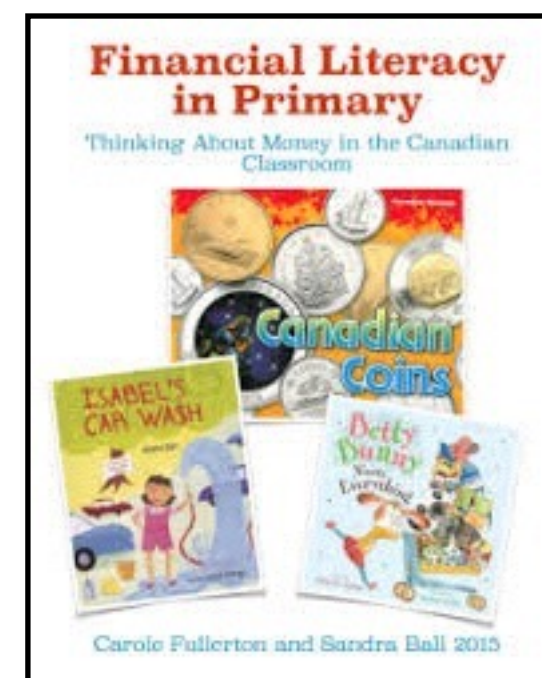
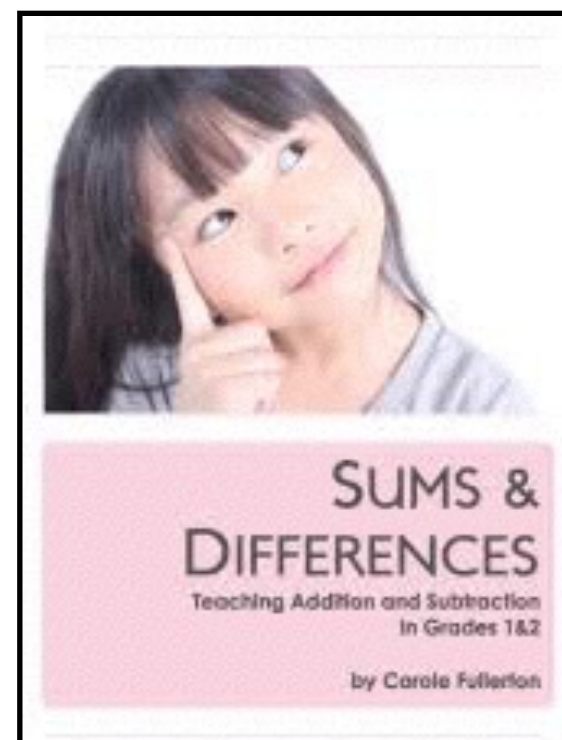
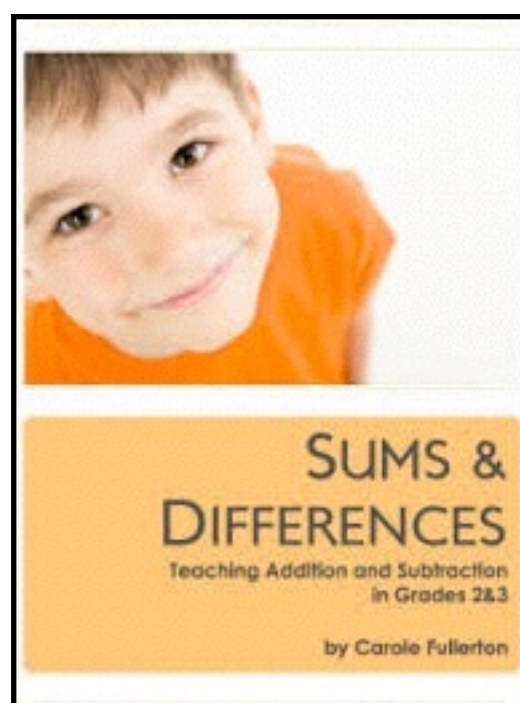
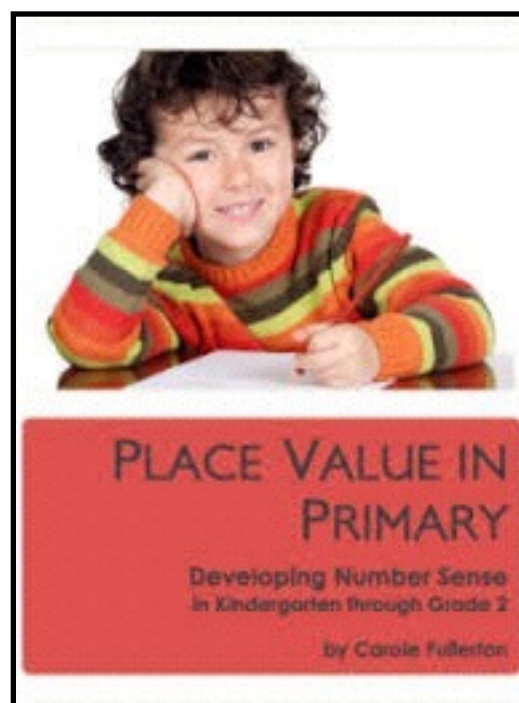
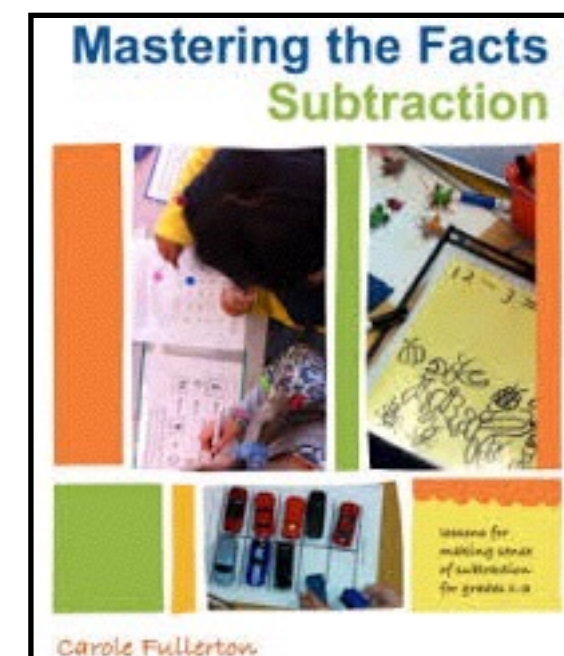
$$5 + 6 = 11$$

$$11 - 6 = 5$$

$$11 - 5 = 6$$



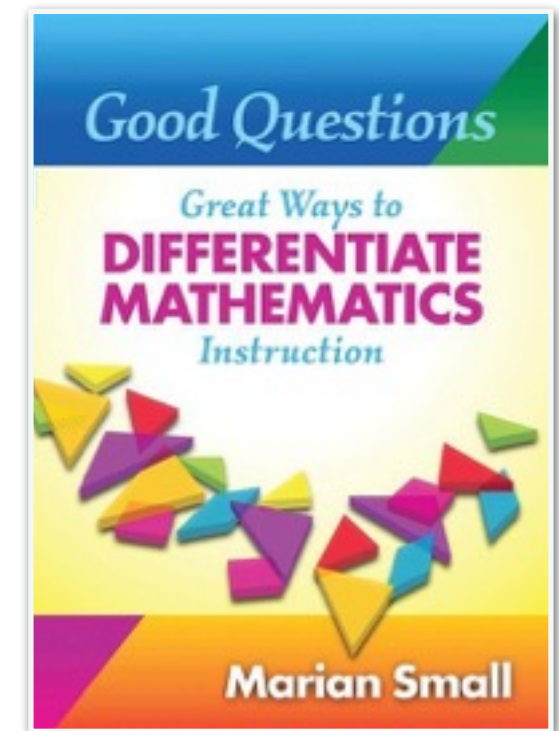
These are key resources that will help teachers develop an understanding how to teach in conceptual ways.



Open Questions

Why use this approach?

“The teacher can create a single question or task that is inclusive of not only allowing for different students to approach it using different strategies, but also in allowing for students at different stages of mathematical development to benefit and grow from attention to the task.”



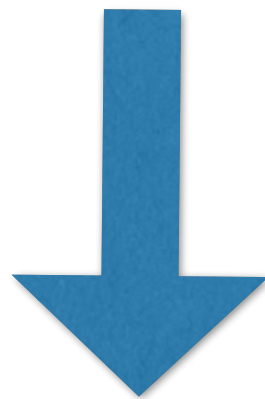
~ Marian Small (2012) Good Questions: Great Ways to Differentiate Mathematics Instruction

Open Questions

How do I create an open question?

Turning around a question

$$8 + 12 = 20$$



I have a total of 20 apples.

Some are red and some are green.

How many green and red apples could I have?

Work backwards...

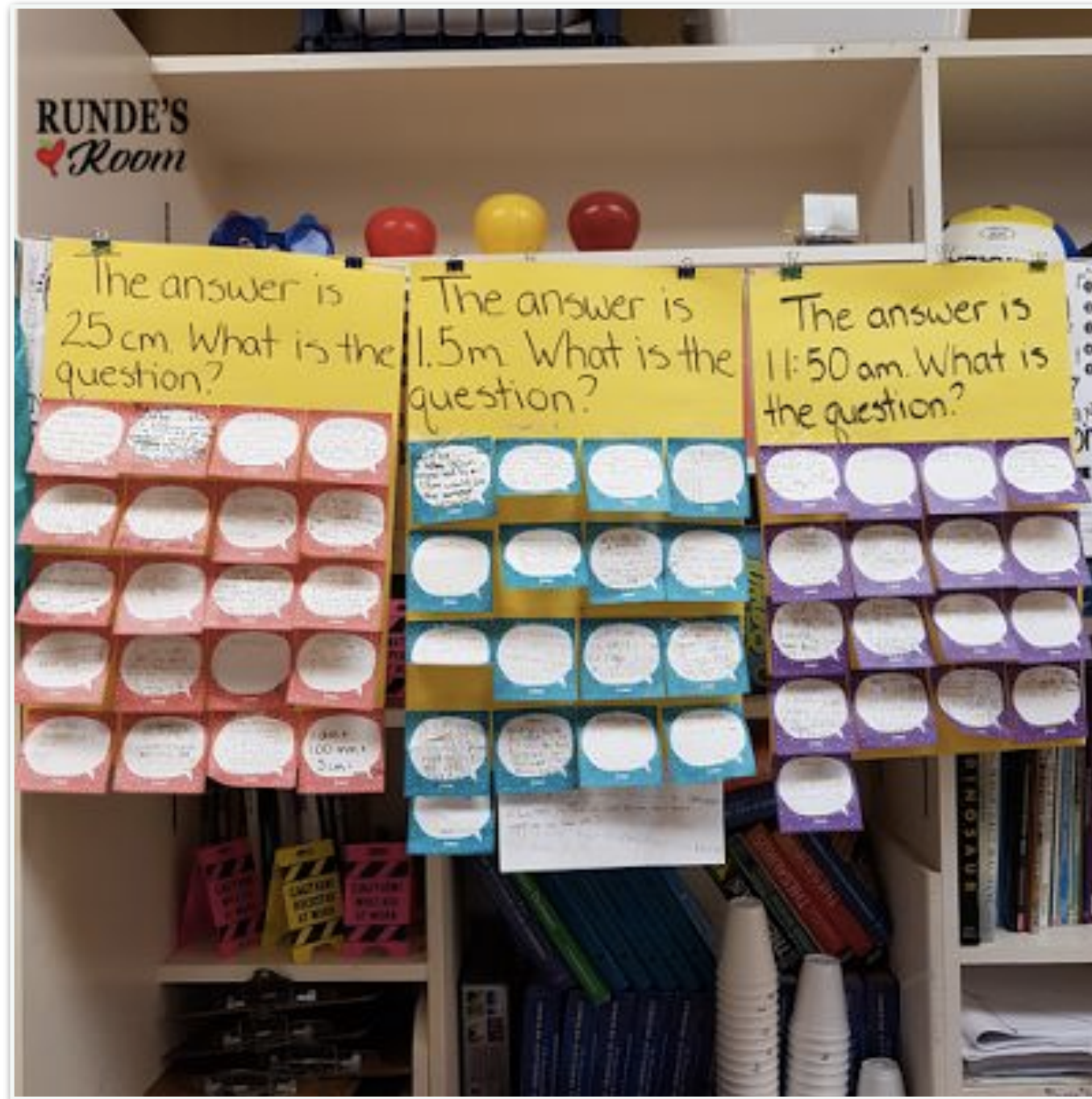
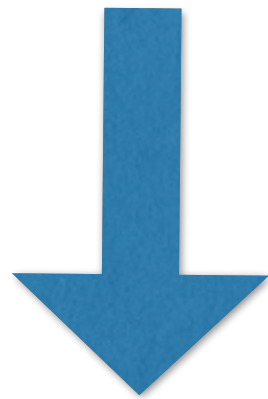


Image retrieved from: <http://www.rundesroom.com/2017/02/5-activities-for-teaching-problem.html>

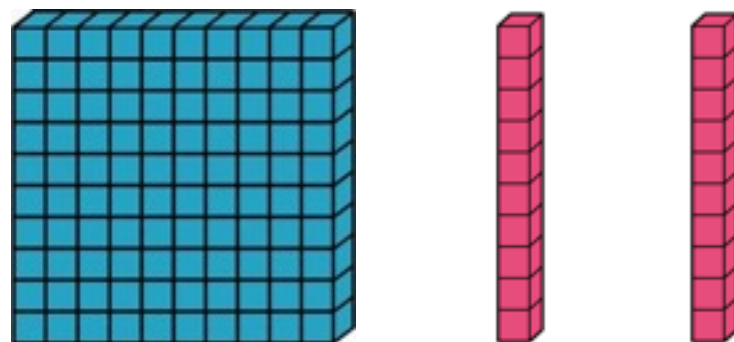
Change the Question

What number has 2 tens, and 9 ones?



You can model a number with 3 base 10 blocks.
What could the number be?

120



Or many other numbers!



Open Questions

What resources are available?



Each book spans several Grades (e.g., K - 3, 4 - 6, and 7 - 9).
Currently only the Number Strand is aligned to our BC Curriculum.
The other strands are coming in Spring 2018.

GETTING STARTED

Q Name some stories or poems in which the number 3 is important.


SAMPLE RESPONSE

Goldilocks and the Three Bears **OR**
The Three Little Pigs **OR**
"Three Blind Mice" **OR**
"The Three Sisters"

Q What number from 1 to 10 do you think is the most important? Why?

SAMPLE RESPONSE

I think 10 is important because that's the number of fingers and thumbs we have. **OR**
I think 1 is important since everything is made up of ones. **OR**
I think 2 is important since so many things come in twos. **OR**
I think 1 is important because it means you are first.

 **Q** Stand on a number on a number line. Name two numbers that come before your number. Name two numbers that come after your number.

SAMPLE RESPONSE

I stood on 5. 2 and 3 come before.
8 and 10 come after.

Q When you count, what are some numbers that take a while to get to?

SAMPLE RESPONSE

It takes a while for me to get to 10 when I start at 1.
OR
It takes a while to get to 20.

WORKING ON IT

Q Choose a number up to 10. Write the numeral. Draw a picture that has that number of lines or dots. Tell a story about your picture.

SAMPLE RESPONSE


My number is 3. I am the red dot and my 2 friends are the blue dots. I like to walk between them.



Q Find a number in the classroom. Tell what it means.


SAMPLE RESPONSE

I see a 5 on the door.
It means Room 5. **OR**
I see 7 on the calendar.
It is the date.

 **Q** Choose a number up to 10. Start at 0 and walk to that spot on a number line. Move forward 3, then backwards 2, and then forward 1. Say each number along the way and tell whether the number gets bigger or smaller.

SAMPLE RESPONSE

I walked to the number 5. I moved 3 spots forward to 8, and the number got bigger. Then, I moved 2 spots backwards to 6, and the number got smaller. Then, I moved 1 spot forward to 7, and the number got bigger.


 **Q** How would you figure out if there are more than 3 blue counters? Would you need to count them?



SAMPLE RESPONSE

I think I would just be able to look at them and tell that there are more than 3 blue counters. **OR**
I would line the blue counters up and see if there are more than 3. **OR**
I would need to count them because I can never be sure without counting.

CONSOLIDATING

 Tell as many things as you can about the number 2.


SAMPLE RESPONSE

I have 2 feet and 2 hands and 2 eyes and 2 ears. **OR**
2 is not a very big number. **OR**
I say it right after the number 1 when I count.

 Tell about a game where you use numbers.

SAMPLE RESPONSE


We count spaces on the game board when we play Snakes and Ladders. **OR**
When we play cards, we match the numbers to make pairs. **OR**
When we play soccer, we have numbers on our shirts.

 Arrange 7 counters in as many ways as you can. Draw them. Which way is the easiest to draw?

SAMPLE RESPONSE

The easiest to draw is 7 in a row. **OR**
The easiest is a group of 5 and a group of 2.



 Choose a number. Suppose you want to say a greater number. How would you figure out a greater number?

SAMPLE RESPONSE

I would keep counting and say a number that comes later. **OR**
I would look at a number line and find my number and then go past it. **OR**
I would just think of a big number like 10. **OR**
I would show the number with counters and then make a bigger pile. **OR**
I would show my number with counters on a 10-frame and then add more counters to make a greater number.

Open Questions

<http://www.onetwainfinity.ca/presentations/AMElemNov.pdf>

Think about that child in your class that seems to struggle the most.

How would he/she participate in *this* activity?

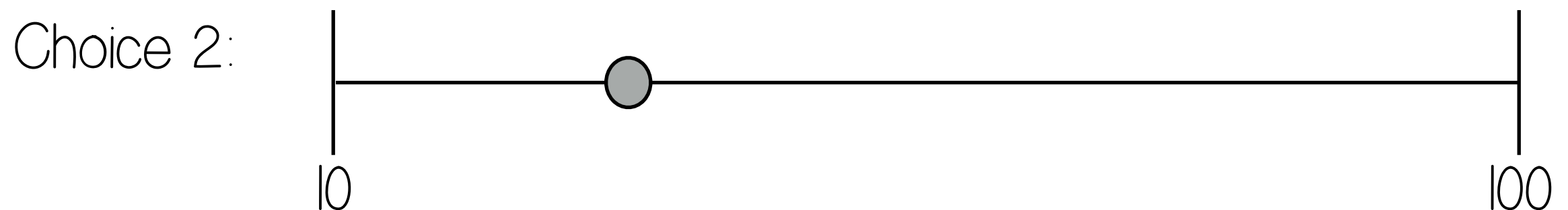
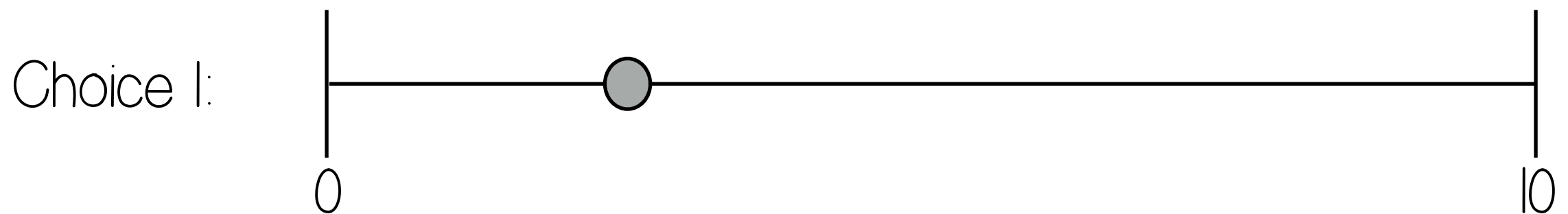


Can everyone “get in” at their developmental stage?

Parallel Tasks

Parallel tasks are a set of two or three tasks that are designed to meet the needs of students at different developmental levels, but that get at the same big idea and are close enough in context that they can be discussed simultaneously.

What value do you think the dot on the number line represent?



Open Middle Problems

These questions have a 'closed' beginning and a 'closed' ending but how students approach the question can occur in different ways.

Open Middle

<http://www.openmiddle.com/>



Make a graph that show the results of ten students favourite colour and that shows red as the favourite colour.

How might you start?

Open Middle

Challenging math problems worth solving

Home Kinder ▾ Grade 1 ▾ Grade 2 ▾ Grade 3 ▾ Grade 4 ▾ Grade 5 ▾ Grade 6 ▾ Grade 7 ▾ Grade 8 ▾ High School ▾ About Submit

Operations & Algebraic Thinking

Number & Operations in Base Ten

Measurement & Data

Geometry

THE TOP 10 MOST

1. Two-Step Equations by Luevanos, and Robert Kaplinsky
2. Order of Operations by Michael Fenton and his students
3. Dot Card Counting by Dan Meyer
4. Rational and Irrational Numbers by Bryan Anderson
5. One Solution, No Solutions, Infinite Solutions by Bryan Anderson
6. Multiplying a Two-Digit Number by a Single-Digit Number by Robert Kaplinsky
7. Exponents and Order of Operations by Zack Miller
8. Converting Between Fractions and Decimals by Robert Kaplinsky
9. Interpreting Percentages by Robert Kaplinsky
10. Two-Step Equations 3 by Erick Lee

Search



OPEN MIDDLE WORKSHEET

Download the Open Middle Worksheet (Regular):
Version 1.2

Download the Open Middle Worksheet (Large):
Version 1.1

BROWSE BY DEPTH OF KNOWLEDGE LEVEL

DOK 2: Skills and Concepts

DOK 3: Strategic Thinking

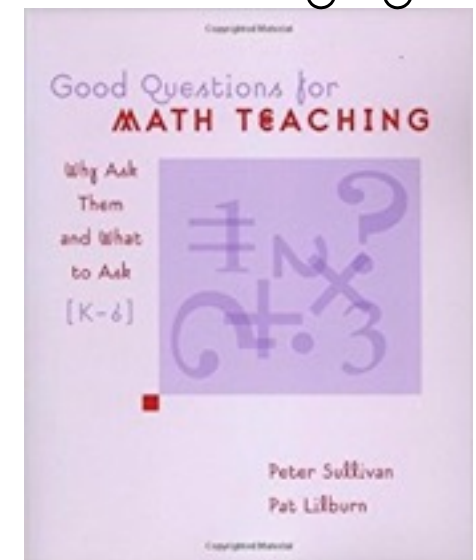
BROWSE BY COMMON CORE STATE STANDARDS

Kindergarten (10)

Rich Tasks

Rich tasks enable students to work mathematically by allowing them to:

- Step into activities even when the route to a solution is initially unclear
- Get started and explore because the tasks are accessible to pupils of wide ranging abilities
- Pose as well as solve problems, make conjectures
- Work at a range of levels
- Extend knowledge or apply knowledge in new contexts
- Work successfully when using different methods
- Broaden their problem-solving skills
- Deepen and broaden mathematical content knowledge
- See and make sense of underlying principles or make connections between different areas of mathematics
- Work within include intriguing contexts
- Observe other people being mathematical or see the role of mathematics within cultural settings



~NRICH Mathematics, Steve Hewson (2011)

My Favourite Places to go for Rich Math Tasks

Created by Margie Pearse

My Fav Places to go to Find Rich Math Tasks created by Margie Pearse @pearse_margie ...

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	A	B	C	D	E	F	G	H
1		My Fav Places to Find Rich Math Tasks by Margie Pearse & Lane Walker						
2	Title and Link	Description	CCSS*	accepting** submissions	Author	Twitter Handle		
3	Agree or Disagree	Gr 6-12 images are designed to start robust discussion	Yes	Yes	Tim McCaffrey	@timsMcCaffrey		
4	Andrew Stadel	Spreadsheet of his 3-acts, 180's and other activities			Andrew Stadel	@mr_stadel		
5	Balanced Assessment	K+ investigations that are engaging and open-ended	No	No	Harvard Graduate School of Education			
6	Breakout EDU	Immersive learning games platform for purchase	No	No				
7	https://clotheslinemath.com/	The Clothesline is a manipulatable number line that makes	No	Yes	Andrew Stadel			
8	http://www.conceptuamath.com/math-t	Interactive math tools, 3-Act Math Tasks, and rich problems	Yes	No	Conceptua Math			
9	Daily Desmos	Intriguing activities designed to build graphing skills	No	No		@desmos		
10	Dan Meyer 3-Acts	Spreadsheet of K-12 activities	Yes	No	Dan Meyer	@ddmeyer		
11	https://emergentmath.com/my-problem	Common Core Problem-Based Problems based on Grade Level	Yes	Yes				
12	EMMaths Puzzles	Puzzles grouped by category	No	No	Emma Bell	@El_Timbre		
13	Estimation 180	Gr 4-8 Building number sense through estimation	Yes	No	Andrew Stadel	@mr_stadel		
14	http://www.expeditionarymath.com/	Gr 3+ lessons, wonders, explorations to discover	No	No		@livethemath		
15	Fraction Talks	Simple visuals to foster creative thinking around fractions	No	Yes	Na Banting	@NatBanting		
16	GFletchy 3-Acts Lessons	K-8,G 3-acts	Yes	No	Graham Fletcher	@gfletchy		
17	Got It -> Get It Transfers	Gr 7-Algebra 2 Replace a direct instruction lesson with a simple activity	Yes	Yes	Lane Walker	@LaneWalker2		
18	Heinemaann Pblm of Week	Primary to Geometry - Open-ended interesting problems	Yes	No	The Math Forum	@themathforum		
19	https://hungryteacher.com/	Real World Math Activities that promote student engagement, collaboration, and problem solving	Yes	No	Zack Patterson	@misterpatterson		

https://docs.google.com/spreadsheets/d/lyGaZy9g8X0HHFuWMBQkFI4pVStu_SlBnbZSkxo9nWPI/edit#gid=0

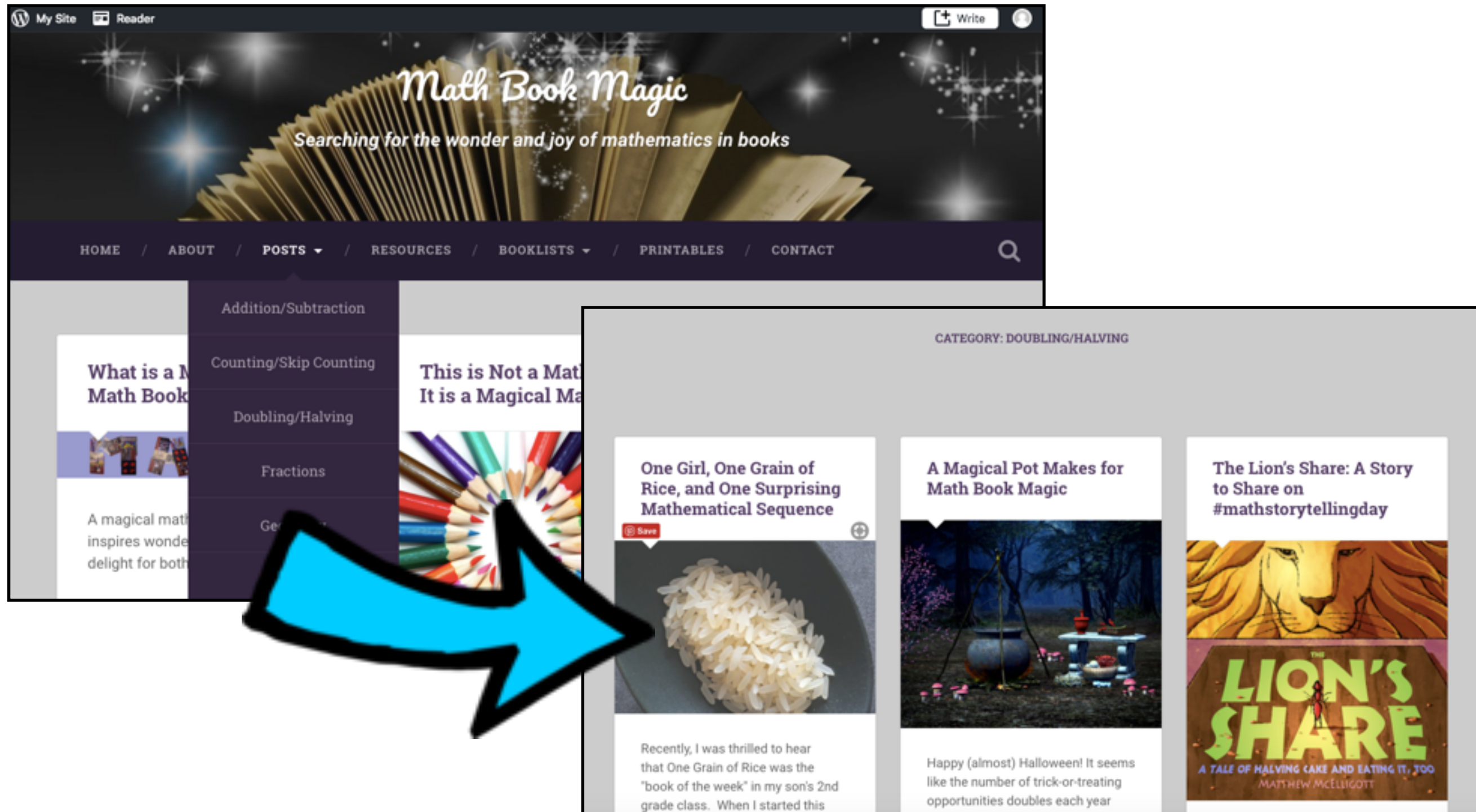
Literature Based Lessons

What could this look like?

Math in literature ~ Primary Selected by Debbie Nelson & Joan Pearce in collaboration with SD 72 <i>Big Idea : Numbers</i>	
	<p>Title: <u>Five Speckled Frogs</u> by Steven Anderson CD included with book has a rendition of the nursery rhyme 'Five speckled Frogs' (also available online) Pictures and text demonstrate the successive subtraction pattern of subtracting by one until there are no longer any frogs on the log. http://teachmath.openschoolnetwork.ca/kindergarten/number</p>
	<p>Title: <u>The Sneetches</u> by Dr. Seuss https://www.youtube.com/watch?v=qPhOZzsi_6Q Zax are all about 59! Just like the Sneetches, the Zax certainly wasted a lot of time arguing. One of the Zax threatened to stand there for 59 days, and the other Zax, for 59 years! 59 is an interesting number. Can you use blocks to represent 59 as groups of 10s and 1's? Can you find another way of representing 59 with groups of 10s and 1's? Hint: Think about how many 10s are needed to make 50. Now think about how many 1's are needed to make 9.</p>
	<p>Title: <u>How to Pulverize Pirates</u> by Catherine Leblanc and Roland Garrigue This book reveals the most precious of treasures: unbeatable tricks to make a pirate walk the plank! All kinds of opportunities for counting ~ pirates behind doors, sea urchins, folks floating in an enormous rubber ducky. Bath-time = pirates riding the waves</p>
	<p>Title: <u>Number Fun</u> by Isabel Thomas Children can learn the numbers 1 to 20 while getting "in shape!" To successfully form many of the numbers, children</p>

Math Book Magic

<https://mathbookmagic.com/>



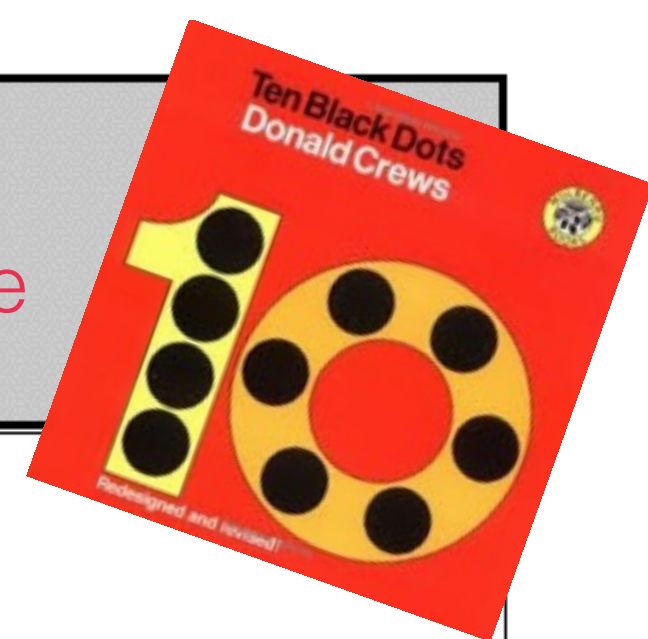
“Mathematizing a read-aloud provides students with opportunities to learn mathematical concepts in meaningful contexts. Using literature to connect concepts with students’ experiences helps foster understanding and motivates students to learn.”

~ Hintz and Smith (2013) Mathematizing Read-Alouds



The BIG Mathematical idea

Numbers tell how much and how many and can be represented in many different forms.



Learning Activity:

What can your dots make?

Curricular Competencies:

(Mathematical Habits of Mind)

- apply counting strategies and mental math strategies for addition to represent numbers (e.g., counting on, one more, one less, making 10, doubles).
- represent numbers pictorially
- describe their picture orally
- creatively represent numbers
- demonstrate flexibility with numbers through representing the same quantity of dots in multiple ways

Extension:

After each student has completed a page and you have compiled a class book, ask how many dots do you think we used to make our book?

Mathematical Concepts:

The students will know and understand:

Kindergarten

- Number Concepts to 10

Grade One

- Number Concepts to 20

Assessment:

Record anecdotal comments about the number each child chose to represent and the success and challenges they had with the task. Use this information to guide future lessons.

I e n e



3 dots can make

EROWN



2 dots can make

GLASSES



6 dots can make

LADE Bug

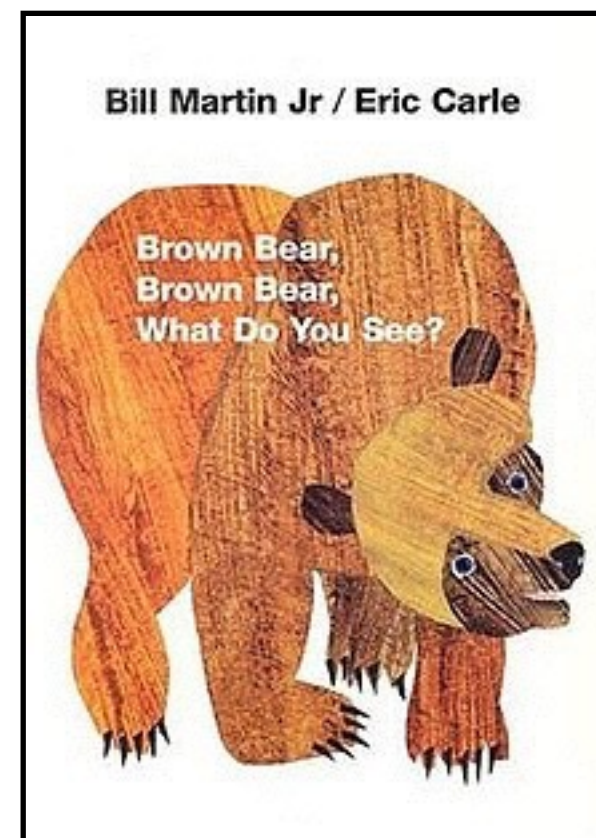


9 dots can make

ICE CREAM

Learning Intentions for ALL - Some - Few

- I can engage in a problem solving experience in relation to a story to develop strategies for counting to 10
- I can use pictures to show what I know.
- I can make connections between a quantity I see and how many I need to draw.



Kaylee can do a cartoon!

All About Me!

I am special,
I am neat,
I have two eyes, ●●
A nose, 6
And two feet, JJB
I

Mm	Nn	Oo
Pp	Qq	Rr
Ss	Tt	Uu
Vv	Ww	Xx
Yy	Zz	

Spring
Summer
Fall

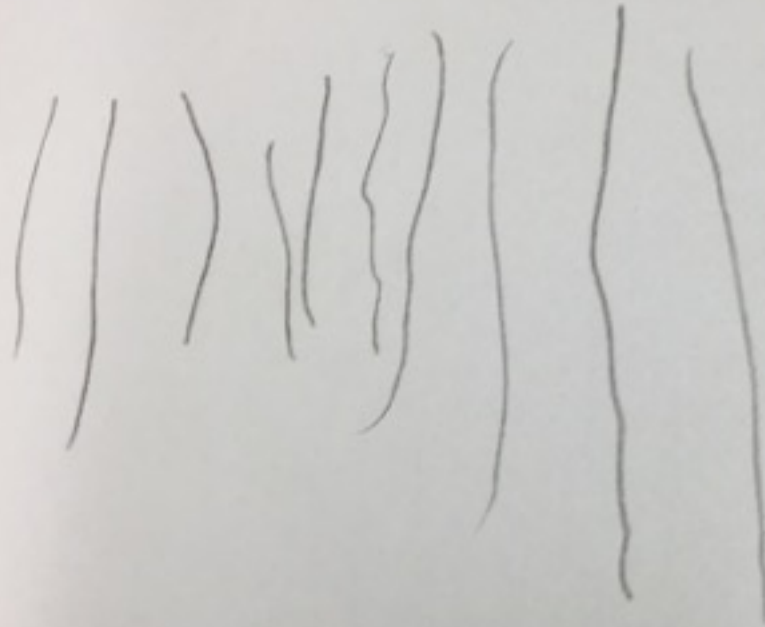


Teacher,
Teacher,
What do you see?

I see children
looking at me.

Name MOREGS *موريس*

How many animals did we see in the book?



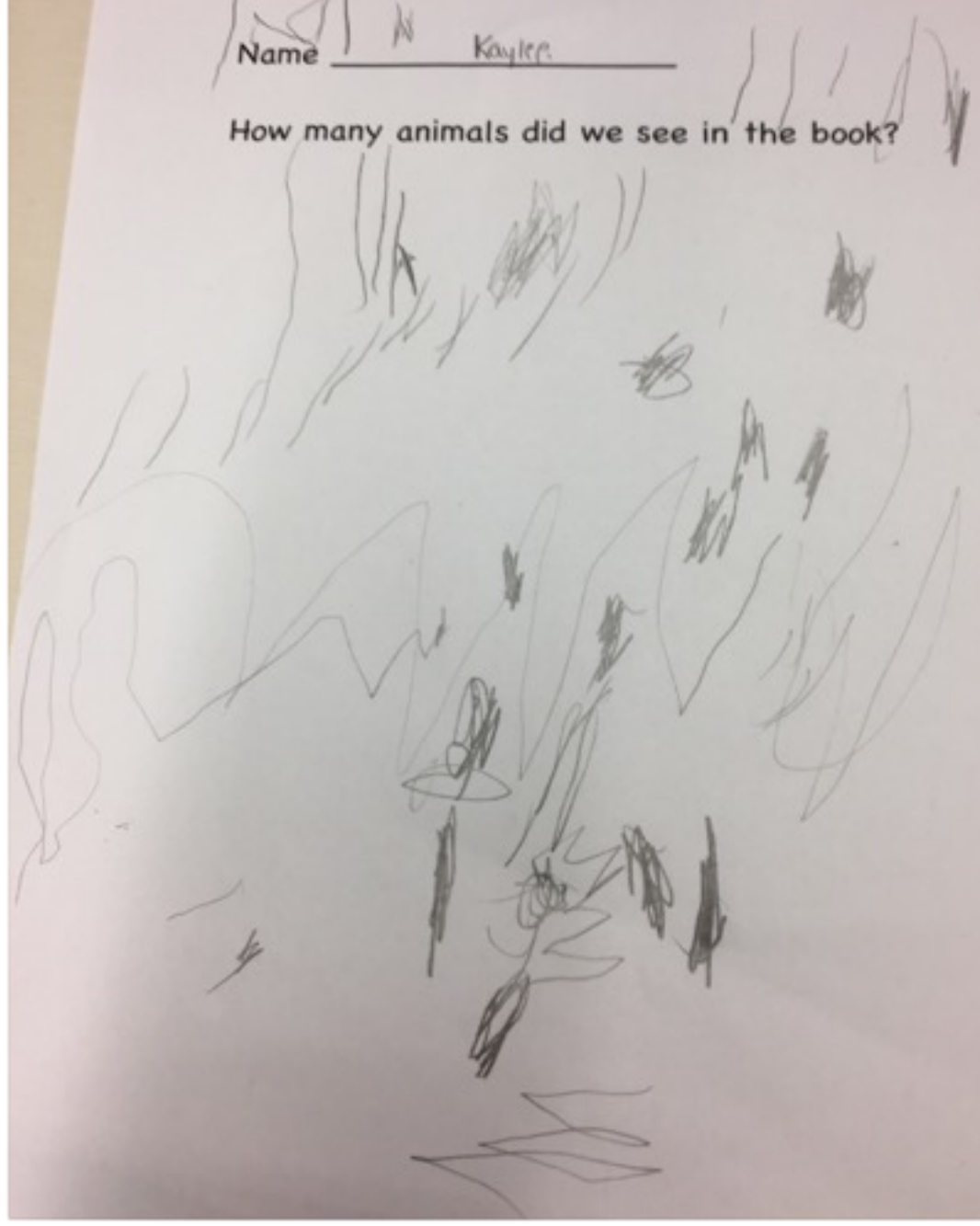
Name Noor

How many animals did we see in the book?



Name Kaylee

How many animals did we see in the book?



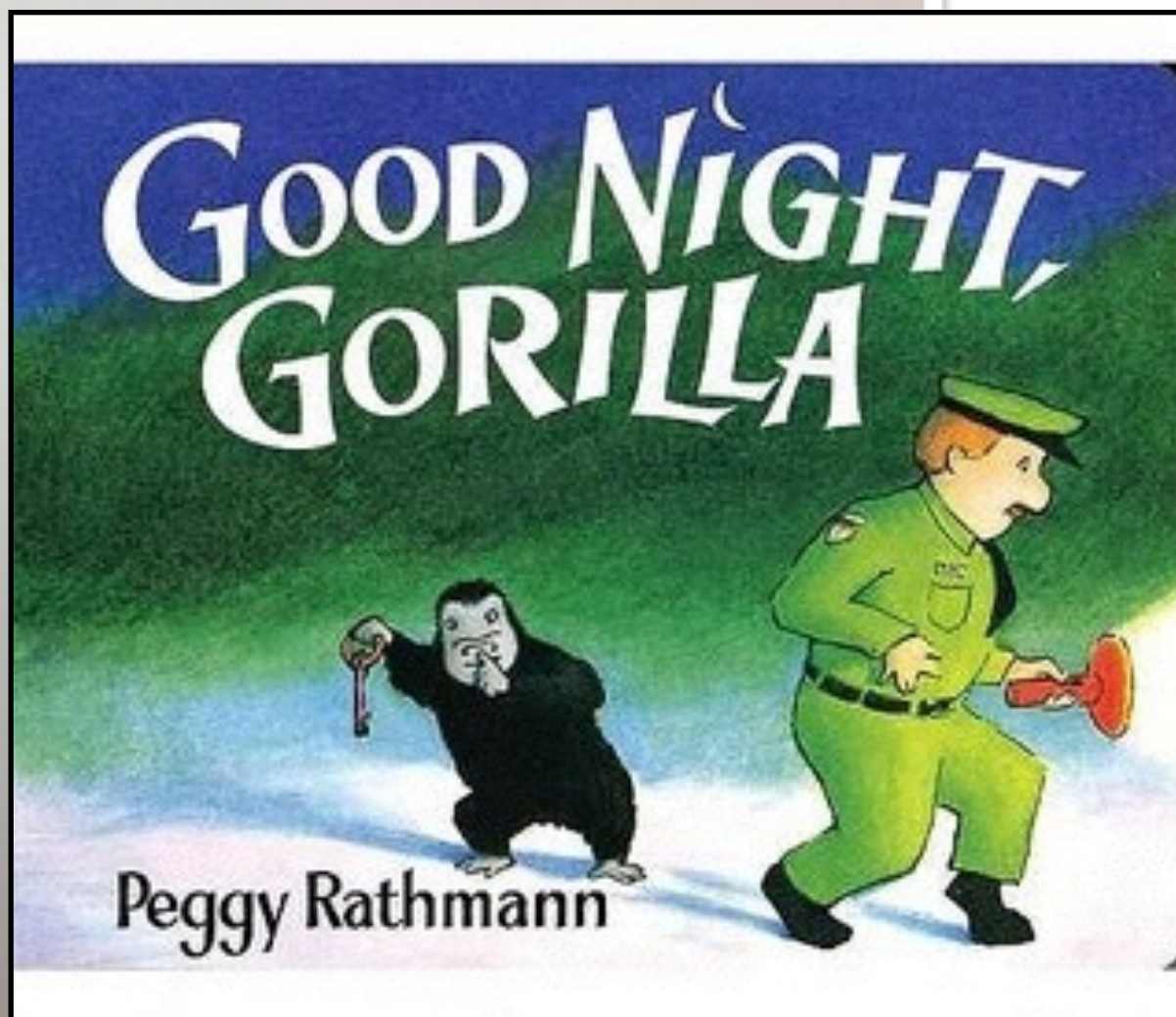
Name claire

How many animals did we see in the book?



How many animals escaped from the zoo?

1 2 3 4 5 6 7 8



How many animals escaped from the zoo?

JADE

Tally marks

~~||||~~ ||

7

sereniah

How many animals escaped from the zoo?

1234567

0000000

How many animals escaped from the zoo?

V V V V V V

12 7



2

2

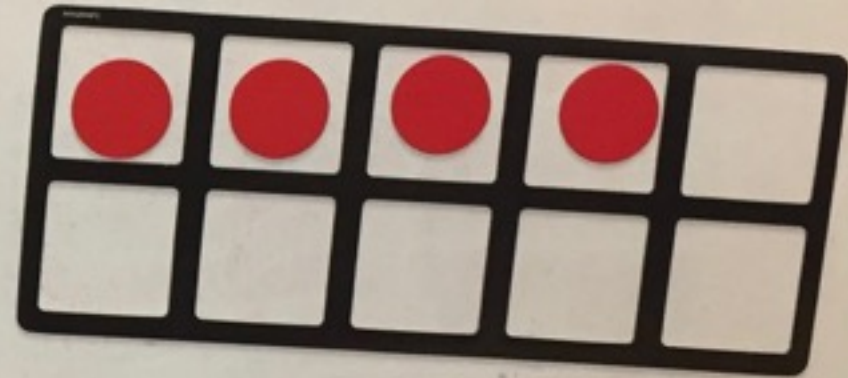
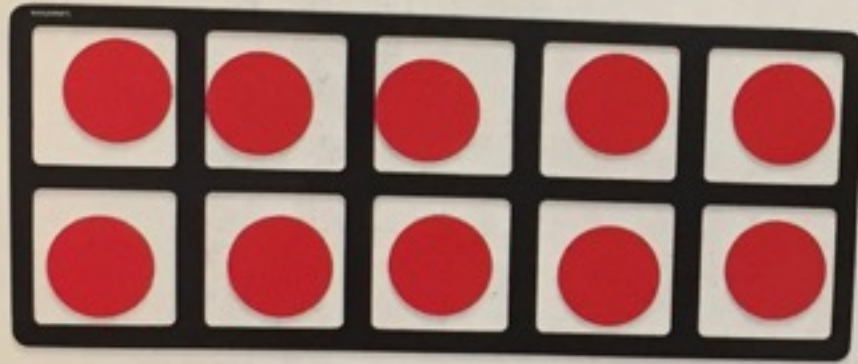
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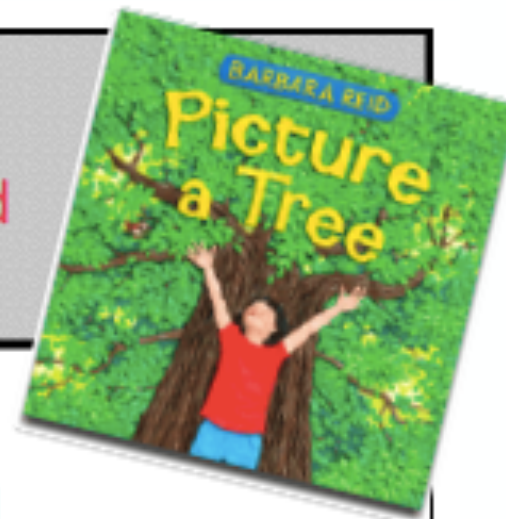


10 and 4

is 14

The BIG Mathematical idea

Numbers have values and can be described, represented, and calculated in many ways.



Learning Activity:

Using plasticine create a fraction that you can see in your mind.

Curricular Competencies:

(Mathematical Habits of Mind)

- apply knowledge of fractions when visualizing fractions one sees in the real-world
- describe fractions one might see in the real-world
- represent a fraction concretely using plasticine
- orally communicate the fraction(s) represented using the Book Creator app - record narration of the page
- communicate in written form the fraction using words and symbols
- creatively construct fractions using plasticine
- reflect on the different fractions created by their peers (through sharing component was well as the Digital book)

Other Possibilities:

- Picture a Half, Picture a Quarter
- Do you see any fractions on the pages that are not stated? (e.g., The fractional part not being considered, the other part of the whole)
- Can any page in the class created book be described differently (allowing for knowledge of fractions and percent)

Mathematical Concepts:

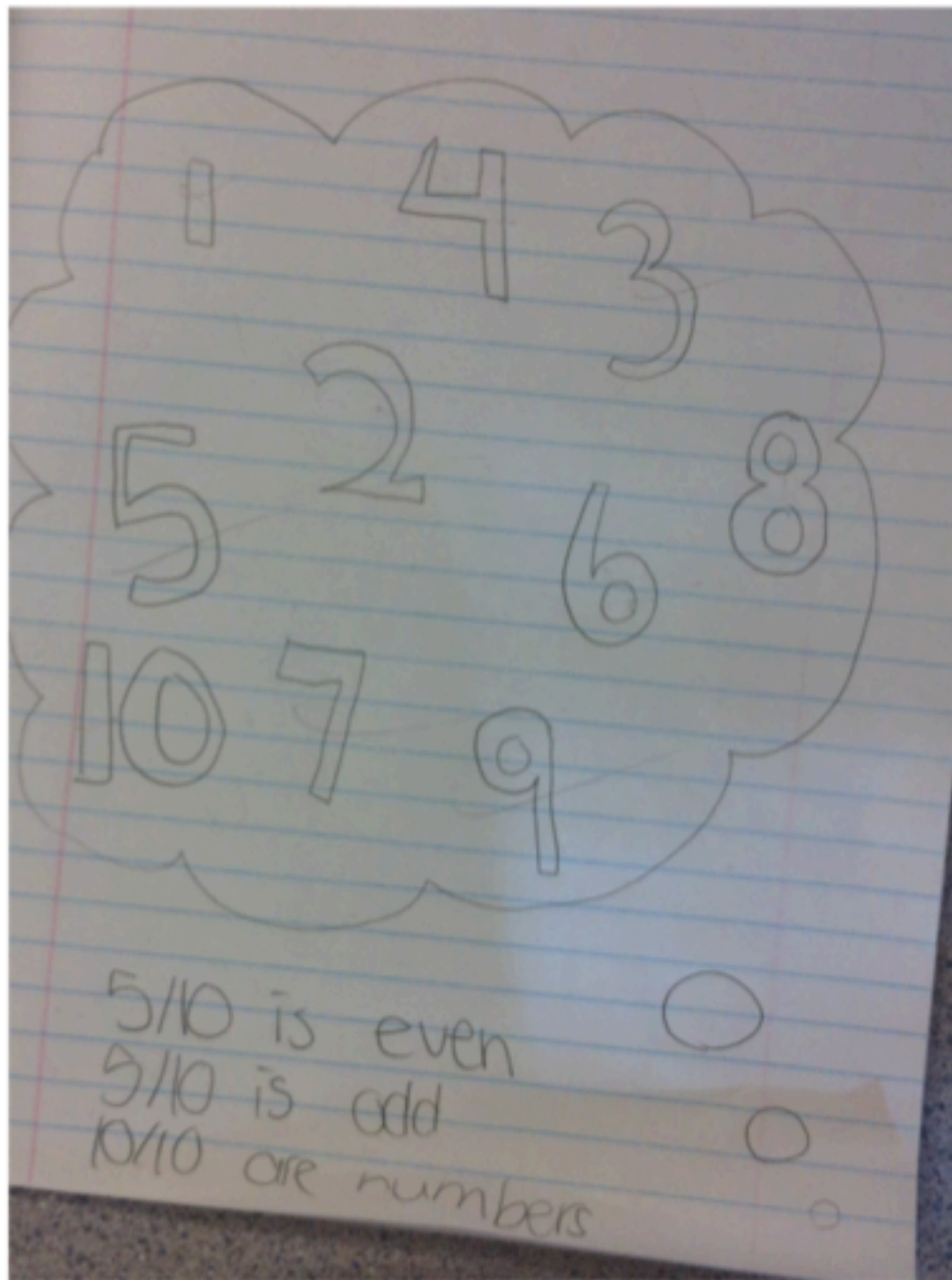
The students will know and understand:

Grade Three

- fractions
- 2D and 3D objects

Assessment:

Four point rubric (Van de Walle,, 2006, Teaching Student-Centered Mathematics, Grades 3 -5, p. 33).





$\frac{2}{3}$ are red cars



$\frac{1}{3}$ is a pink car

Ruby "I picture fractions when I see cars". (Gr. 4)



1/2 of the people have black skin



1/2 of the people have white skin

Oscar "I picture fractions when I see people. Not everybody looks the same". (Gr. 3)



3/8 of the planets have rings



5/8 of the planets do not have rings

Jason "I picture planets when I think about the planets in our solar system. Only some have rings". (Gr. 4)



$\frac{2}{3}$ of the cookies are whole



$\frac{1}{3}$ of the cookies is cut in half

Sharon "I picture fractions when I think of sharing cookies". (Gr. 3)



1/3 of the snowballs is a face



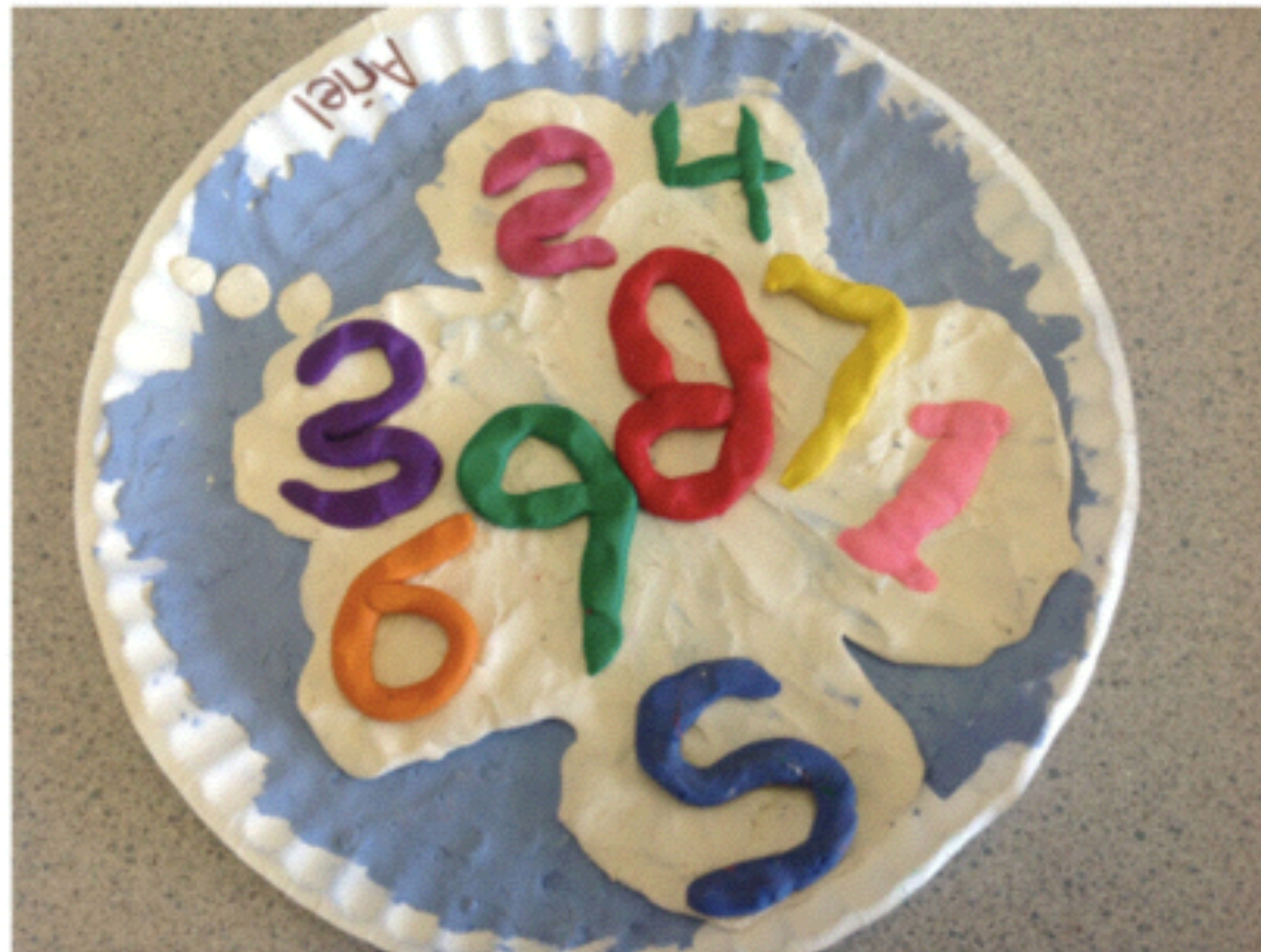
2/3 of the snowballs make the body of the snowman

Kristina "I picture fractions when I make snowmen because I make three balls". (Gr. 3)

5/9 of the numbers are odd



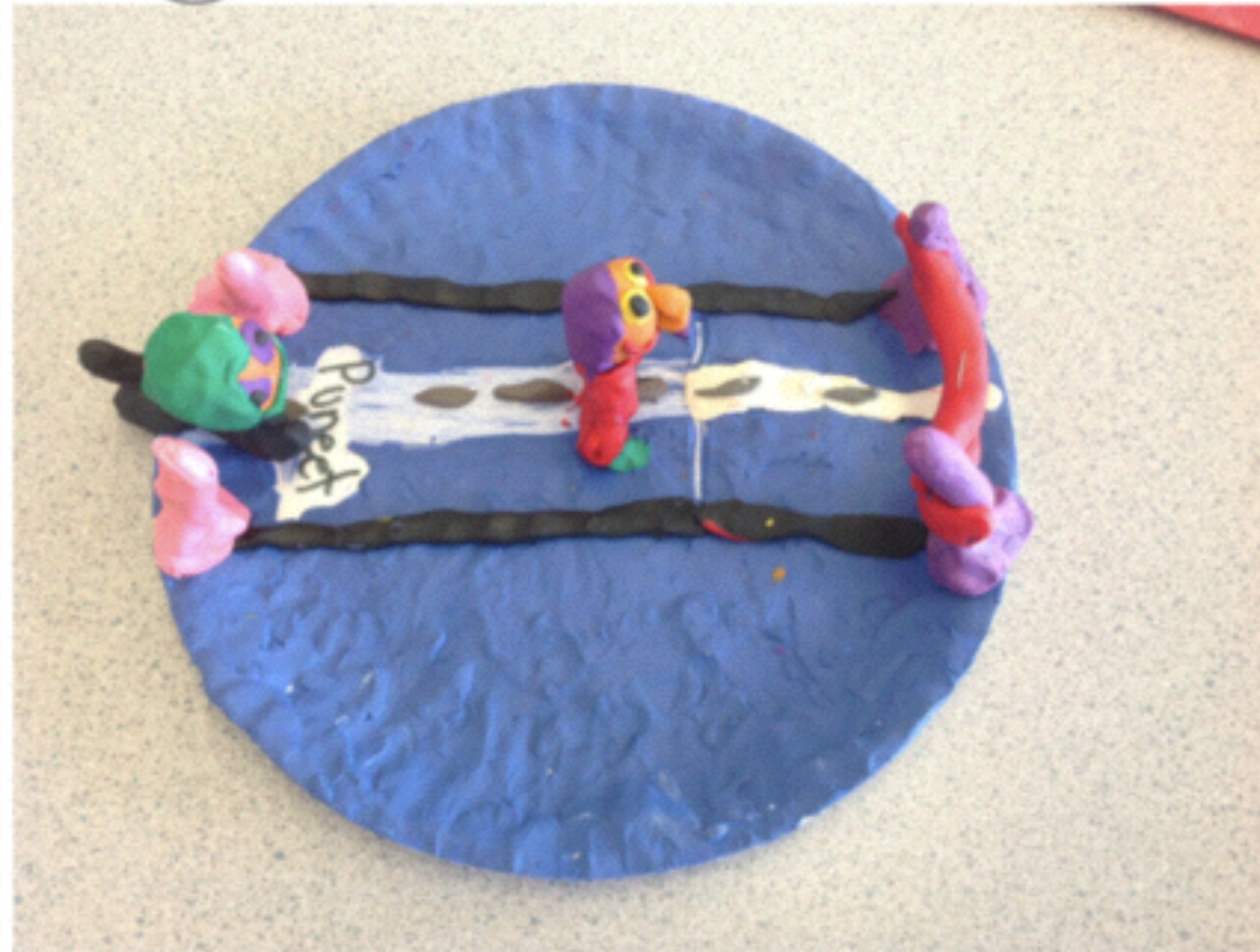
4/9 are even



9/9 are numbers

Ariel "I picture fraction when I think about different kinds of numbers".
(Gr. 4)

The person with purple hair is $\frac{1}{2}$ way finished the race



Puneet "I picture fractions when I remember running a race and being half way done". (Gr. 4)



The girl with black hair is $\frac{3}{4}$ the height of the other girl.



Johnathan "I picture fractions when I see short and tall people and compared them". (Gr. 4)

Three Act Tasks

1) The Question, 2) Gathering Information, and 3) The Reveal.

The entire activity typically takes a full math period or the acts can be split up and worked on across multiple days. The goal of the activity is to engage children in asking mathematical questions, identifying information that will allow them to answer the question, developing a mathematical model of the situation, and revising their models to more closely reflect the real world.



Act One



Act Two

He was ...

- 5 orange cubes
- 5 green cubes
- 5 yellow cubes
- 5 white cubes

...but then he grew 2 more orange cubes

Act Three



Which would you rather? This

Word Problems

- 1) Sara had 12 Pokemon cards. Benny gave her 23 new Pokemon cards. Sara bought 22 Pokemon cards. How many Pokemon cards does Sara have now ?

- 2) Joan went to 19 soccer games this month. She went to 11 games last month, and plans to go to 13 games next month. How many games will she attend in total ?

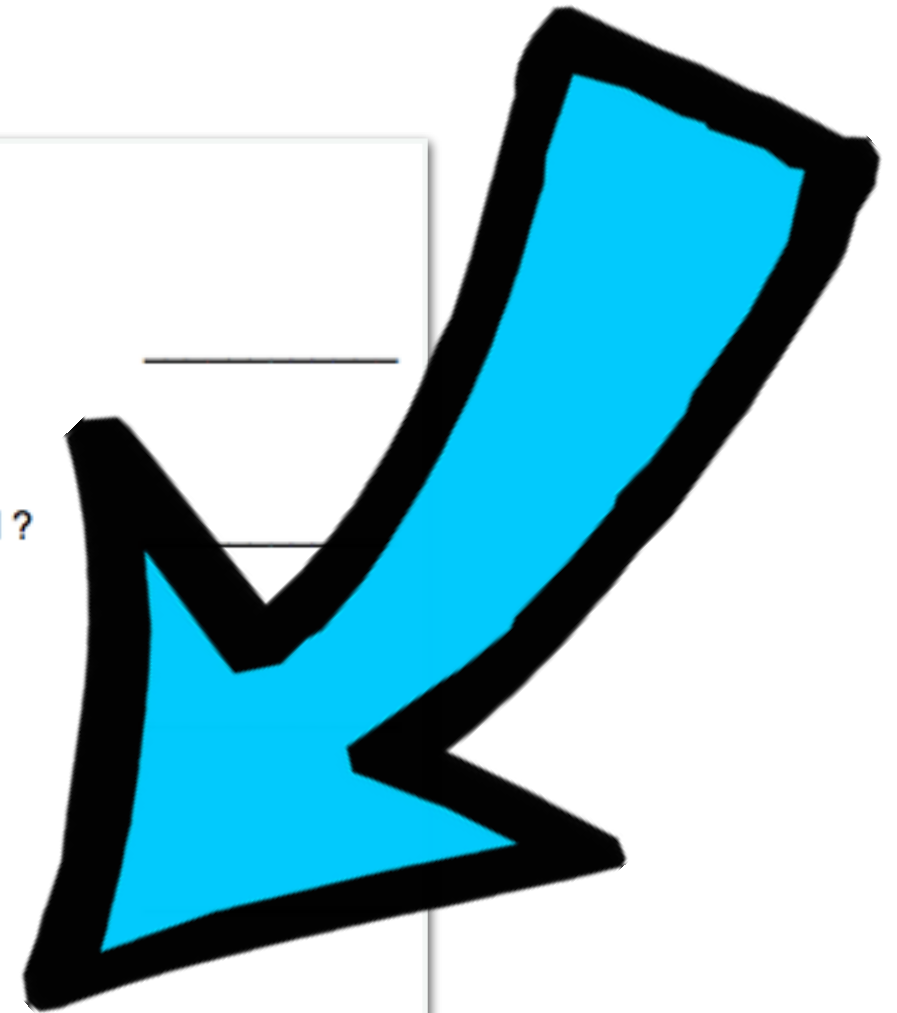
- 3) Sally has 36 red balloons, Tim has 21 red balloons, and Jessica has 35 red balloons. How many red balloons do they have in all ?

- 4) Fred picked 17 pears, Jason picked 29 pears, and Melanie picked 12 pears from the pear tree. How many pears were picked in all ?

- 5) Sara found 27 seashells, Fred found 19 seashells, and Nancy found 36 seashells on the beach. How many seashells did they find together ?

- 6) Sara had 37 nickels in her bank. Her dad gave her 32 nickels and her mother gave her 43 nickels. How many nickels does Sara have now ?

- 7) Alyssa has 49 books, Dan has 25 books, and Jason has 36 books. How many books do they have together ?



Or tasks, like the one we just did where students are:

- making sense and understanding the context
- asking interesting questions which math can solve
- determining what information is needed to solve the problem
- mathematically modelling situations

Website 3-Act Tasks (Graham Fletcher) ☆ 🌐

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	A	B	C	D	E	F
	Date Added	Lesson Title	Standard 1	Standard 2	Big Ideas	What do you wonder?
1	4/17/2014	Peas In a Pod	K.NBT.1	K.CC.4	counting	If all the peas were in one pod, how many peas would there be?
2	4/25/2014	Dotty	K.CC.1,2,3	K.CC.4,5	counting and patterns	How many dots will be on the screen after the last bell?
3	2/9/2016	the Candyman	K.CC.1,2,3	K.CC.4,5	counting and joining sets	How many candies are in are in his hand?
4	12/6/2015	Share the Love	K.CC.1,2,3	.	sharing quantities within 20	How many M&Ms will each girls get?
5	1/16/2015	Counting Squares	K.NBT.1	K.CC.4,5	counting and patterns	How many tiles are in the pile?
6	1/16/2015	Stage 5 Series	K.NBT.1	K.CC.4,5	counting and patterns	What will stage 5 look like?
7	3/24/2015	Shark Bait	K.NBT.1	K.CC.4,5	counting and joining sets through 20	How long is the worm?
8	3/4/2014	Lil' Sister	K.MD.2	K.CC.6	comparing measurements	How much shorter is Lil' Sister than Big Sister?
9	9/1/2015	Bag-O-Chips	K.OA.4	K.OA.5	building fluency through 10	How many bags of chips were missing?
10	5/8/2014	Balancing Numbers	K.OA.2	.	number combinations through	What is needed to make both side of the scale equal? (balance)
11	9/27/2015	Humpty Dumpty	K.OA.1,2,3	.	addition and subtraction within 20	How many eggs didn't break?
12	10/10/2017	Popping Balloons	K.OA.1,2,3	.	building fluency through 10	How many balloons are left?
13	2/15/2015	the Cookie Monster	1.NBT.1	1.NBT.4	addition and subtraction within 50	How many cookies did the cookie monster eat?
14	11/7/2016	the Pringle Ringle	1.NBT.1	1.NBT.4	addition and subtraction within 100	How many Pringles did it take to make the Pringle Ringle?
15	5/3/2014	the Juggler	1.NBT.1	1.NBT.4	addition and subtraction	How many times will the juggler be able to bounce the ball off a body part unt
16	11/10/2014	Graham Cracker	1.NBT.1	1.NBT.4	addition and subtraction within 100	How many crackers will fit inside the Graham Cracker box?
17	5/16/2016	Bright Idea	1.NBT.1	1.NBT.4	addition and subtraction within 100	How many Skittles fit inside the light bulb?
18	9/4/2017	Snack Machine	1.NBT.6	.	addition and subtraction within 100	How much did the Munchos cost?
19	3/30/2017	Sliced Up	1.G.3	4.NF.4	working with quarters and wholes	How many orange wednes are in the bowl?
20	2/9/2016	the Whopper Jar	2.NBT.5	1.NBT.4	addition and subtraction within 100	How many Whoppers are inside the jar?
21	3/3/2014	Cover the Floor	2.OA.4	.	building arrays with repeated addition	How many blue squares will it take to cover the yellow square?
22	3/7/2015	It All Adds Up	2.NBT.5	.	adding and subtracting money	What coins are in the bank?
23	9/9/2015	Let It Fly	2.NBT.7	.	adding and subtracting within 1000	How far did he throw the disc?
24	2/1/2016	Downsizing Tomatoes	2.NBT.7	.	adding and subtracting within 1000	How many little ketchup bottles will will the big bottle fill up?

to learn more....

Three-Act Tasks



ABOUT THIS ACTIVITY

This activity is made up of three parts or "acts;" 1) The Question, 2) Gathering Information, and 3) The Reveal. The entire activity typically takes a full math period or the acts can be split up and worked on across multiple days. The goal of the activity is to engage children in asking mathematical questions, identifying information that will allow them to answer the question, developing a mathematical model of the situation, and revising their models to more closely reflect the real world.

INTRODUCE

PREPARE

ENACT

ANALYZE



ABOUT THIS ACTIVITY	
INTRODUCE	
<h1>1</h1> <h2>Introduce</h2> <p>Introducing Practices of Ambitious Teaching</p>	<hr/> <h3>Resources</h3> <ul style="list-style-type: none"> Three-Act Task Primer Article: Trying Three-Act Tasks with Primary Students Three-Act Task Overview Modeling with Mathematics Primer Blog Post: Modeling with Mathematics Video: Three-Act Task in Kindergarten Video: Three-Act Task in Second Grade



ABOUT THIS ACTIVITY	
INTRODUCE	
PREPARE	
<h1>2</h1> <h2>Prepare</h2> <p>Helping Teachers to Prepare to Enact</p>	<hr/> <h3>Resources</h3> <ul style="list-style-type: none"> Planning Guide Planning Template Three-Act Task Resources Anticipating Student Thinking Three-Act Task Planner



ABOUT THIS ACTIVITY
INTRODUCE
PREPARE
ENACT

3

Enact

Supporting Teachers to Enact Ambitious Teaching

Resources

- [Planning Template](#)
- [Student Recording Sheet \(version A\)](#)
- [Student Recording Sheet \(version B\)](#)



ABOUT THIS ACTIVITY
INTRODUCE
PREPARE
ENACT
ANALYZE

4

Analyze

Guiding Teachers in Analyzing Practice

Resources

- [Prompts for Reflection](#)

When does Math feel like PLAY to you?



Playful Mathematical Inquiry

Begin with your students interests and curiosities...

Think like a child...

What materials will pique curiosity and act as an invitation?

Discuss what you notice and wonder

Provocations can include:

- Books
- Artifacts
- Photos



Image from Janice Novakowski - http://janicenovkam.typepad.com/reggioinspired_mathematic/

What growing and
shrinking patterns
can you make with
these materials?

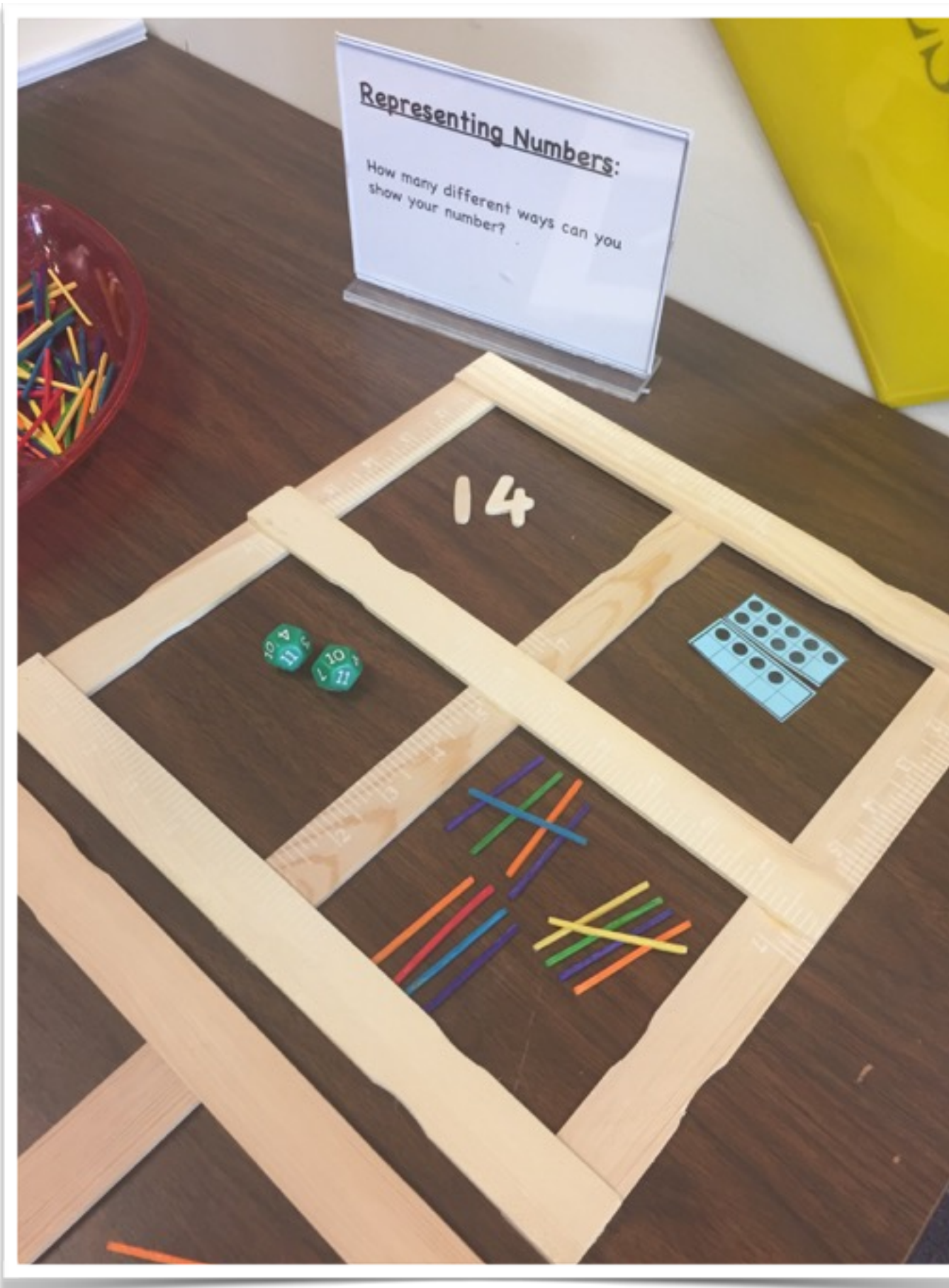


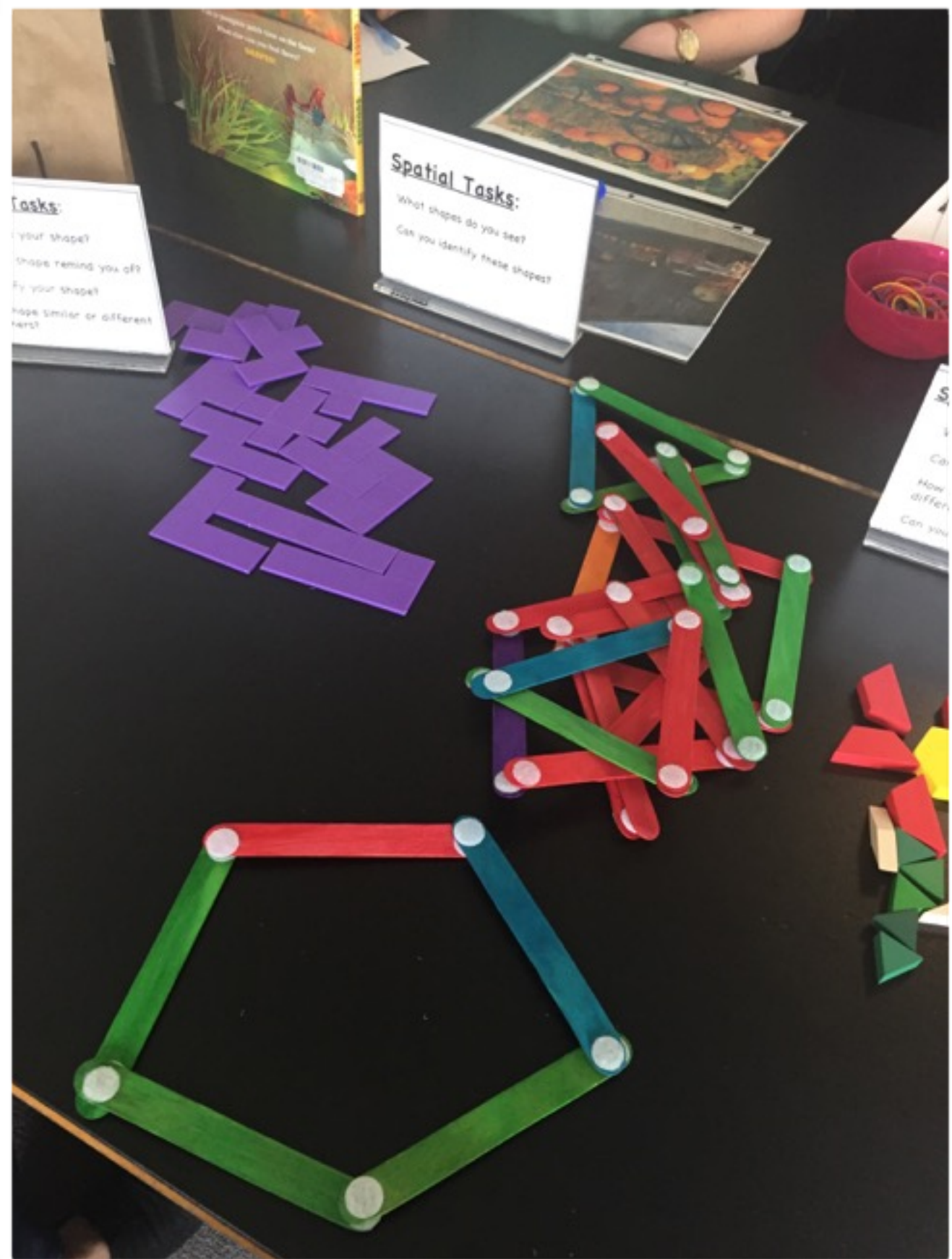
1 2 3 4 5 6 7 8 9 10 11

What patterns do
you see?

Hundred Chart

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





I wonder how many lucky charms you will find in a bowl?



Fewest

Rimi 12
Jeremiah 15
Nicolas 16
16
Marita
Loyky 18
Rafael 19

Jio 20

Harden 21

Yusef 22

Ahmed 24

Aaron 25

Sarah 30

Ray 31

Mattia 35

Mariam 36









24
Sah

Jade 25

Garnish 24

Sarah 24

Most

- ① Name  write
- ② sort shapes   
- ③ count  write
- ④ colour  
- ⑤ Turn over 
Fill ten frames
- ⑥ I had — charms



PLAY GIVES
CHILDREN
A CHANCE
TO PRACTICE WHAT
THEY ARE
LEARNING.
-MR. ROGERS

Independent Practice

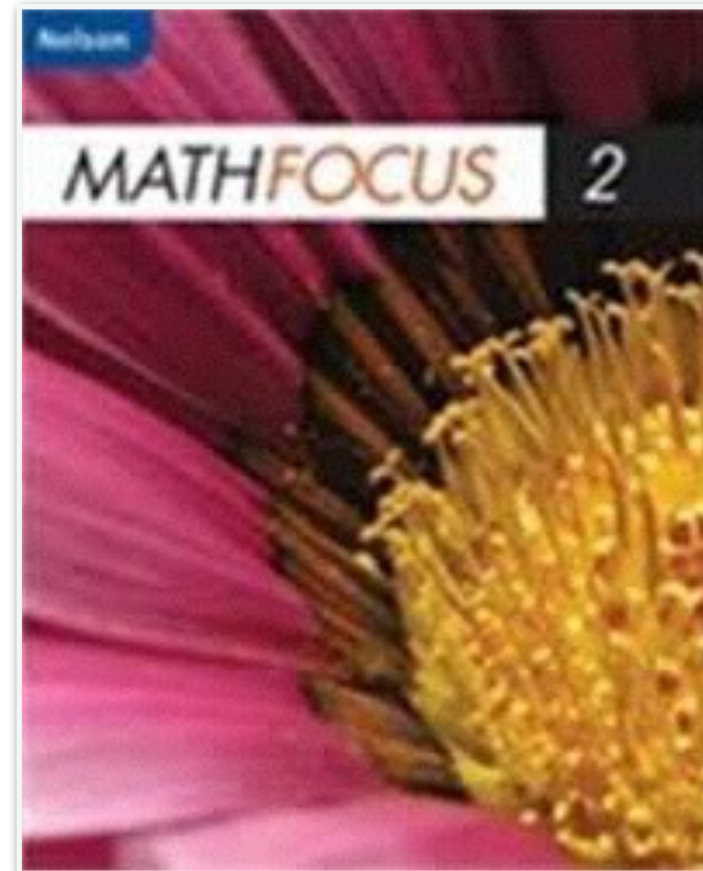
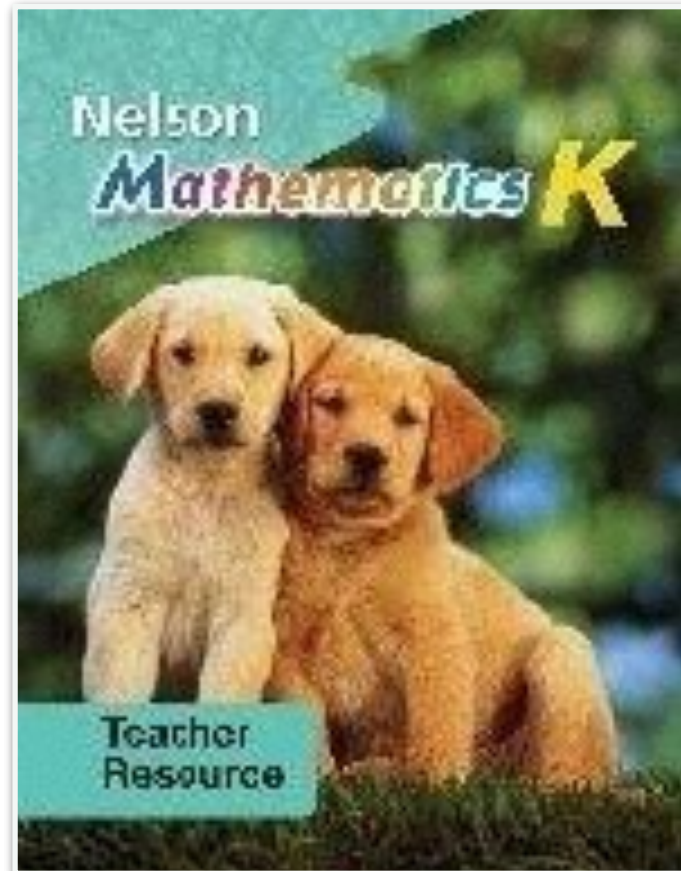
Provides authentic, engaging learning opportunities to review competencies/concepts. Students will need to take ownership of their own learning and work independently or with a partner to develop their understanding.

Considerations:

- Provide learning opportunities that will allow students to apply understanding and share thinking.
- Ensure that learning opportunities are CAREFULLY selected to focus on the learning intentions and provide STUDENT CHOICE
- Ensure there are diverse learning opportunities that provide ACCESS FOR ALL.
- Provide games, rich tasks, or provocations that involve thinking, reasoning, and communicating which assist students in developing their understanding of mathematics.

Textbooks

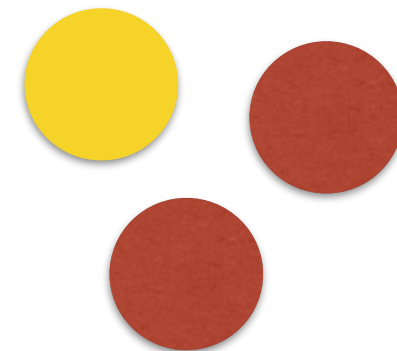
Remember one size does NOT fit all!





Independent Practice

What could this look like?



Let it Snow

Materials: game board, 3 dice, 8 chips for each player

Directions: Players take turns rolling the dice and finding the sum. Cover the sum. Be the first to cover all your boxes to win the game.

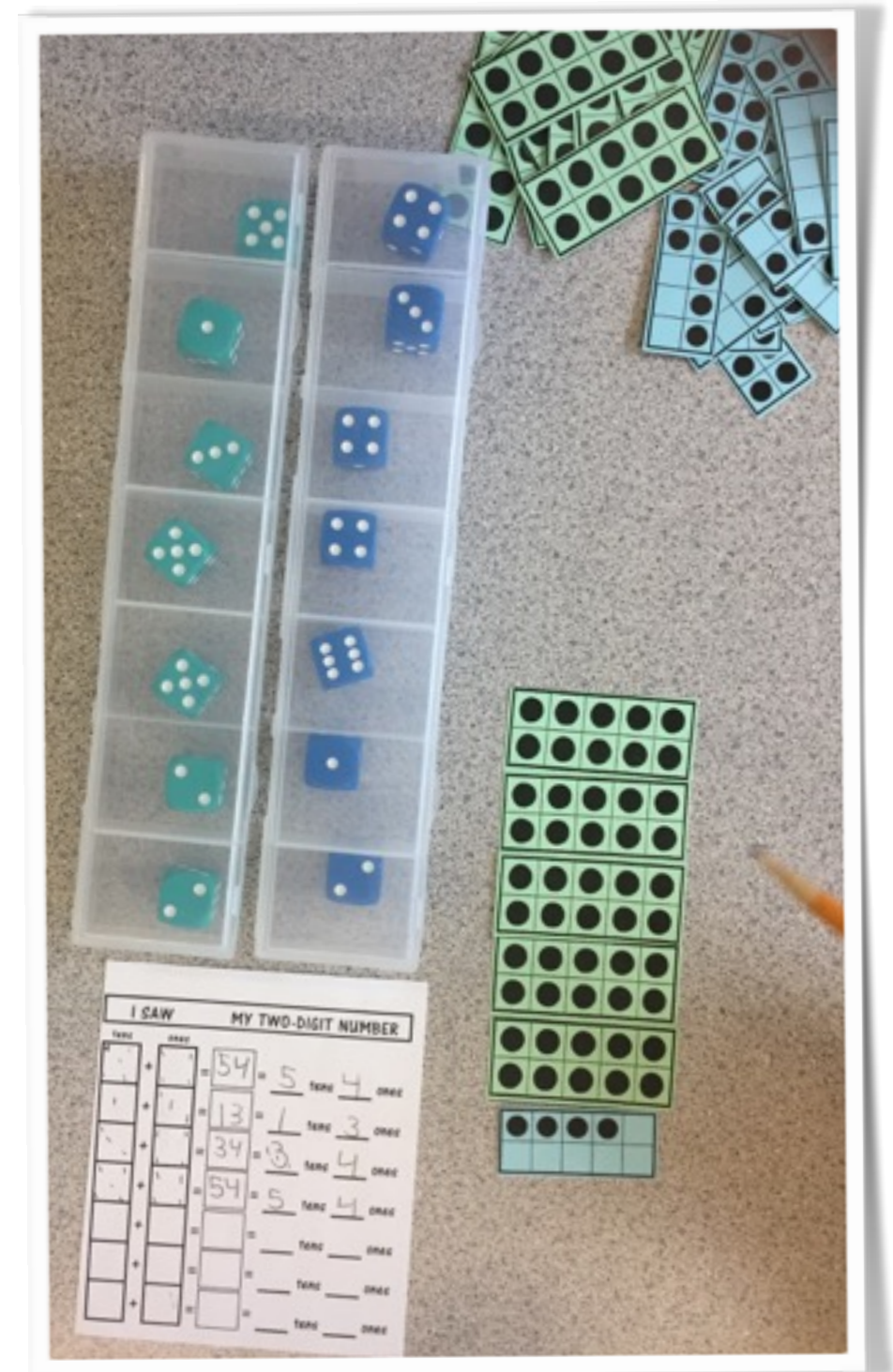
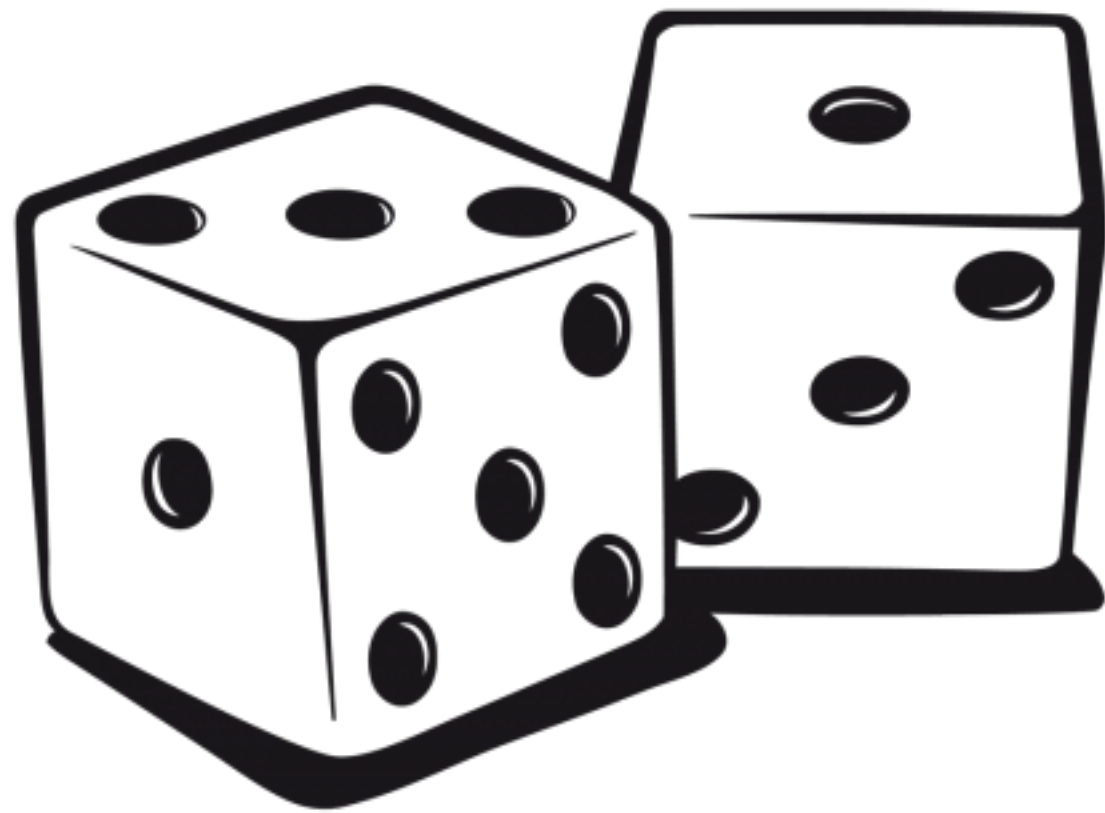
4	3
17	16
8	11
12	7
15	14
9	10
10	9
6	18

Ten More

12	16	13	14	11	13
15	11	16	12	16	14
14	15	12	16	15	11
13	14	16	12	15	13
11	13	11	16	12	14
15	11	16	12	14	11

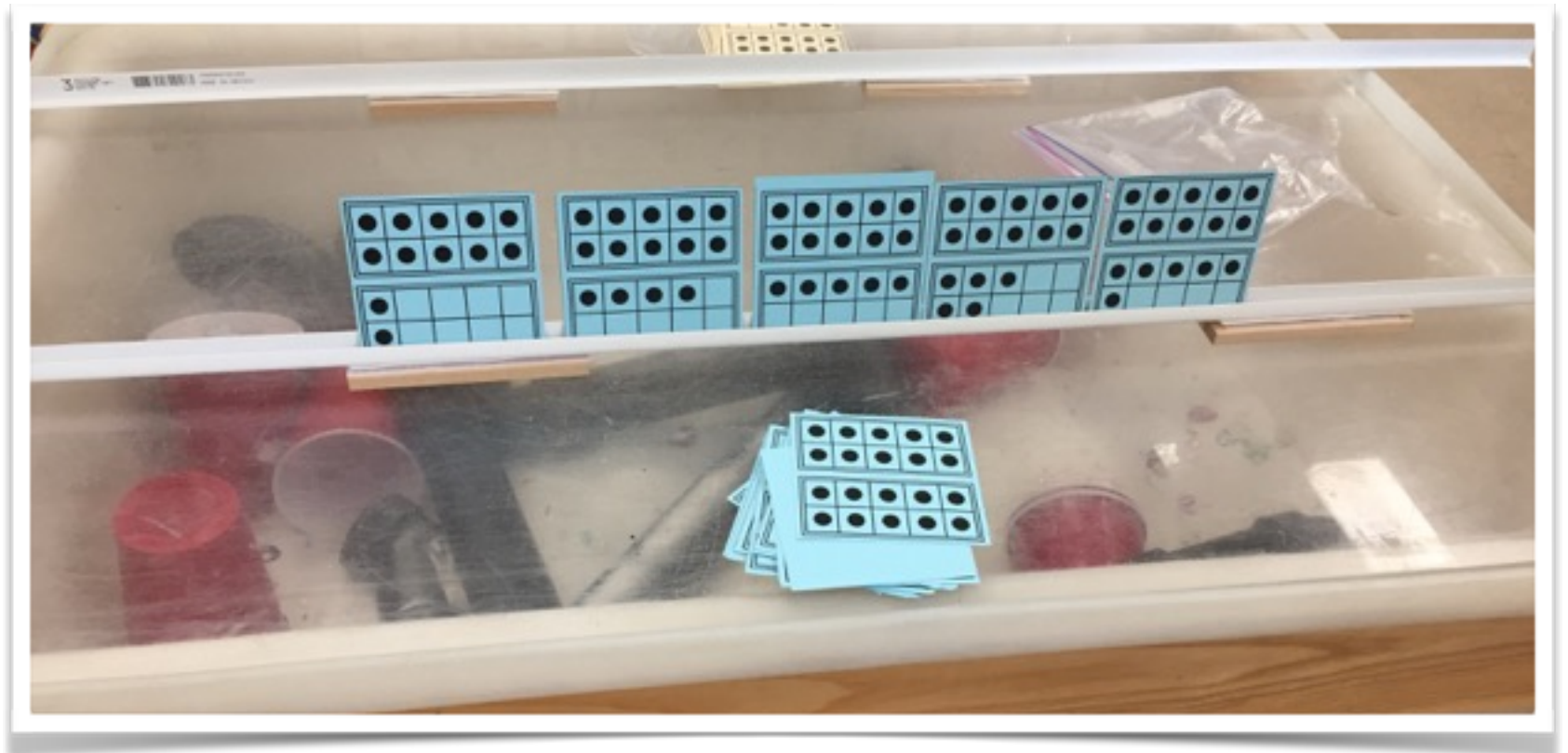
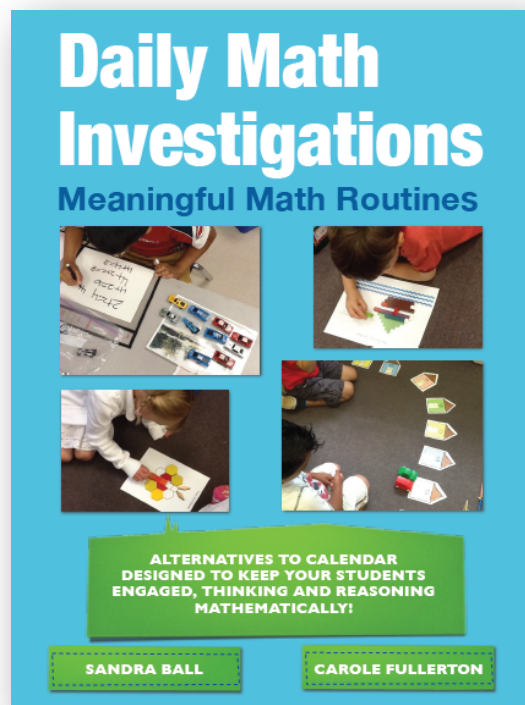
independent and/or Partner Games

Box Cars and One Eyed Jacks



Daily Math Investigations

What does this look like?




- investigations are not new
- students choose where they go
- students can work alone or with others
- each investigation can be differentiated

Sandra Ball's Website

Starting With The Beginning

Early Learning – Planting the Seeds

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Numeracy Centres



What's Included?

Penguin Package

What's Inside?

1. Domino Penguin Match - Matching Activity - 1 set

- students match quantities on a penguin with the numerals on a matching penguin



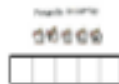
2. Feed Me - Individual - BLMs

- reinforce partitioning of numbers into 2 parts.
- students use 2 sided counters and sort them into 2 parts



3. Penguin Cover Up Five Frame - Individual

- roll the 1 - 6 sided die
- cover the rolled quantity on to the five frame
- students could record on a blank five frame the quantity (using bingo dabbers or felts)
- ask "How many more/less to get to 5?"



4. Penguin Cover Up 0-10 - Individual

- player #1 needs to roll die (0 - 9 sided)
- build quantity on a ten frame and cover up the numeral
- students could record on a blank ten frame the quantity (using bingo dabbers or felts)
- ask "How many more/less to get to 10?"



5. Penguin Cover Up 1-10 - Partner Game - BLM

- player #1 needs to roll 2 (1 - 10 sided) die
- build quantity on the ten frames and cover up the numeral
- players take turns rolling the die, building the quantity and covering the numeral
- first one to cover all the numerals wins

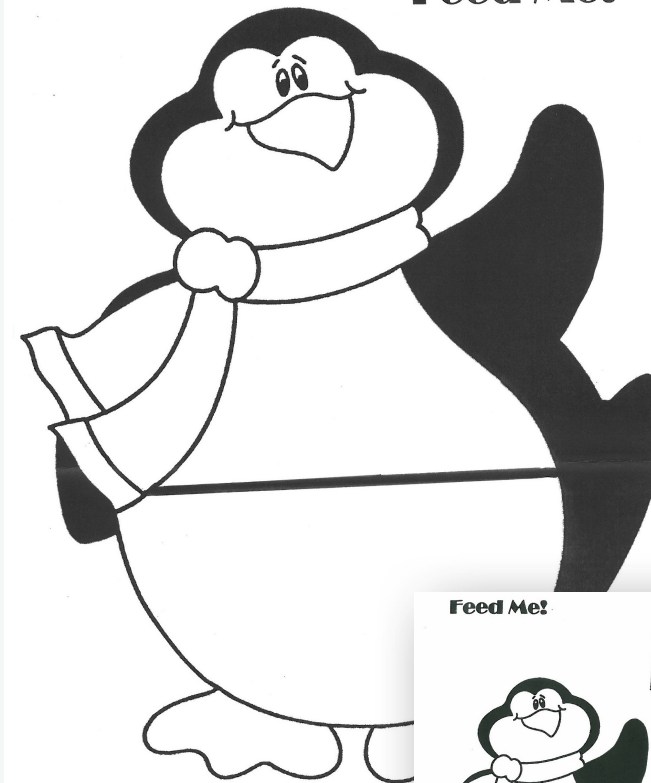


6. Penguin Cover Up 2-12 - Partner Game - BLM

- player #1 needs to roll 2 (1 - 6 sided) dice and find the sum
- build the sum on the ten frames and cover up the numeral
- players take turns rolling the die, building the quantity and covering the numeral
- first one to cover all the numerals wins



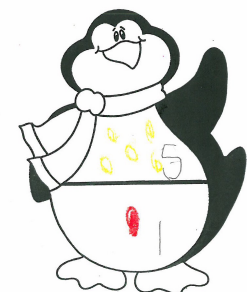
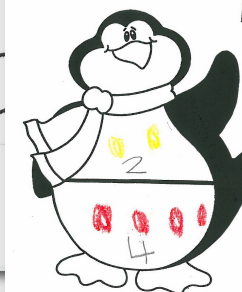
Feed Me!



Feed Me!

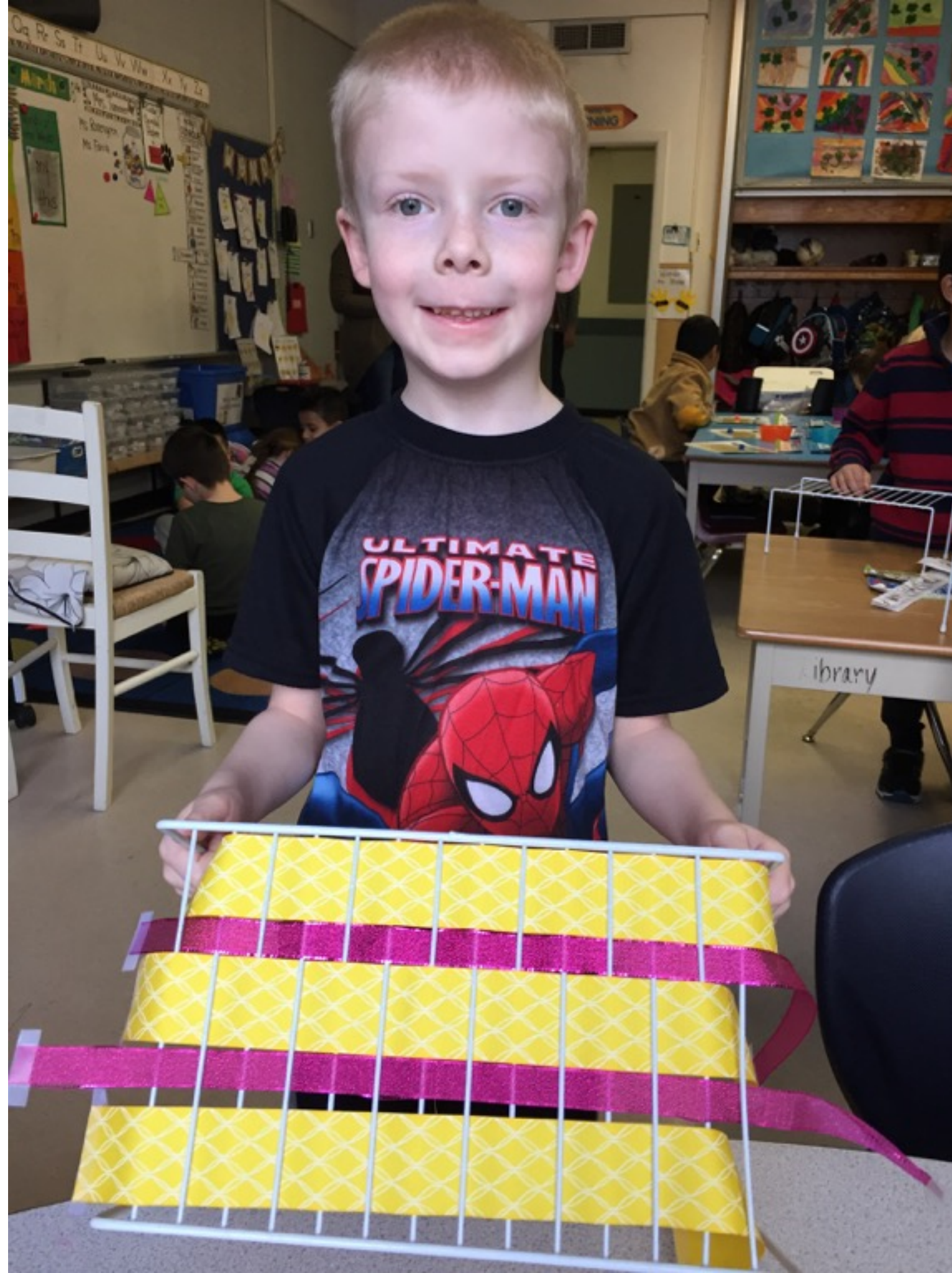
Bob 6/6

6







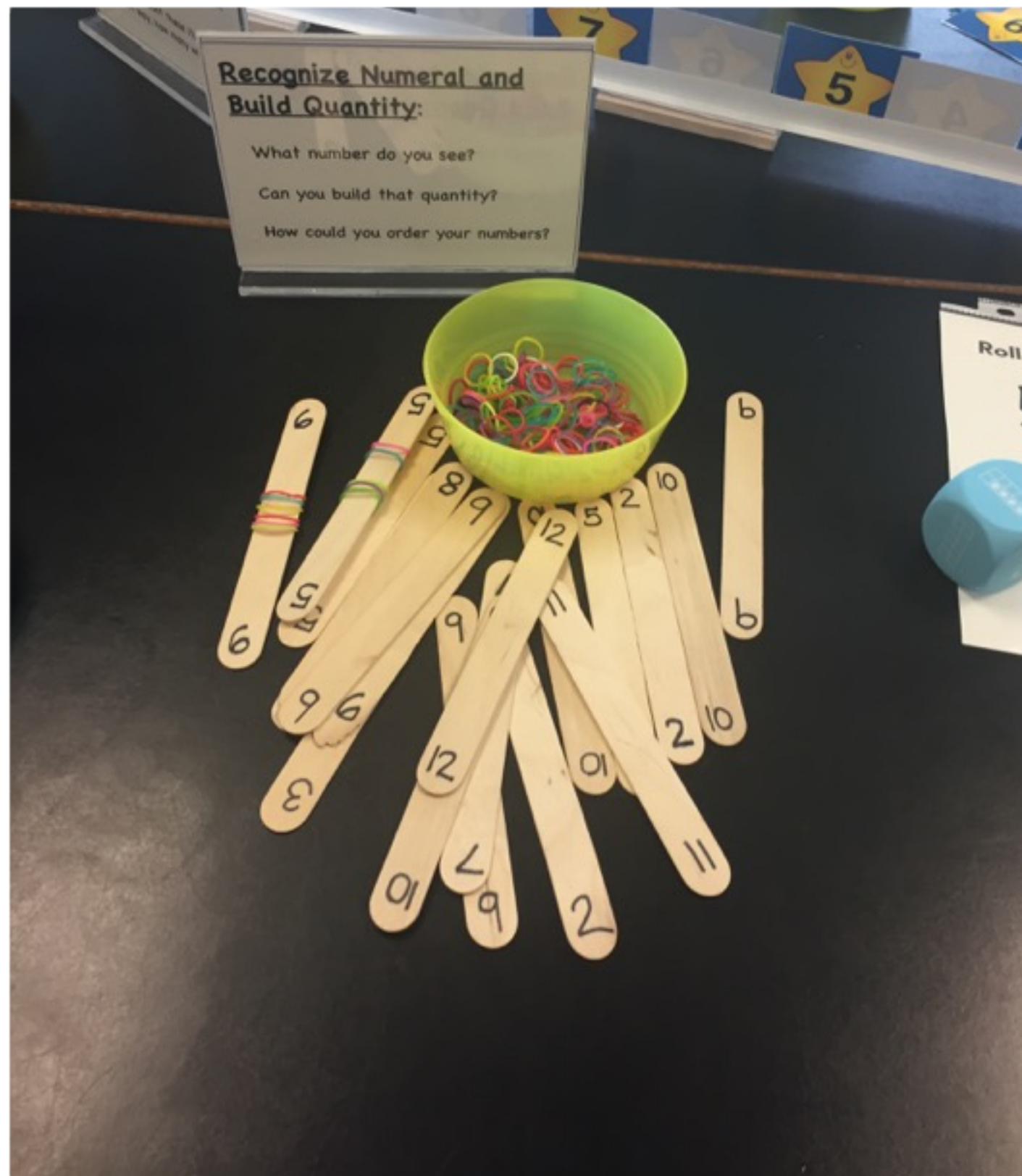


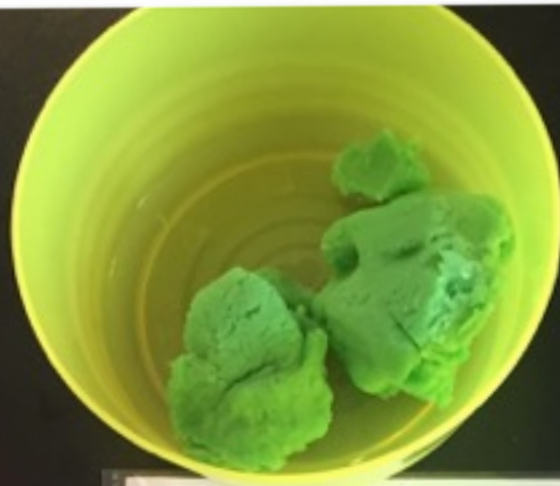
**Recognize Numeral and
Build Quantity:**

What number do you see?

Can you build that quantity?

How could you order your numbers?





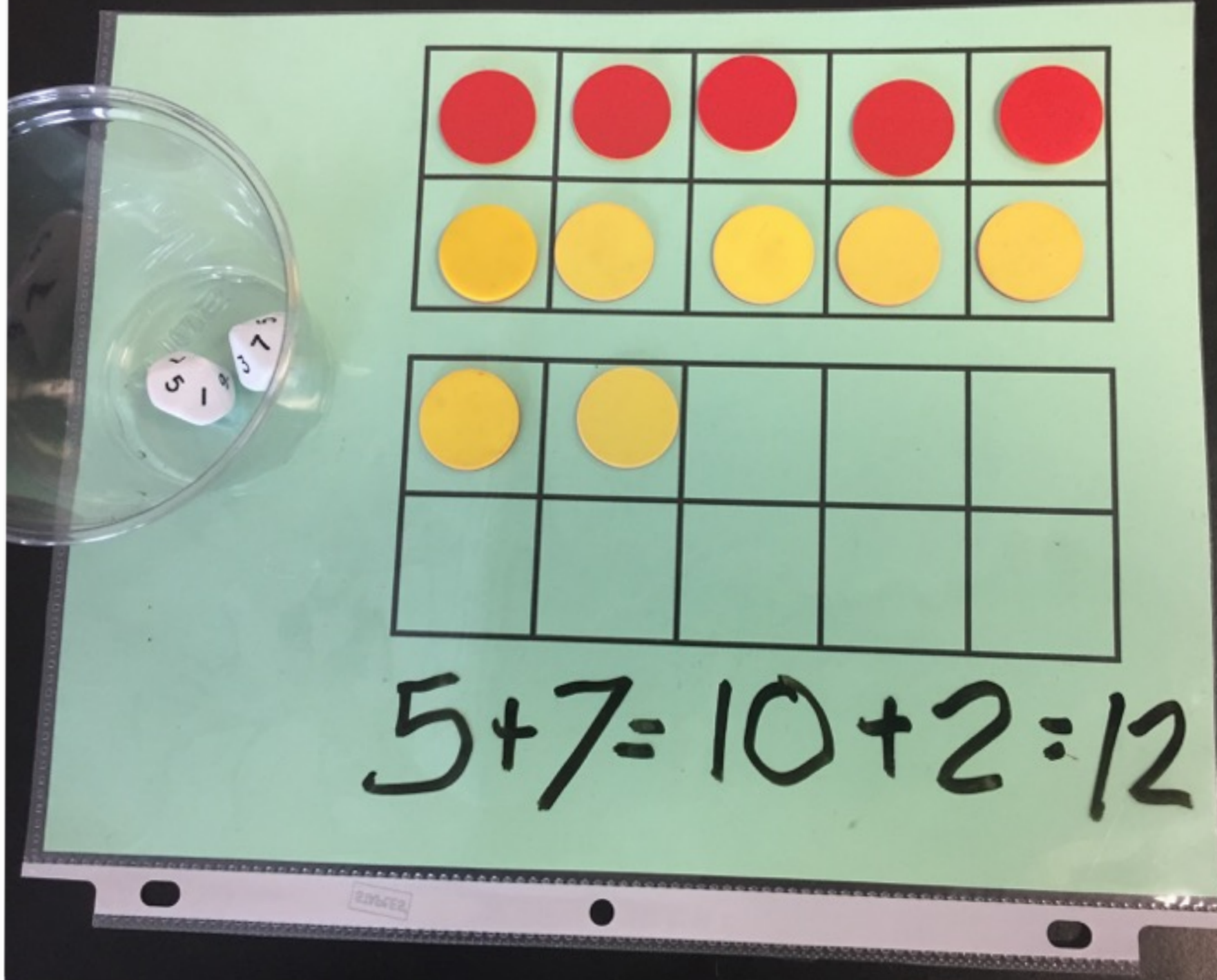
PLAY DOUGH SMASH!



6 - 3

=

3

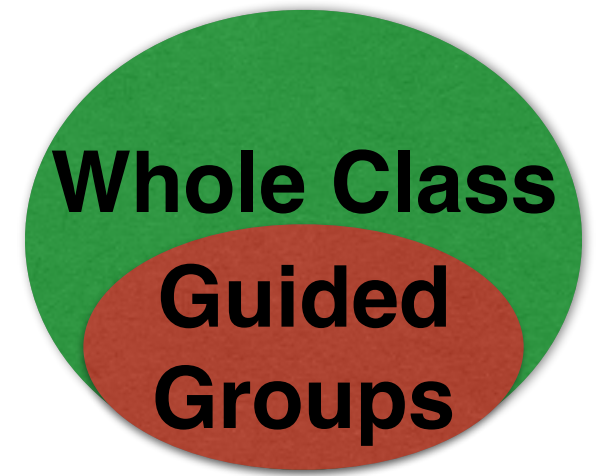
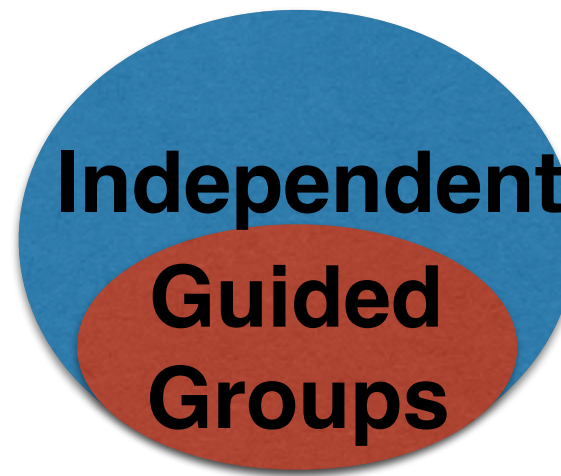






IMPORTANT

Nested within Independent Practice
and Whole Group Lessons is

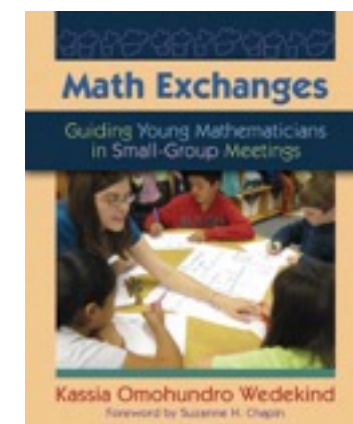


Guided Small Group Instruction

Learning opportunities that support students' strengths and stretches and intentionally move them forward.

- Present rich tasks to identify the students' prior knowledge
- Identify the students' strengths and stretches.
- Focus on scaffolding or extending the learning opportunities.
- Conferencing with the students and asking probing questions.
- Embedded formative assessment to help inform instruction.
- Focus on building students' confidence and risk taking.
- Introduce new learning opportunities for independent practice.

Kassia Omohundro Wedekind author of
<https://www.youtube.com/watch?v=Lgl2EeqApCo>



Guided Small Group Instruction

What could this look like?



- Groups are **FLEXIBLE** and composition changes according to the needs of the students.
- Might include working with students on practice questions, teaching a new game, reviewing a concept taught to the class or working with students who are unsure how to start a problem

Why is it important for teacher's to confer with students?



- Conferring builds identity and agency.
- Deep listening is at the heart of conferring.
- Conferring follows a predictable structure.
 - The teacher asks guiding questions to determine the student's understanding
 - Decide on a point to nudge
- Nudges may connect what a student is doing with ideas being considered by classmates or by the class as a whole.
- A goal of conferring is to facilitate understanding that goes beyond the single problem in front of the student.



Kassia Wedekind engaging in a
conferral during Counting
Collections

[https://
www.youtube.com/
embed/FxnMSYCPuG0](https://www.youtube.com/embed/FxnMSYCPuG0)

Why do we need all 3 parts?

“For a person learning to play baseball, batting practice is an important part of learning how to play the game. However, imagine a person who has never [played] a baseball game. Making that person do nothing but batting practice may lead to the misconception that baseball is about standing at the plate and repeatedly swinging at the ball. That person would miss the purpose of baseball and would think it a boring way to spend an afternoon.” (Stahl, 1992).



What might a week look like?

	Monday	Tuesday	Wednesday	Thursday	Friday
Number Routines (10 - 15 min) These vary depending on my intentions and classroom observations.	<u>Number Talk:</u> Quick Image of two ten frames. How many? How do you see them? Image to encourage thinking of ten and some more.	<u>Number Talk:</u> Present students with a string of questions that will encourage thinking about making tens.	<u>Notice and Wonder with Data Analysis:</u> Preset graph with no labels – what do you notice and wonder?	<u>Choral Count</u> – Focusing on counting by backwards from 20 by 1's.	<u>Number Lines</u> – Build the line – show a number – provide quiet thinking time – talk at your talk – where would you place this and why. Add the 5 numbers then provide mystery number.
Whole Class Note: Teacher meets with small groups as needed	Counting Collections Mini-lesson: How might we count the collections using fractions?	Concept based 3- part lesson: Inquiry-based Problem solving Open task Parallel task Three Act Task Text book whole class lesson	Concept based 3- part lesson: Inquiry-based Problem solving Open task Parallel task Three Act Task Text book whole class lesson	Concept based 3- part lesson: Inquiry-based Problem solving Open task Parallel task Three Act Task Text book whole class lesson	Concept based 3-part lesson: Inquiry-based Problem solving Open task Parallel task Three Act Task Text book whole class lesson
Independent Practice		(30 min) – Soft Start - Daily Math Investigations: centres/games/ choice	(30 min) – Soft Start - Daily Math Invest – centres/ games/ choice	(30 min) – Soft Start - Daily Math Invest – centres/games/ choice	
Guided Groups	While the students are counting the collections, the teacher is circulating and conferencing with small groups.	During the Independent Practice time, the teacher meets with specific students in small groups. Guided instruction and/or explicit.	During the Independent Practice time, the teacher meets with specific students in small groups. Guided instruction and/or explicit.	During the Independent Practice time, the teacher meets with specific students in small groups. Guided instruction and/or explicit.	

How might we think about planning for the year?



Find out what your students know -
This doesn't mean a test the first week!



Build a community of learners - what is their history with Math? Provide opportunities to uncover what it means to be a Mathematician.

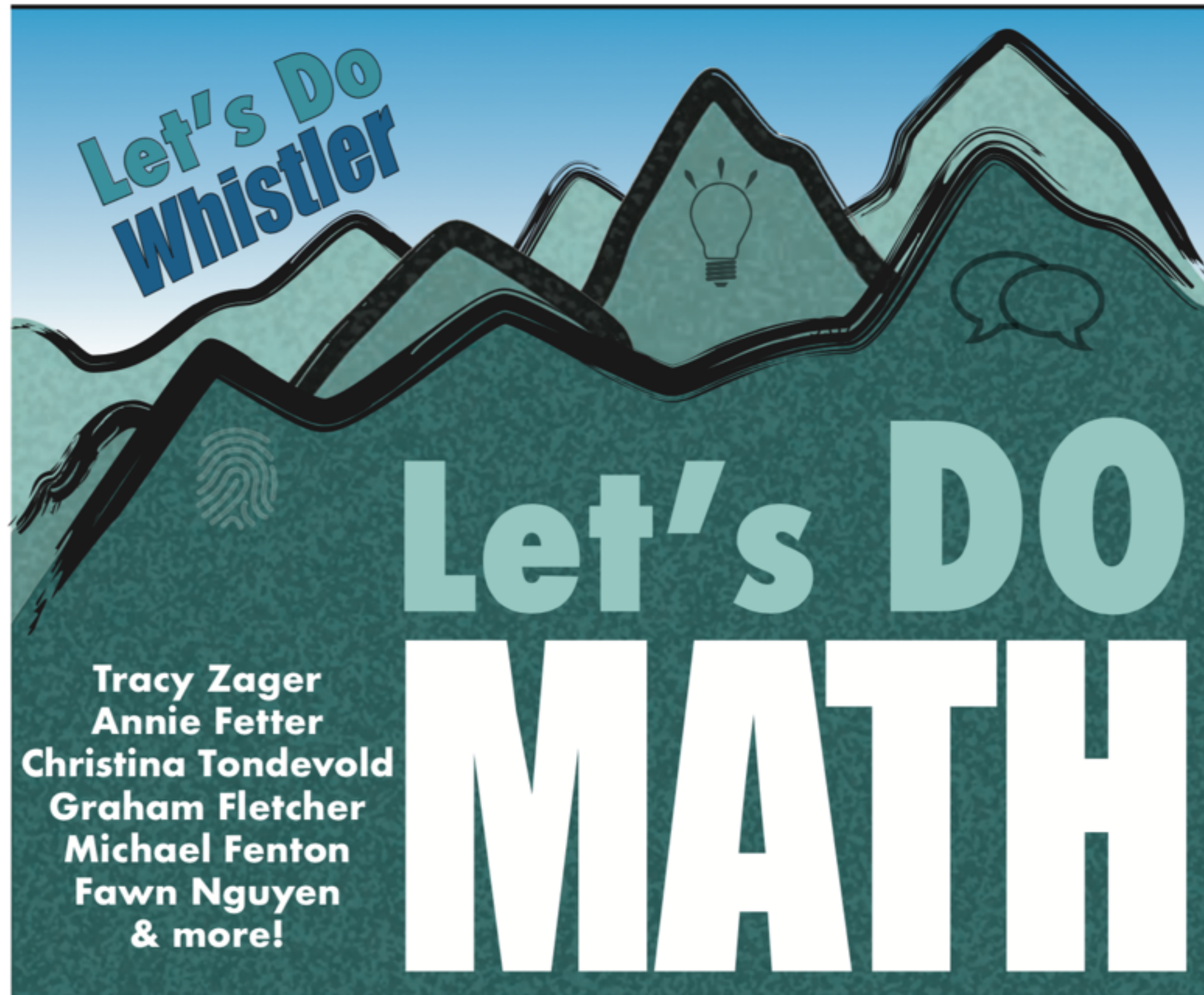
Begin with a unit in which students can learn about one another - data analysis or how to engage with materials.

Consider including a visual spatial unit each term so that students for whom this is a strength have an opportunity to feel success.

What concepts are new to this grade?

What concepts need to be experienced through out the year?

57th Northwest Mathematics Conference



Tracy Zager
Annie Fetter
Christina Tondevold
Graham Fletcher
Michael Fenton
Fawn Nguyen
& more!

October 18-20, 2018 • www.bcamt.ca/nw2018

Thank you for spending your morning with me!

Math Program



Acknowledgement



We recognize that we are here today to learn on the unceded, shared territories of the Coast Salish people on which our schools are located.