Please take some time to **PLAY**! Engage with a question and the materials.

Acknowledgement

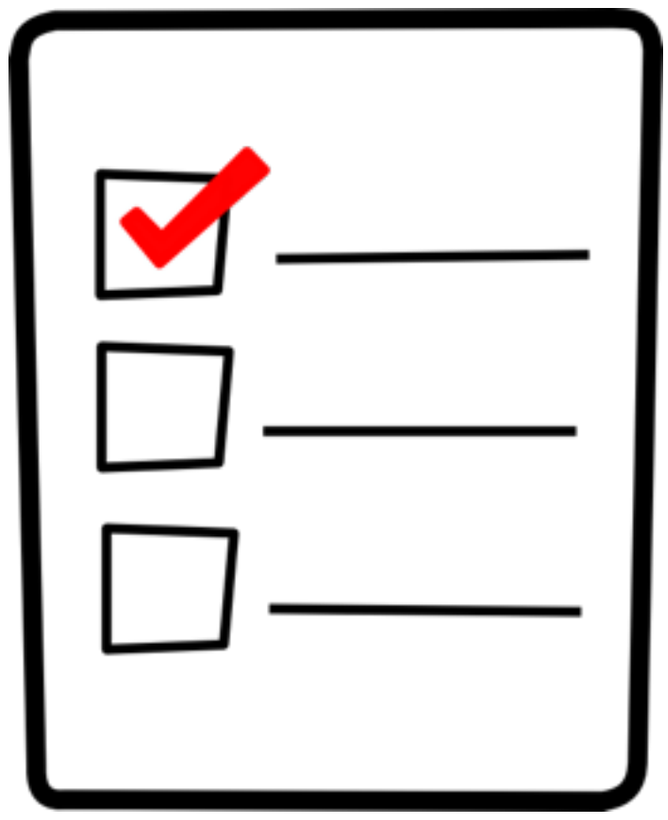
We recognize that we are here today to learn on the unceded, shared territories of the Coast Salish people on which our schools are located. We recognize the Katzie and Semiahmoo First Nations who have signed the Surrey Schools Aboriginal Education Enhancement Agreement.

Playful Mathematical Inquiry in Grades 3 to 5: Patterning & Number Concepts

November 3rd, 2017 ~ Curriculum Implementation Day
Green Timbers Elementary
Presented by Jen Barker
Twitter: @barkerJBarker

Agenda

- What is play? and What is inquiry? How do they fit together?
- What could playful inquiry look like in Patterning?
- BREAK
- What could playful inquiry look like in Number Concepts?



Acknowledgements

- Thanks to Tracy Guraliuk, Robyn Thiessen, Jen Sedmen, Jennifer Pilchak, Marci Vanik, and Christina Syms who let me play with their classes!
- These ideas have been collected and/or inspired from a number of sources, including Janice Novakowski, Kassia Wedekind, Michelle Hikida, Marian Small, etc. Please see handout for links.

Learning Intentions

- I have an emerging definition of **PLAY**!

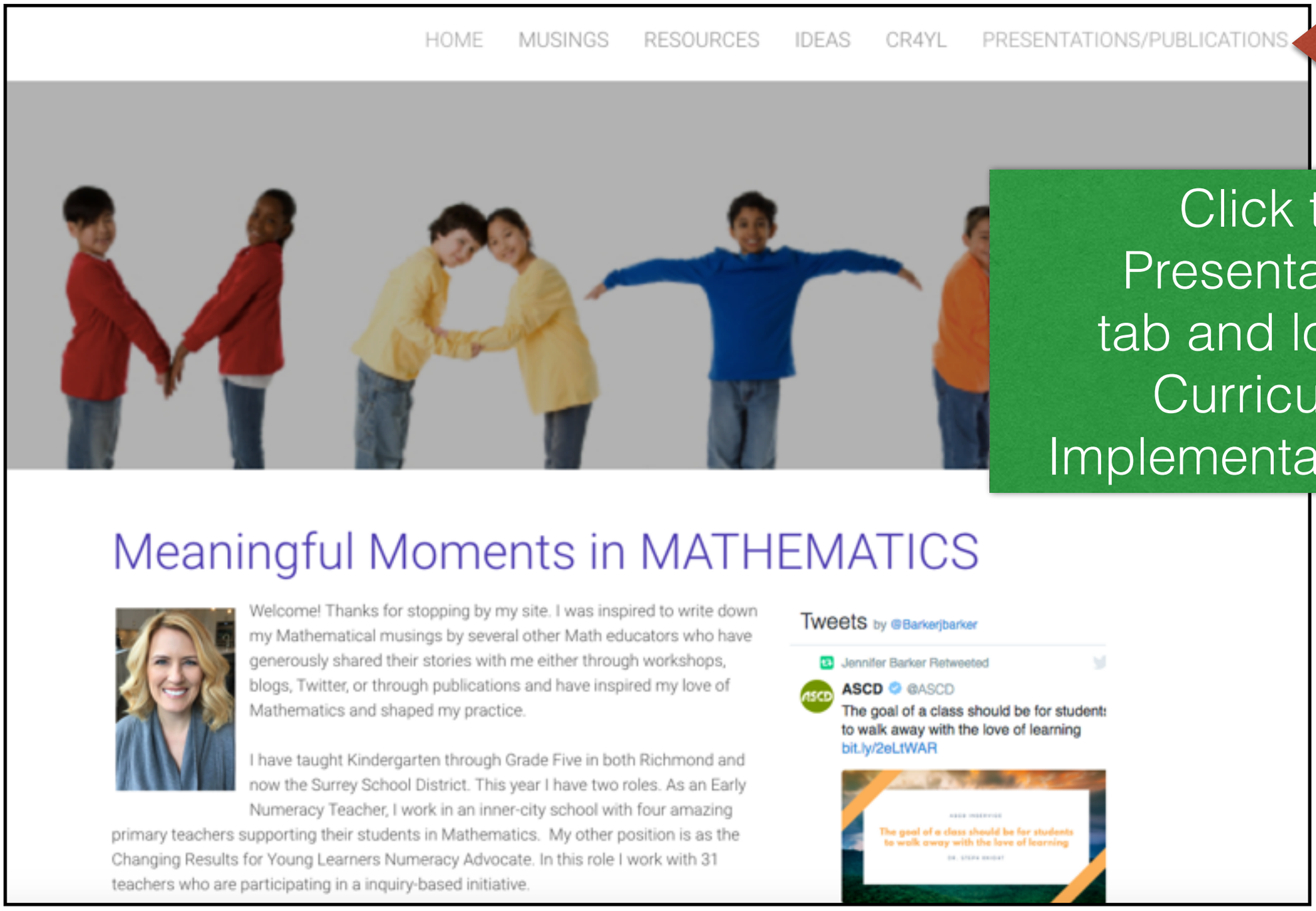
- I understand there are different types of **inquiry** and what these look like.

- I understand **my role as the teacher** during playful mathematical inquiry, including designing the learning opportunities, asking nudging questions, and providing formative and summative assessment.

- **I have a few ideas** about how to design and incorporate playful Mathematical inquiry in my math class with regard to patterning and number concepts.

Where can you find PPT, learning intentions, and more ideas?

www.meaningfulmathmoments.com



Click the Presentations tab and look for Curriculum Implementation Day

What grade do you teach? Why did you sign up for this session? When does Math feel like play to you?

PLAY

Diminished consciousness of self

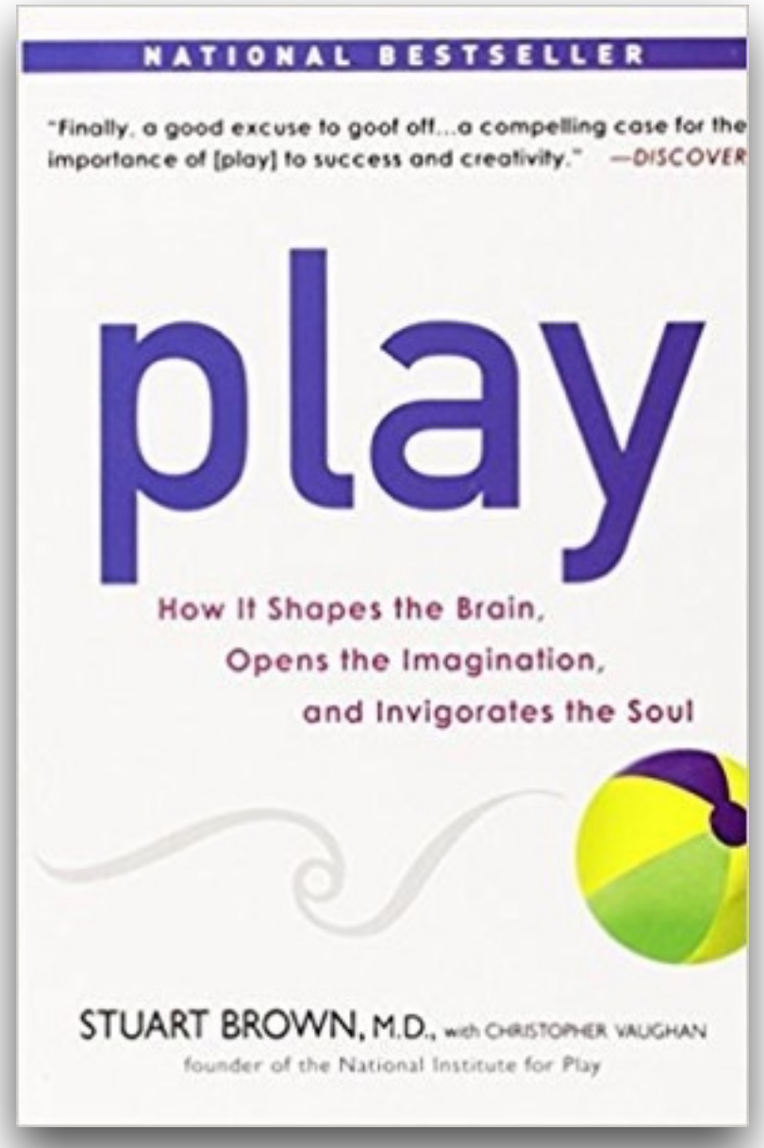
- no good or bad
- willingness to take risks

Improvisational Potential

- its openness
- co-constructing understanding

Continuation Desire

- it hooks! Focused attention
- self motivated



What is Inquiry-based learning?

Inquiry-based Learning is a dynamic and emergent process that builds on students' natural curiosity about the world in which they live.

As its name suggests, Inquiry places students' questions and ideas, rather than solely those of the teacher, at the centre of the learning experience. Students' questions drive the learning process forward.

Teachers using an inquiry-based approach encourage students to ask and genuinely investigate their own questions about the world. Teachers further facilitate students' learning by providing a variety of tools, resources, and experiences that enable learners to investigate, reflect, and rigorously discuss potential solutions to their own questions about a topic the class is studying.

Shifting Pedagogical Paradigms

Traditional learning	Inquiry learning
Have to learn	**Want to learn**
What to know	**How to know**
Tell and memorize	**Ask and inquire**
Only one right answer	**Many conclusions**
Teacher-directed	**Learner-centred**
One-size-fits-all	**Personalized**
Passive learning	**Active learning**
Assess for marks	**Assess for learning**

Thinq 4 - 6: Inquiry based learning in the junior classroom (2016), p 12.

Types of Inquiry

<u>Structured Inquiry</u>:

- The teacher determines the big idea and what the students will come to understand by the end.
- The teacher starts with the guiding question.
- The students help create the plan and guide the inquiry with their questions, interests, ideas, analysis, reflections and understandings.

<u>Guided Inquiry</u>:

- The teacher comes up with the big idea or topic and or the teacher come up with the questions.
- The students are responsible for designing and following their own procedu to test the question and then communicate their results and findings.

<u>Open Inquiry</u>:

- The students determine the purpose and formulate the questions.
- The students design procedures, gather the materials and communicate their findings.
- The teacher facilitates, supports, asks questions and redirects the investigation.

From Michelle Hikida, Richmond Teacher

Whole class structured inquiry

- everyone has the same question & the same materials

Whole class guided inquiry

- everyone has same question and choses from the different materials at each table

Small groups guided inquiry

- Different questions and materials at each table
- could have 2, 3, or 4 questions

Individual or Partner Open Inquiry

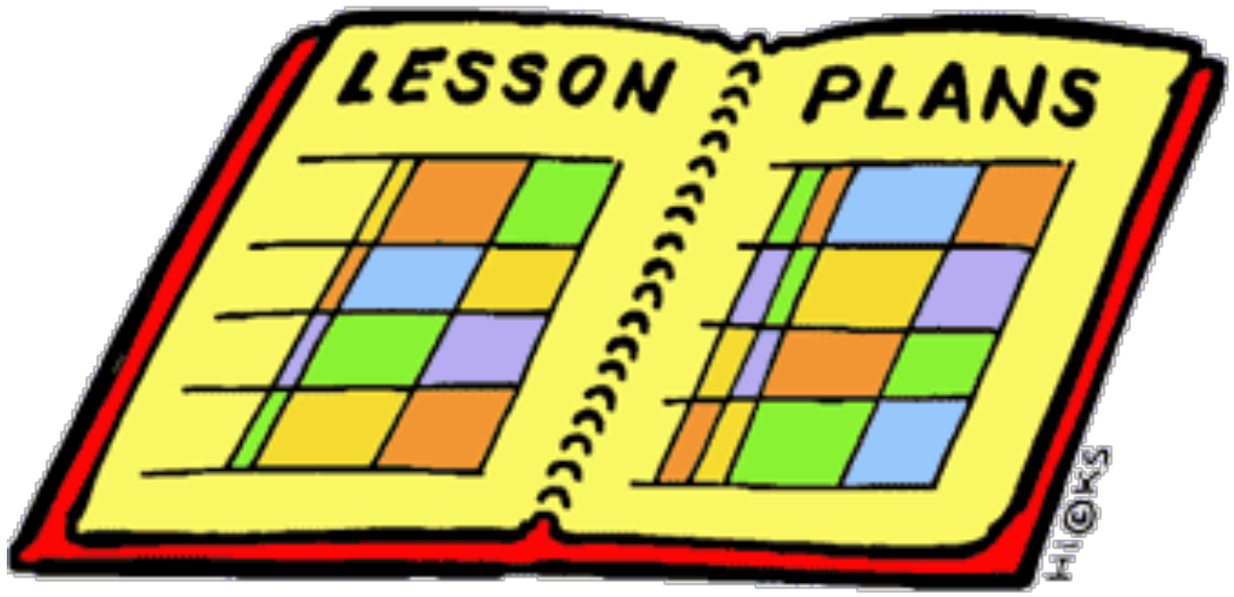
- Lots of different questions
- Many different materials dependent on what students choose

Structure of a Whole Class Lesson

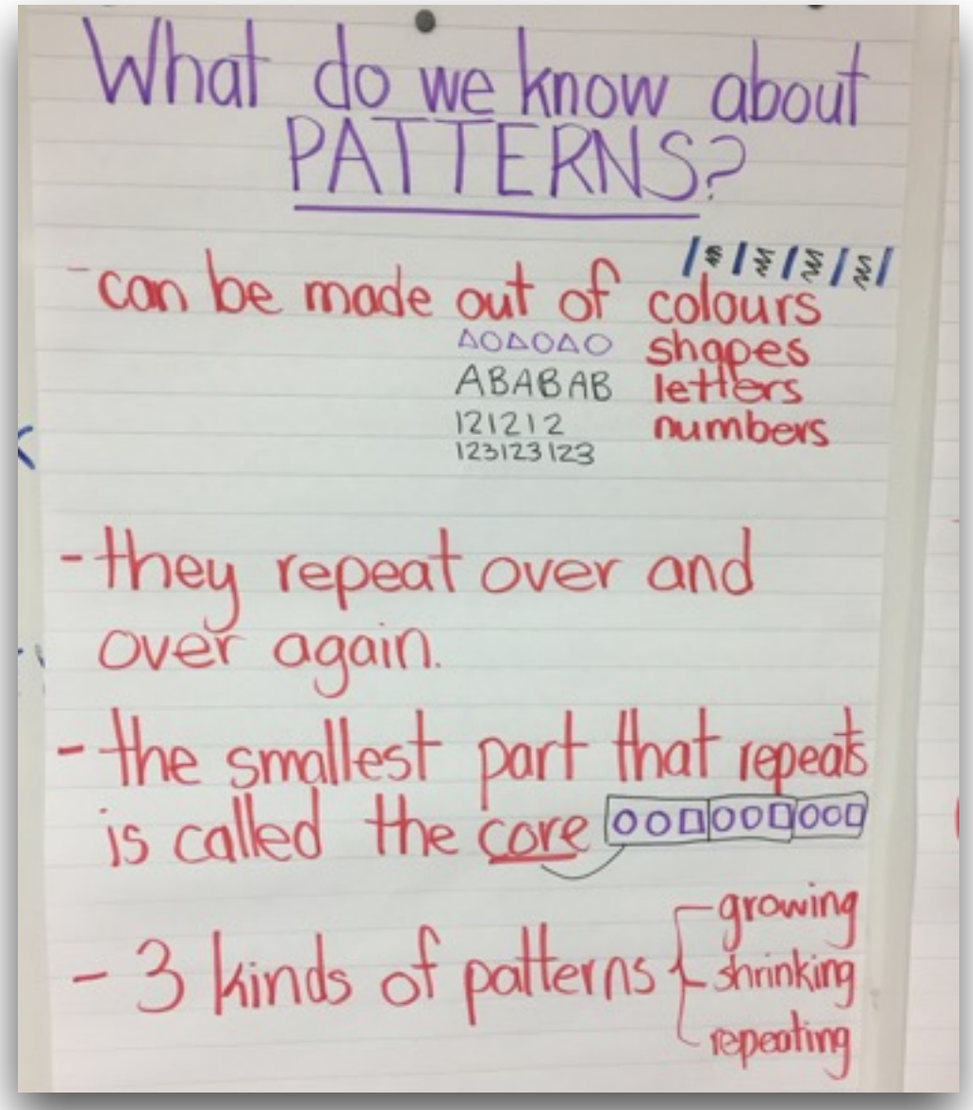
1. Introduce the problem - use a book, image, artifact

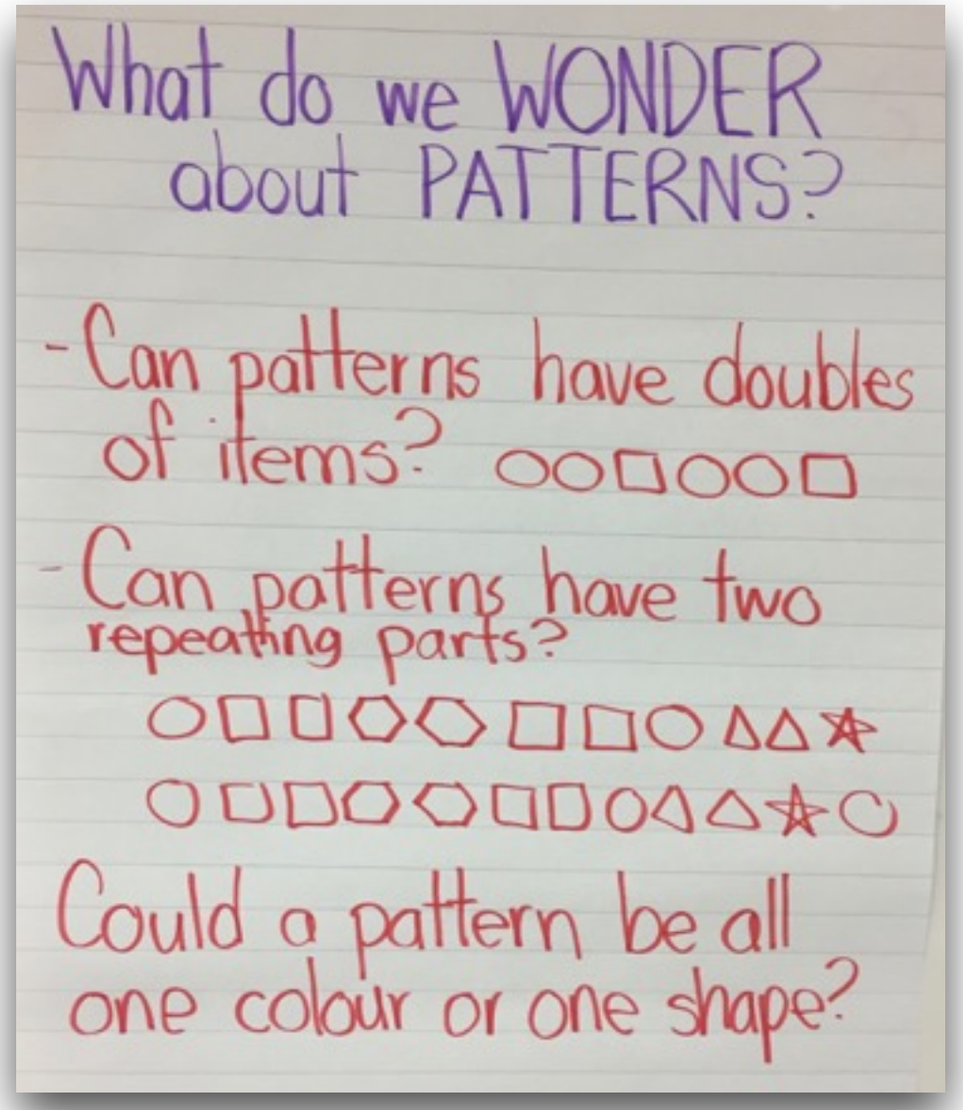
2. Exploration Time - what materials will you need?

3. Sharing - what strategies did you try?

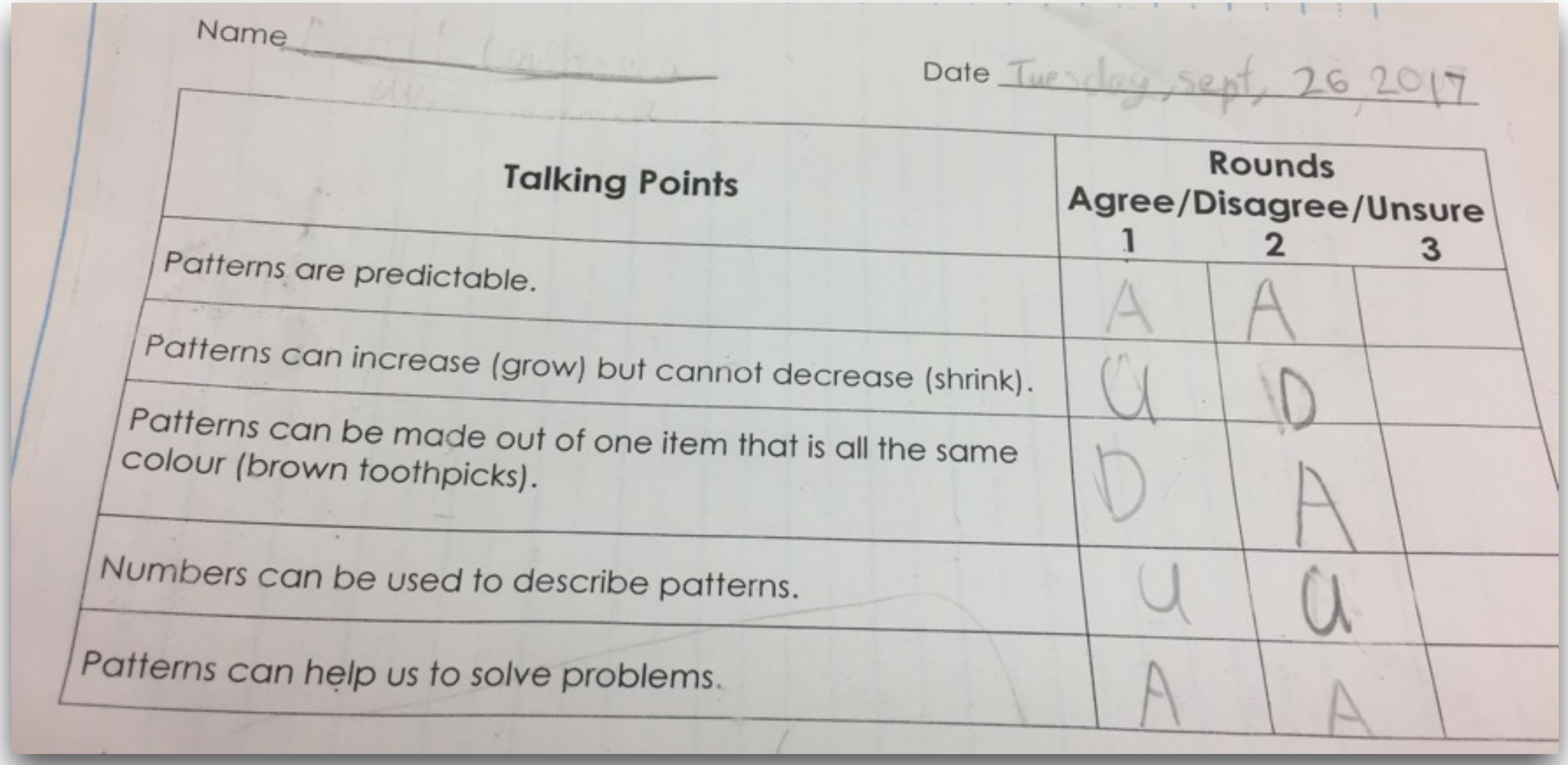


What do your students know?
What do they wonder?





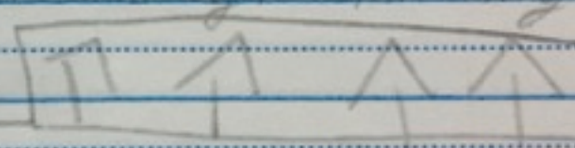
Talking Points



Name _____ Date Tuesday, sept, 26, 2017

Talking Points	Rounds Agree/Disagree/Unsure 1	2	3
Patterns are predictable.	A	A	
Patterns can increase (grow) but cannot decrease (shrink).	U	D	
Patterns can be made out of one item that is all the same colour (brown toothpicks).	D	A	
Numbers can be used to describe patterns.	U	U	
Patterns can help us to solve problems.	A	A	

1. Witch talking point are you sure you were right with your awnser?

I am pretty sure I'm right about patterns are predictable because if you Draw two shapes you could just copy it so it is predictable Example=  triggd and a sqaure if you keep on adding to it, you will get the hang o So it will be predictable. 

2. Witch talking point are you unsure about?

I am most unsure about Numbers can be use to discribe patterns" because I don't re learning that last year.

2. Patterns can increase but cannot decrease. I do know that Patterns can increase but before I never knew that Patterns can decrease.

I was sure about that Patterns can
1. be made out of Items that are all the same colour because You can make diffrent design that can be used in diffrent ways.

September 26 2017

1. The talking point I am sure I am right with my answer is Patterns are predictable because you can always predict what comes next when you do 3 or 2 shapes.

2. The talking point I am unsure about is Numbers can be used to describe patterns because I really don't get it and I don't know if it is a disagree or a Agree so I just wrote unsure/U.

(7) The talking point I am sure is right is patterns can be made out of one item that is all the same colour brown too thpick

(8) Which talking point are you unsure about that is patterns can Help us to solve problems.

Designing learning opportunities that are **PLAYFUL** & **ENGAGING**?

Exciting literature
Inviting Materials
Connected to students' interests
Multi-modal - hands on, kinesthetic, visual, auditory
Opportunities for Collaboration
Organized

"Almost all creativity involves purposeful play."

- Abraham Maslow

Lessons that provided an entry point for all and allow each student to work to their potential

Learning Intentions for:

ALL

SOME

FEW

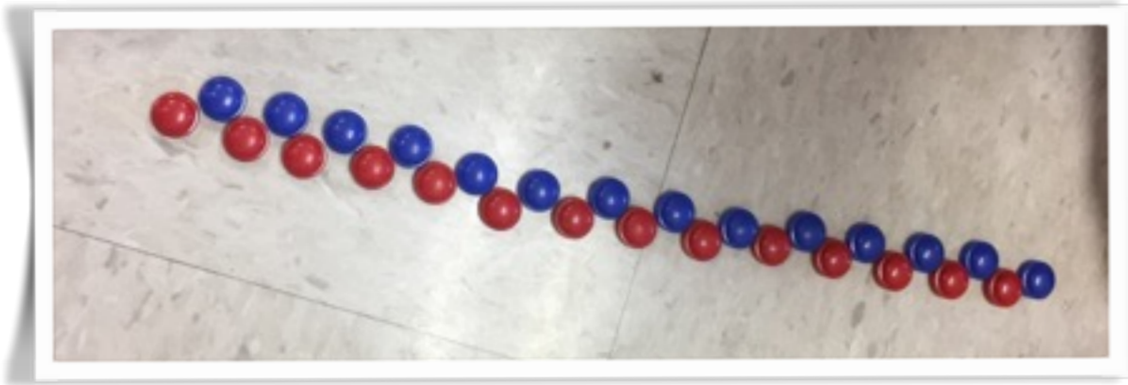
Think about that child in your class that seems to struggle the most.

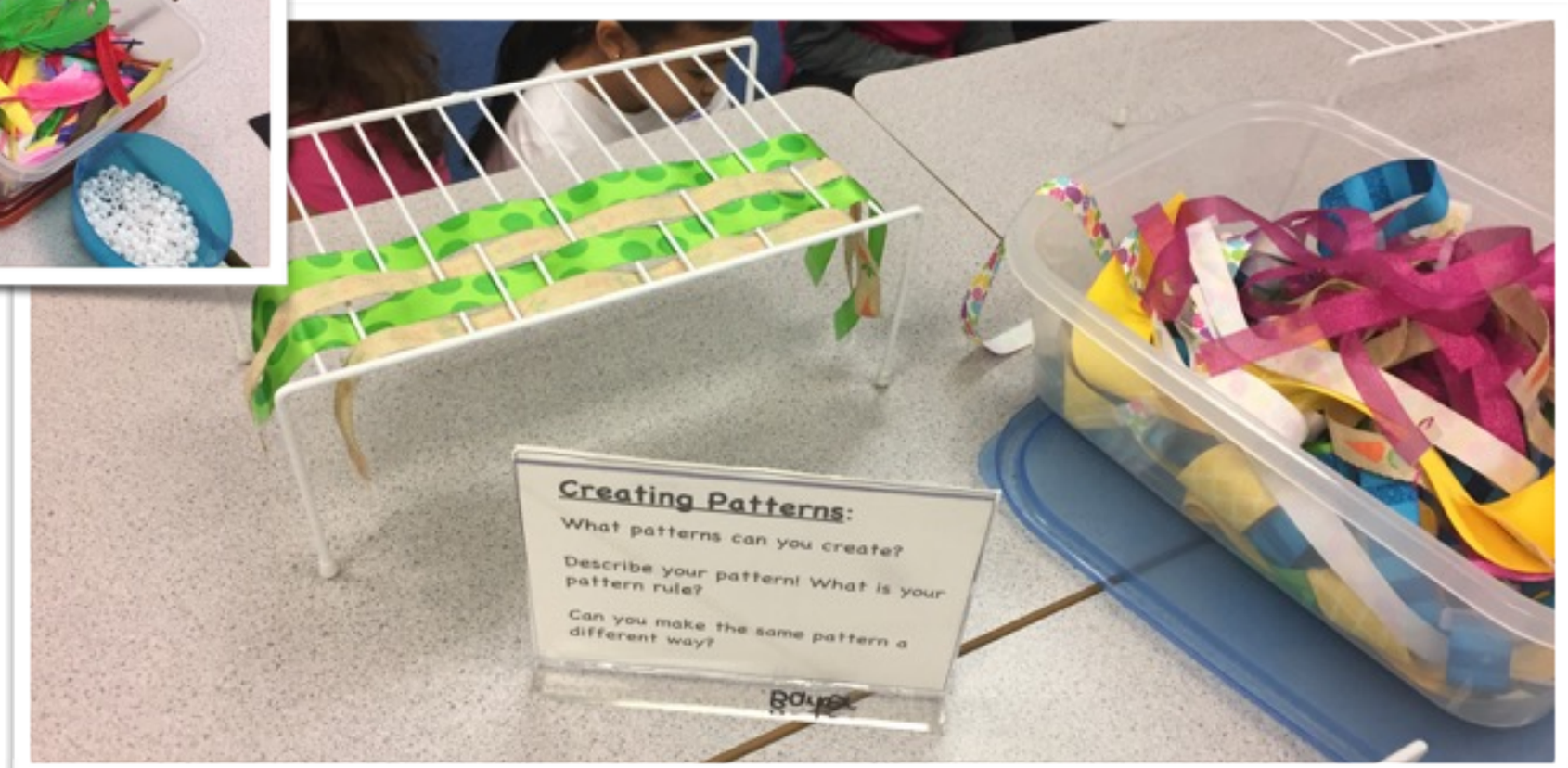
How would he/she participate in *this* activity?

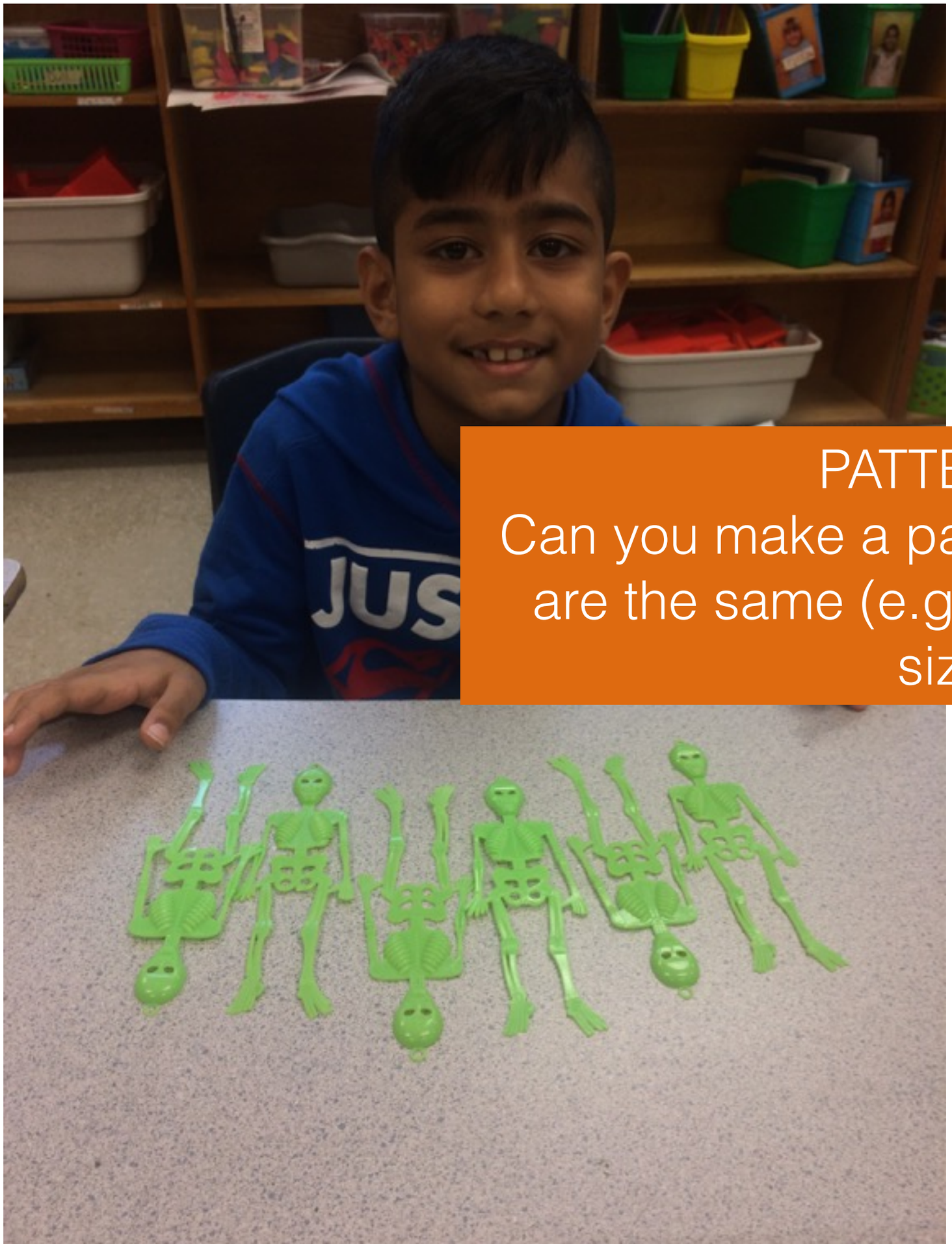
Can everyone “get in” at their developmental stage?

PATTERING:
Where do you see patterns in the world?

PATTERING:
What patterns can you create?



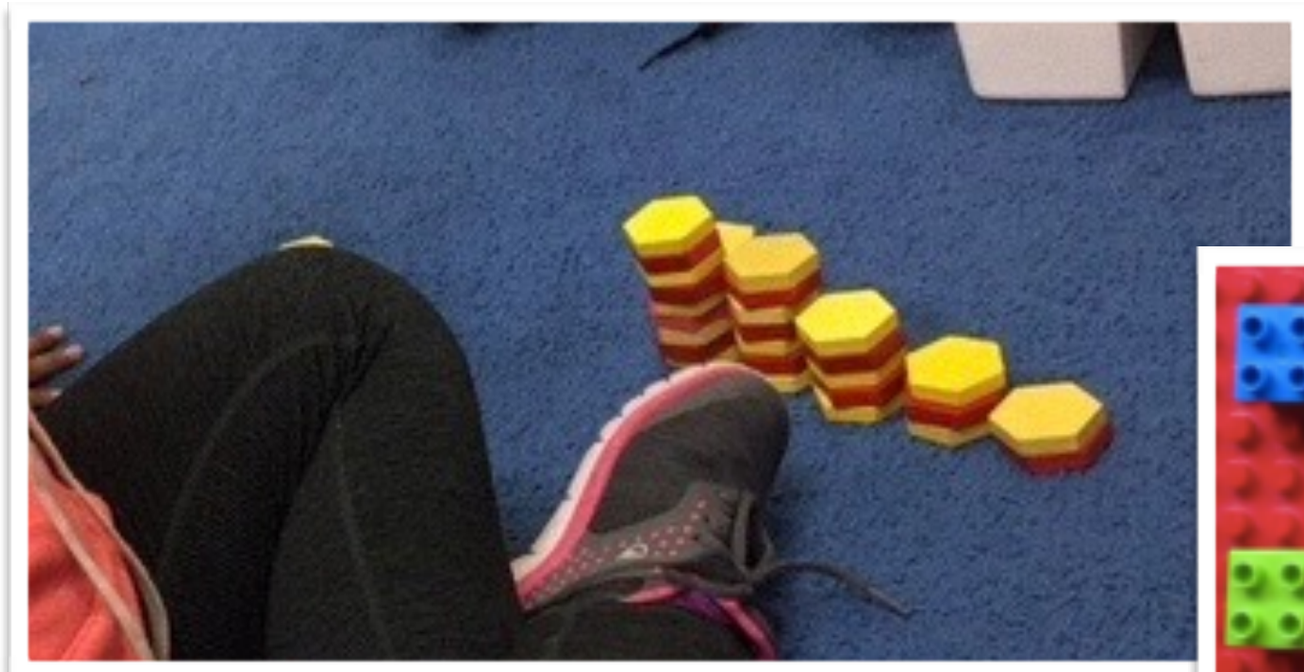


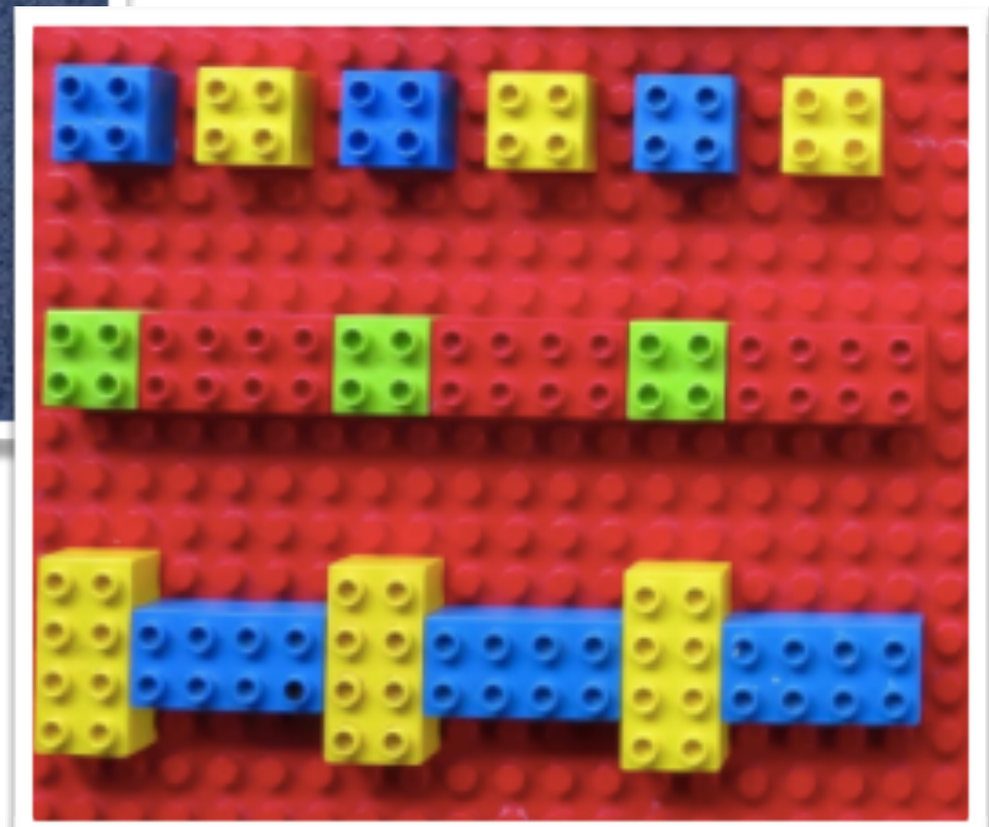


PATTERING:

Can you make a pattern with items that are the same (e.g., same colour and size)?

PATTERING:
Can a pattern be 3D?

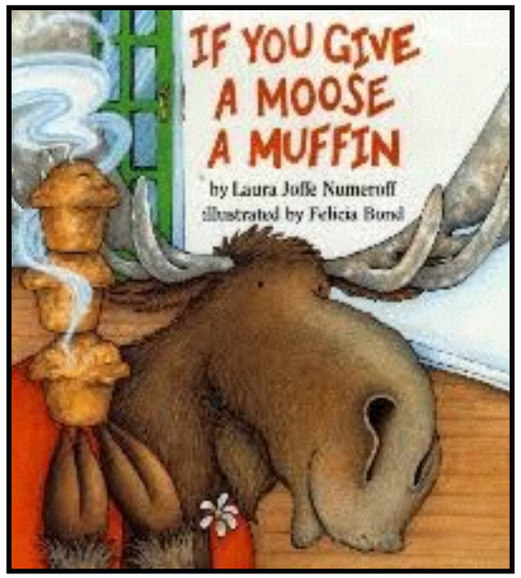


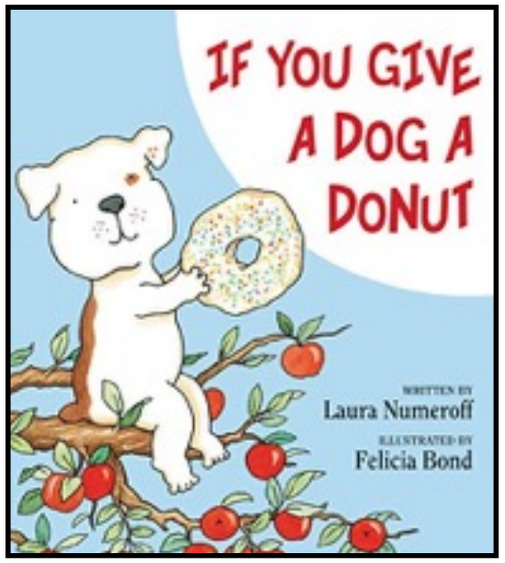


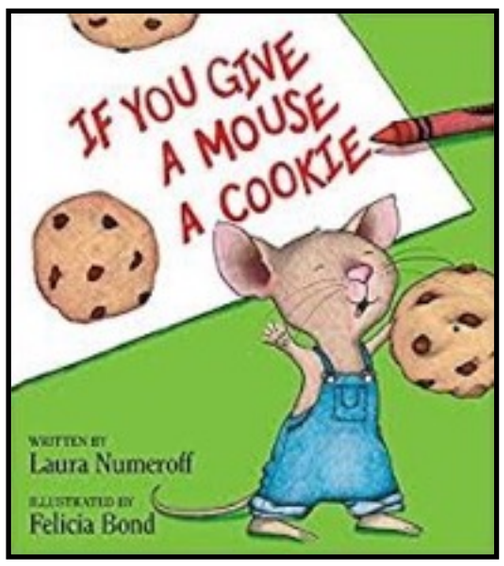
PLAY GIVES CHILDREN A CHANCE TO PRACTICE WHAT THEY ARE LEARNING.

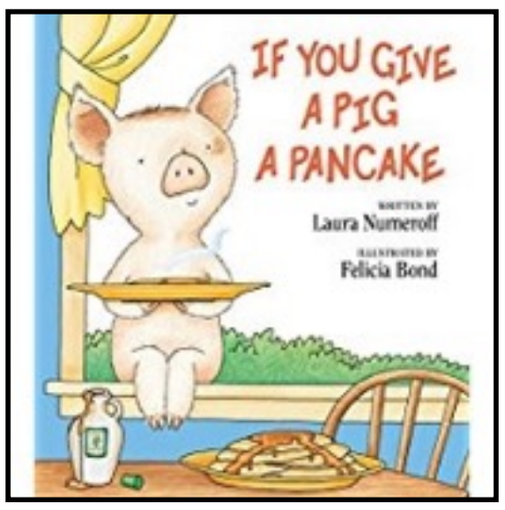
-MR. ROGERS

PATTERING:
Can you represent the pattern in the story?









Diminish consciousness of self

Improvisational potential

Continuation Desire

What is a Mandala?

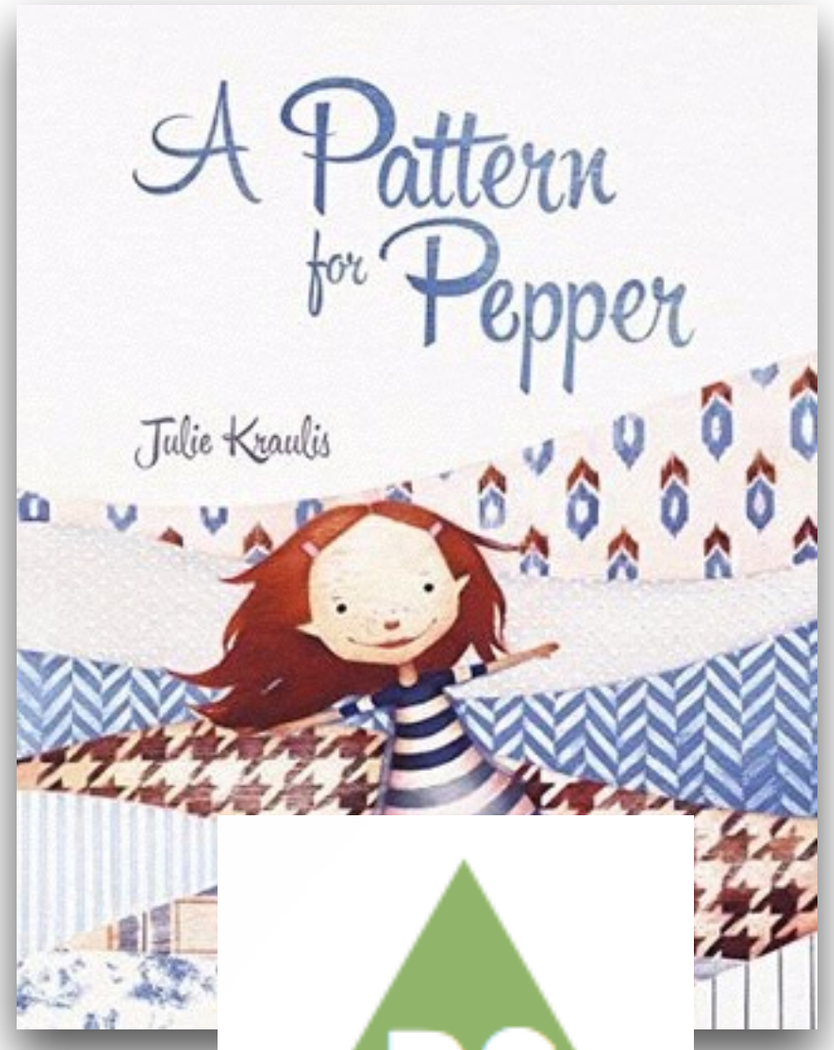
A mandala is a geometric design meant to symbolize the universe and our connection to it. It represents both the visible world around us (the circle is the whole world) and the invisible one inside our minds and bodies (the centre is the healing circle). It is an art form that is found in many cultures around the world.

“How does your Mandala represent you?

What patterns can you create?

- Patterns can be circular!
- What do you notice about the mandalas?

PATTERNING:
What patterns live in fabrics?



PS

Real world objects build connections and can spark inspiration!

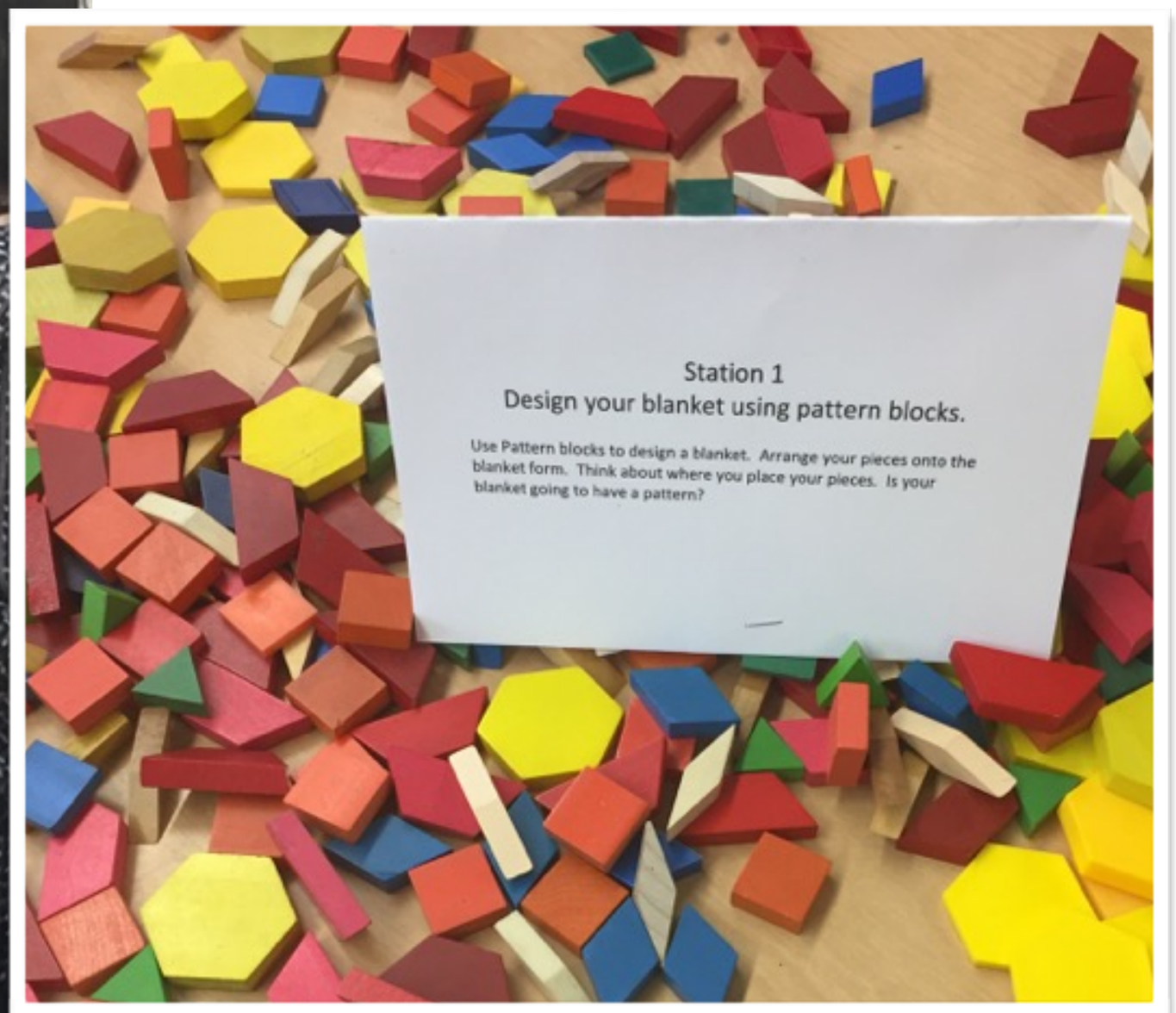
“Can you describe your pattern to me?”

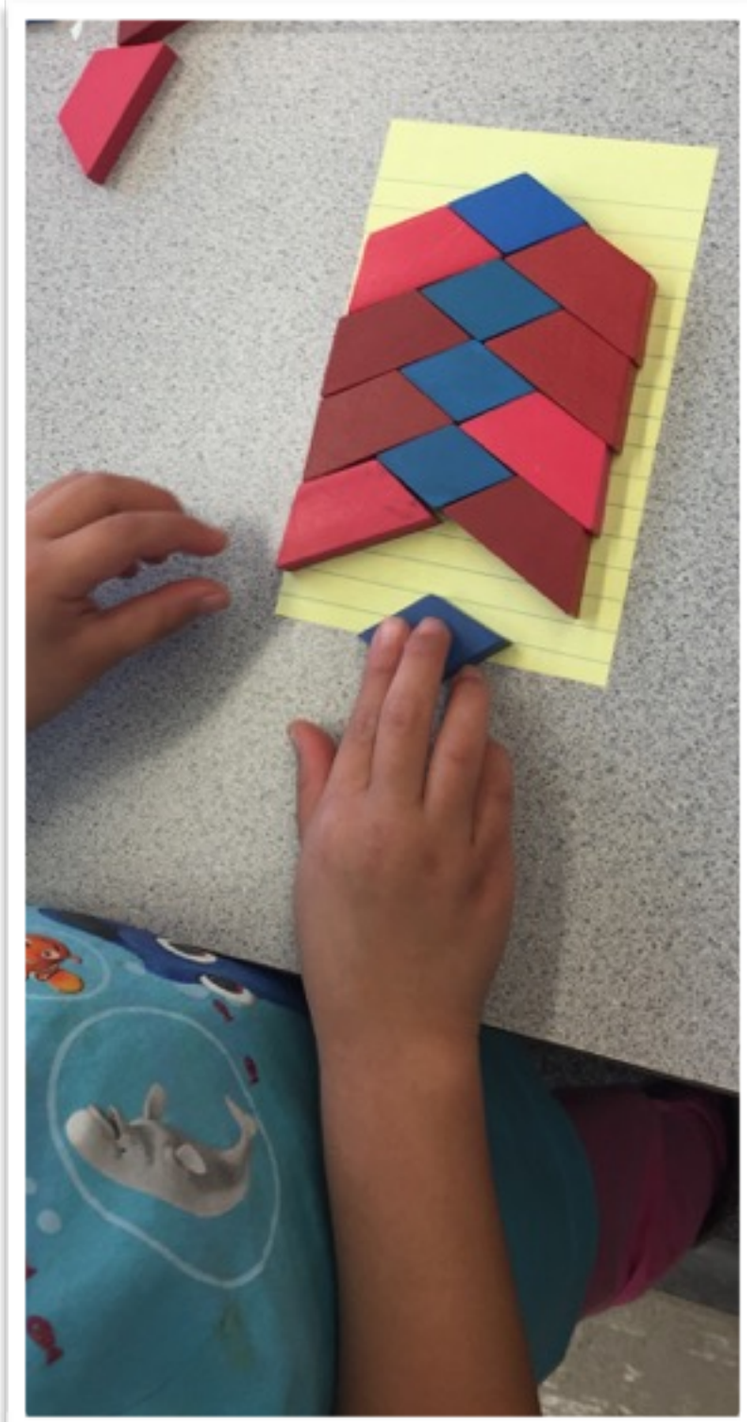
PATTERNING:
What patterns live in art?

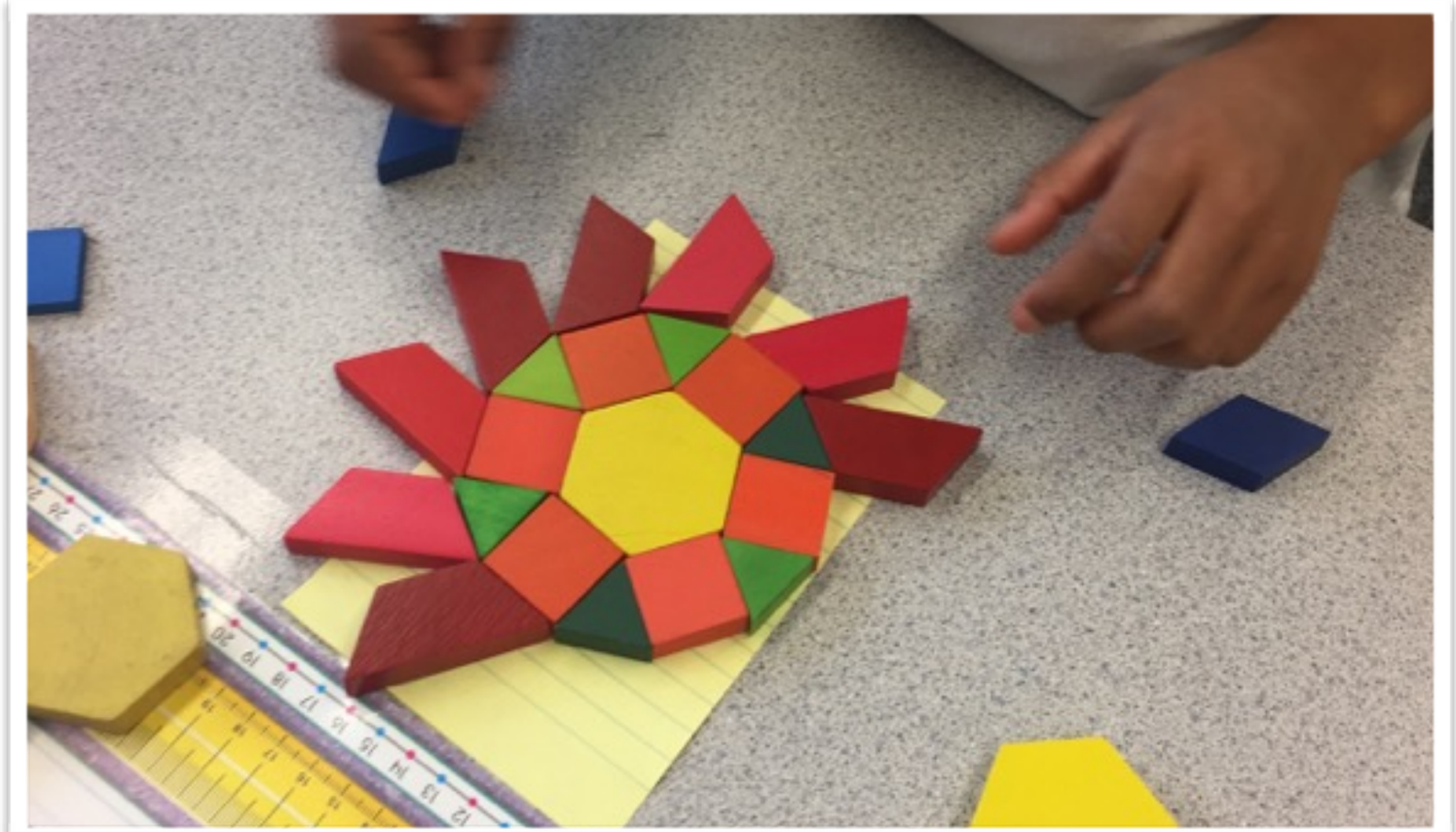
Heather Galler Folk Art

https://www.tes.com/lessons/EJW8WSIV_JC3MQ/folk-art-landscapes

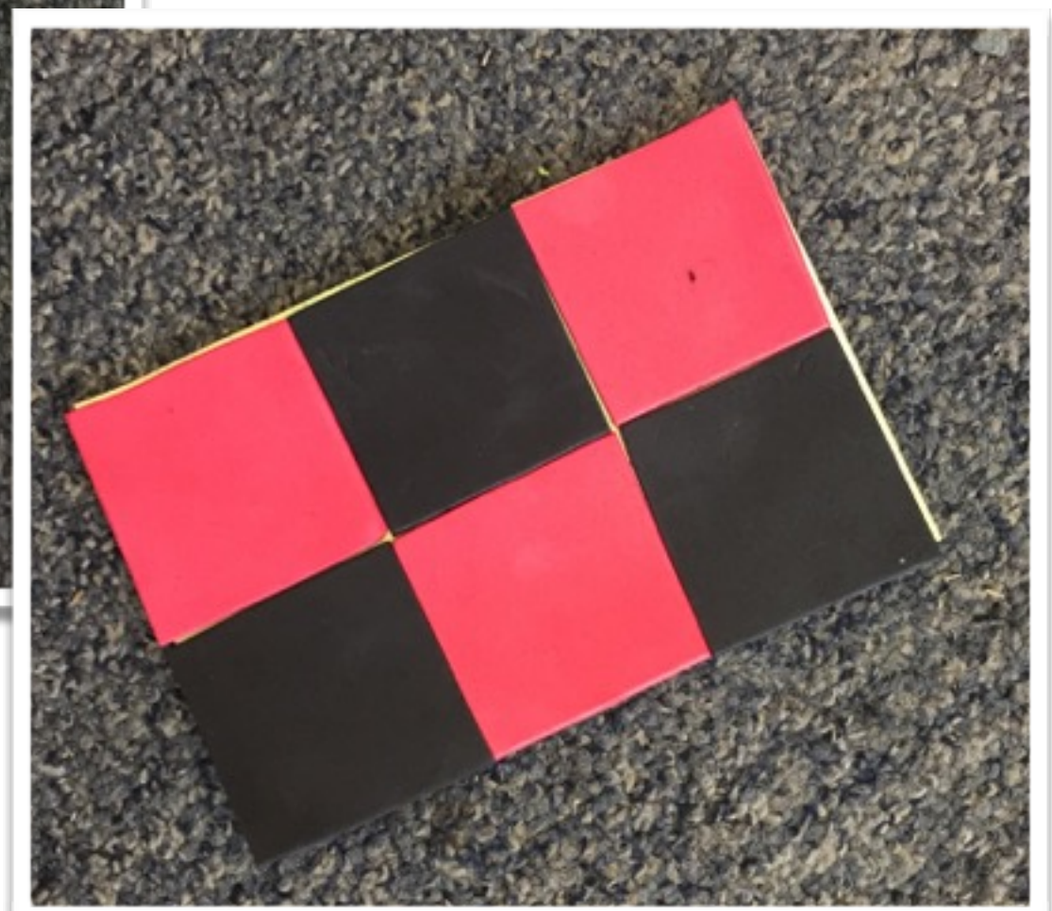
Exploring patterns through Coast Salish weaving!

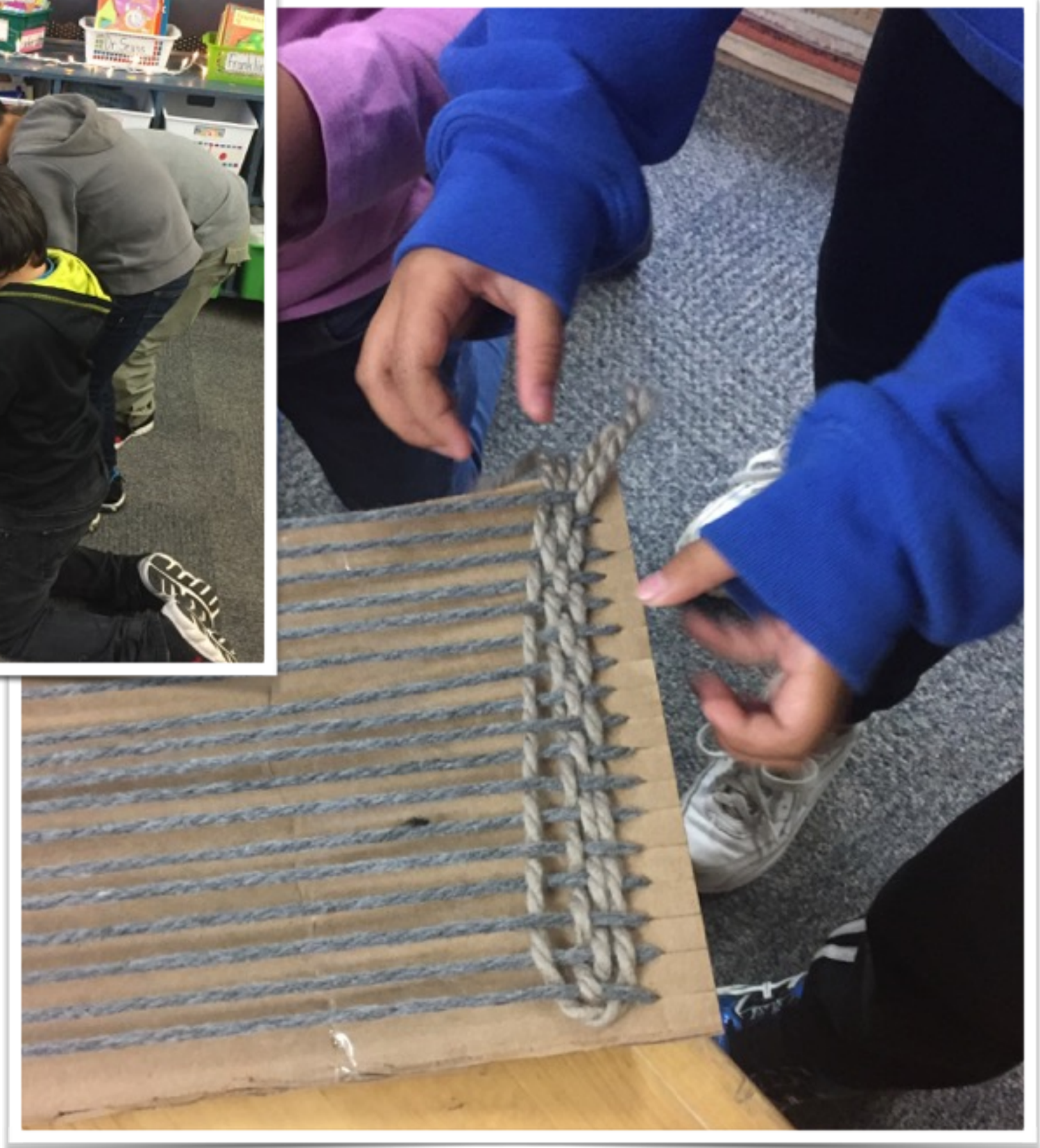


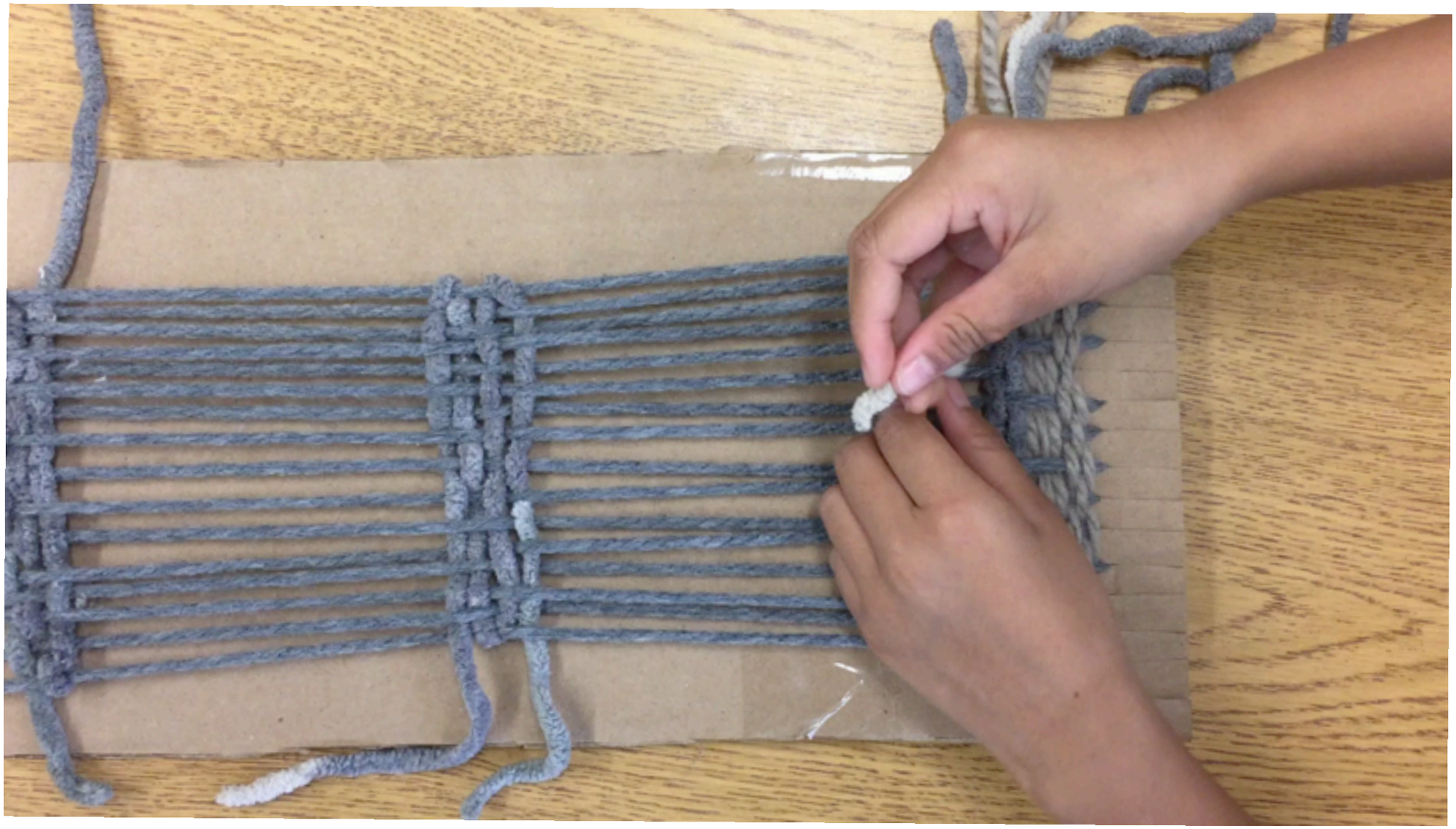




Foam Blankets

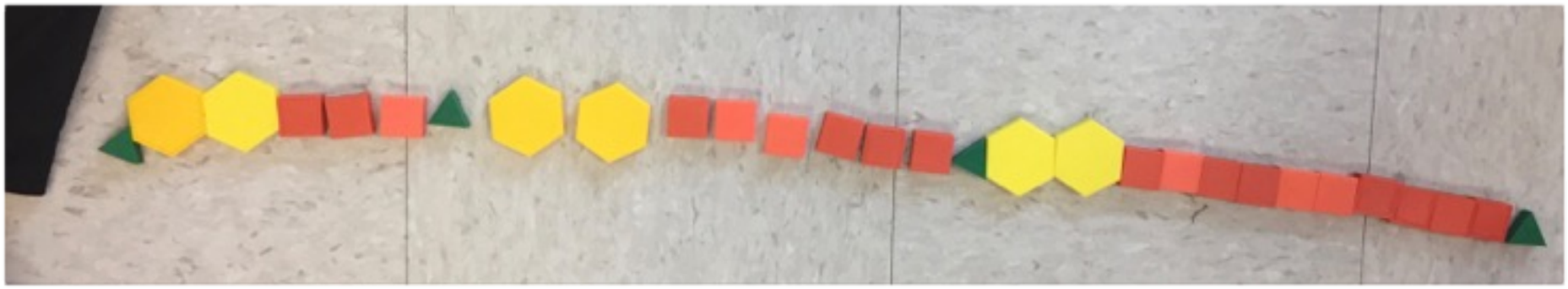


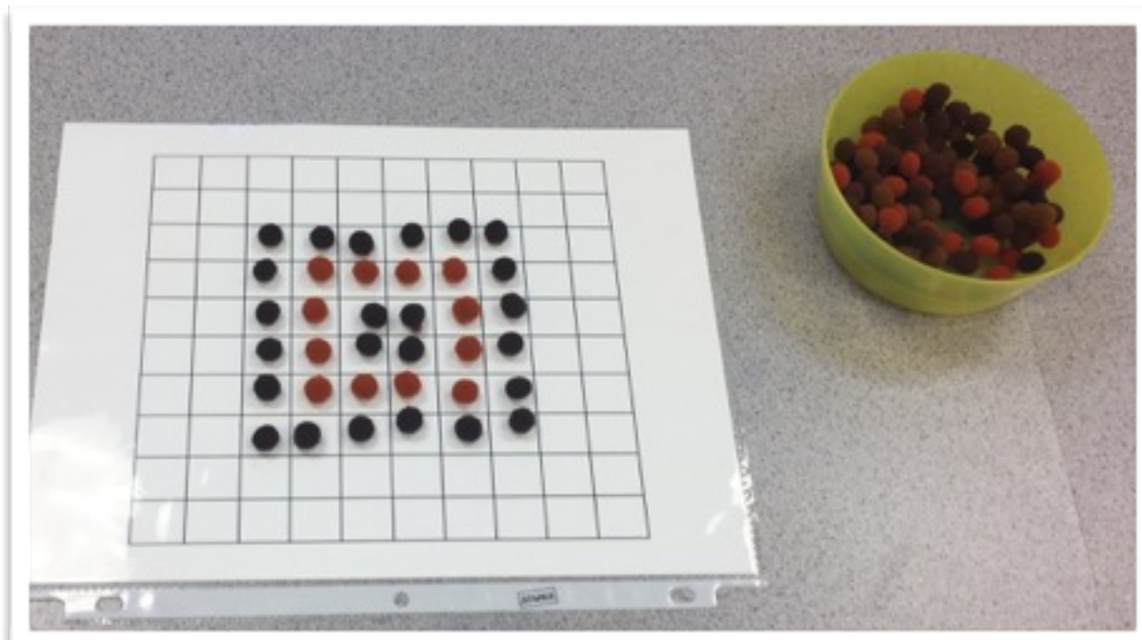




PATTERNING:
Growing Patterns

Though they don't repeat, they are still predictable. Students need to learn to pay attention to the *patterns in the relationships among the quantities* - patterns are built into the structure of growing patterns.





What growing/shrinking patterns can you create?

How are these patterns alike and different?

Can you describe your pattern?

"ALMOST all
CreaTiviTy involves
purposeful play."

-Abraham Maslow
(Educational
Theorist)

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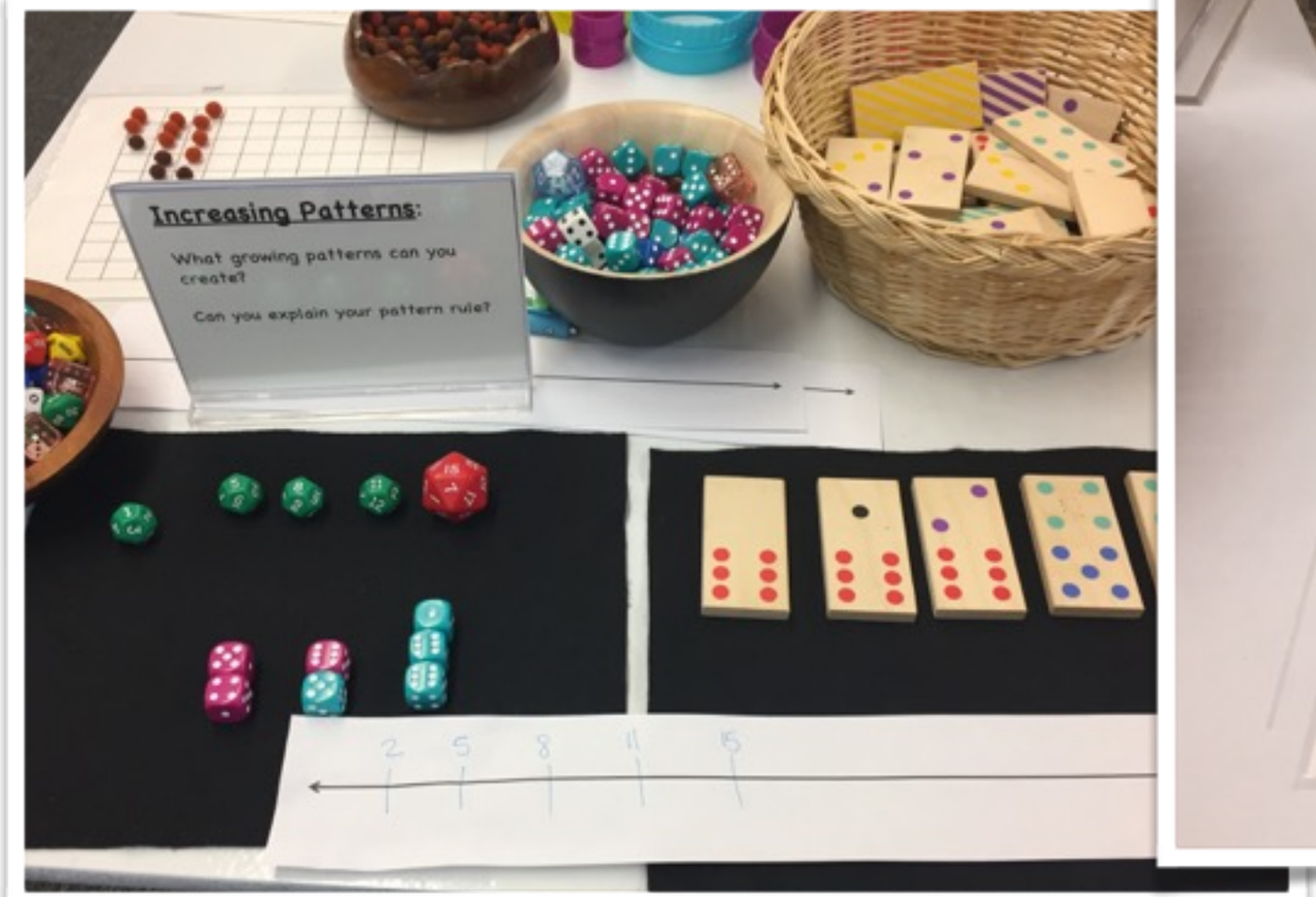
Children have real understanding only of that which they invent themselves, and each time that we try to teach them too quickly we keep them from reinventing it themselves.

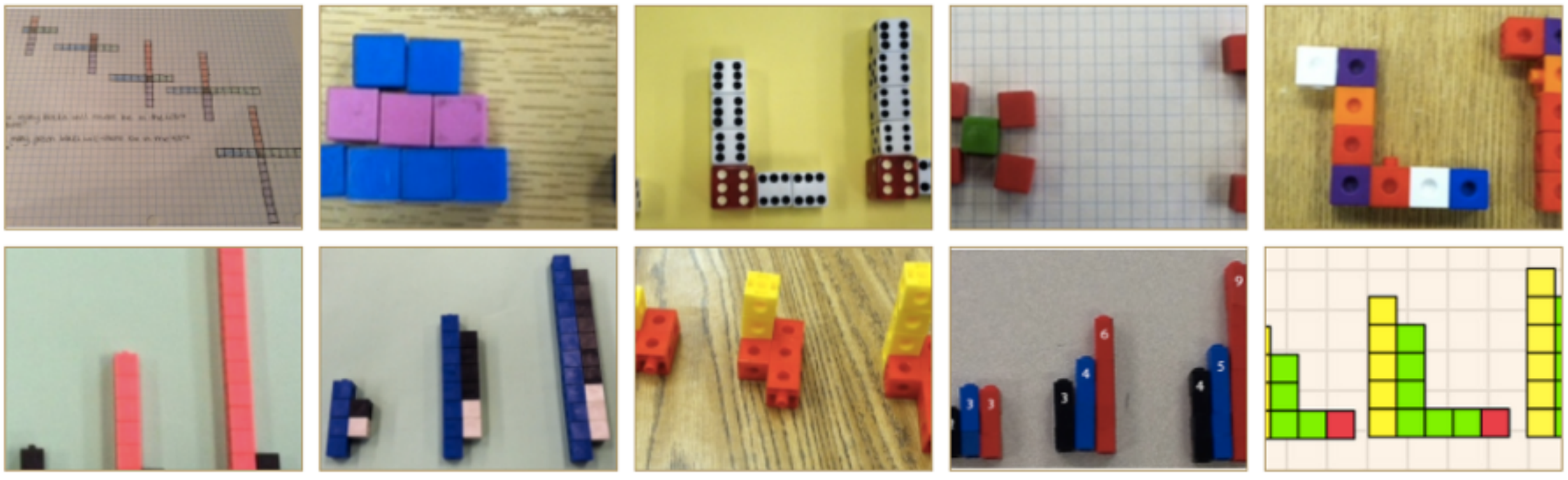
- Piaget


Patterns
Sarah C. Campbell
Increasing P
What growing pat
create?
Can you explain yo


Increasing Patterns:
What growing patterns can you create?
Can you explain your pattern rule?
2 5 8 11 15

Visual Patterns

Patterns created by students



www.visualpatterns.org

Important considerations

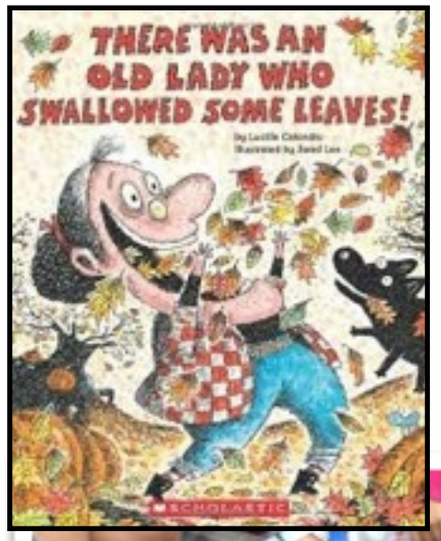
- Students need the opportunities to physically grow the patterns. They need to play and build!

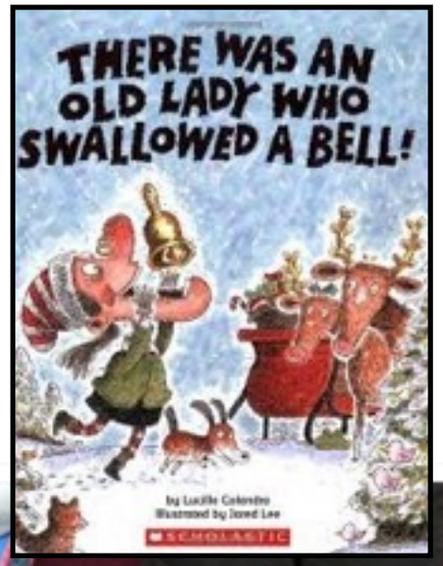
- Don't just ask "What comes next?" Instead ask "What will the fifth term/case look like?" "What stays the same? What changes?" and "How do you see this pattern growing?"

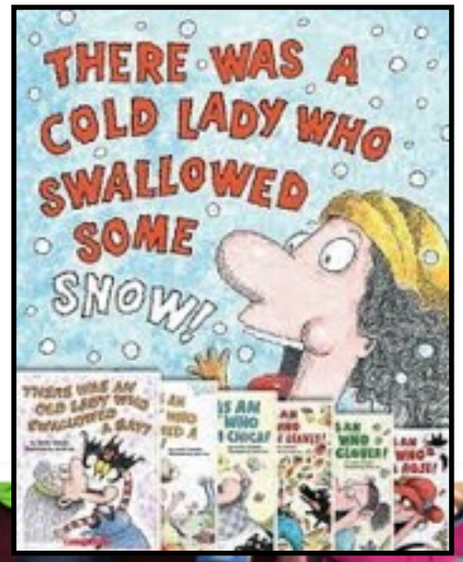
- Play games such as "Guess my Rule"

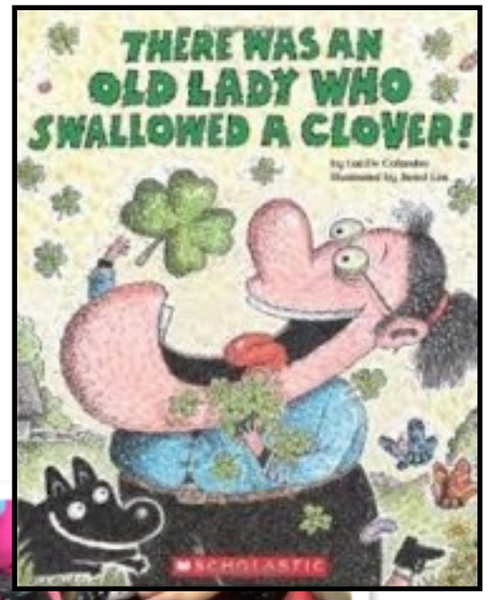
- Provide writing materials for students to represent and communicate how they visualize the growing pattern.

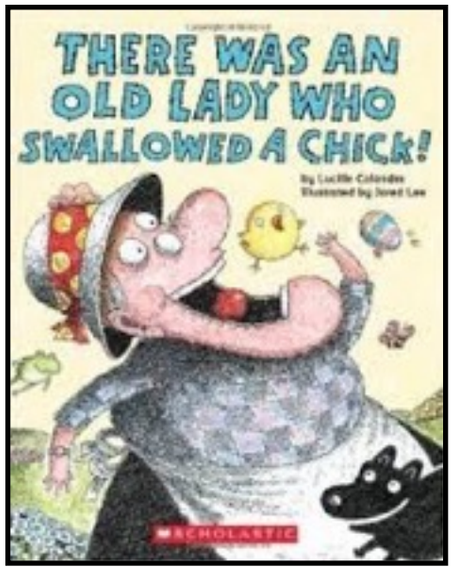
(Ideas from Zager, 2017)

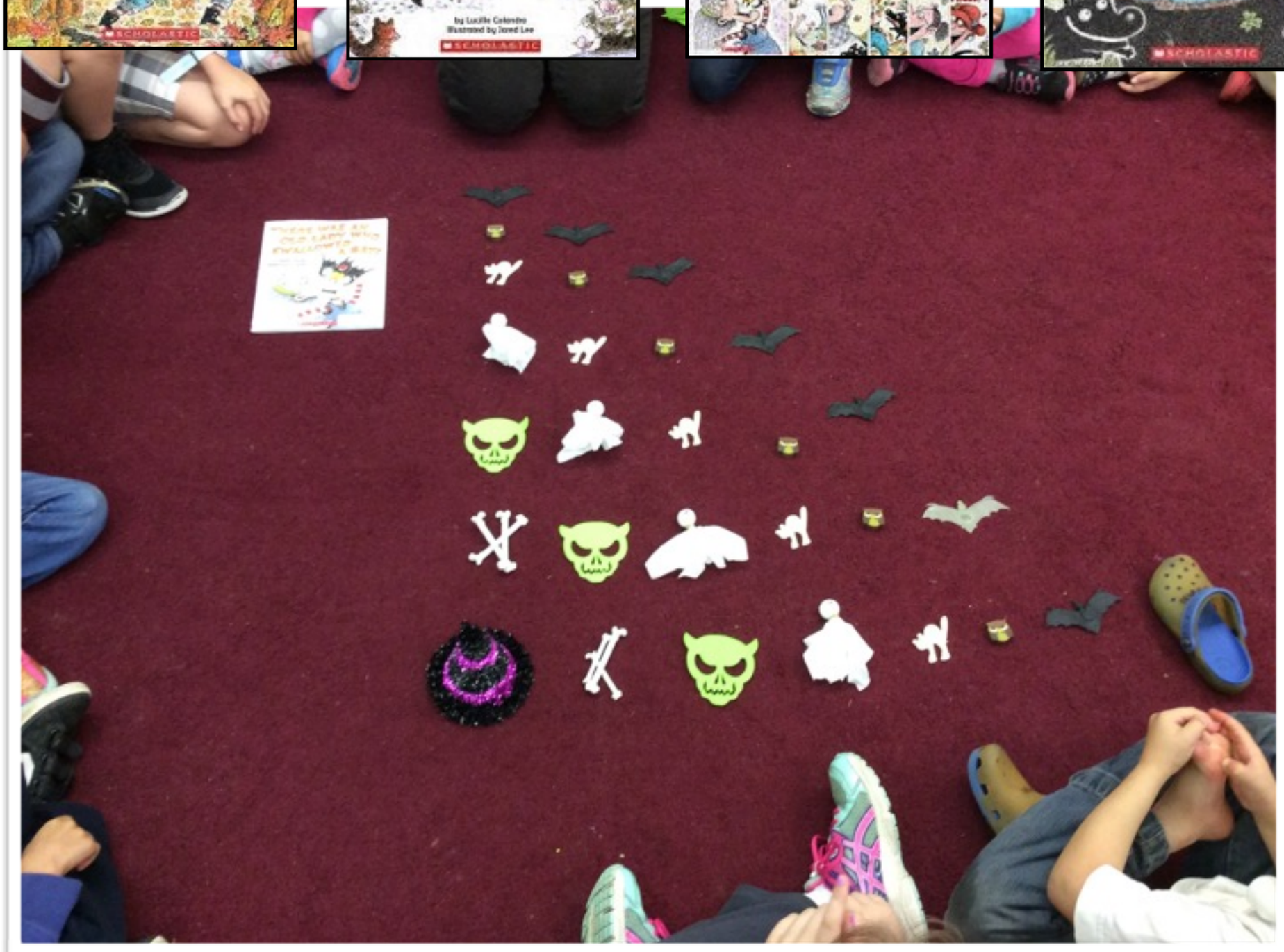

THERE WAS AN OLD LADY WHO SWALLOWED SOME LEAVES!
SCHOLASTIC


THERE WAS AN OLD LADY WHO SWALLOWED A BELL!
SCHOLASTIC

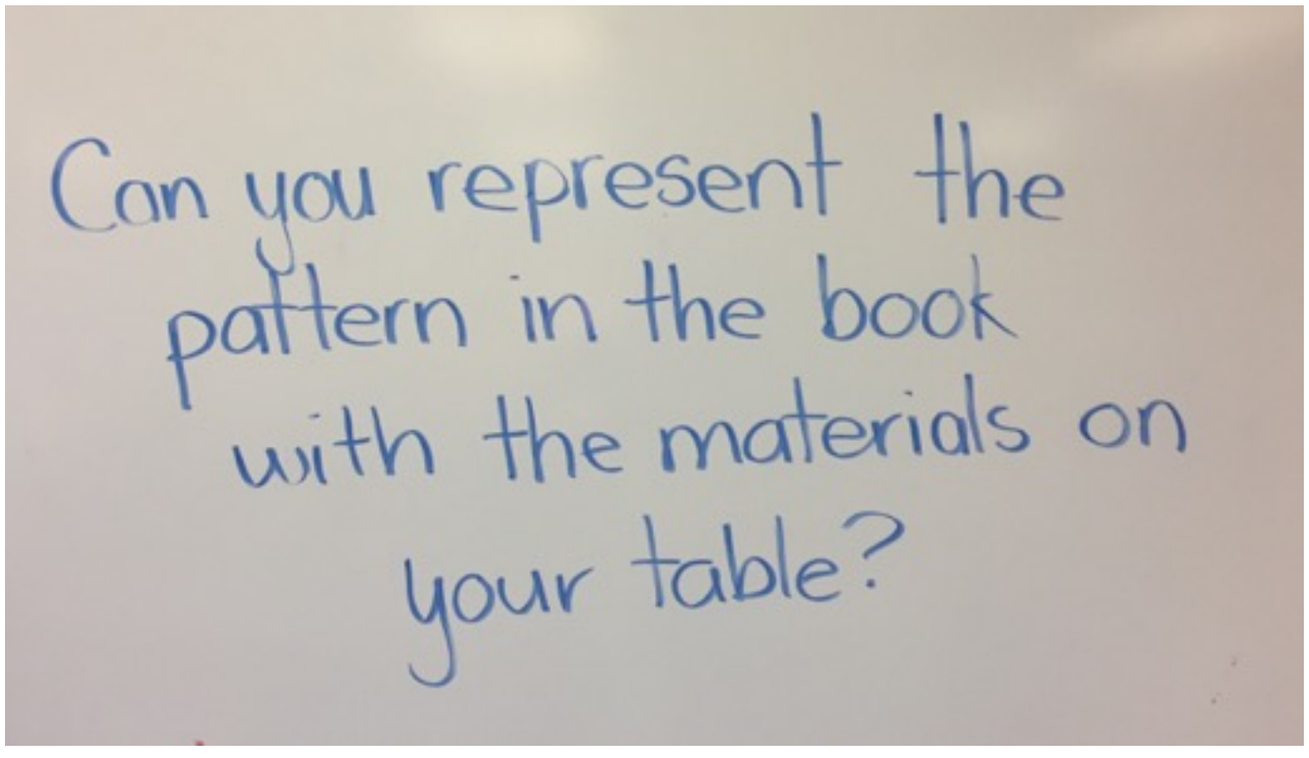

THERE WAS A COLD LADY WHO SWALLOWED SOME SNOW!

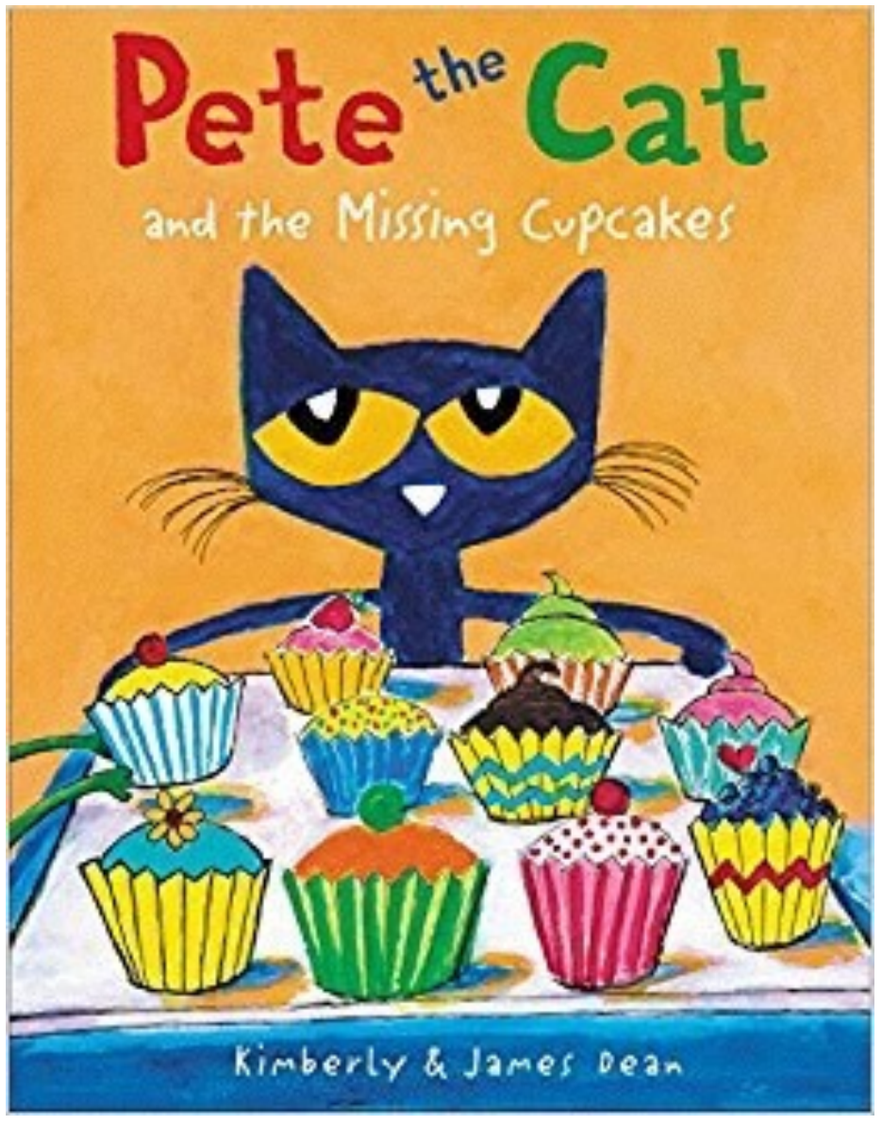

THERE WAS AN OLD LADY WHO SWALLOWED A CLOVER!
SCHOLASTIC


THERE WAS AN OLD LADY WHO SWALLOWED A CHICK!
SCHOLASTIC

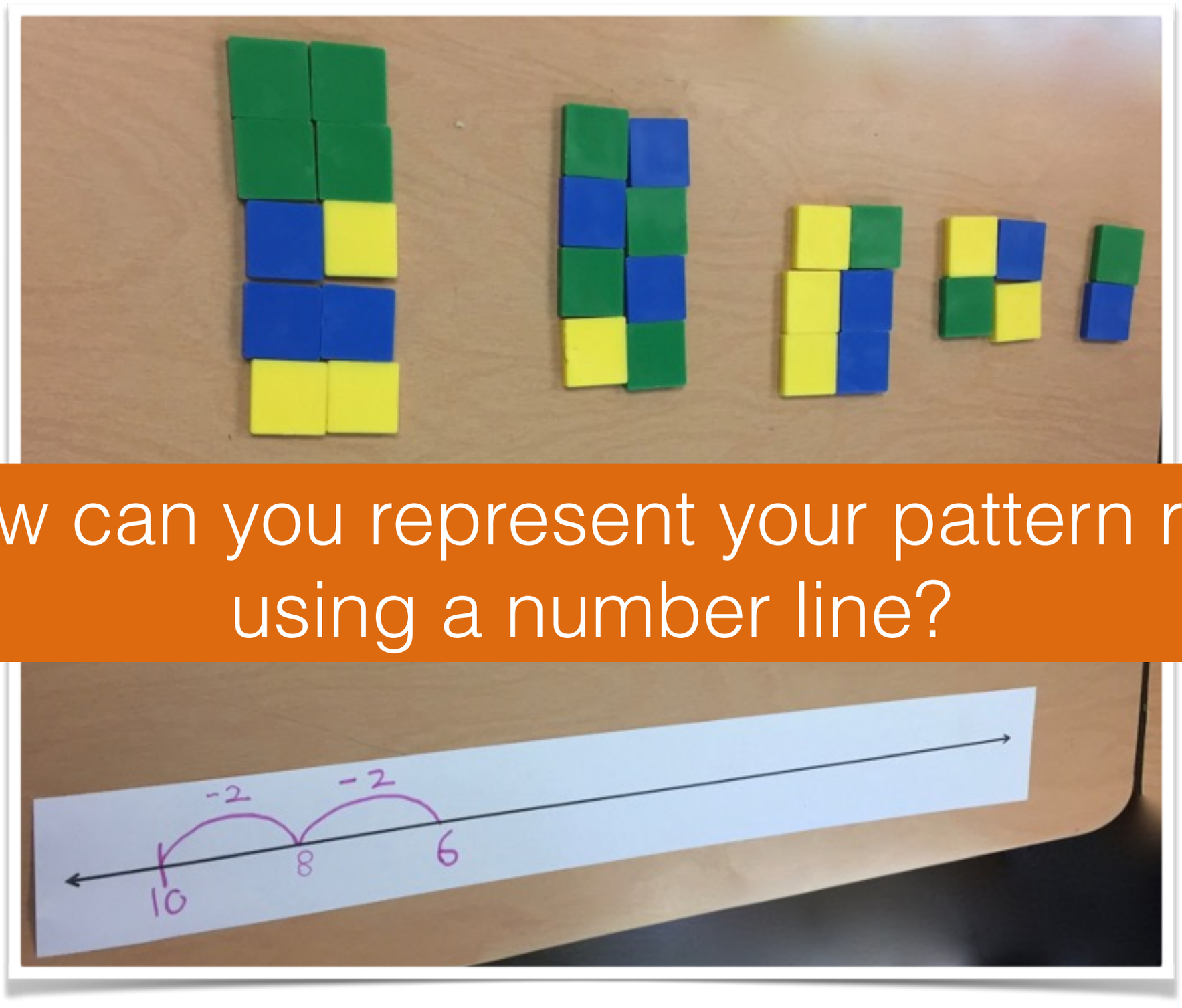


PATTERNS:
What decreasing patterns can you create?





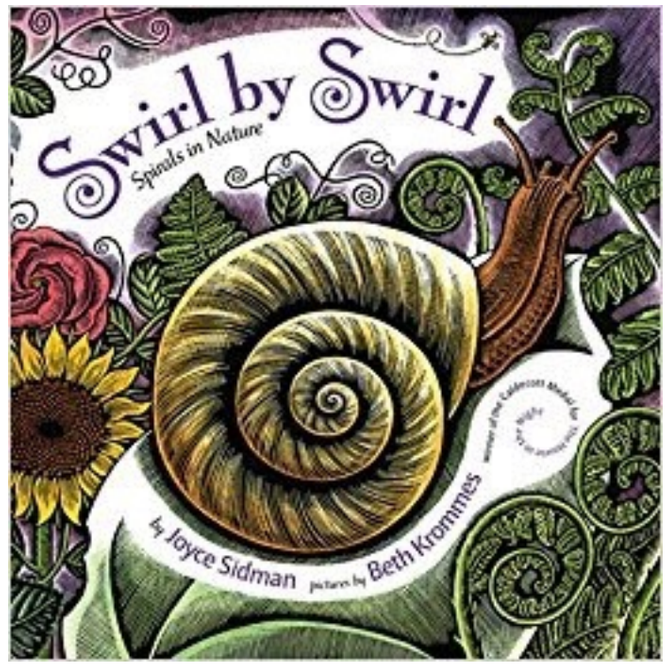
Examples from Ms. Guraliuk
Grade 3 Green Timbers



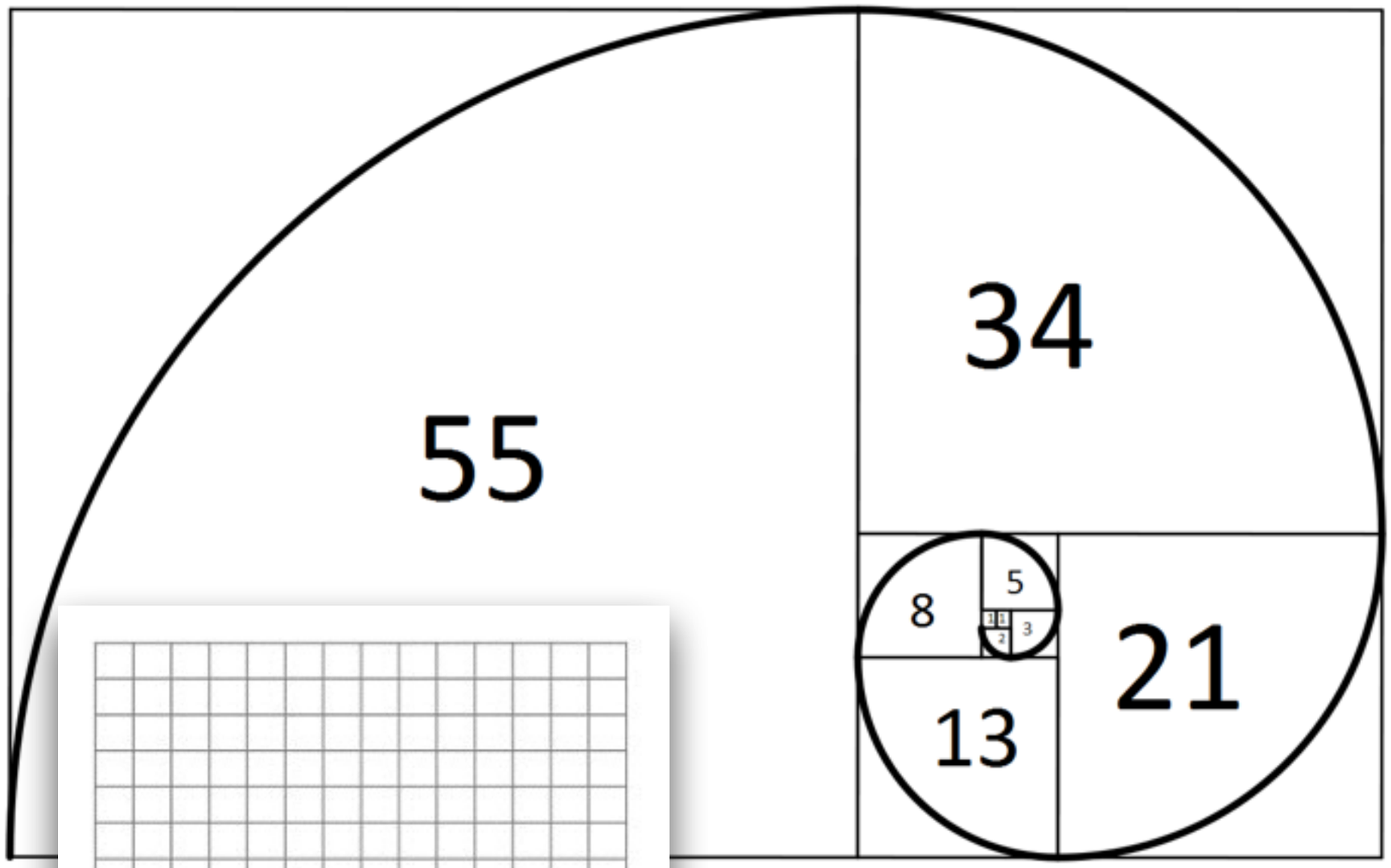
How can you represent your pattern rule using a number line?

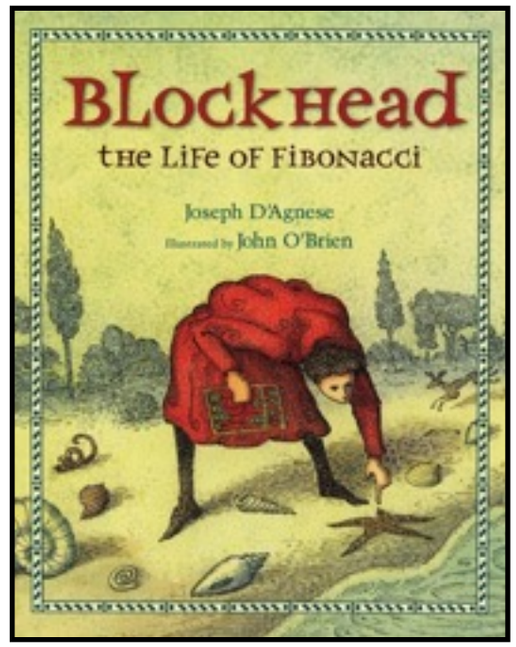
Where do you see circular patterns in the world?
What do you notice? What do you wonder?

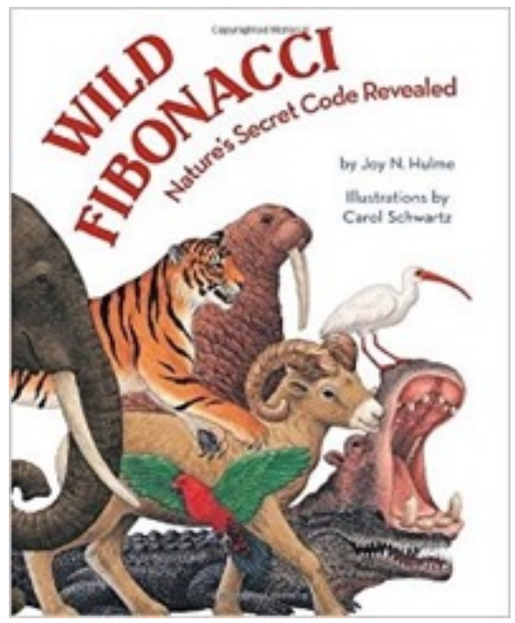
Noticing patterns, wondering about them, and investigating them is doing math! (Zager, 2017)

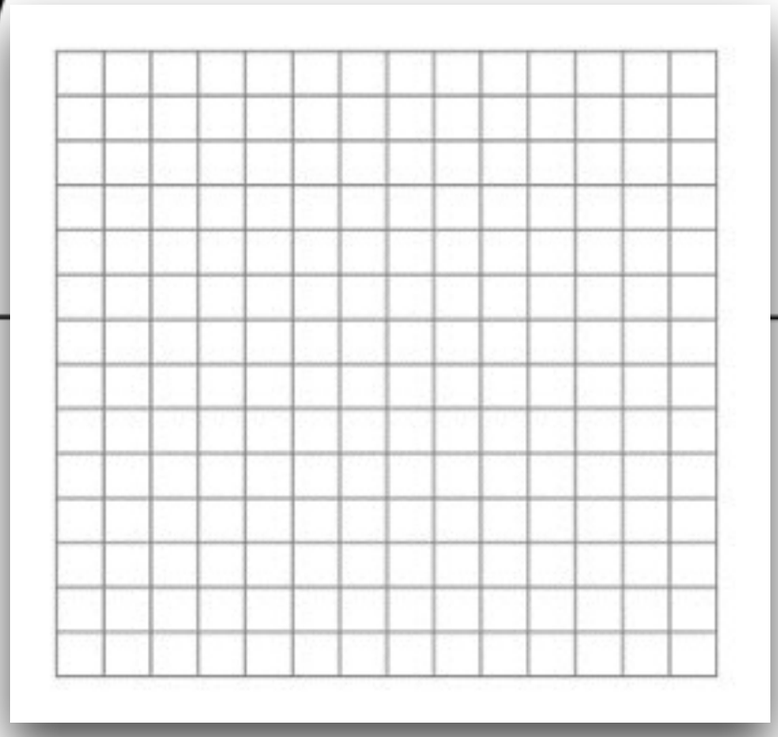


1, 1, 2, 3, 5, 8, 13, 21, 34



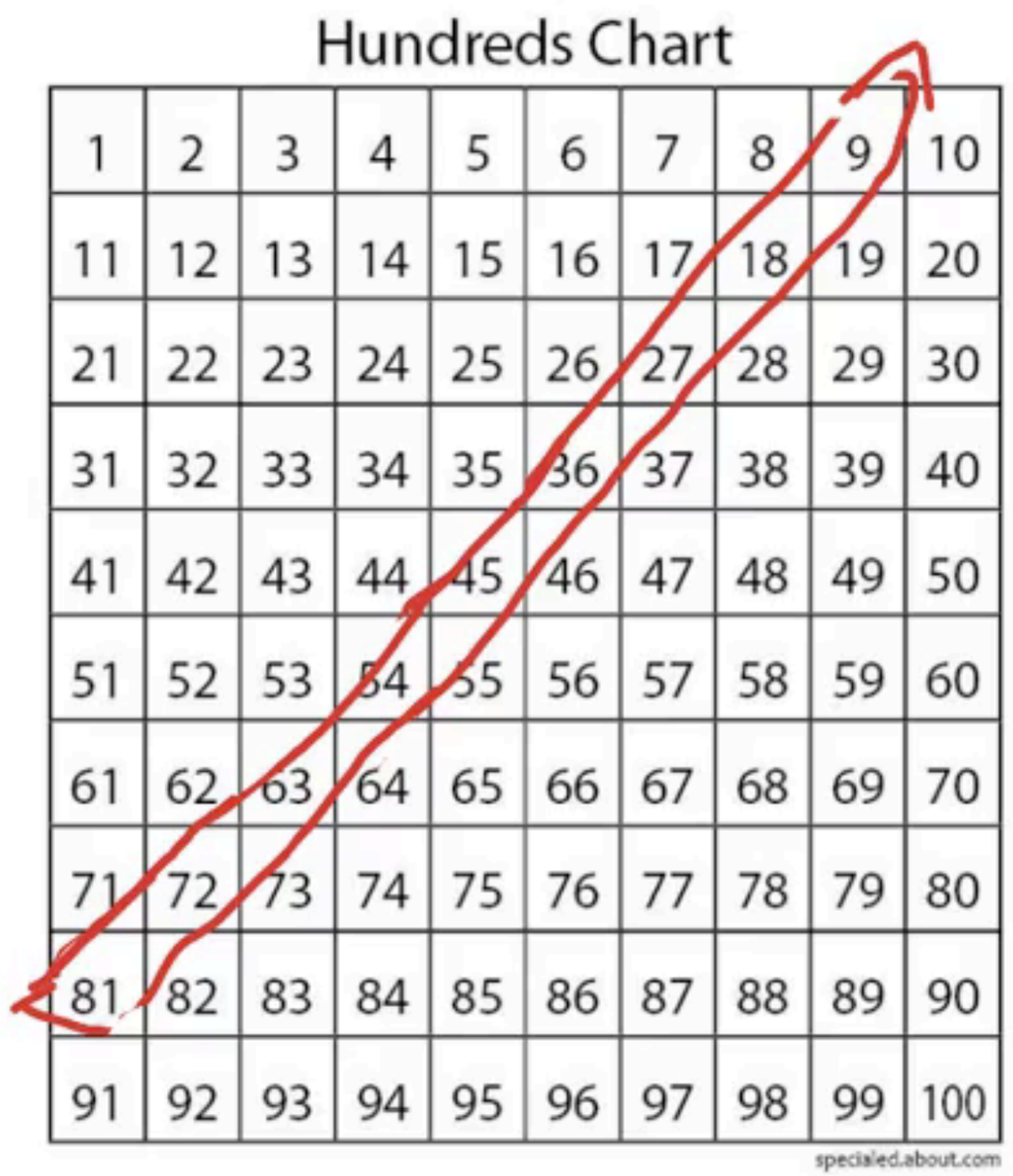




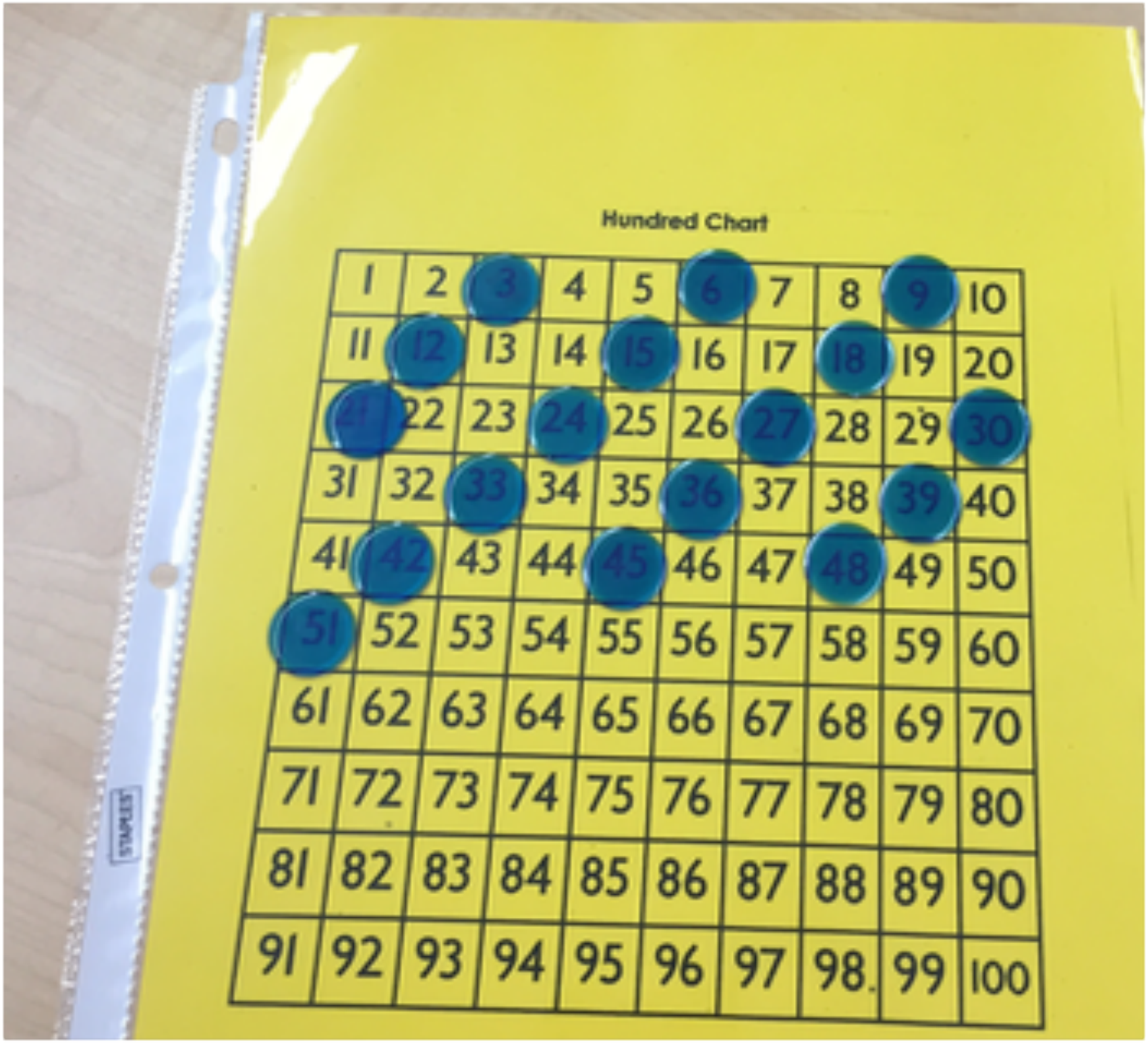


Can you construct a Fibonacci Spiral?

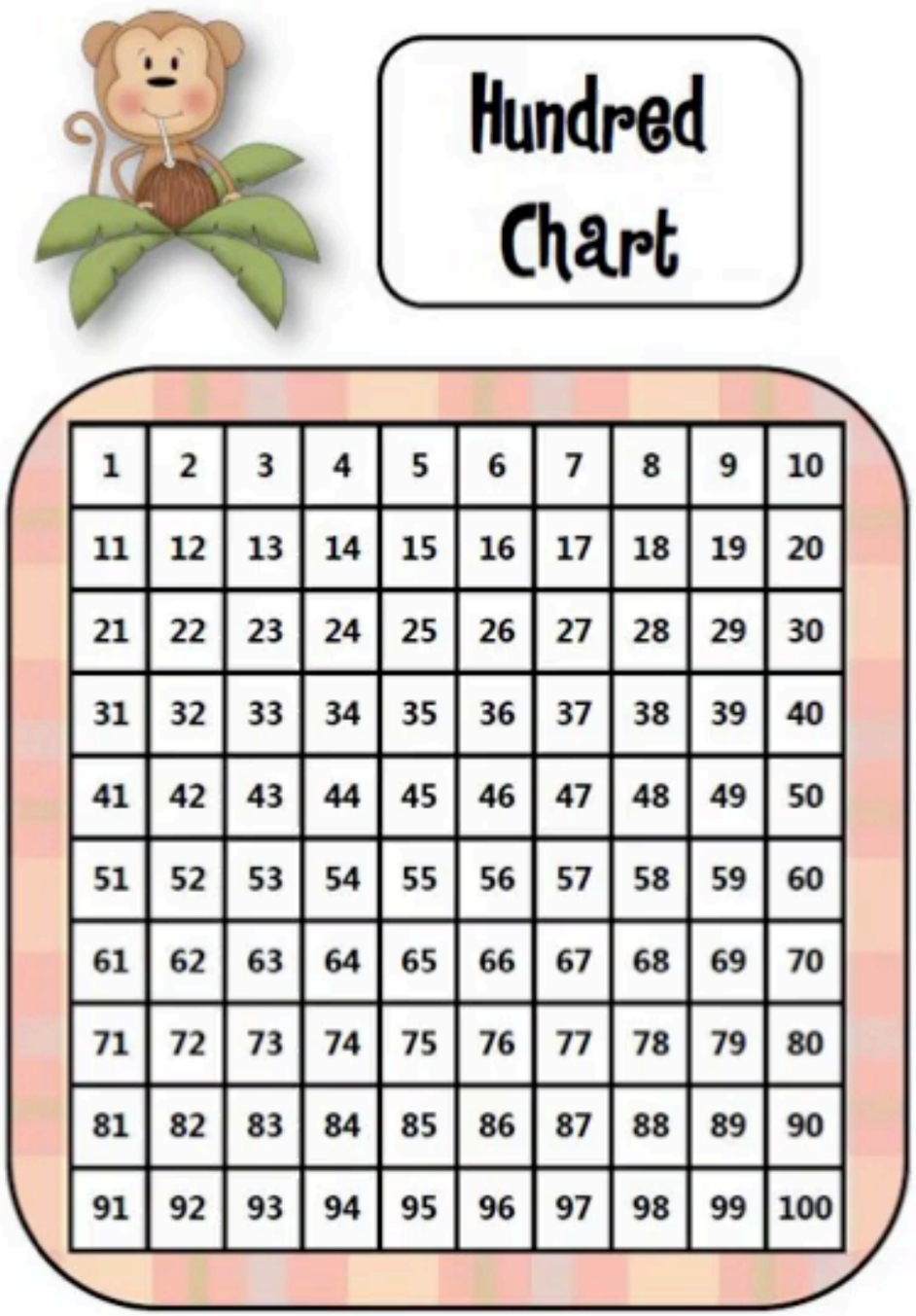
What patterns live in these charts?



ShowMe.com


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

How are place value patterns repeated in numbers?



ShowMe.com

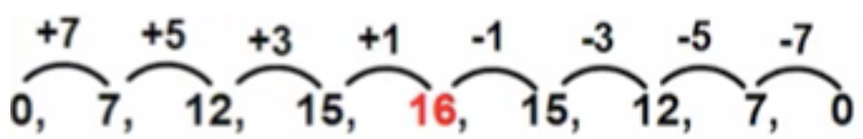
What patterns live in these charts?

0	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

Highlight and describe the patterns you see!

Multiplication Chart (12 x 12)

X	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144



How does your understanding of patterns help you solve these puzzles?

Patterning:

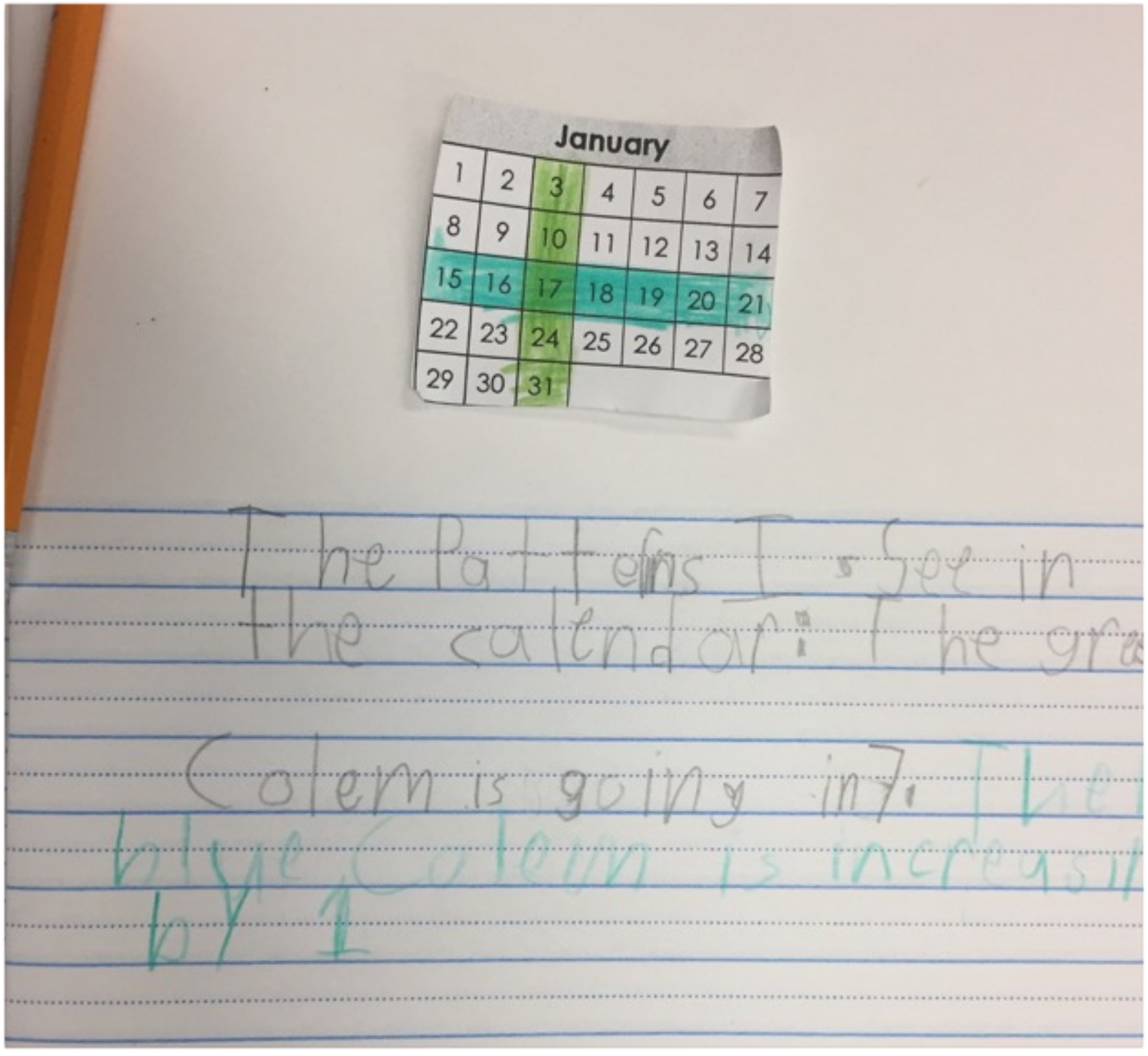
How does your understanding of patterns help you solve these puzzles?

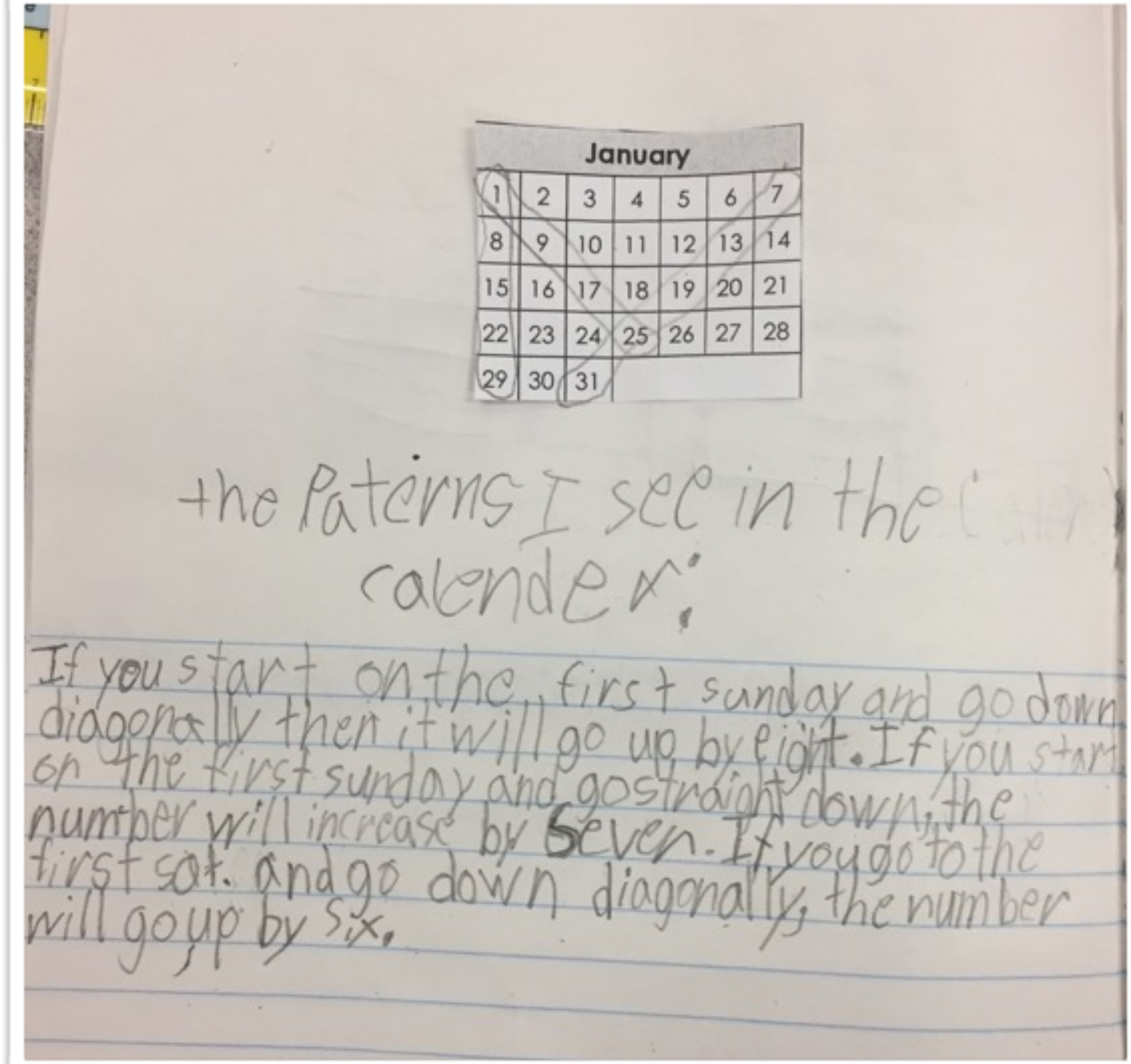
Number Chart Cut-Outs

Puzzle Pieces

Lukas

What patterns are related to time?



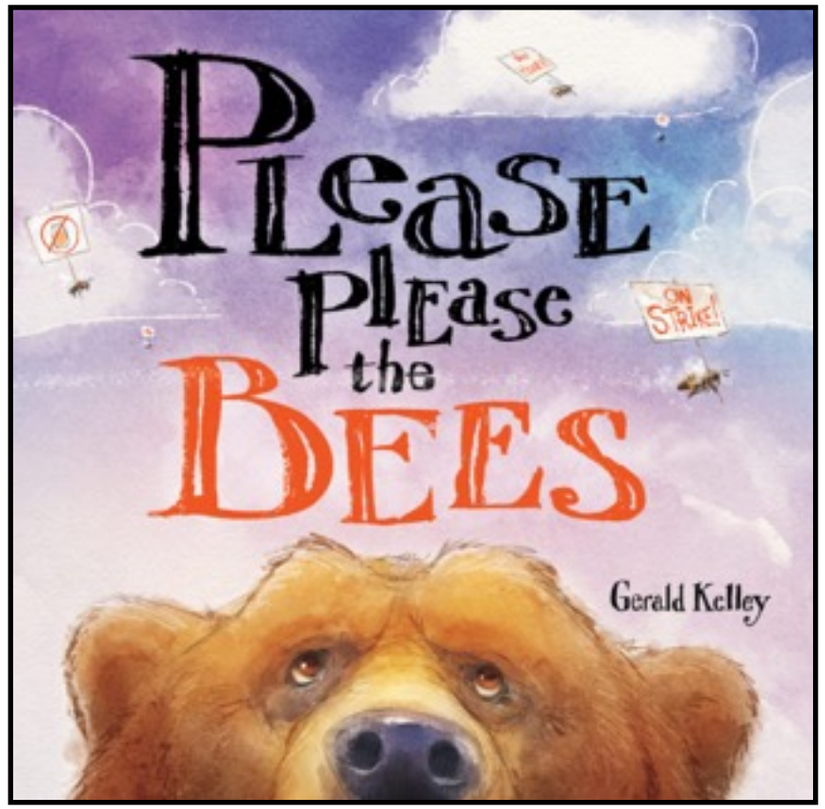


January

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				

the Paterns I see in the calender:

If you start on the first sunday and go down diagonally then it will go up by eight. If you start on the first sunday and go straight down, the number will increase by Seven. If you go to the first sat. and go down diagonally, the number will go up by Six.

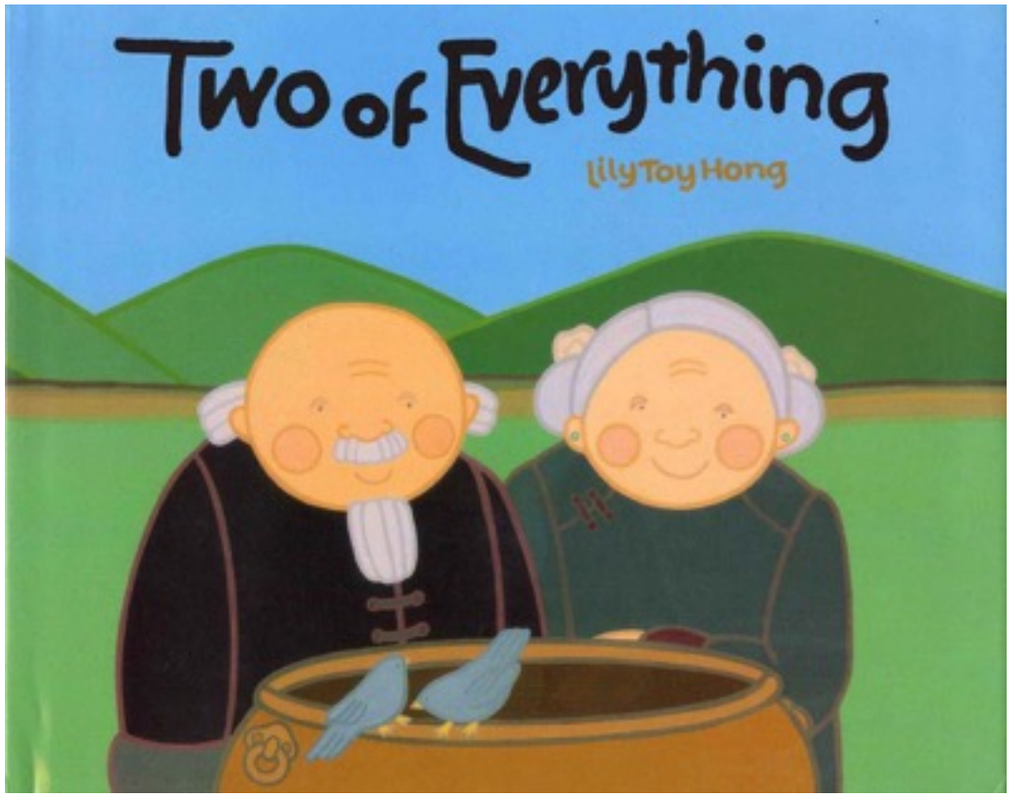


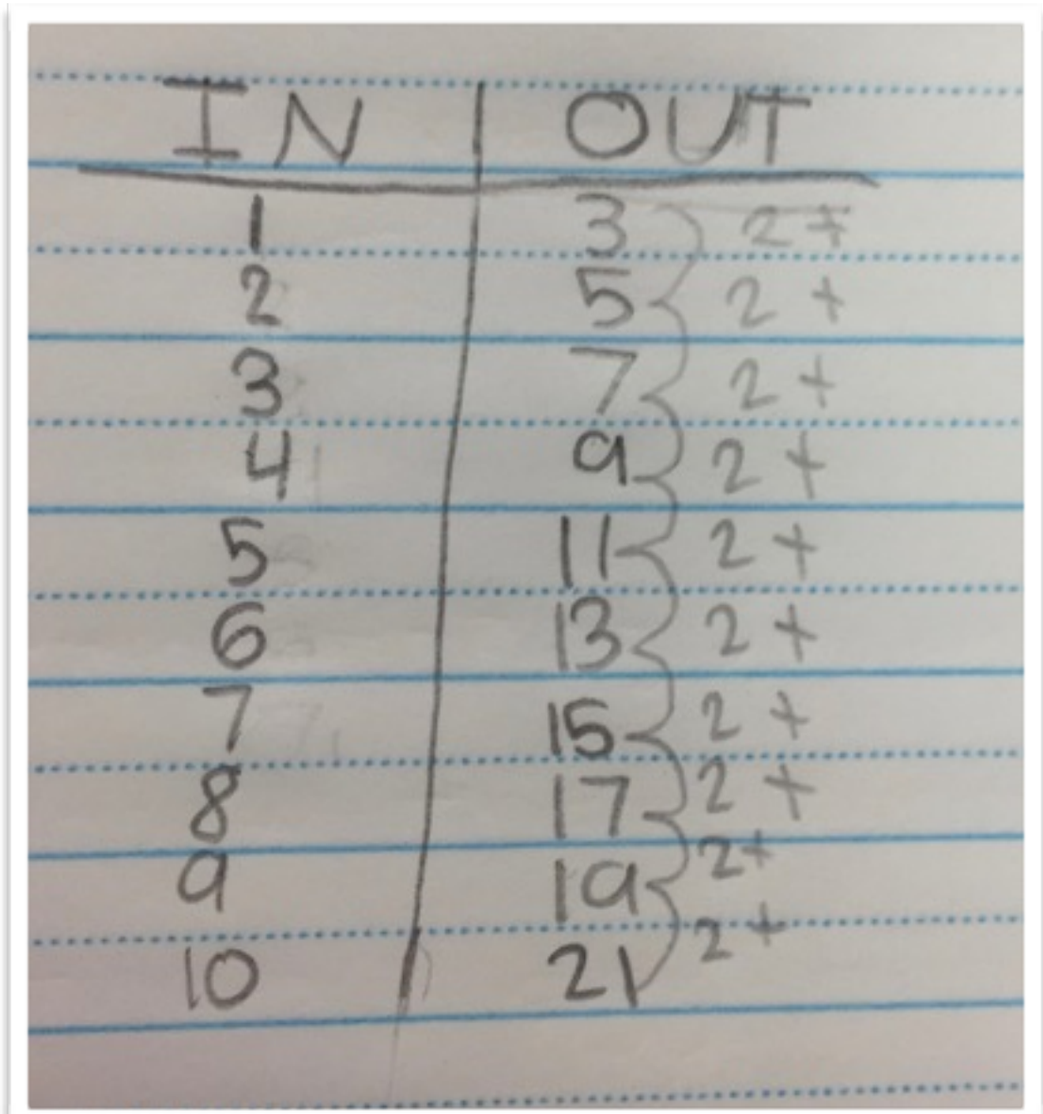
PATTERNS:
How do tables and charts help us to understand patterns?

What colour will the 25th cube be? Or the 100th?

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

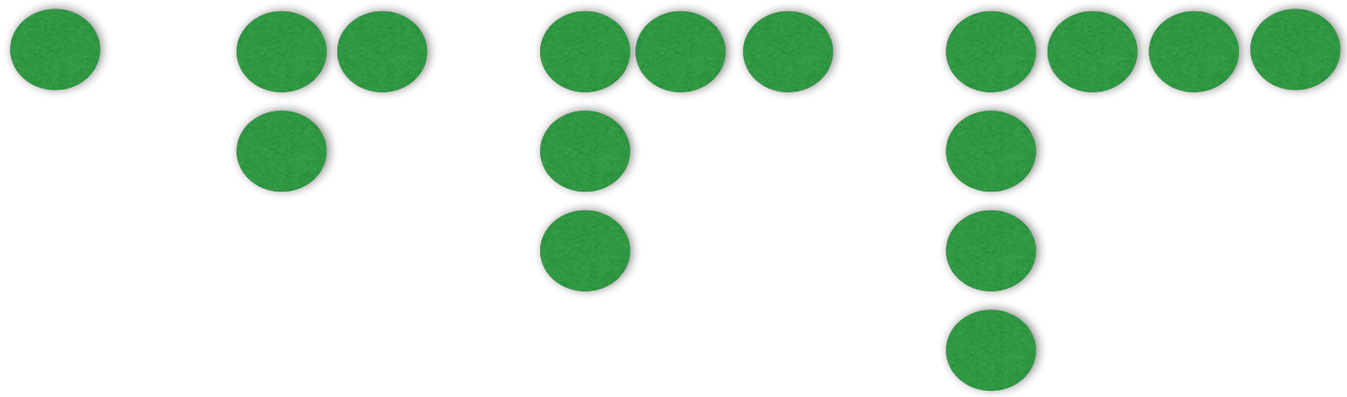
PATTERNS:
How can we represent the pattern in the story?





PATTERNS:
How do tables and charts help us to understand patterns?

Steps	Circles
1	1
2	3
3	5
4	7
5	9

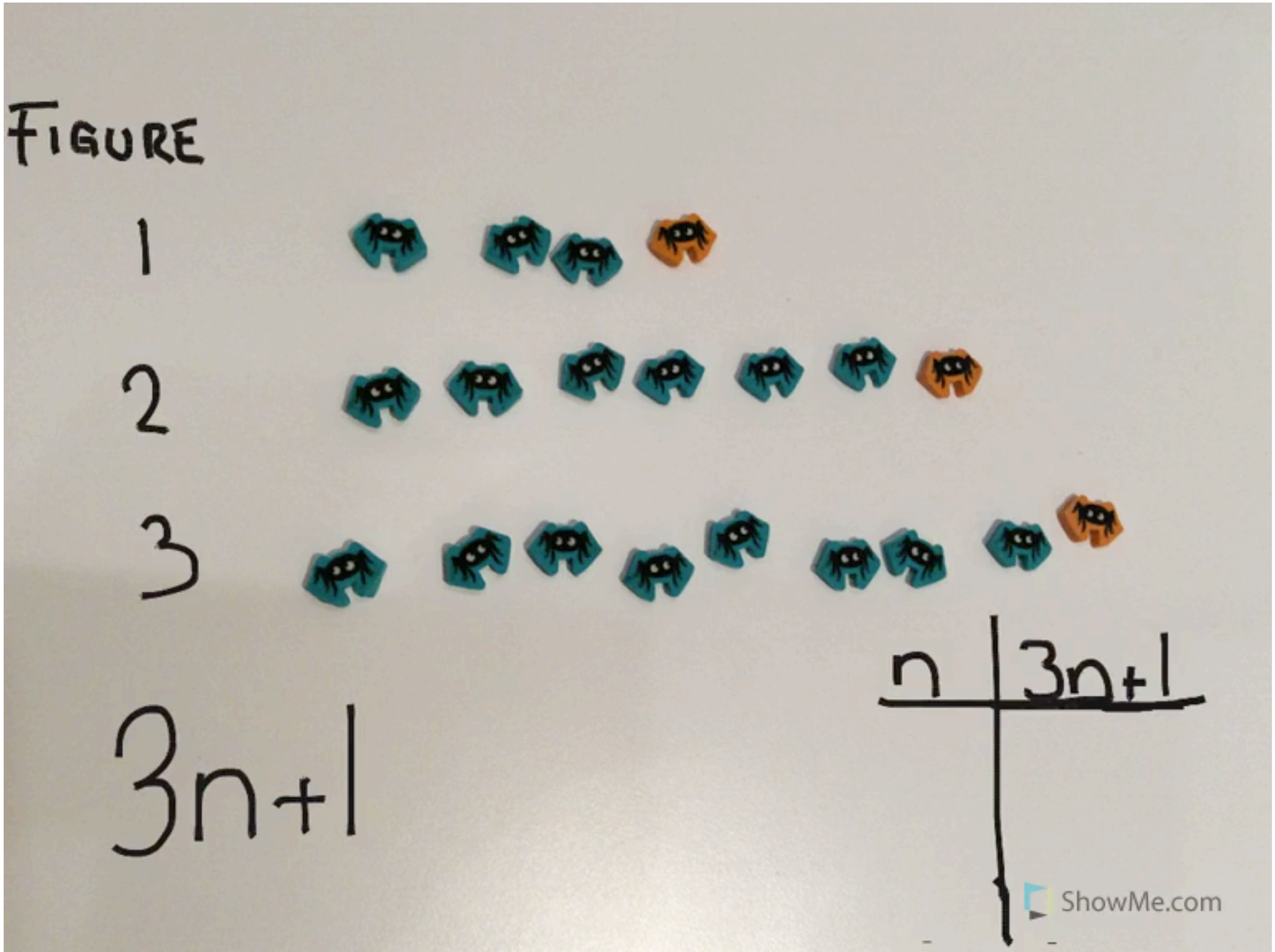


"I can see it increases by 2"

Provide lots of materials to build patterns with an empty T charts.

Can a table help us to make sense of the pattern?

PATTERNS:
Can you represent this expression?



What is our role in playful inquiry?

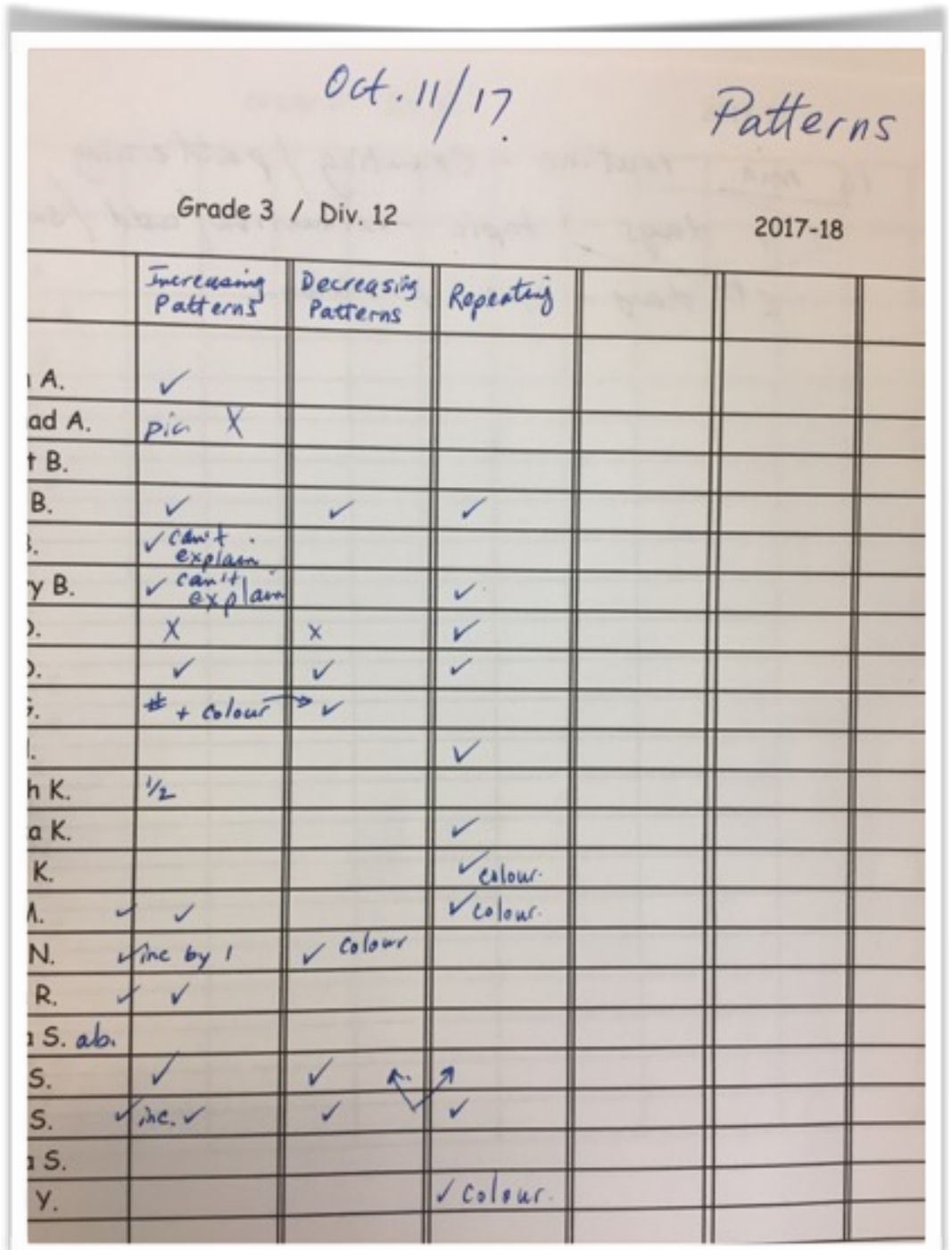
- **talk less and listen more**
- **be open to the children's questions**
- **ask open questions - design inviting, playful learning opportunities**
- **notice and name the curricular competencies**
- **ask questions to nudge learning**
- **use mathematical vocabulary**
- **build in time to reflect and connect**
- **know and honour student's interests**
- **establish a culture that supports wondering and playfulness**

Formative Assessment

We circulate and observe. Based on what we see, we ask questions to clarify our understanding and nudge learning forward.

We document the learning we see using anecdotal notes, photos, videos, checklists, collection of student work samples.

Performance Based Assessment



Oct. 11/17

Patterns

Grade 3 / Div. 12

2017-18

	Increasing Patterns	Decreasing Patterns	Repeating			
A.	✓					
ad A.	pic X					
t B.						
B.	✓	✓	✓			
.	✓ can't explain					
y B.	✓ can't explain		✓			
.	X	x	✓			
.	✓	✓	✓			
.	# + colour →	✓				
.			✓			
h K.	1/2					
a K.			✓			
K.			✓ colour.			
M.	✓ ✓		✓ colour.			
N.	✓ inc by 1	✓ colour				
R.	✓ ✓					
S. ab.						
S.	✓	✓				
S.	✓ inc. ✓	✓	✓			
S.						
y.			✓ colour.			

"I want teachers to become addicted to listening to students' mathematical ideas…

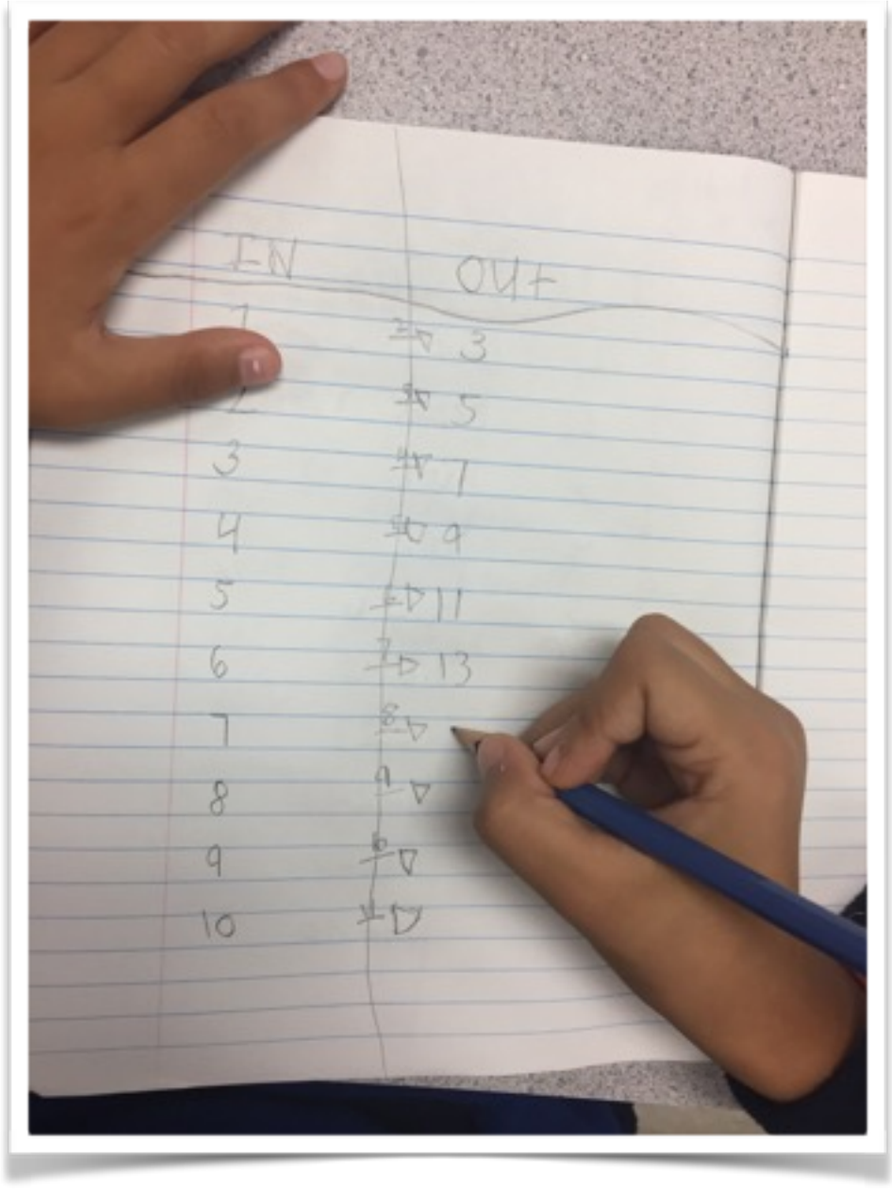
Once we become fascinated by our students' creativity and ingenuity, we become more motivated to teach math…

Aspire to talk less, and listen more, to ask better questions, to make more thoughtful instructional decisions, to support our young mathematicians."

- Zager, (2017)

Journal Prompts

- A pattern is..
- A pattern I created…
- I'm proud of…
- I know…
- I'm thinking now…
- This reminds me of…
- Today I learned…
- A connection I have…
- I noticed…

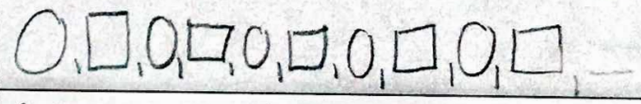
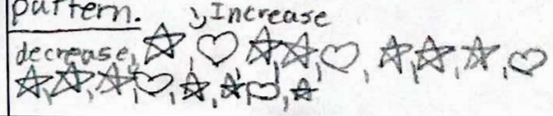
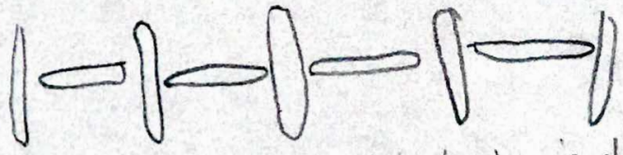
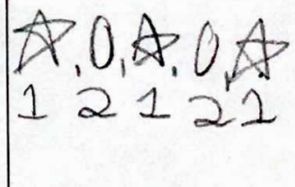


PATTERNS:
Summative Assessment

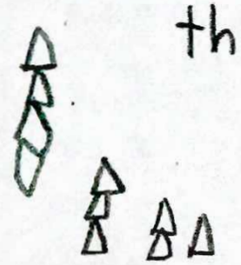
Name _____ Date _____

Talking Points	FINAL A/D/U	Explain your choice Give an example if you can
Patterns are predictable.		
Patterns can increase (grow) but cannot decrease (shrink).		
Patterns can be made out of one item that is all the same colour (brown toothpicks).		
Numbers can be used to describe patterns.		
Patterns can help us to solve problems.		

Name _____ Date Nov 1, 2017

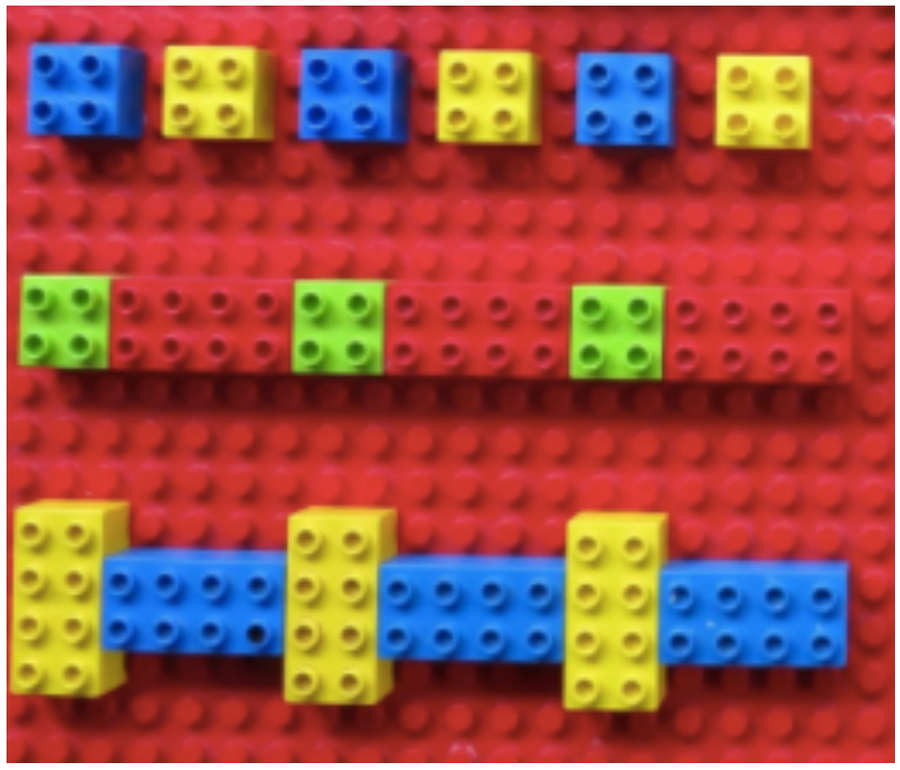
Talking Points	FINAL A/D/U	Explain your choice Give an example if you can
Patterns are predictable.	A	I know patterns are predictable because if a pattern is 1,2,1,2 I know 1 is next. 
Patterns can increase (grow) but cannot decrease (shrink).	D	Patterns can decrease because if you make an increasing pattern you can turn it into a decreasing pattern. decrease, Increase 
Patterns can be made out of one item that is all the same colour (brown toothpicks).	A	 you can make the objects be in different ways.
Numbers can be used to describe patterns.	A	 1 2 1 2 1
Patterns can help us to solve problems.	A	In multiplication there's a pattern like when you do 1 times tables you add by ones.

Name _____ Date Nov 1, 2017

Talking Points	FINAL A/D/U	Explain your choice Give an example if you can
Patterns are predictable.	A	What comes next 
Patterns can increase (grow) but cannot decrease (shrink).	A	they can shrink. 
Patterns can be made out of one item that is all the same colour (brown toothpicks).	A	yes pezishinl pattern.
Numbers can be used to describe patterns.	A	I can tell you a patern 1 2 1 2
Patterns can help us to solve problems.	A	If your stuk on a number use a pattern

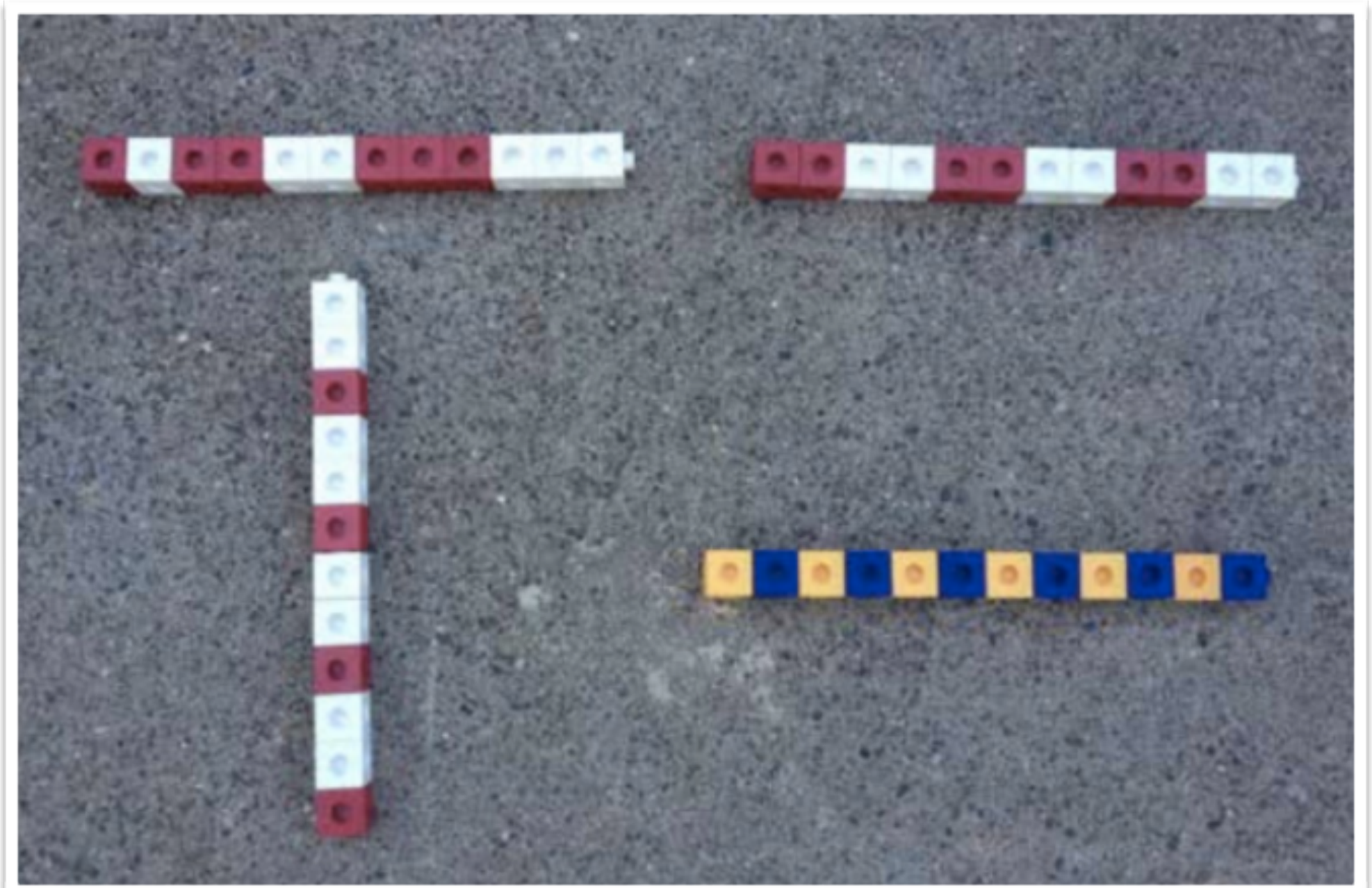
PATTERNS: How do we revisit this topic throughout the year?

Create a pattern
Take a Gallery Walk
Which pattern would you like to extend?



Which One Doesn't Belong?

wodb.ca #wodb



Which One Doesn't Belong?

What could our learning intentions be?

I want my students to gain a **(KNOW)**ledge of:

- Attributes
- Mathematical language
- Spatial Awareness
- Number Sense

I want my students to be able to: **(DOING)**

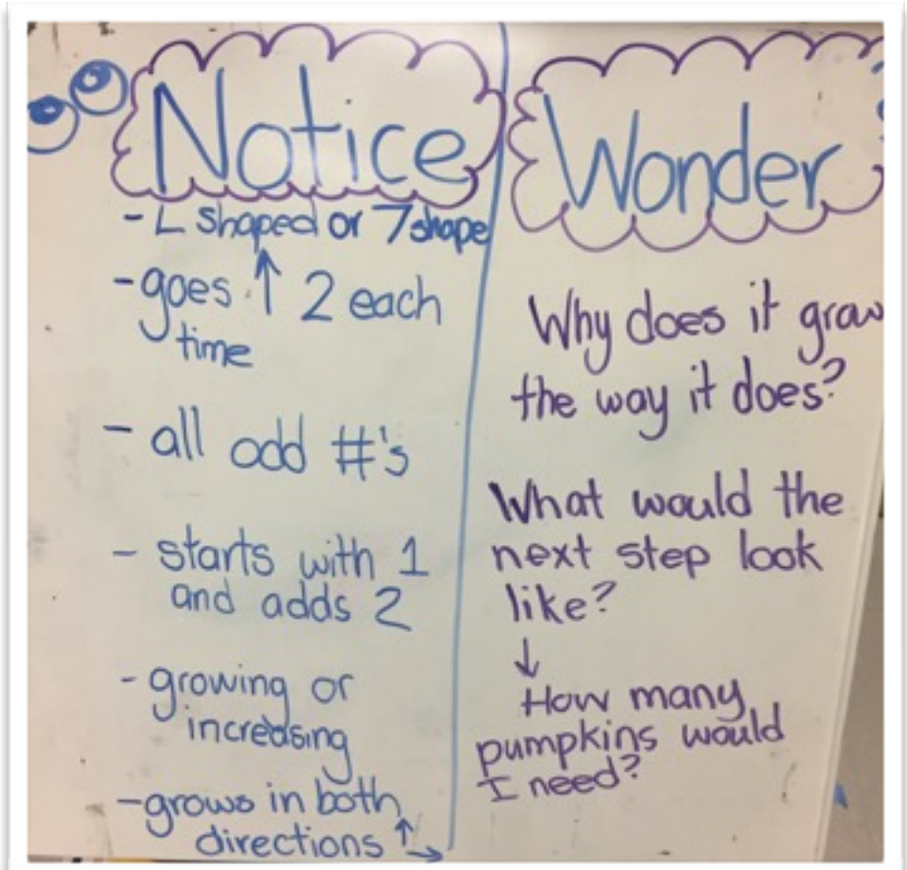
- Reasoning
- Communicating conjectures
- Explain and Justify
- Engaging in Problem Solving

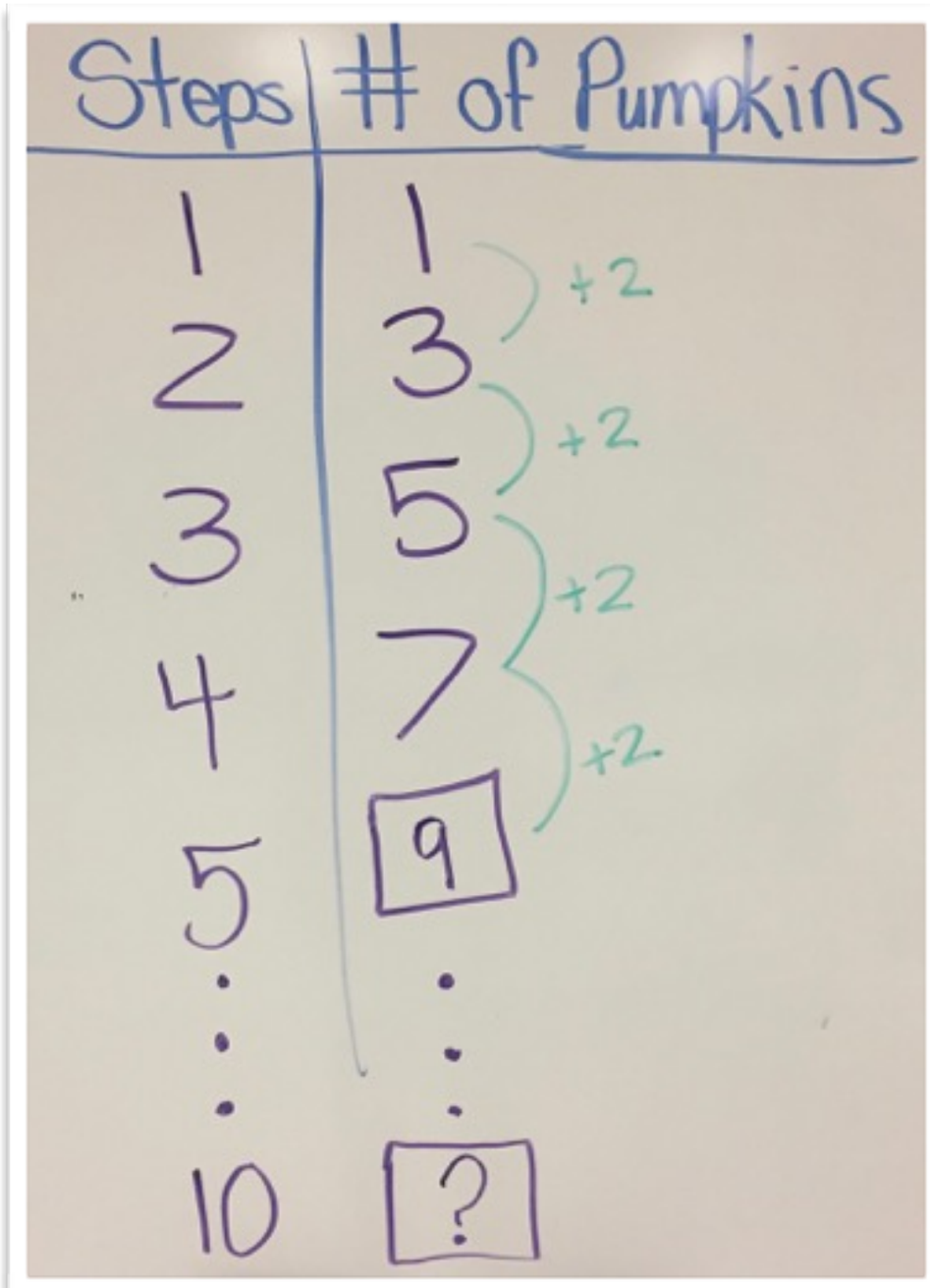
Which One Doesn't Belong?

Christopher Danielson

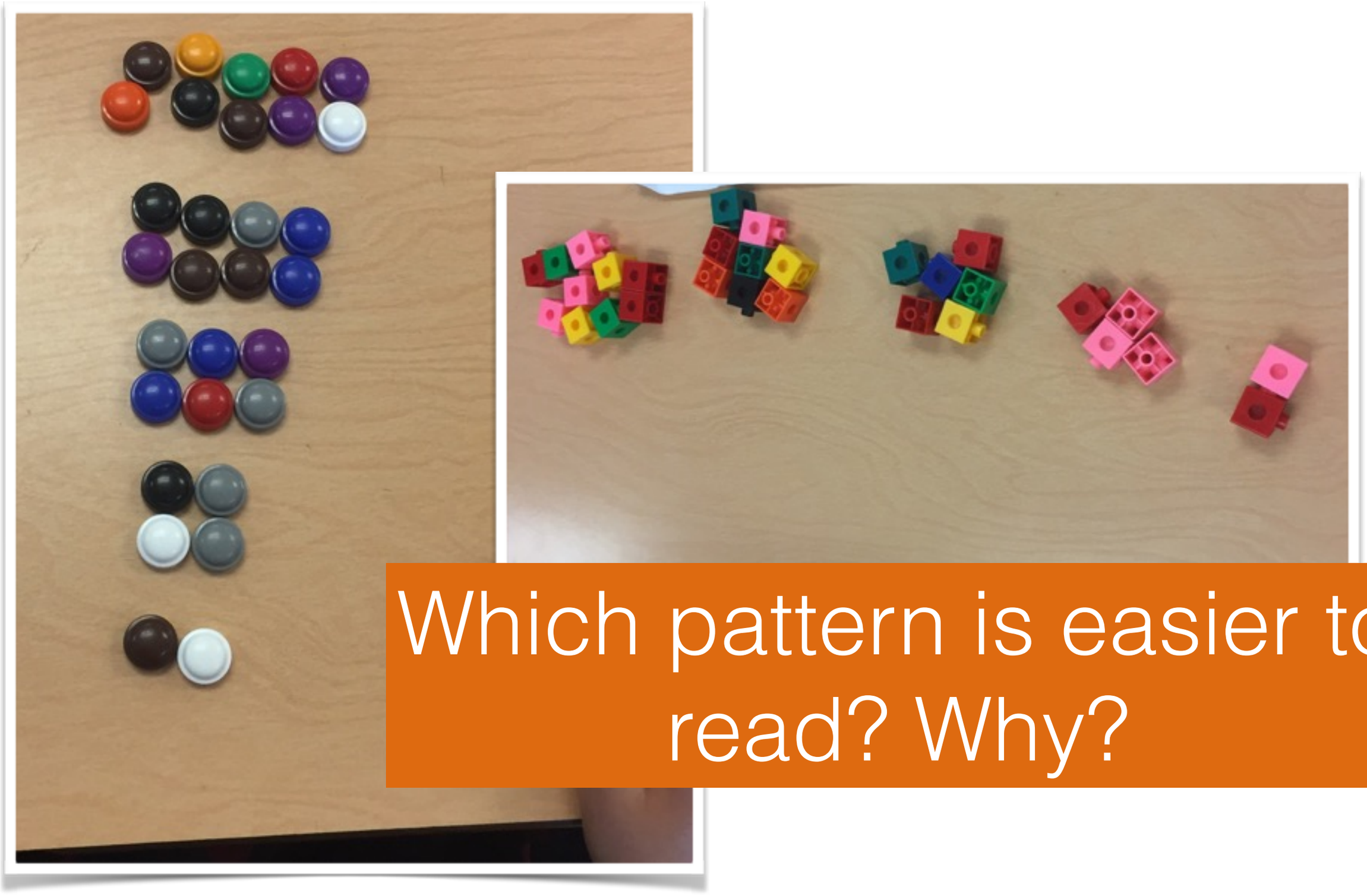
www.wodb.ca

Notice/Wonder





Same/Different



Which pattern is easier to read? Why?

Give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking; learning naturally results.

John Dewey

meetville.com

NUMBER CONCEPTS: Counting Collections

Learning Intentions:

- One-to-one correspondence
- Cardinality
- Counting forward
- Skip counting
- Place Value

Items you could use:

- anything - straws, bottle caps, buttons, pompoms, craft sticks, beans, beads, toothpicks, mini-erasers, play cards, small animals

Launch with a Counting Book

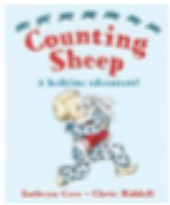
Ed Emberley

John Himmelman

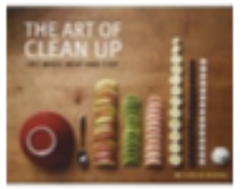
April Pulley Sayre & Jeff Sayre

Andrea Menotti

Paul Giganti Jr.



Kathryn Cave



Ursus Wehrli

Ann Jonas

Margaret McNamara

Melanie Gerth

Ann and John Hassett

Cindy Neuschwander

Kathi Appelt

Matthew McElligott

Tony Ross

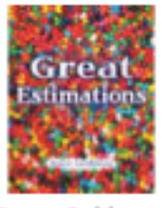
Stuart J. Murphy

Stuart J. Murphy

Donald Crews

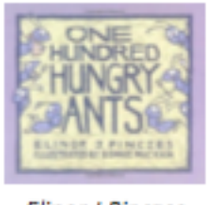
David Schwartz

Anna Milbourne

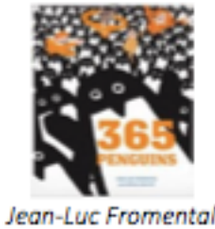


Bruce Goldstone

Masayuki Sebe

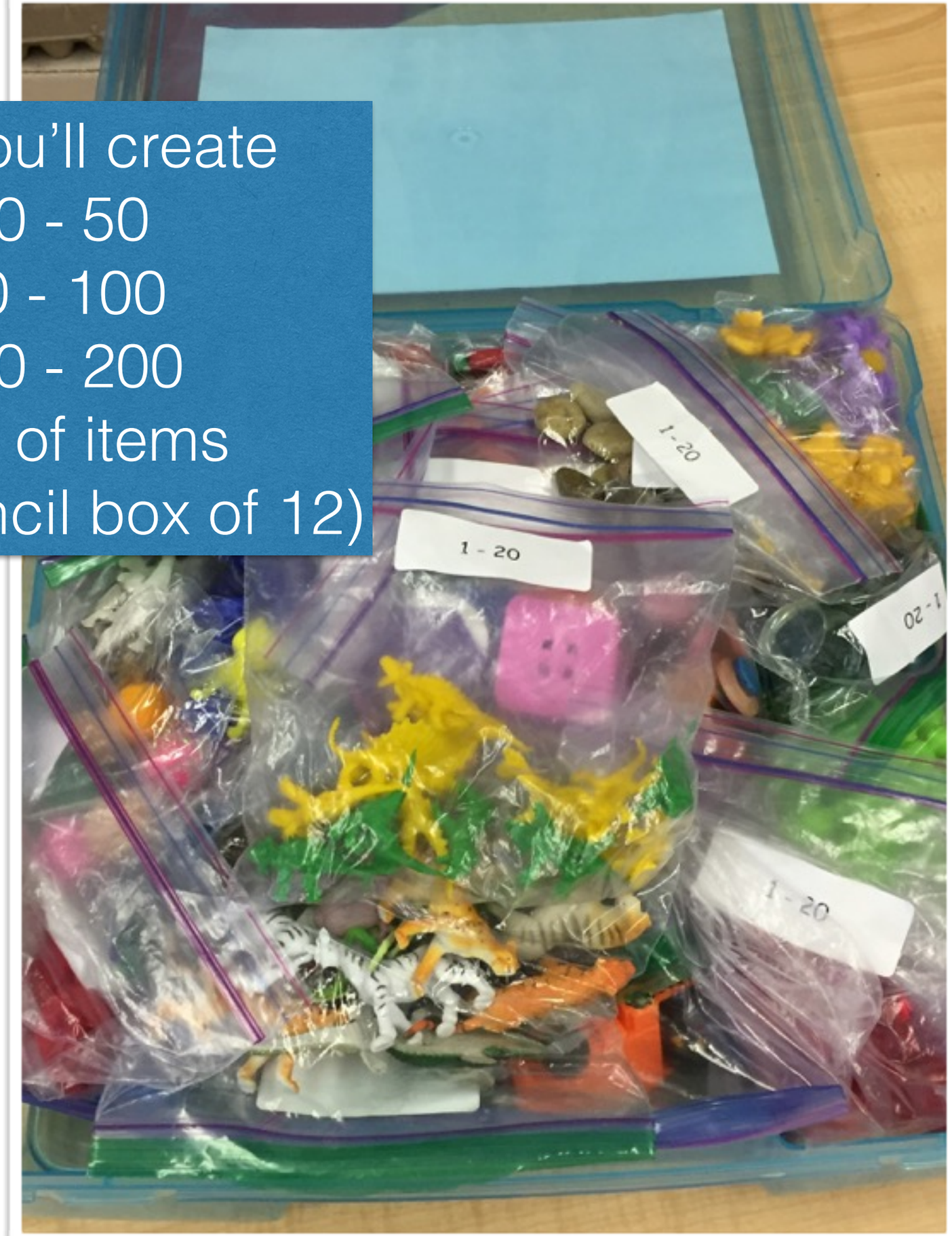


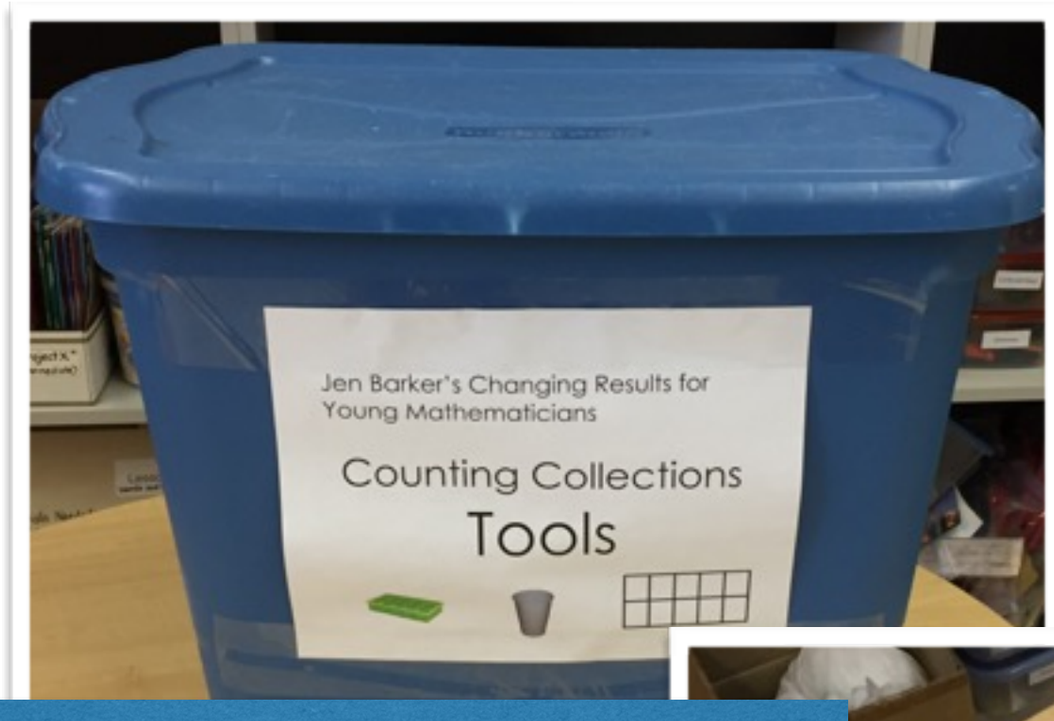
Elinor J Pinczes



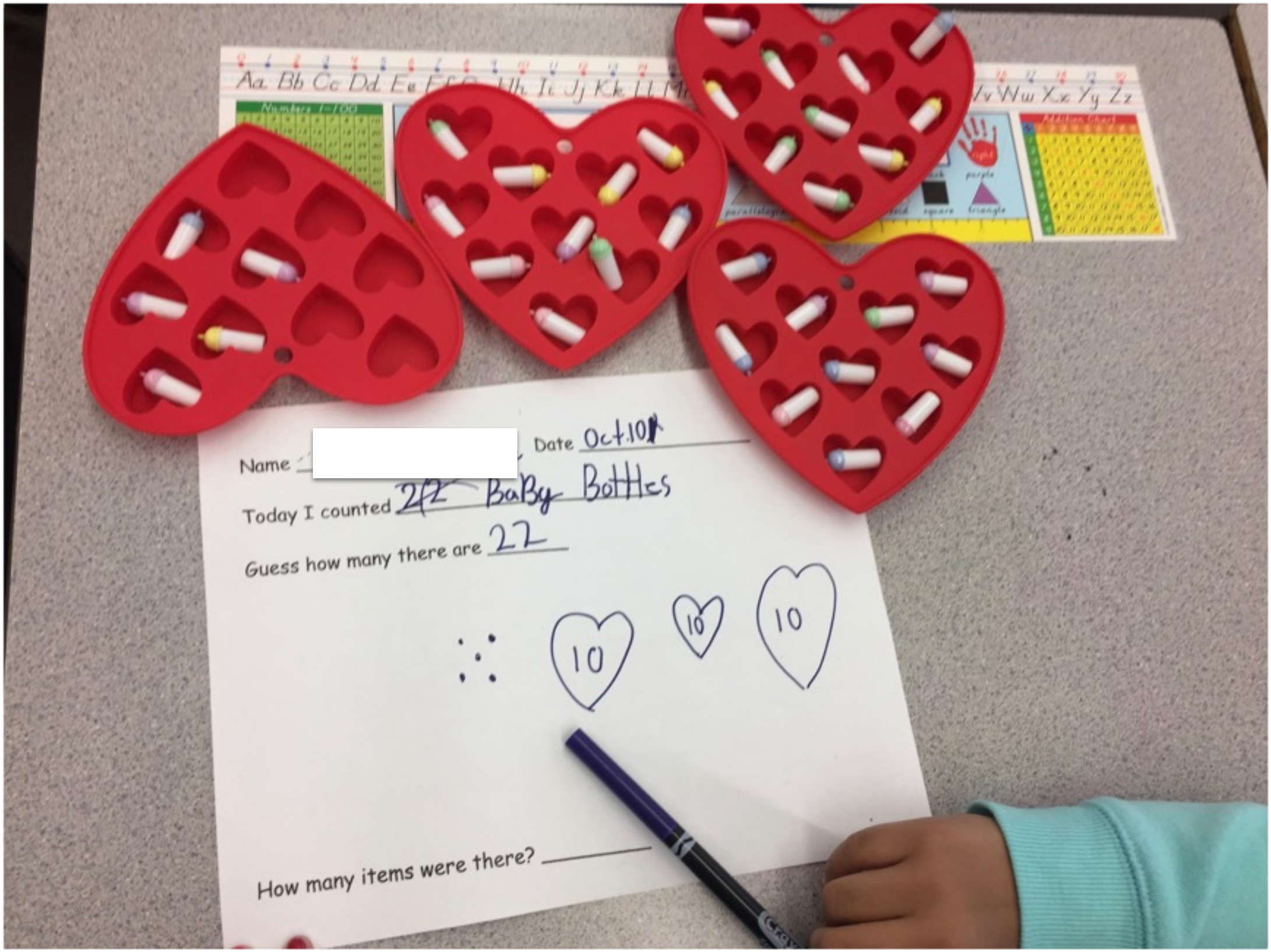
Jean-Luc Fromental

Kits you'll create
20 - 50
50 - 100
100 - 200
Sets of items
(e.g., pencil box of 12)





Our "Tools" that help us keep track.


Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm
Vv Ww Xx Yy Zz
Numbers 1-100
Name
Date Oct.10th
Today I counted 22 Baby Bottles
Guess how many there are 22
10
10
10
How many items were there?

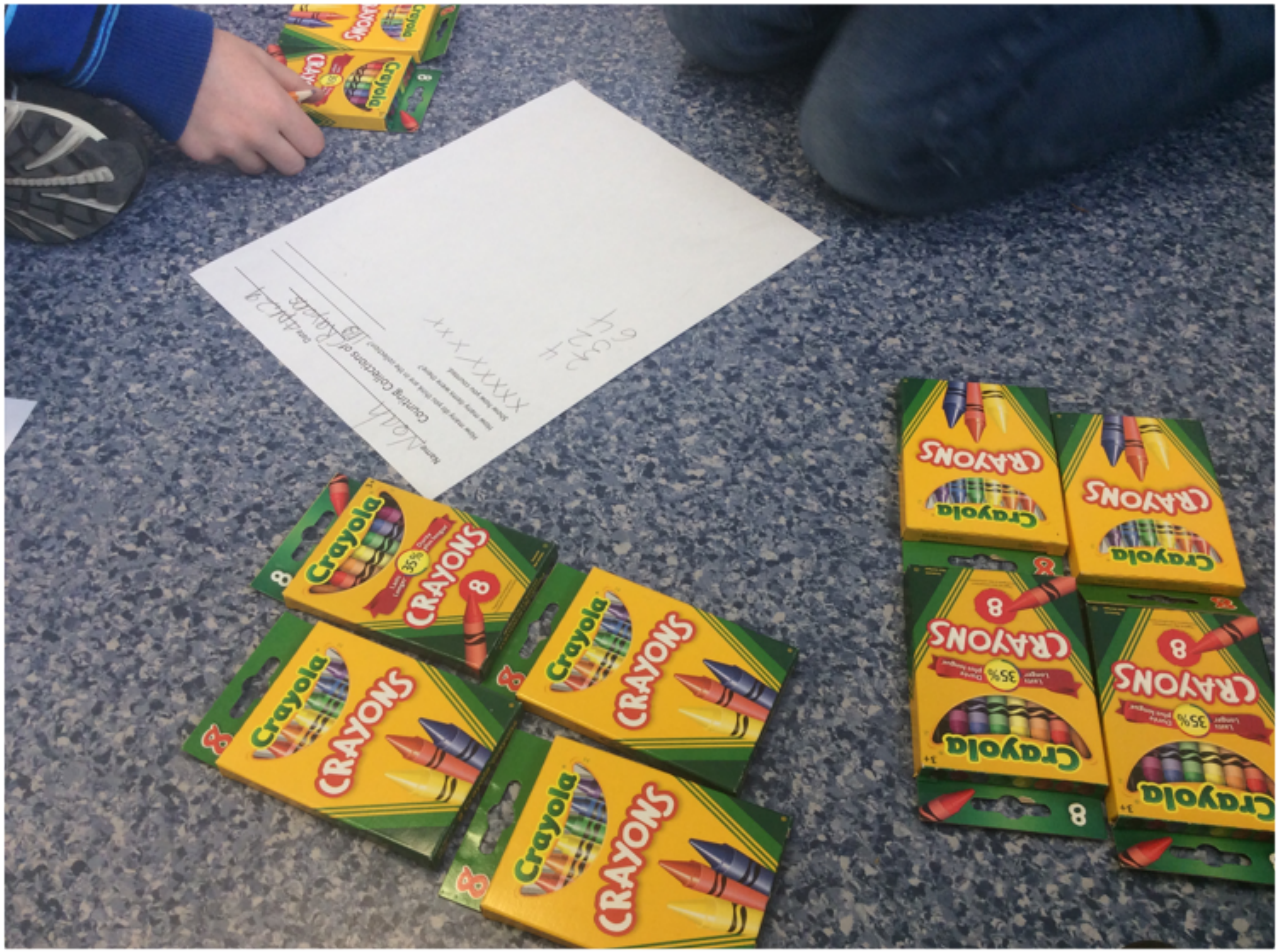
Count by tens using ten-frames

By fives using five-frames or a hand print

by twos using ice-cube trays

by fours using a circle mat

Counting by sets!
Flexibility required


Crayola
CRAYONS
8

Guiding questions…

- How many items do you think you have?
- How many items do you have?
- How did you count them?
- Can you record how you counted?
- What other ways could you count?

We record how we counted on paper.

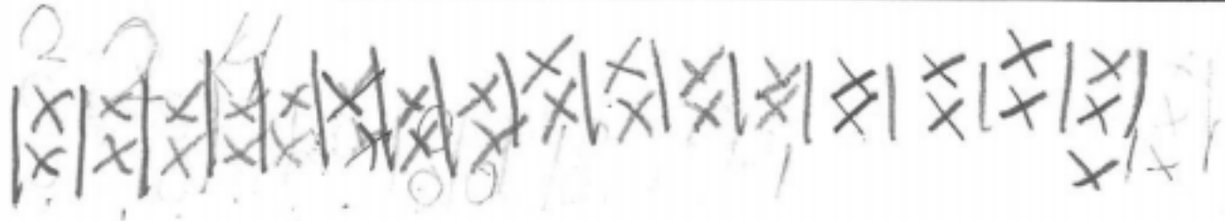
Name Tanner Date Apr. 29

Counting Collections of frogs

How many do you think are in the collection? 34

How many items were there? 33

Show how you counted.



We couted by 2's

Play is the highest form of research

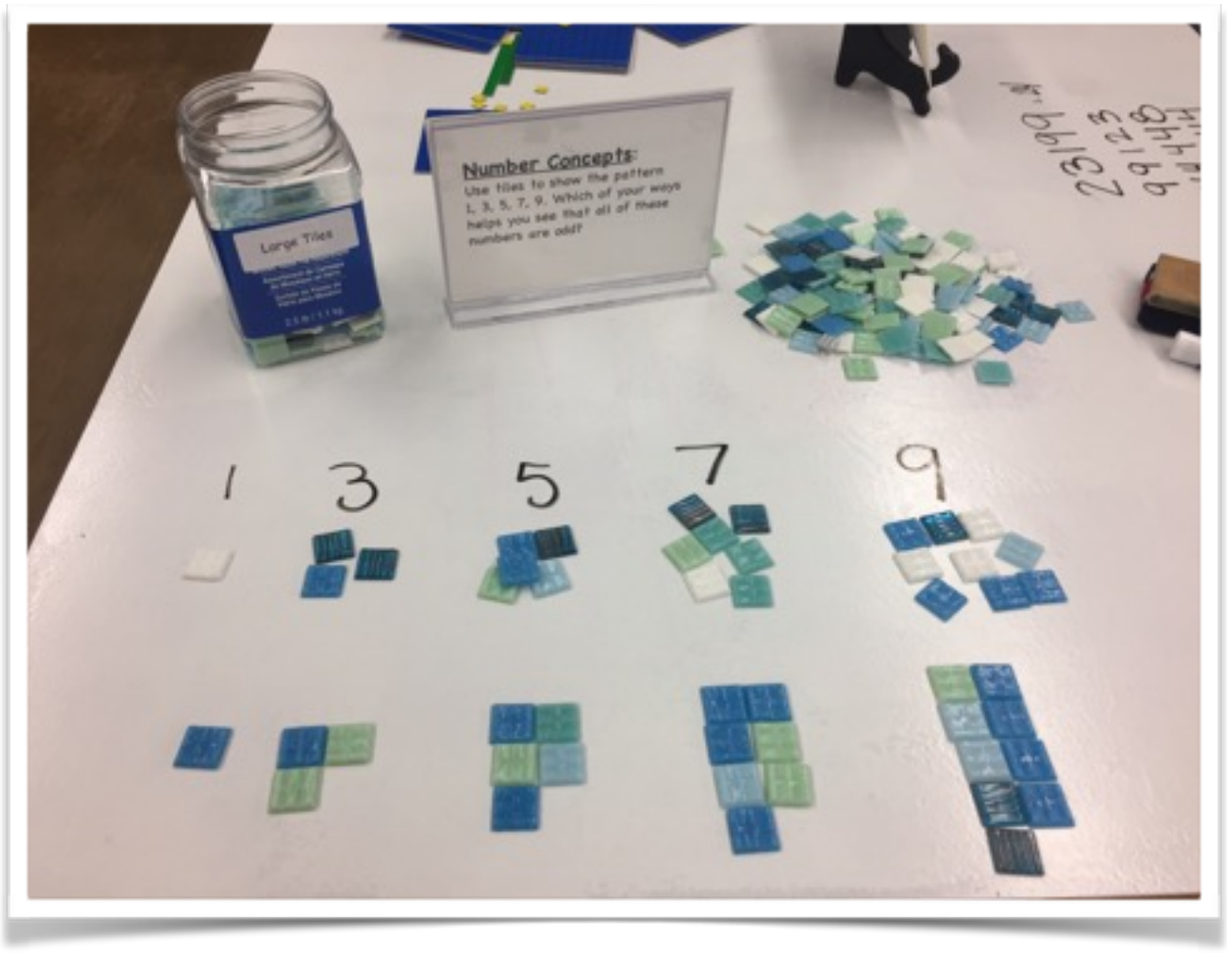
Albert Einstein

NUMBER CONCEPTS: Skip Counting

You skip count forward by a number and you say 40. What might you be skip counting by? What were you NOT skip counting by?

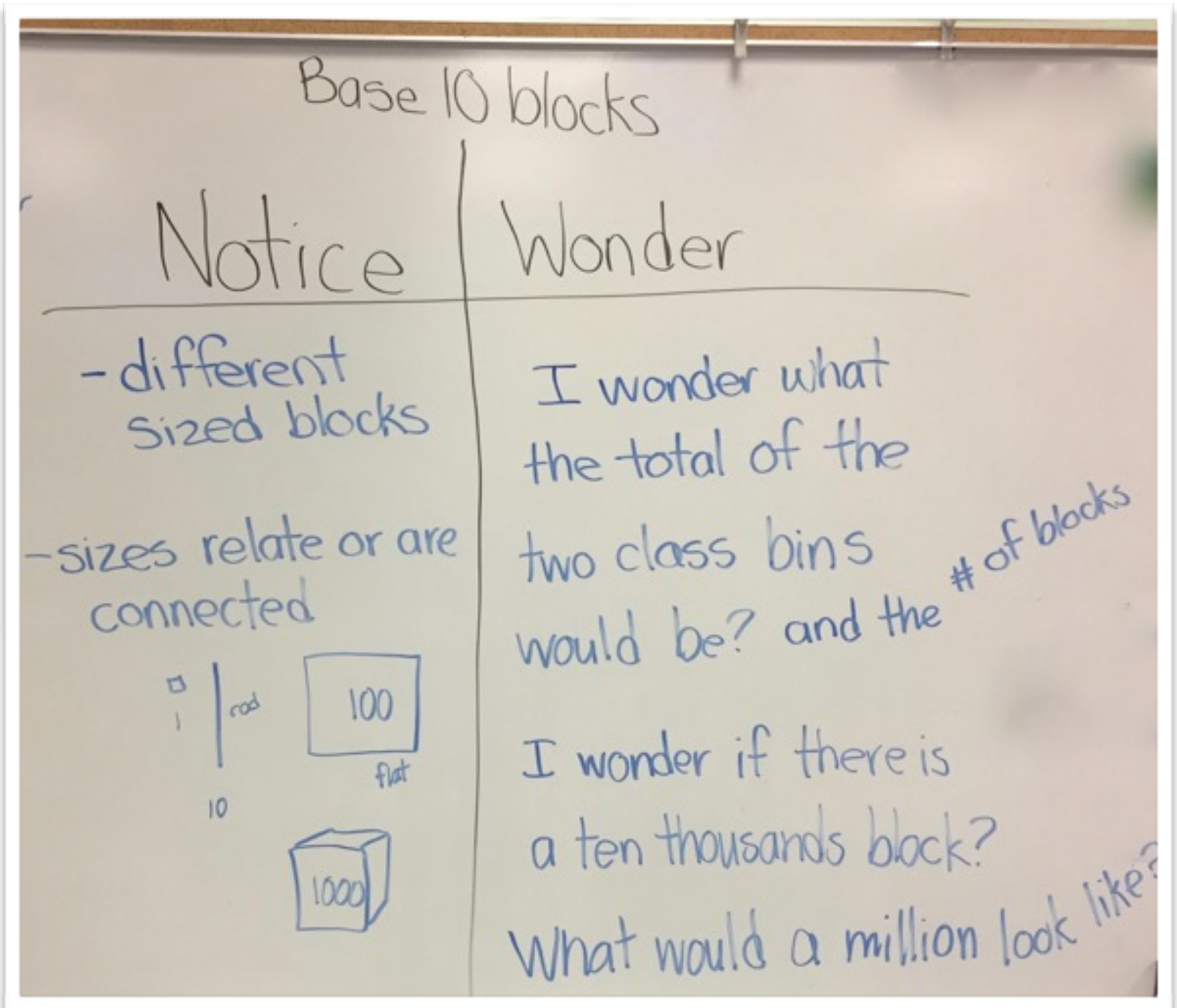
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

NUMBER CONCEPTS: Even and Odd



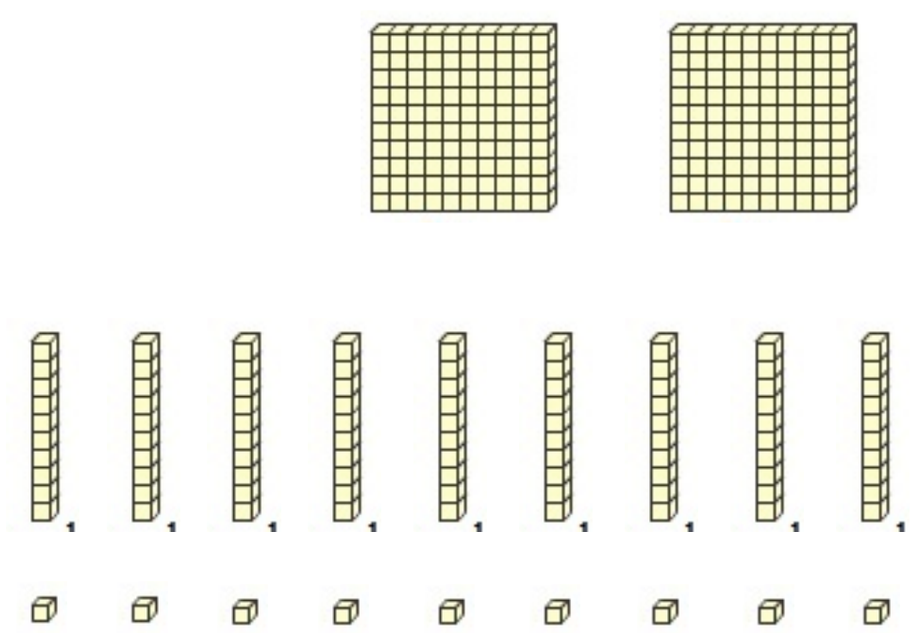
Use tiles to show the number pattern 1, 3, 5, 7, 9.
Which ways help you see that your pattern is odd?

NUMBER CONCEPTS: Base 10 Blocks



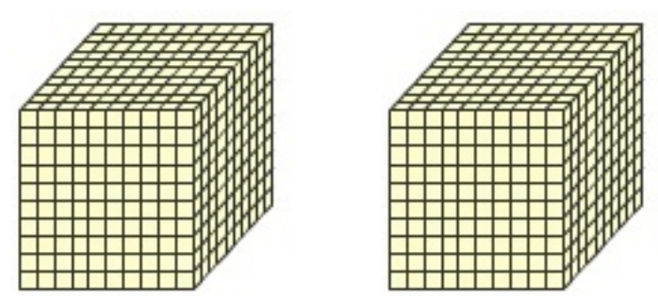
Use base 10 blocks to represent a number. Can it take fewer blocks to represent a greater number?

299



20 blocks

2000

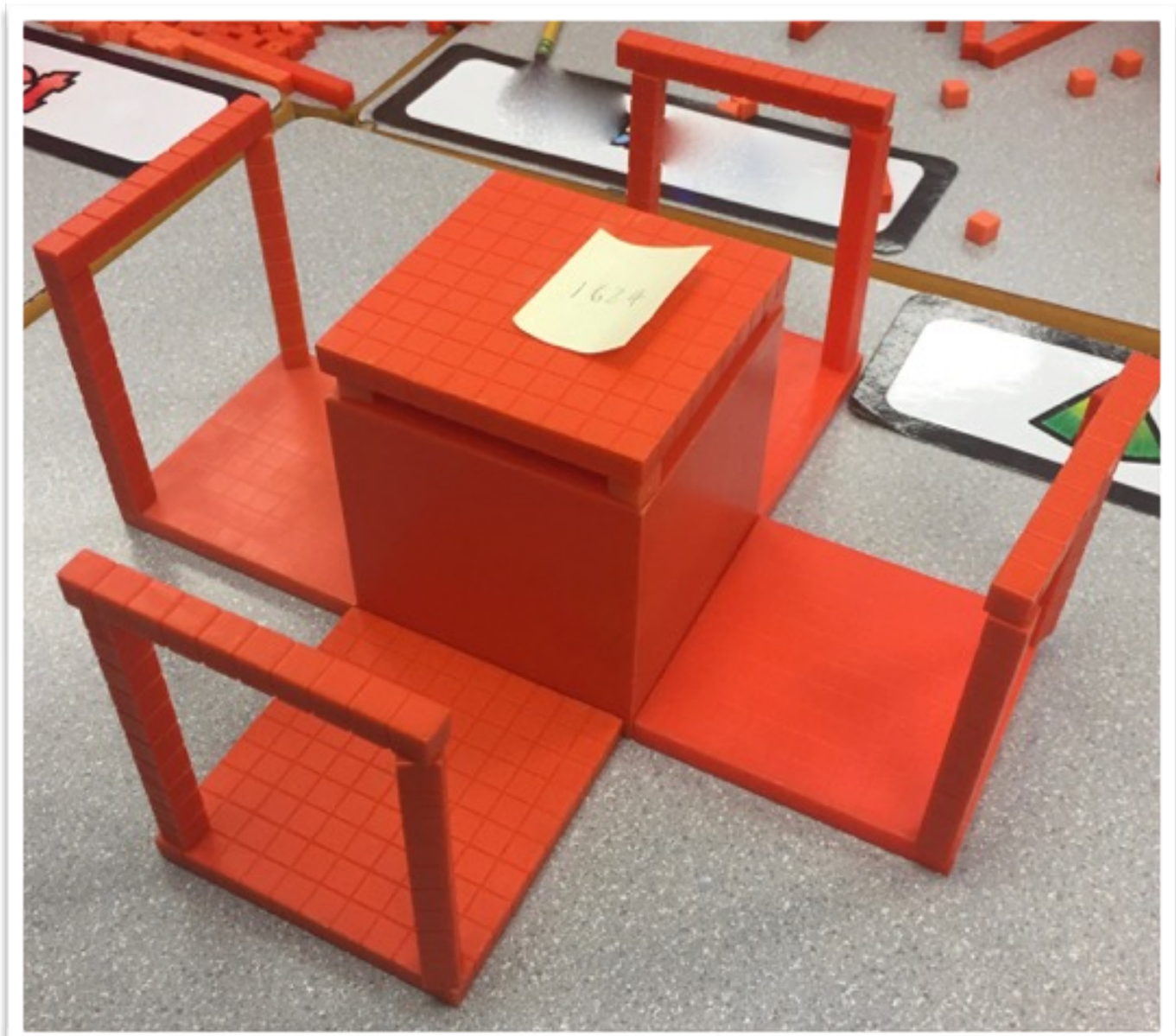


2 blocks

Choose 3-digits. What numbers can you make?

How many numbers could you make? How many are even? Odd?

Choose a 4-digit number.
How many different ways can you represent your number with base 10 blocks?



NUMBER CONCEPTS: Place Value

What five digit numbers could have a sum of 35?

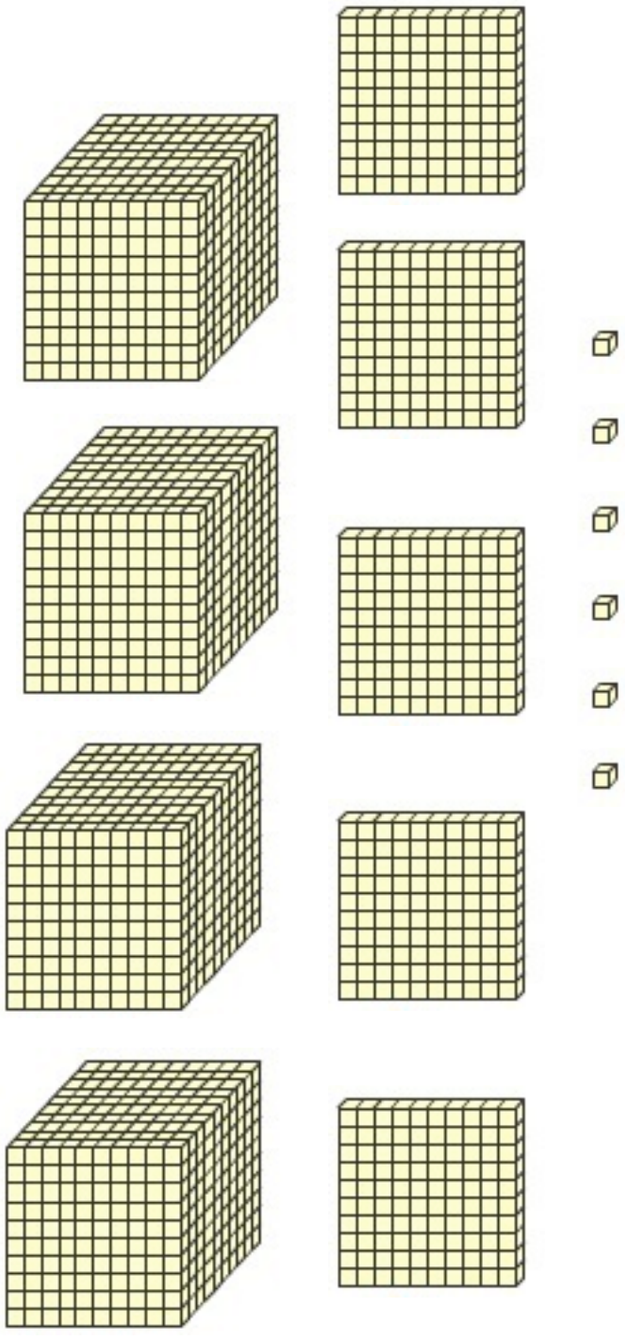
99935

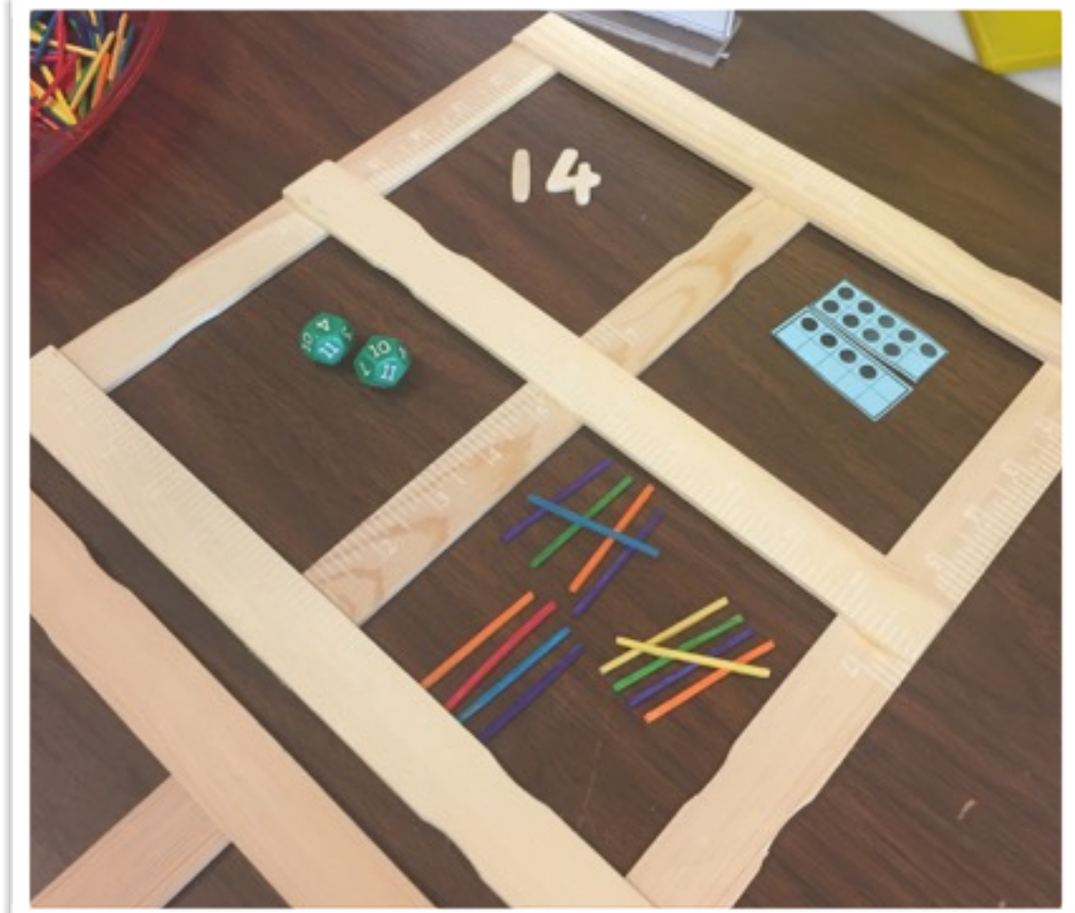
84896

Choose a 4-digit number.
How many different ways can you represent your number?

4506

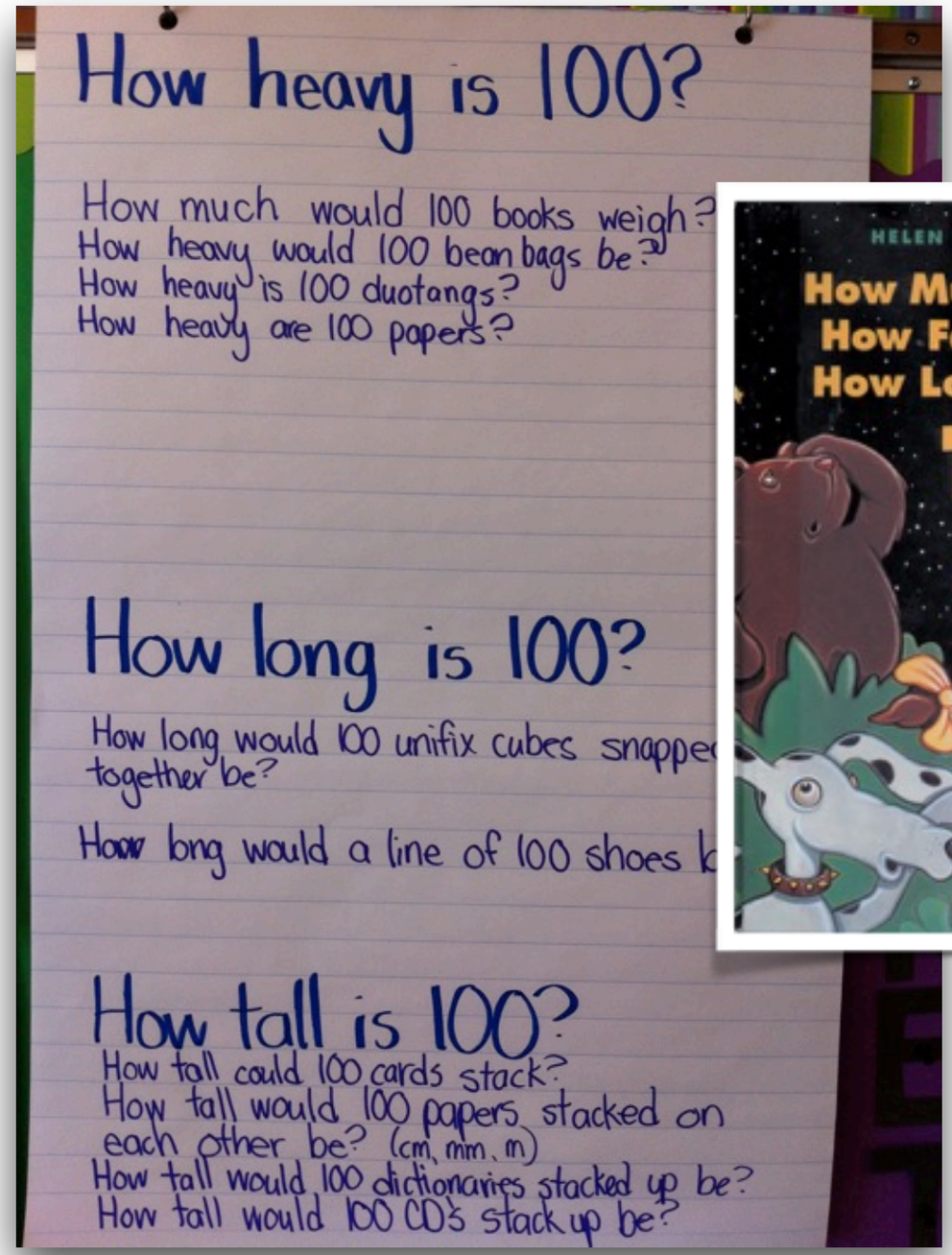
Four thousand six

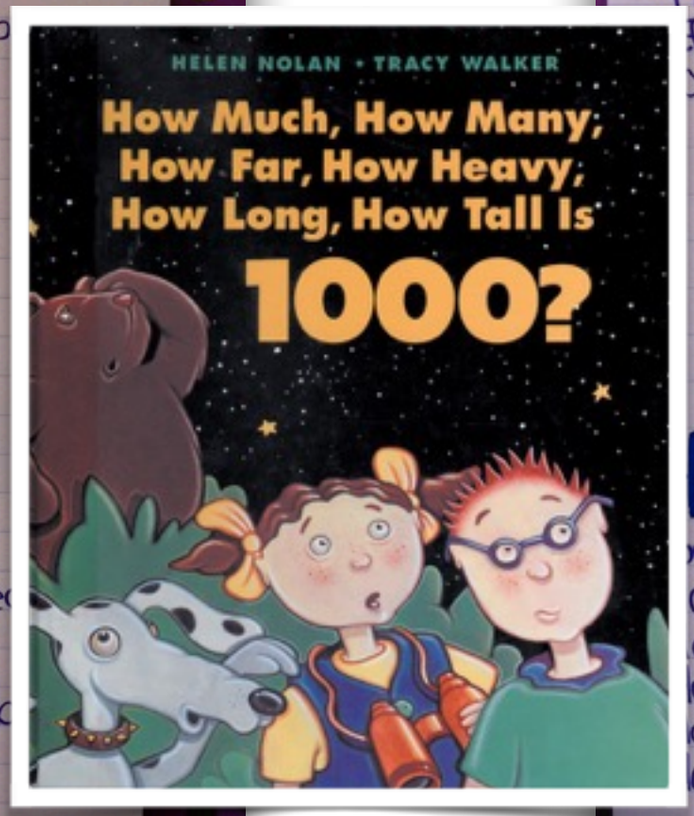


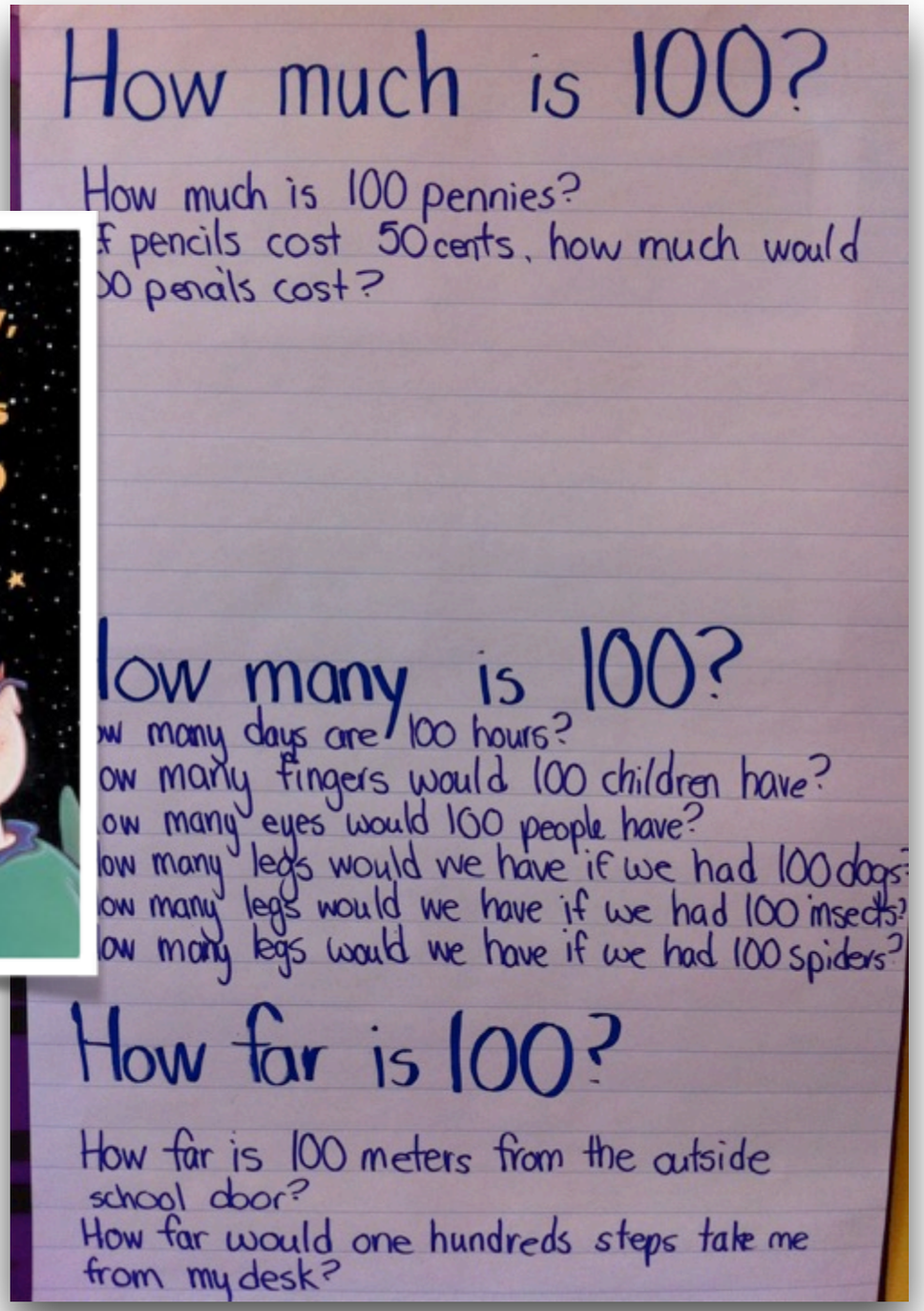


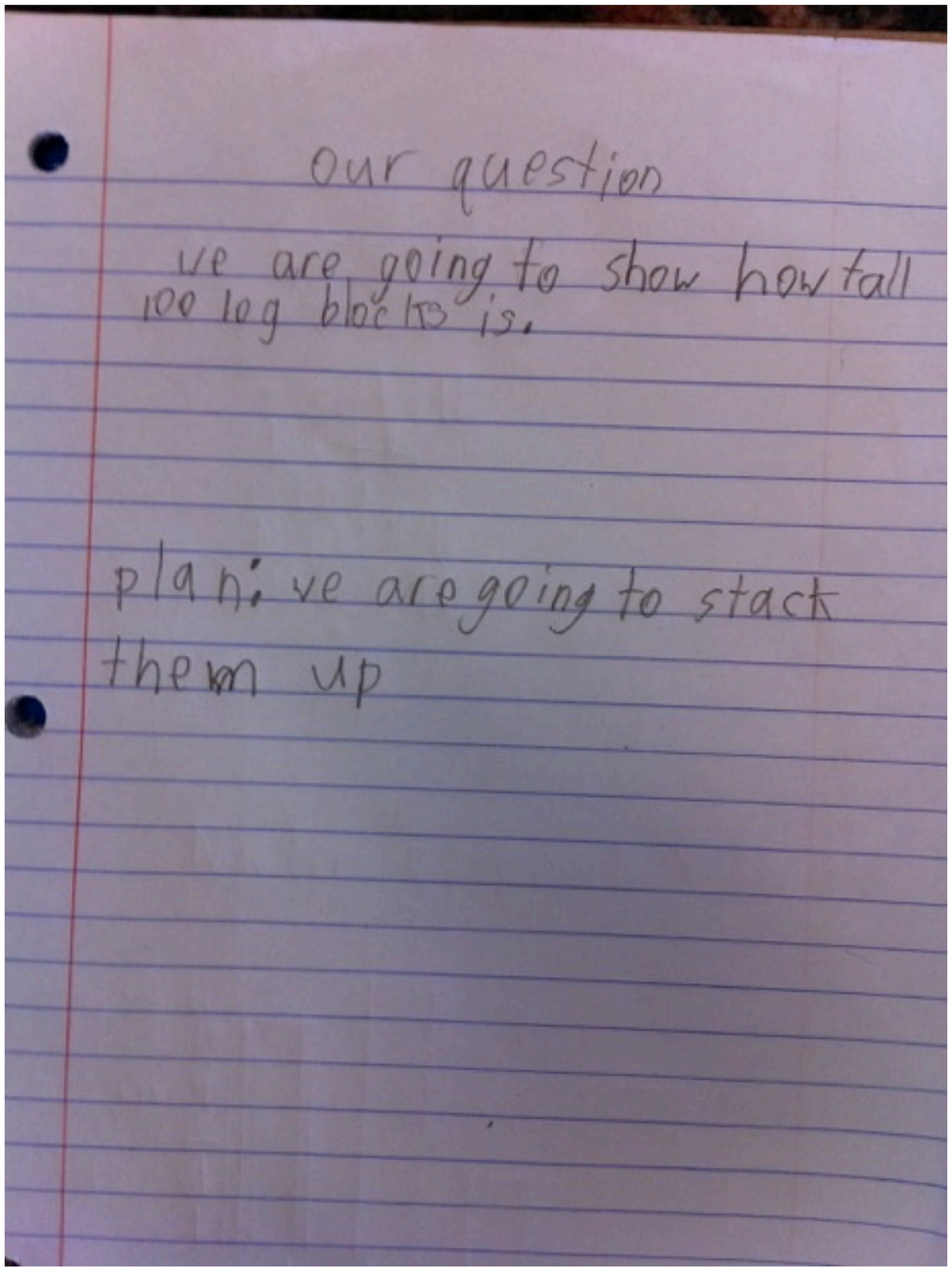
- Playing cards
- Stickies to write number in words
- Ten frames and hundreds frames
- Base 10 blocks
- play money

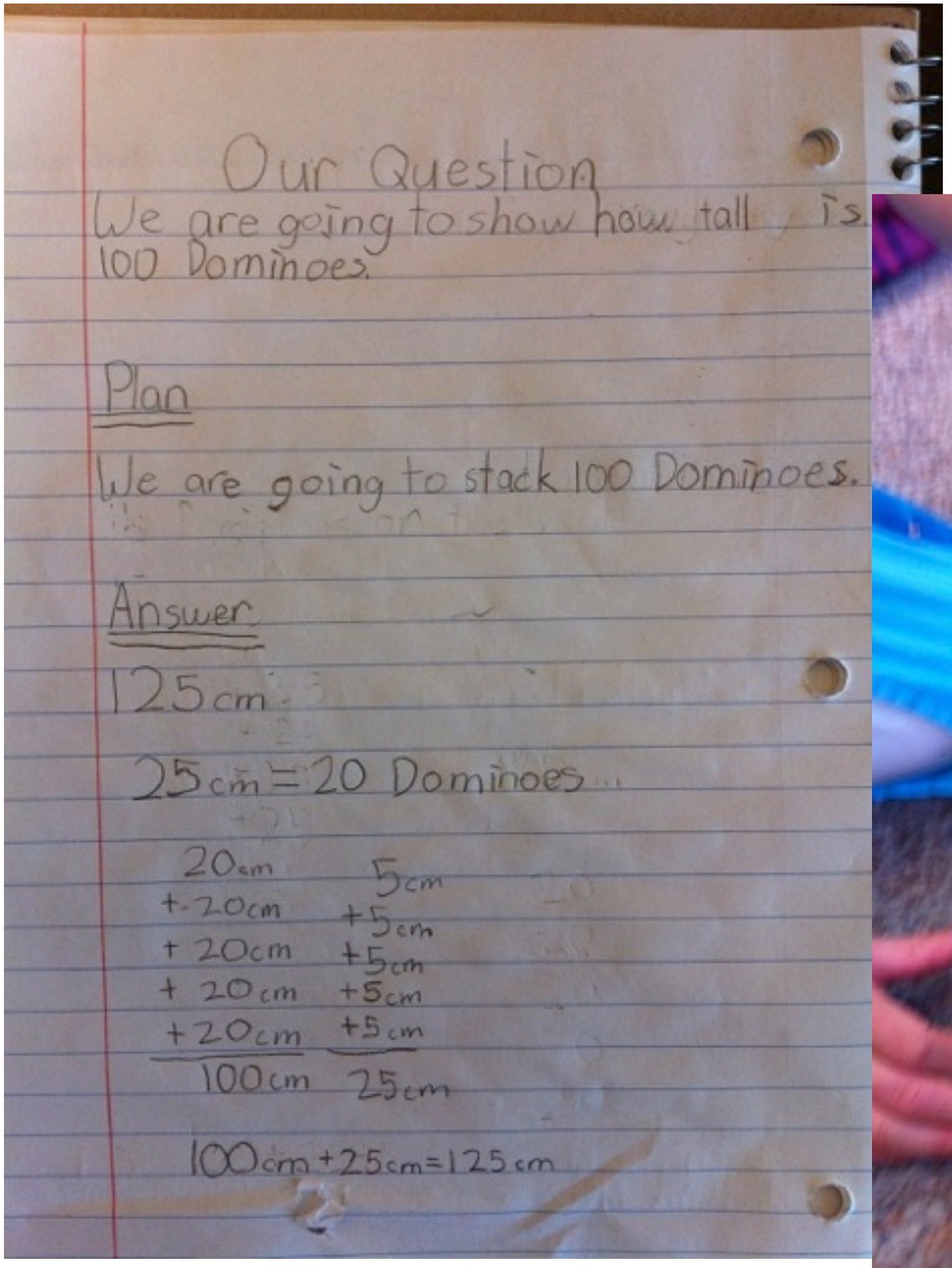
What question would you like to explore?

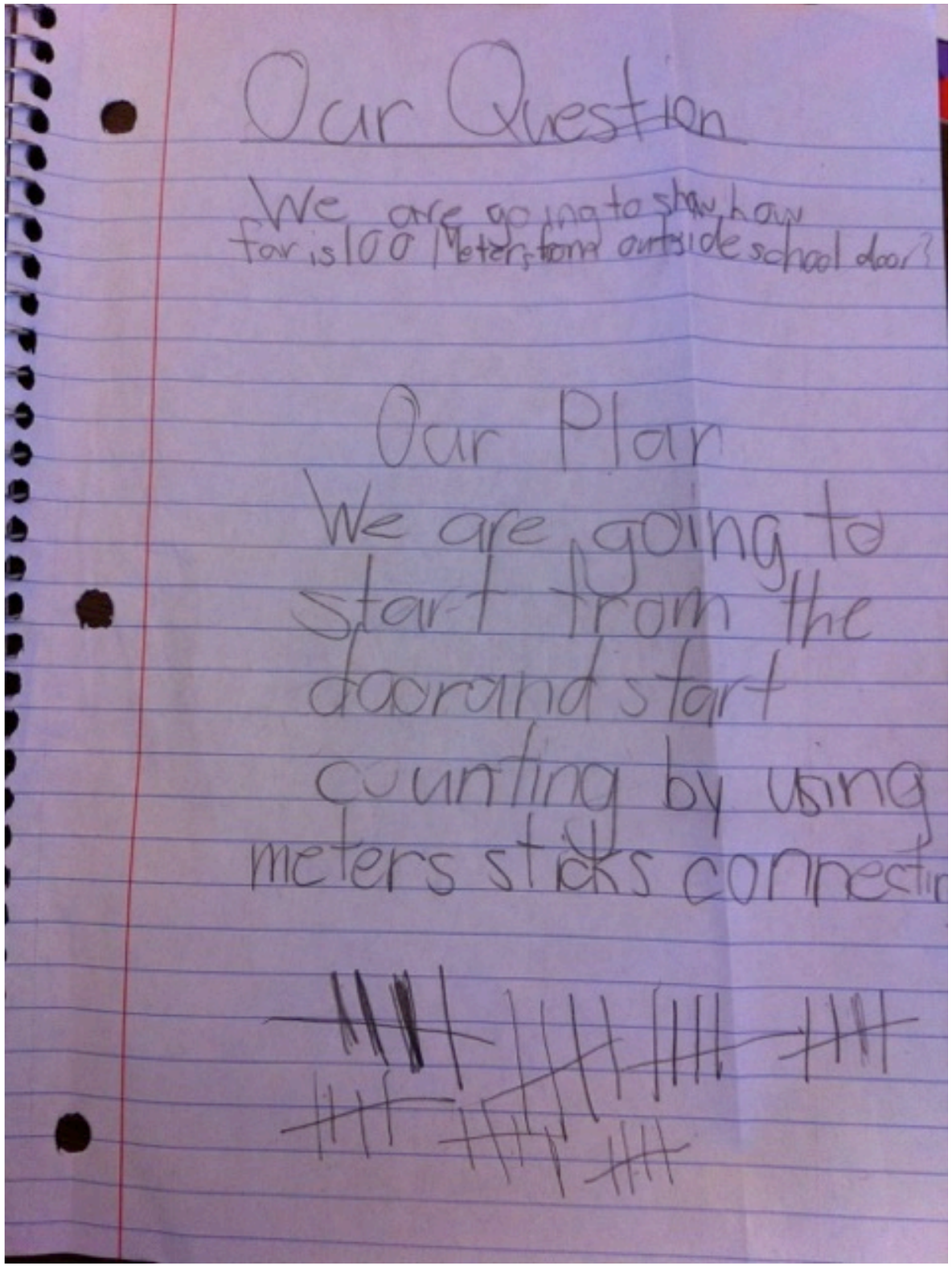






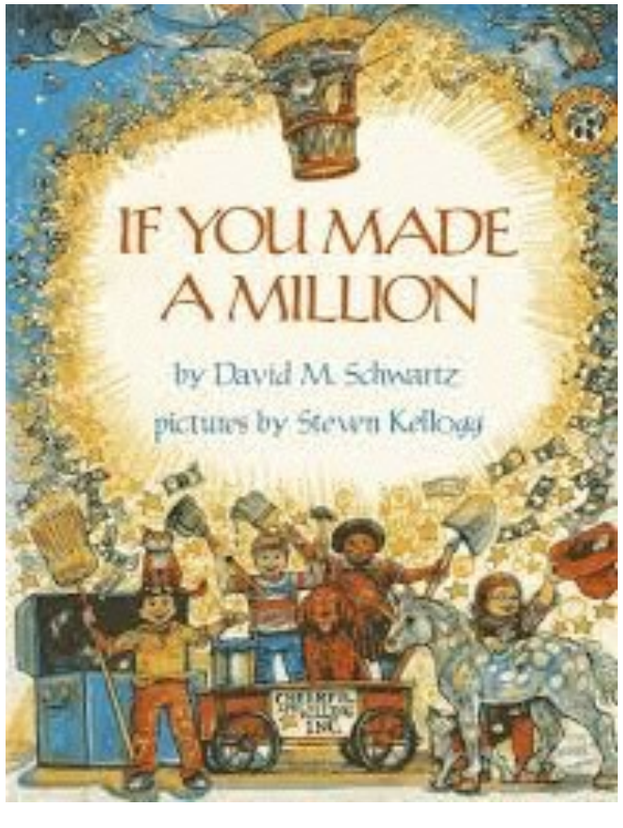

Our question
we are going to show how tall 100 log blocks is.
plan: we are going to stack them up

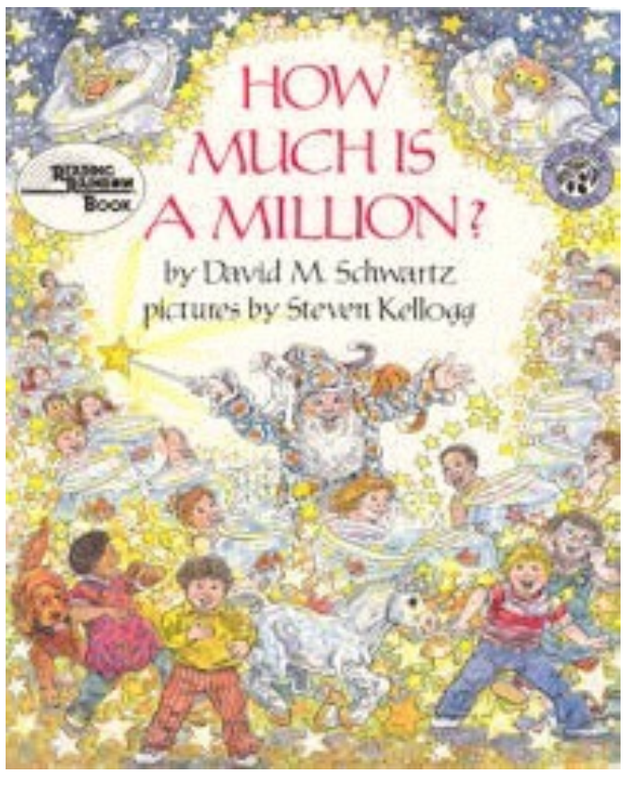

Our Question
We are going to show how tall is 100 Dominoes.
Plan
We are going to stack 100 Dominoes.
Answer
125cm
25cm=20 Dominoes
20cm 5cm
+20cm +5cm
+20cm +5cm
+20cm +5cm
+20cm +5cm
100cm 25cm
100cm+25cm=125cm

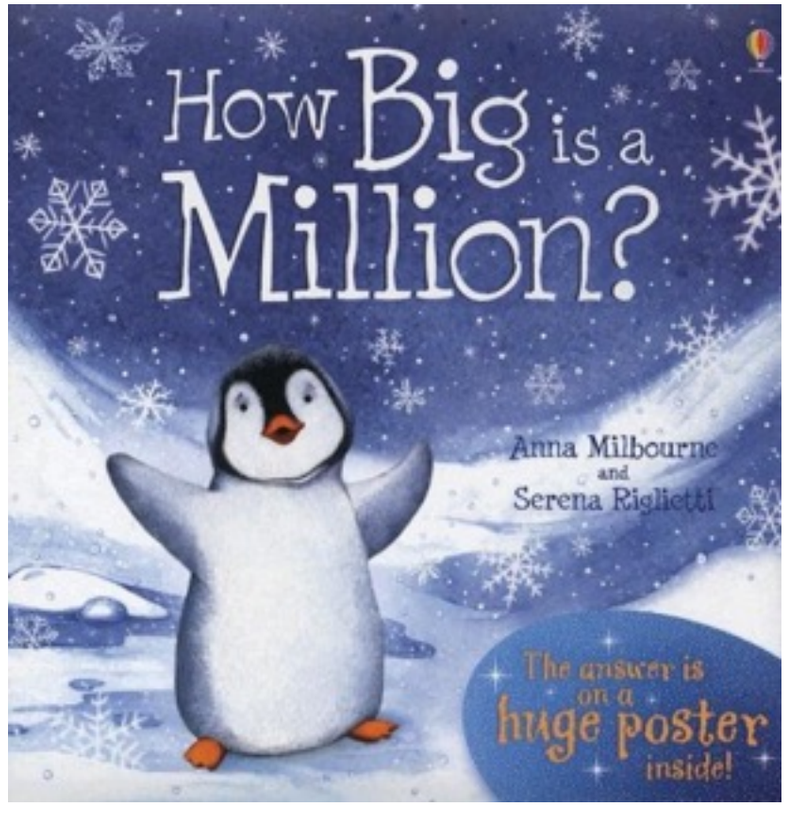

Our Question
We are going to show how far is 100 Meters from outside school door?
Our Plan
We are going to start from the door and start counting by using meters sticks connecti

NUMBER CONCEPTS: Magnitude

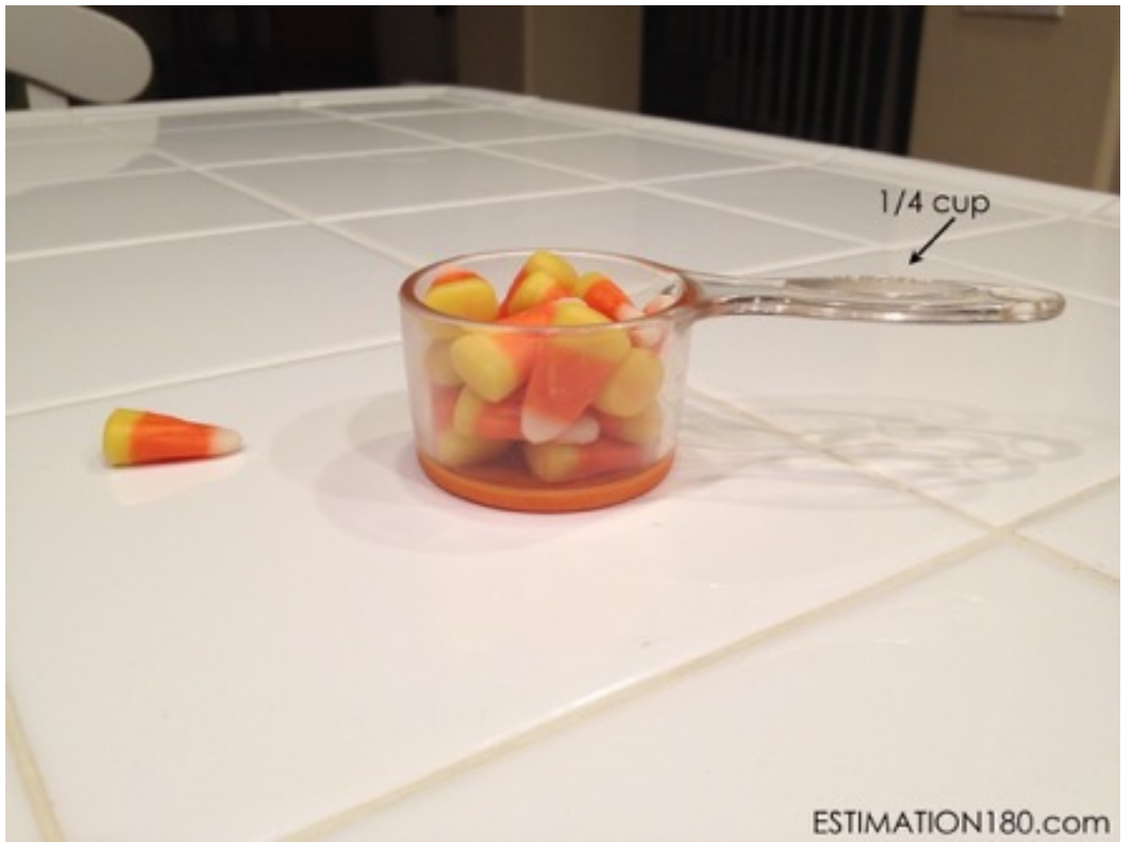
One million can be described as 1000 thousands. What are some other ways to describe a million beyond saying it is big.







NUMBER CONCEPTS: ESTIMATION



How many pieces of candy corn are in the cup?

What estimate would be too high?

Too low?

Draw the class range and mark your best estimate.

http://www.estimation180.com/

ESTIMATION 180

Building number sense one day at a time.

Search

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How many folders come in the box?

Day 21

How many envelopes come in the box?

Day 22

How many writing pads in the package?

Day 23

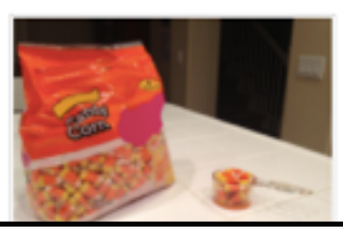
How many sheets of paper in the package?

Day 24

How many pieces of candy corn in the cup?

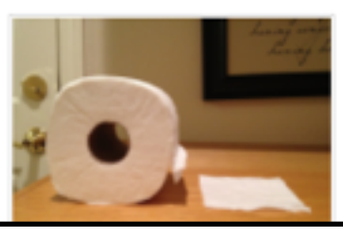
Day 25

How many candy corn come in the bag?



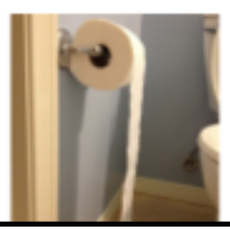
How many scoops of candy corn fill the jar?

How many sheets on the roll of toilet paper?



How many sheets on the smaller roll?

How long is the entire roll of toilet paper?



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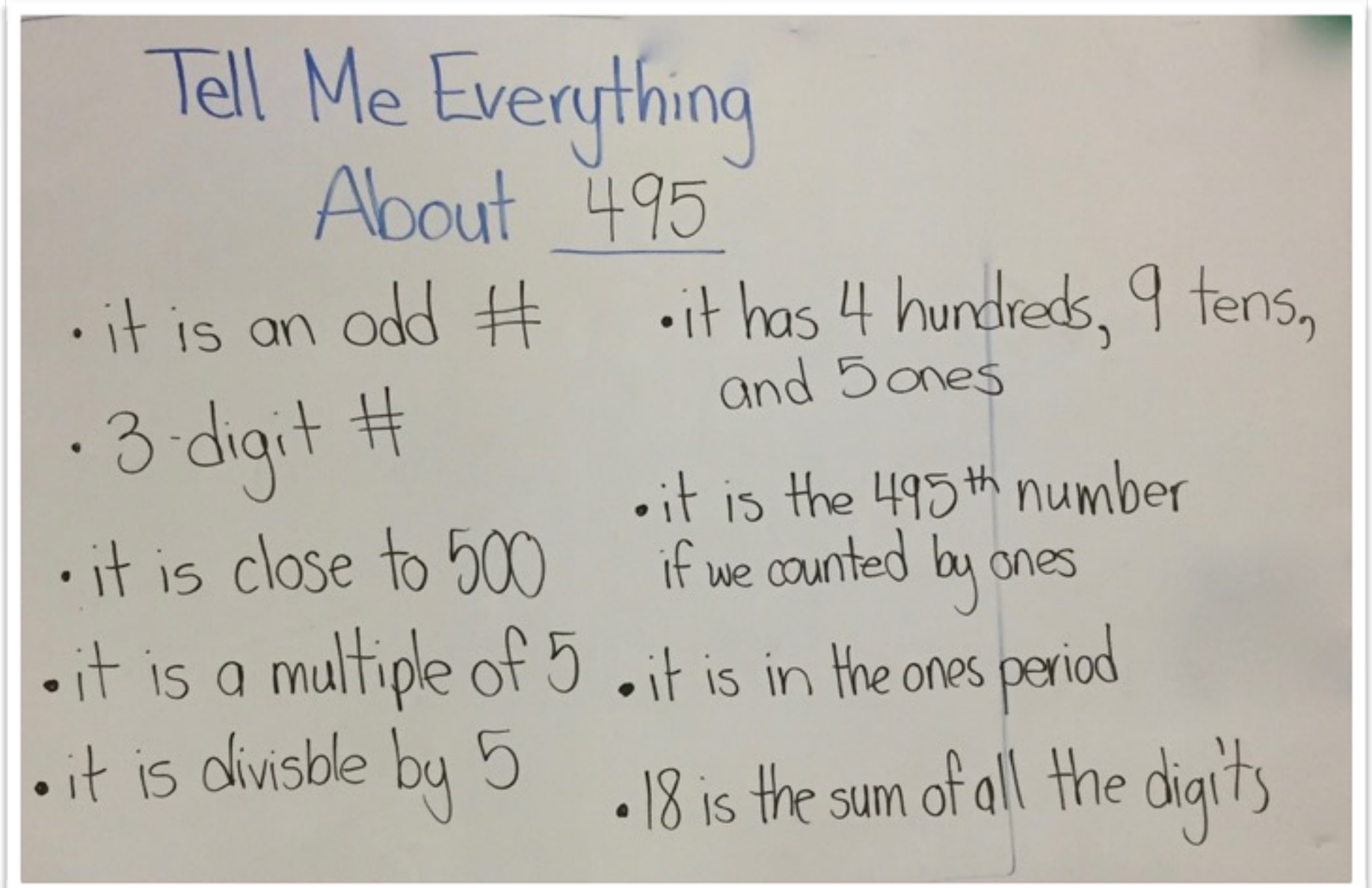
Tell Me Everything



Tell Me Everything About 1022

- it is close to 1000
- it is even
- it has 4 digits
- no one lives that long
- you could find it in a thousands chart.
- 5 is the sum of all the digits
- it has 1 thousand, 0 hundreds, 2 tens, 2 ones
- it is a multiple of 2
- it is divisble by 2
- that many muffins could feed our school
- it is a multiple of 7 and divisble by 7

Number Lines

- Build it, Fix It, Guess the Missing #'s

Key Resources:

Janice Novakowski's blog and Reggio-inspired work - See handout for links!

YOU ARE MAKING
A DIFFERENCE
EVERY
day.