Moving Achievement Together Holistically: The MATH Project

Dr. Lisa Lunney Borden, John Jerome Paul Chair for Equity in Mathematics Education

With support from Dr. Evan Throop-Robinson, Ellen Carter

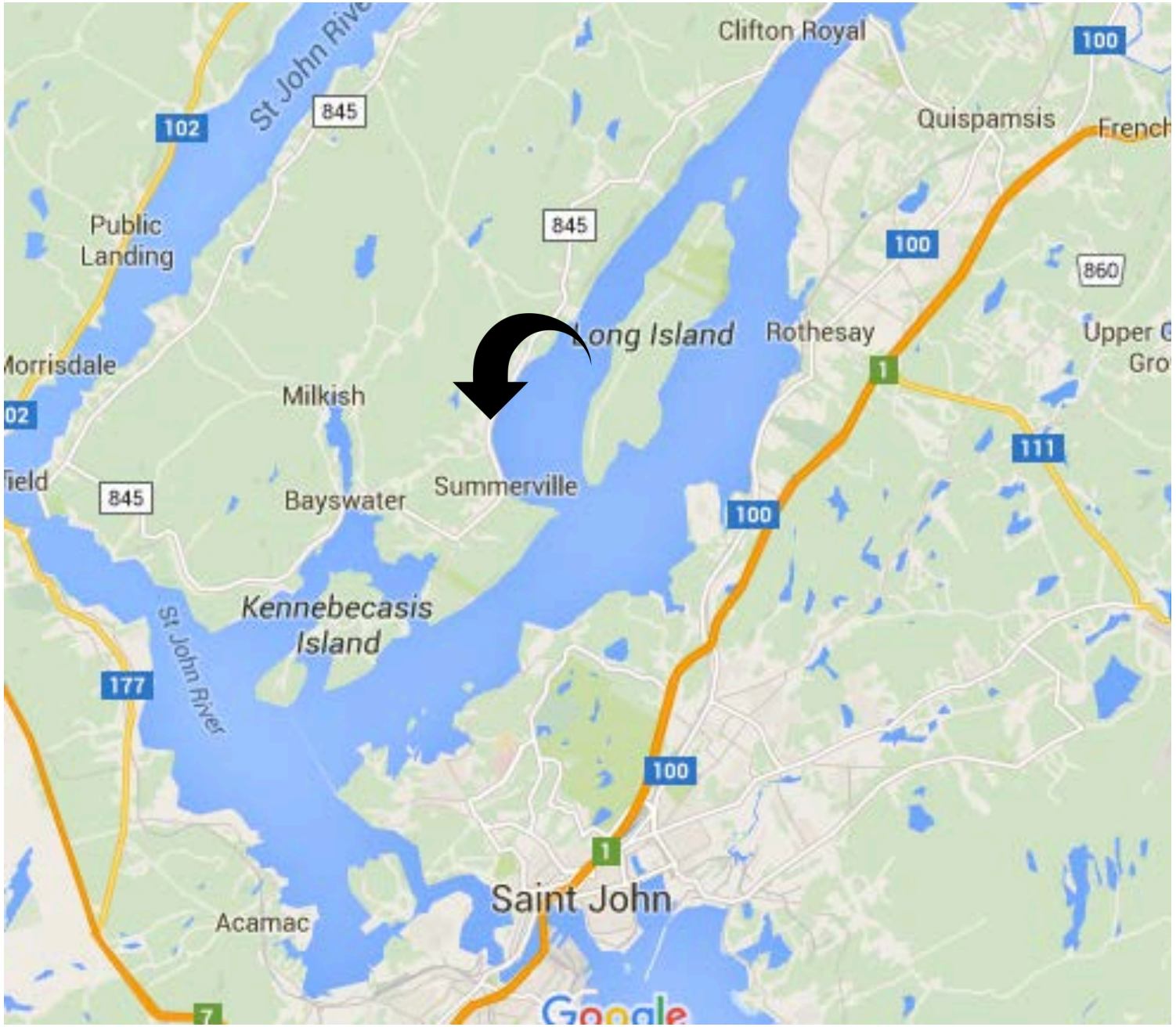
St. Francis Xavier University

https://bit.ly/3iQtZr6

@LLB_315

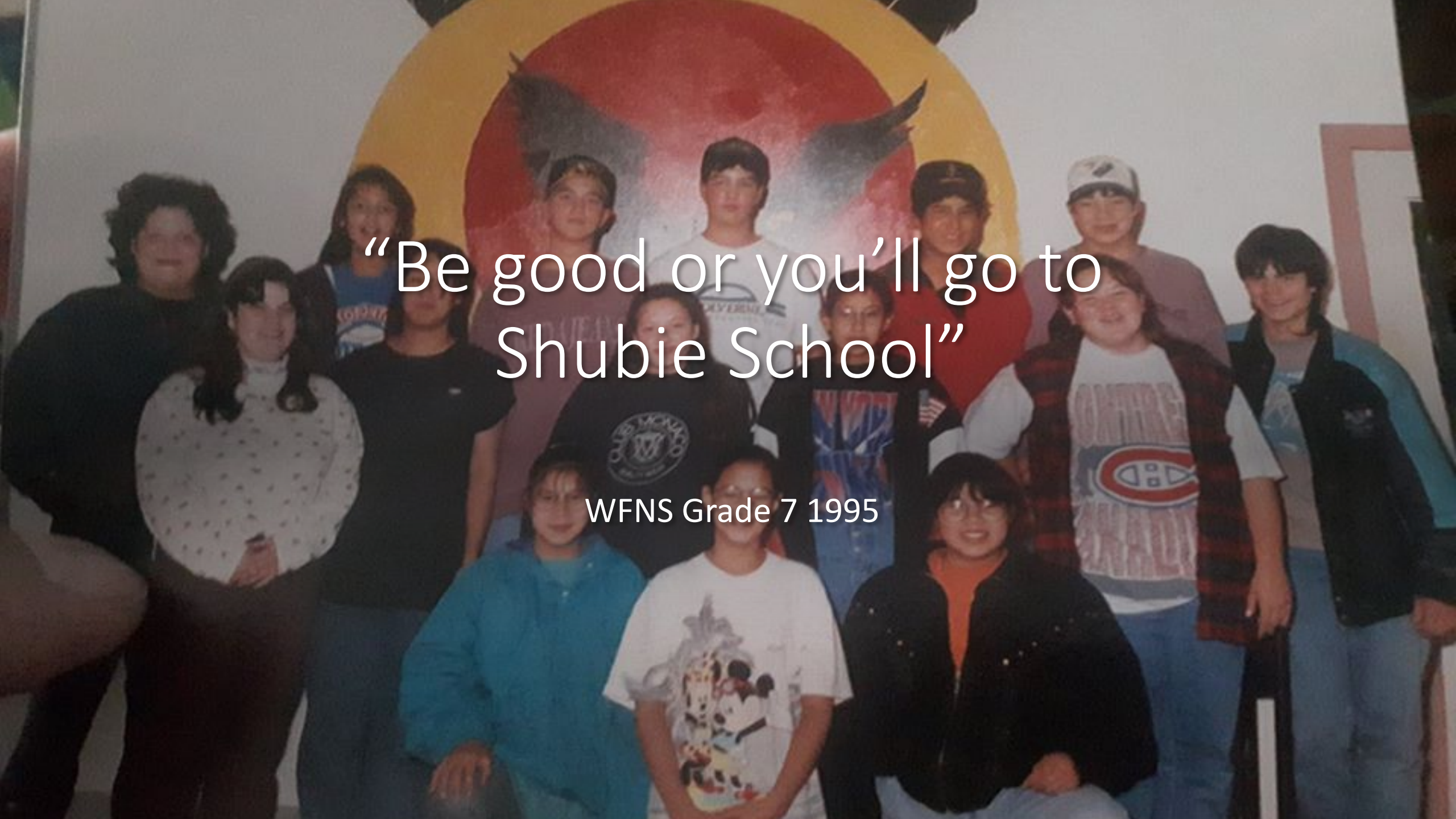
Positioning Myself…

- Wabanaki Confederacy: Mi’kmaw, Wulastoyiqik, Passemequody, Penobsquis
- Mi’kma’ki – 7 districts that lie to the East of the Wulastuk river (now known as the St. John River)
- Evidence to show the Mi’kmaw lived here for over 20,000 years
- Acadians settled in NS in the late 1500s and early 1600s
- Black Loyalists arrived in NB and NS in the late 1780s; having fought alongside the British in the war of Independence, they were granted land and freedom in Mi’kma’ki.


St John River
Clifton Royal
100
102
845
Quispamsis
French
Public
Landing
845
100
860
Long Island
Rothesay
Morrisdale
Milkish
1
111
845
Bayswater
Summerville
100
Kennebecasis
Island
St John River
177
100
1
Saint John
Acamac
Google

X-Project

Mi’kmaw Kina’matnewey



“Be good or you’ll go to Shubie School”

WFNS Grade 7 1995

How can Math Teachers Address the Call to Action of the TRC? How can we Decolonize?

- Understanding the role of Settler Colonialism on Education, including math education
  - As Tuck and Yang (2012) have stated, "Settler colonialism is different from other forms of colonialism in that settlers come with the intention of making a new home on the land, a homemaking that insists on settler sovereignty over all things in their new domain. […] In order for the settlers to make a place their home, they must destroy and disappear the Indigenous peoples that live there" (p. 5-6).
  - Cultural genocide is the destruction of those structures and practices that allow the group to continue as a group. States that engage in cultural genocide set out to destroy the political and social institutions of the targeted group. Land is seized, and populations are forcibly transferred and their movement is restricted. Languages are banned. Spiritual leaders are persecuted, spiritual practices are forbidden, and objects of spiritual value are confiscated and destroyed. And, most significantly to the issue at hand, families are disrupted to prevent the transmission of cultural values and identity from one generation to the next. (Truth and Reconciliation Commission, of Canada, 2015, p. 1)
- Recognizing the discourses that reinforce these ideologies
- Unlearning and Relearning

In our schools, whose math are we doing?

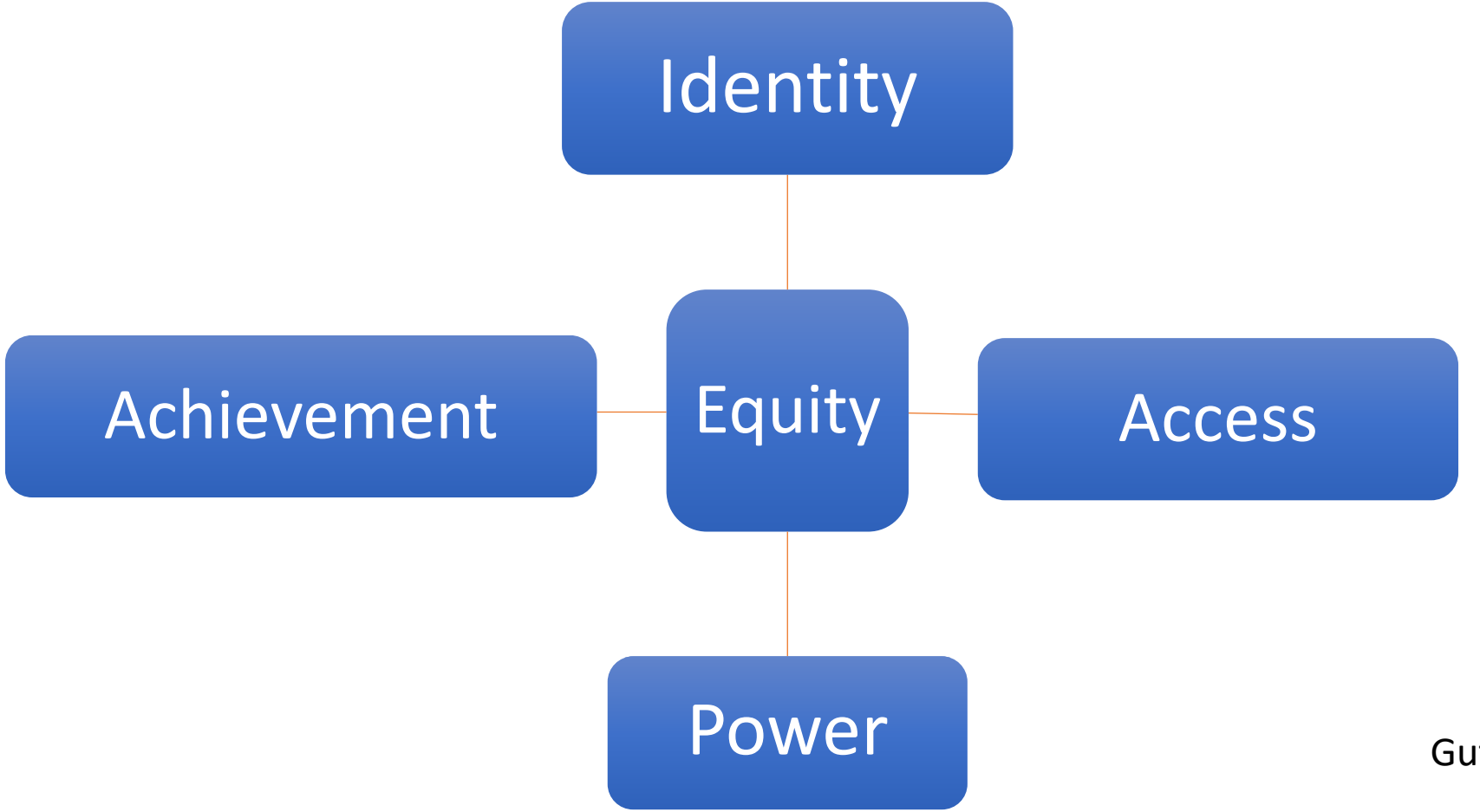
- “School mathematics curricula emphasizing terms like Pythagorean theorem and pi perpetuate a perception that mathematics was largely developed by the Greeks and other Europeans.” (Gutiérrez, 2017 p. 17)
- Joseph (2010) has argued that ideological beliefs about European superiority meant that “The contributions of the colonized peoples were ignored or devalued as part of the rationale for subjugation and dominance” (p. 4)
- Aikenhead (2017) has referred to this phenomenon as “mathematics myth blindness” (p.121) and pointed out that mathematics’ “privileged status rests on the myth that its Platonist content is acultural, universalist, value free, objective in its use, and nonideological” (p.121).
- Reconciliation and decolonization ask us to address this inequity in mathematics education. We need to tell different stories.

2. **a)** Write a linear system to model this situation:
A store sold Inukshuk replicas made with either 6 or 7 stones.
The total number of stones in all Inukshuit sold was 494. The store sold 13 more Inukshuit made with 6 stones than those made with 7 stones.
b) Solve this problem: How many of each type of replicas were sold?

9. Talise folded 545 metal lids to make cones for jingle dresses for herself and her younger sister. Her dress had 185 more cones than her sister's dress. How many cones are on each dress?

11. Louise purchased a Métis flag whose length was 90 cm longer than its width. The perimeter of the flag was 540 cm. What are the dimensions of the flag?

What textbook companies think reconciliation looks like…They're wrong!



Gutiérrez (2012)

Redefining Equity

Dianne’s Quill Boxes

- The late Dianne Toney was a Mi’kmaw elder who made quill boxes like the on in the picture. She always made them by starting with a circle of bark for the top on which she made her pattern. She would always start at the centre of the circle to make her pattern. After that she would make the ring for the top from strips of wood. To ensure the ring was the right size, Dianne said she would measure three times across and add a thumb. She claimed this would make a perfect ring every time.

- Does this always work?
- https://teacher.desmos.com/activitybuilder/custom/563159e8adf49b1e06d63c4a

Show Me Your Math!

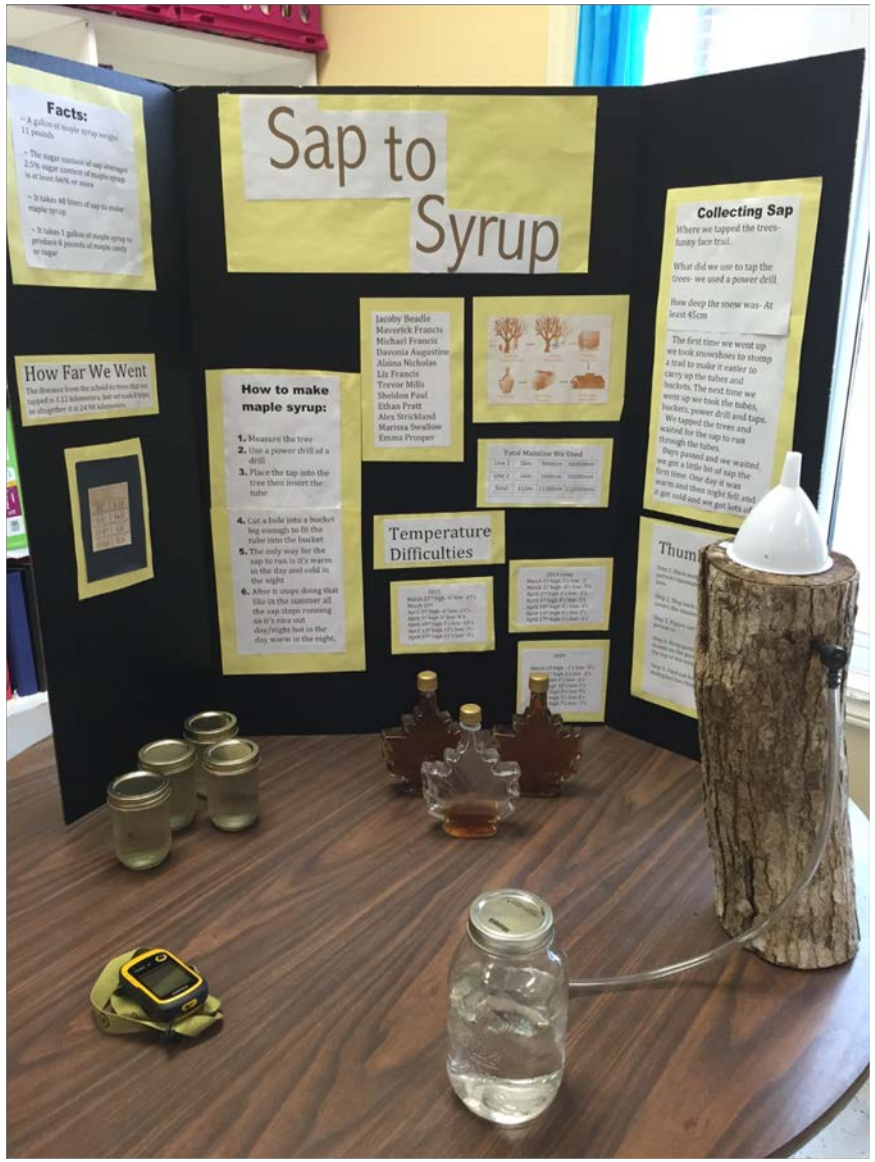
- Began in **2007**
- Inviting Children to be the mathematics researchers
- Where is the math in your community?
- Local Math Fairs
- Annual Regional Math Fair

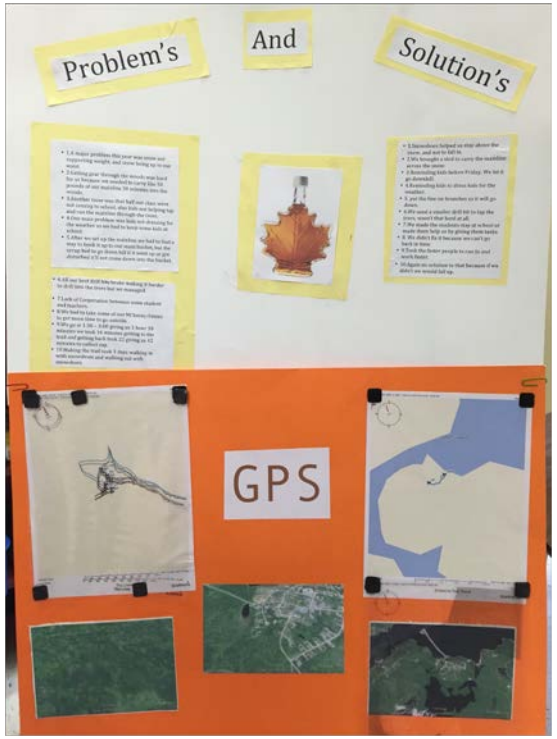
“I’m the last one who can do this…”

- Picture from: http://www.danielnpaul.com/MargaretGrannyJohnson.html

Birch bark biting… “I remember Auntie Caroline doing that at the basket shop”

Maple Syrup Making…





Making a Drum…

Making a Canoe paddle… “It made me feel real Mi’kmaq making my own paddle.”

Wholeness

- Wholeness resists fragmentation, thus quality mathematics experiences require *cultural synthesis* bringing together cultures and values from mathematics and the community, *personal holism* including the child's experiential, conceptual, and spiritual development, and *intergenerational interaction*. (Lunney Borden & Wagner, 2011)

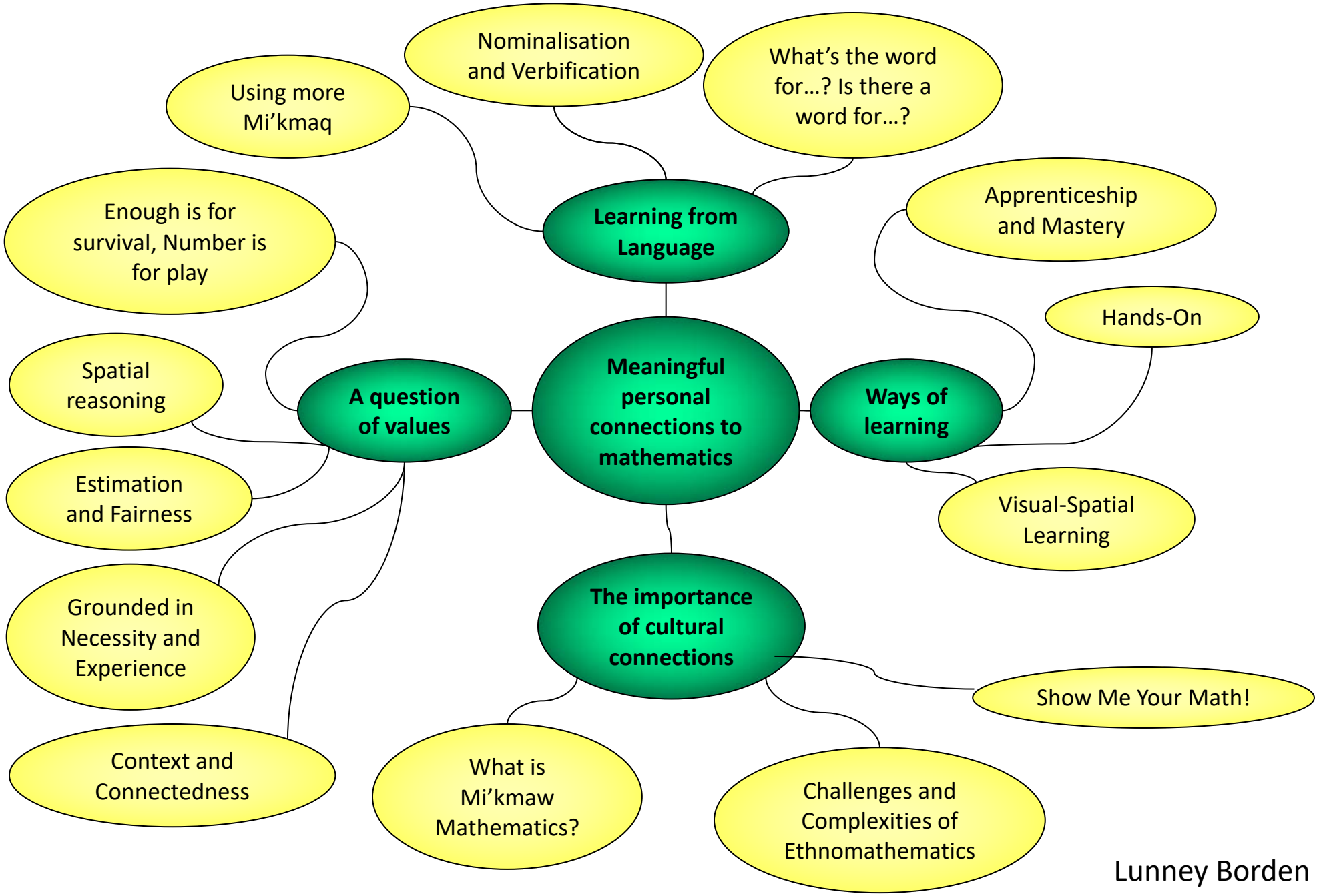
Reconciliation

- **Goal is to "restore what must be restored, repair what must be repaired, and return what must be returned"** (Truth and Reconciliation Commission of Canada, **2015**, p. 6).

L’nui’ta’simk

“Within mathematics education, we have convinced ourselves that “equity” is a strong enough agenda when maybe revolution should be the goal.” Gutiérrez, 2017, p. 11

Often we believe ethnomathematical investigations alone are enough, but they are not. We must also consider ways in which we can teach math with and through Indigenous ways of knowing, being and doing – L'nui'ta'simk!



Lunney Borden 2010

Research Question:

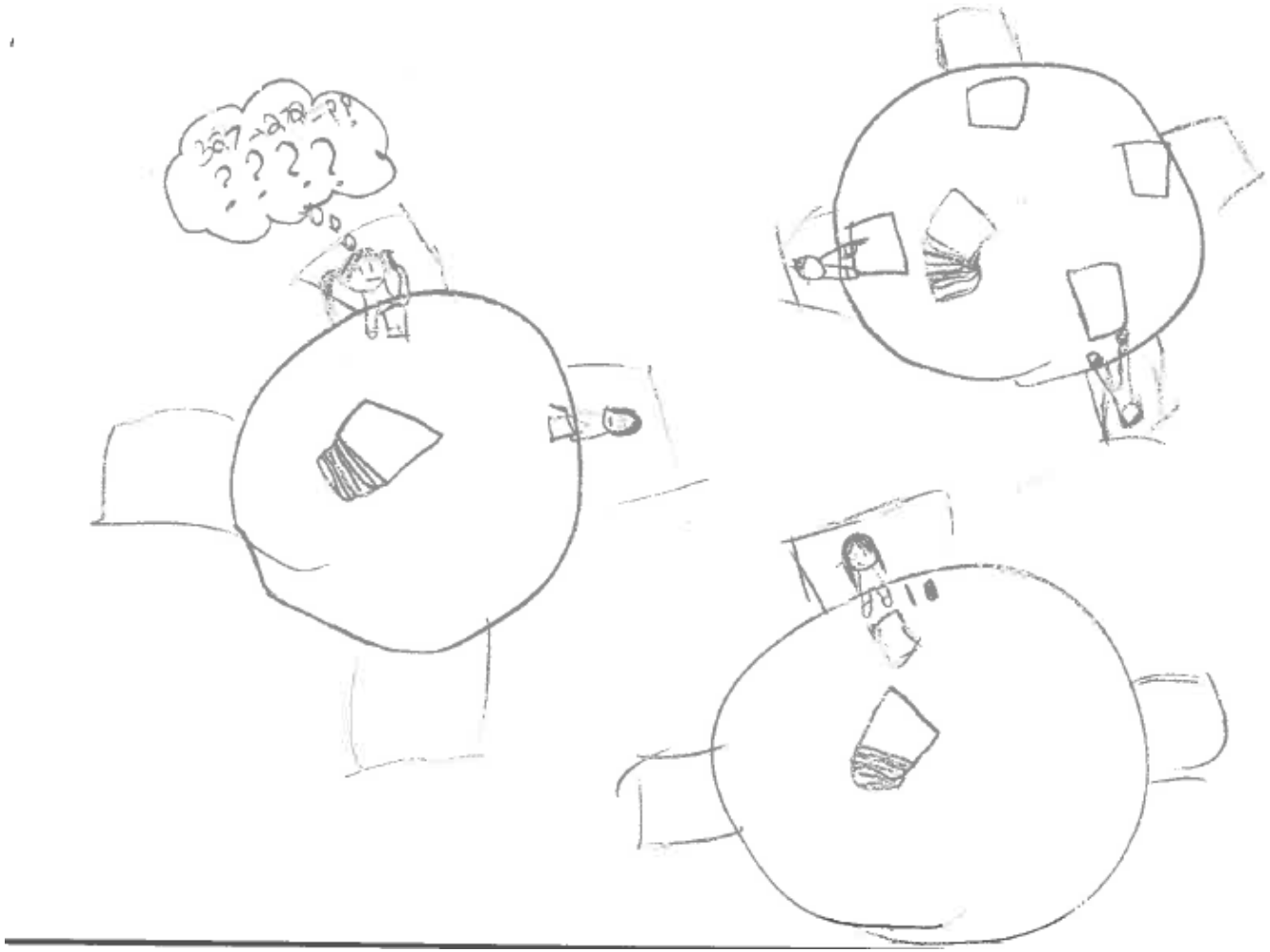
- How can the implementation of the Mawikinutimatimk Framework (Lunney Borden, 2010) for transforming mathematics education in Mi'kmaw communities contribute to increased achievement in these schools across different school contexts serving Mi'kmaw children?
  - How does the professional learning support teacher development? How does the implementation vary across the different contexts?
  - What types of learning and assessment tasks help to improve student learning across these contexts?
  - How do students respond to this approach to learning mathematics in the varying contexts? Does this approach improve engagement and attitude toward learning mathematics?
  - How does the involvement of elders and community knowledge holders in professional learning and classroom teaching support teacher learning and student learning across these contexts?

Our Current Focus

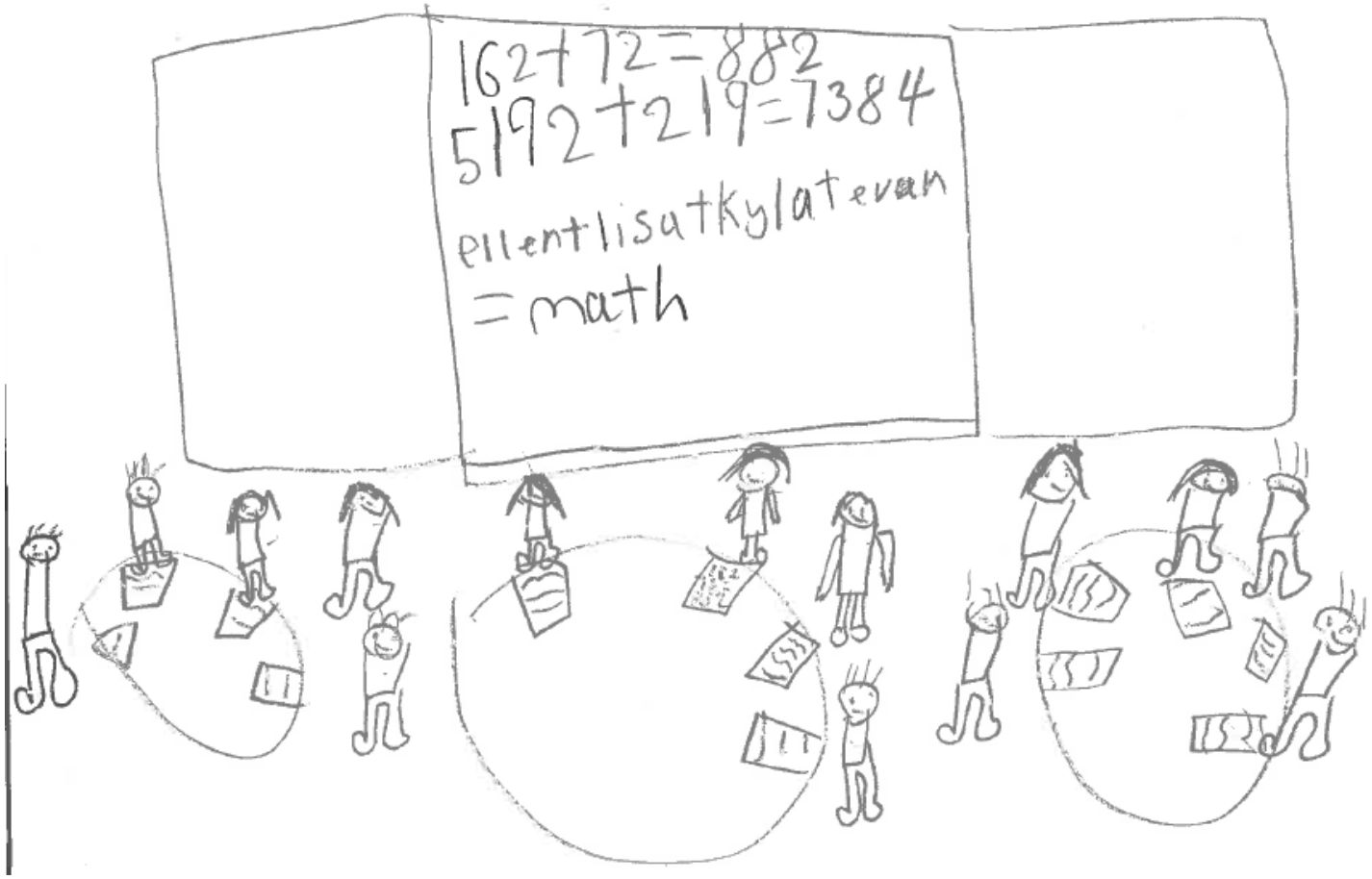
- Working alongside teachers to help them develop an understanding of the model and consider the implications for teaching and learning
- Verbing and Spatializing Math Teaching and Learning
  - Designing tasks and noticing how students engage with those tasks
- Understanding students perceptions of mathematics
- Working with MK on developing a holistic assessment and learning tasks that support our overall goals (Currently just grade 1)

Grade: 3

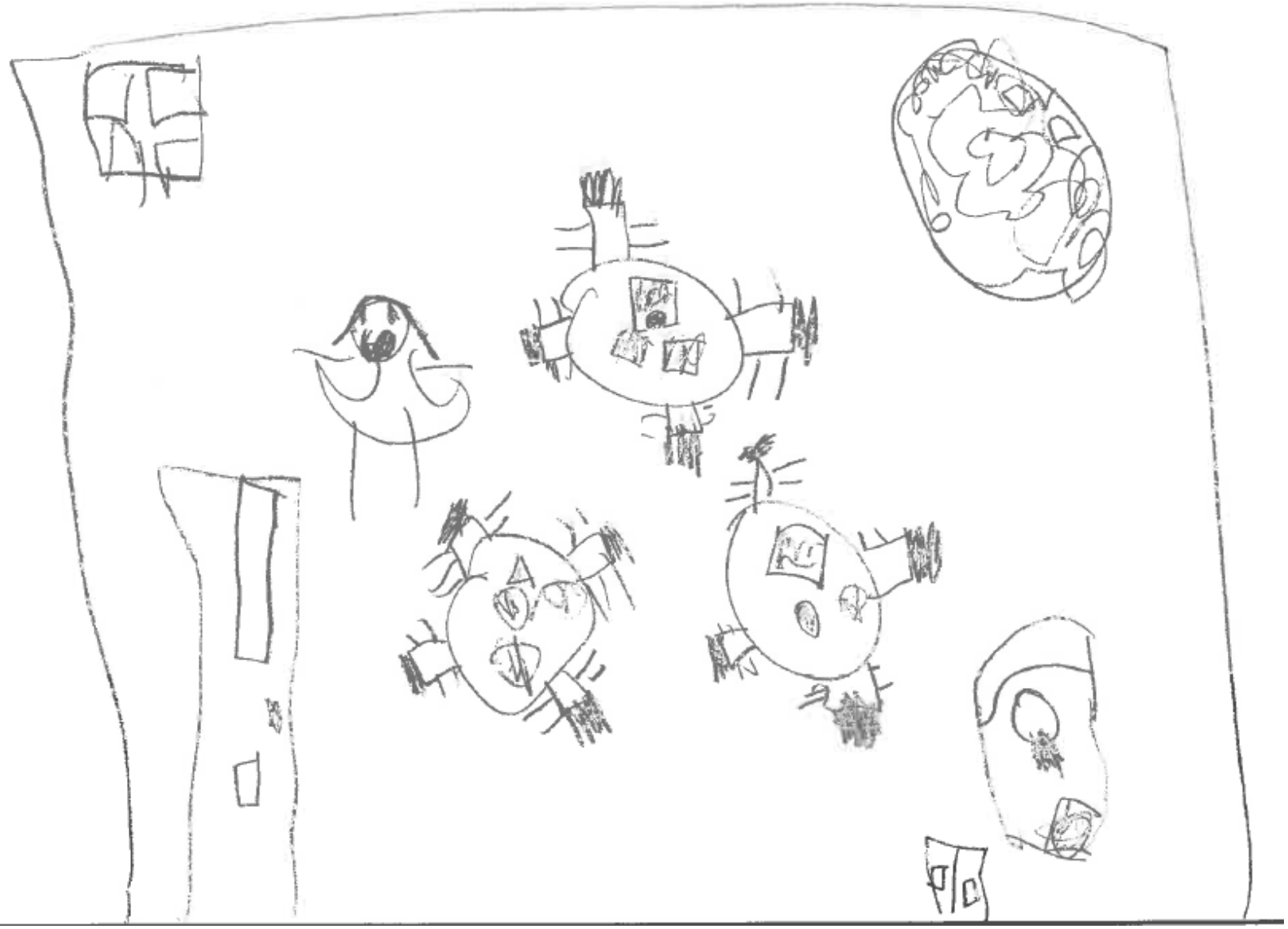
A Picture of Me Doing Math

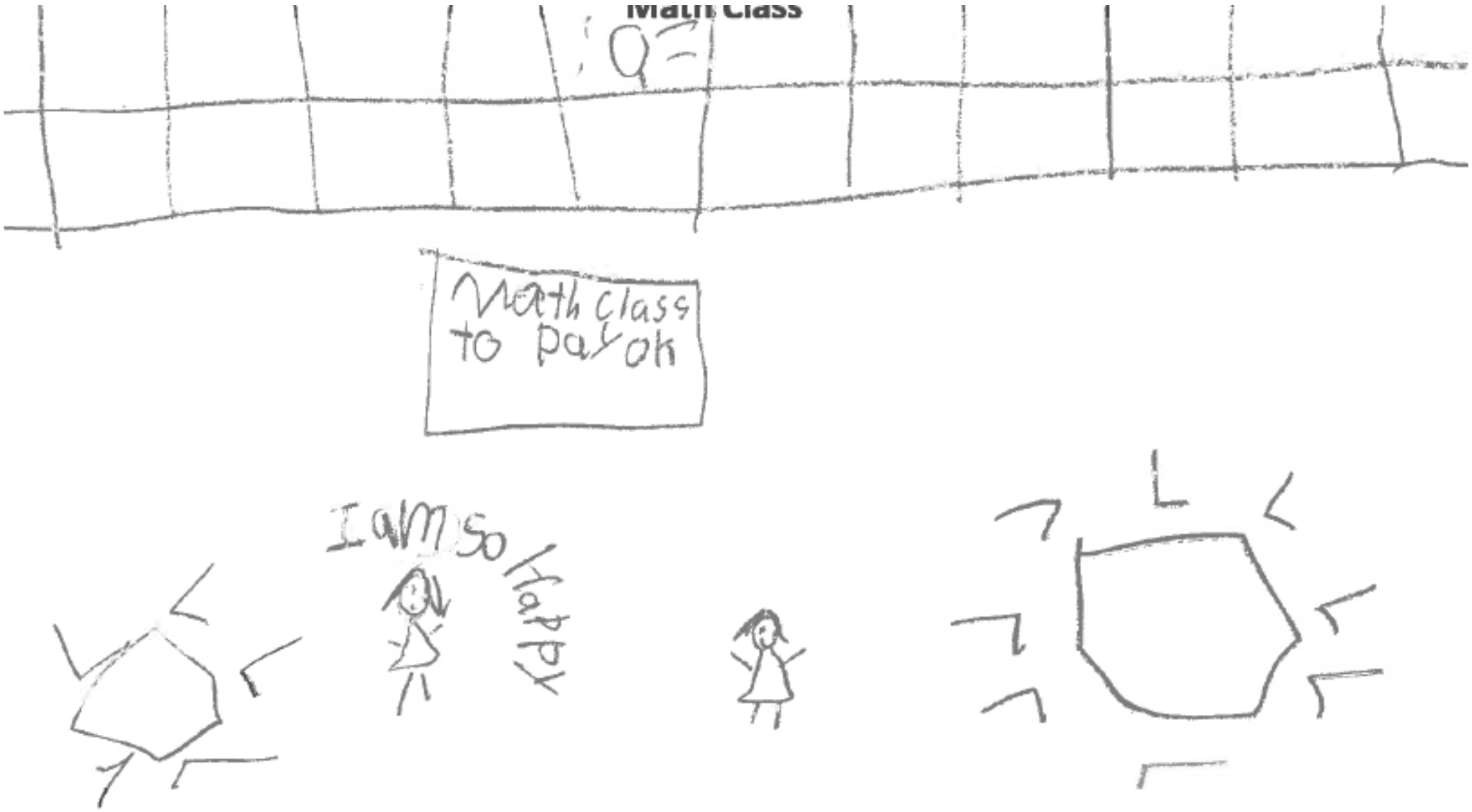


Math Class

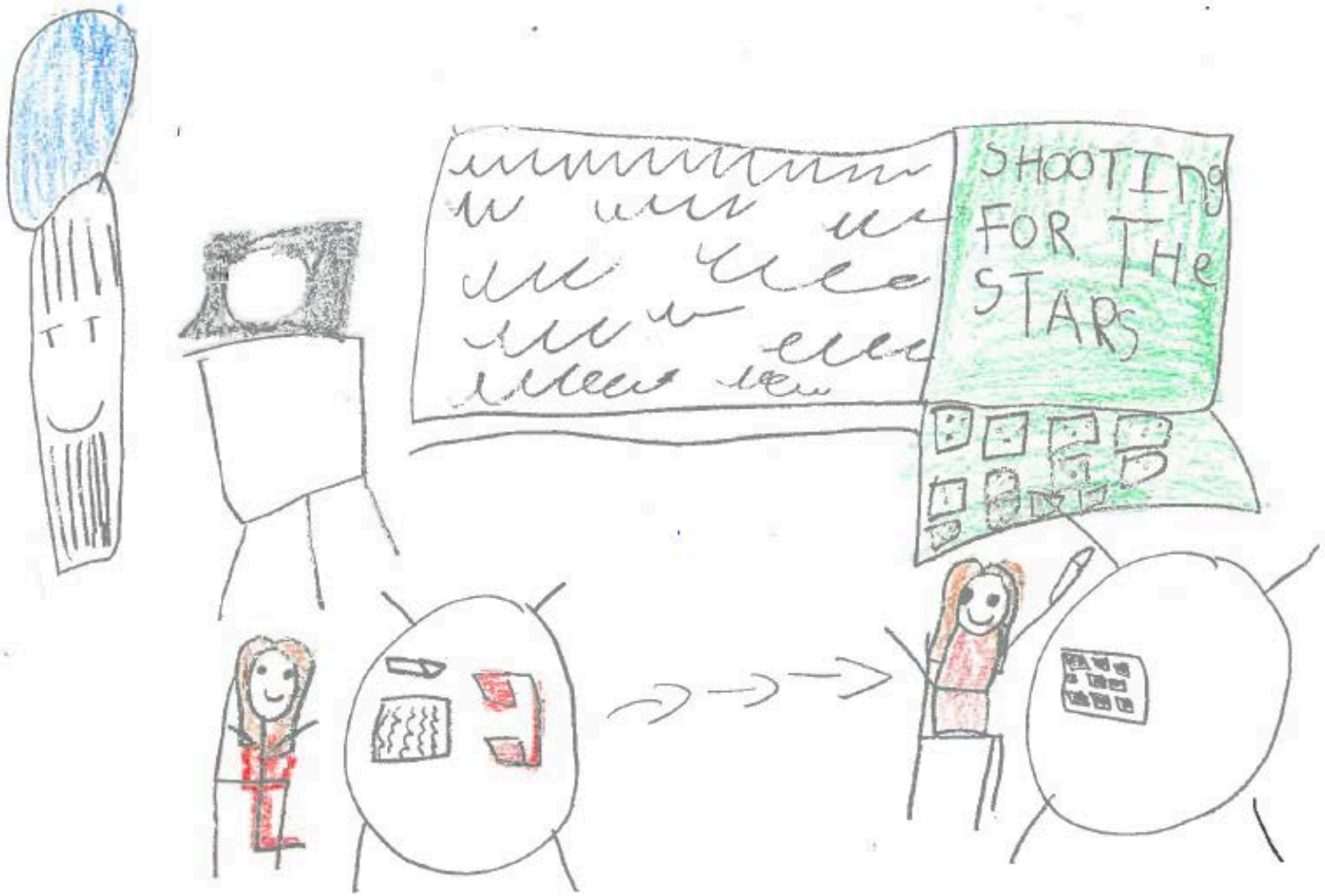


Math Class



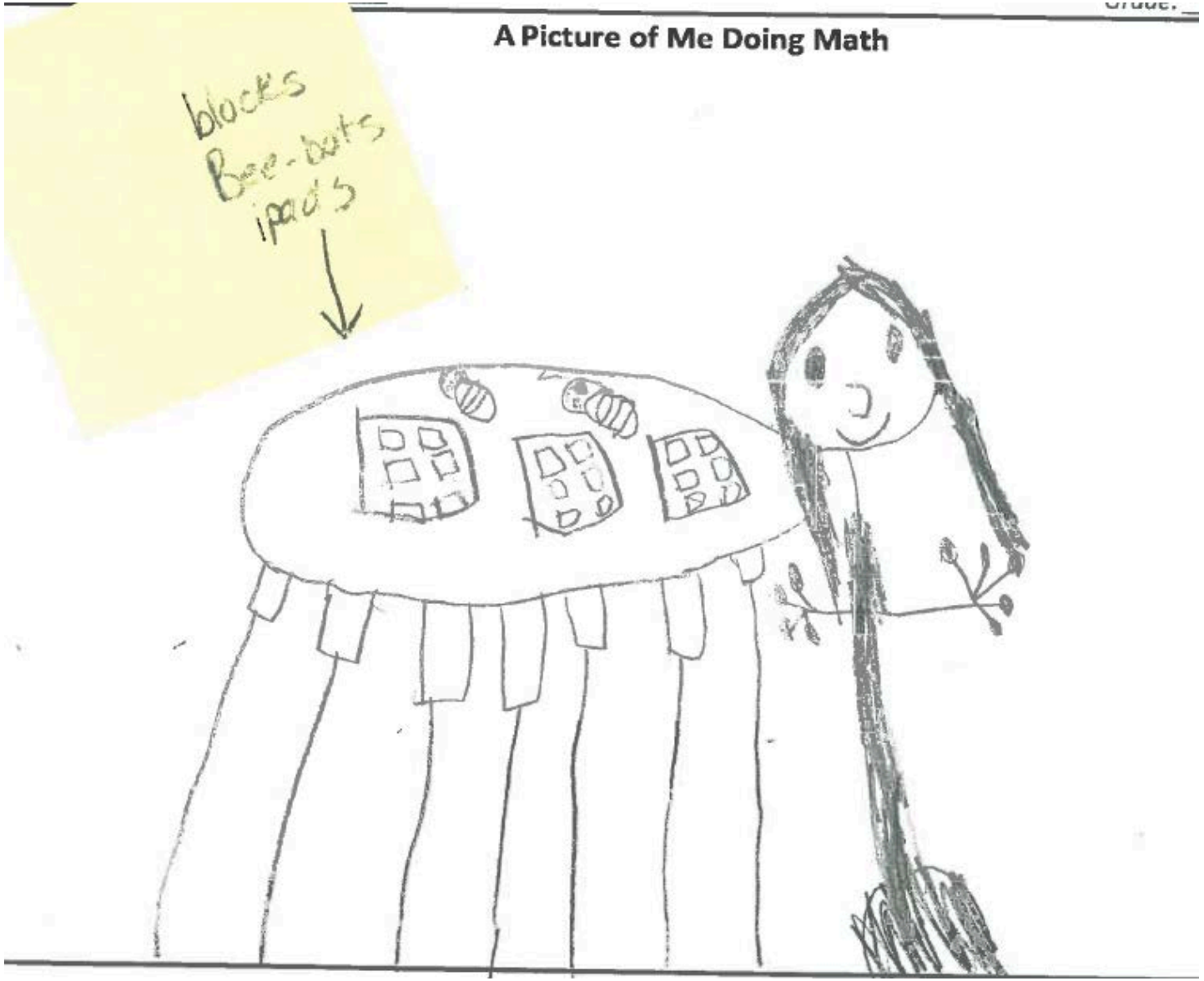

Math Class
Math class
to park
I am so
Happy

A Picture of Me Doing Math



Grade: _

A Picture of Me Doing Math

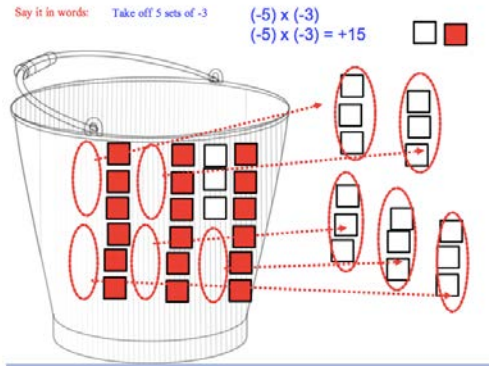


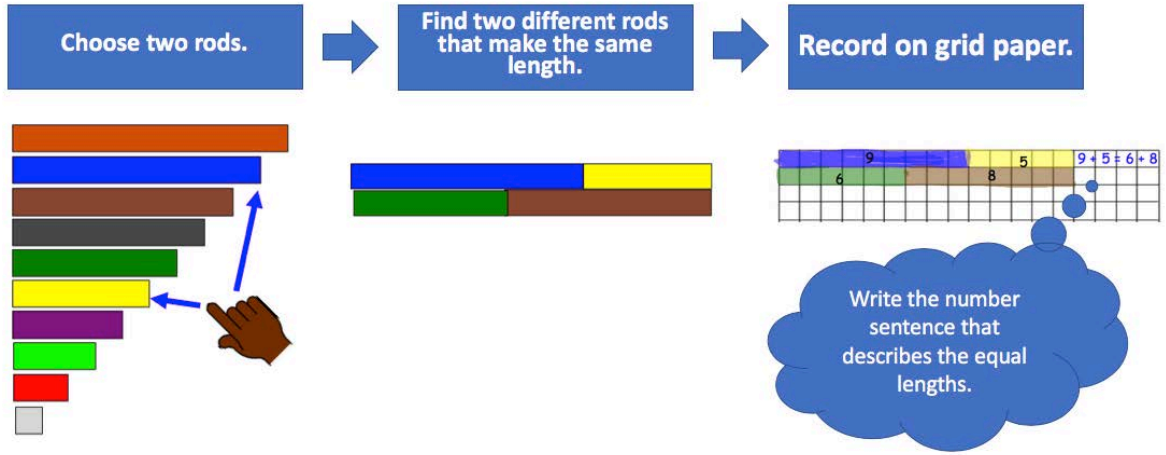
Findings

- Shared drawings with participating teachers to have them co-analyse with us;
- The emphasis on learning centres
  - Classes were collaborative
  - Children saw math as engaging in multiple modes of learning a concept in centres
  - Teachers believe that centres are the best way to teach as it gives them freedom to work individually or in small groups with students
  - Teachers couldn’t imagine any other way of teaching

Verbing

- Focus on change/motion
- How do I make it?
- What happens if…?
- How is it changing?





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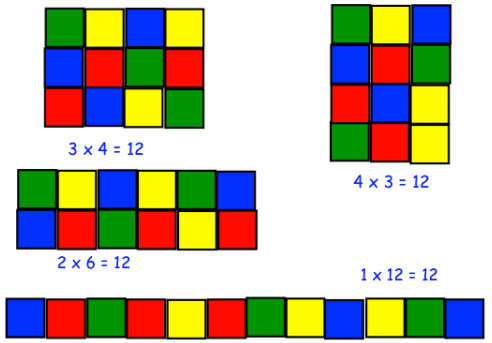
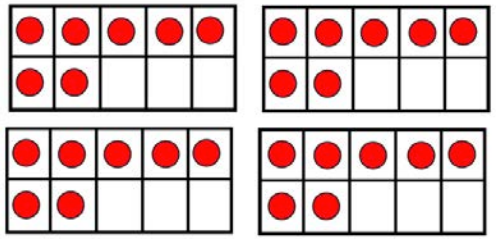
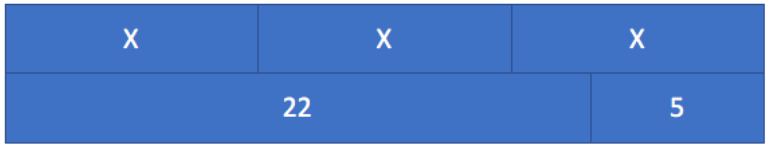
Spatializing

- Linear
- Set
- Area
- Hold it in your hand





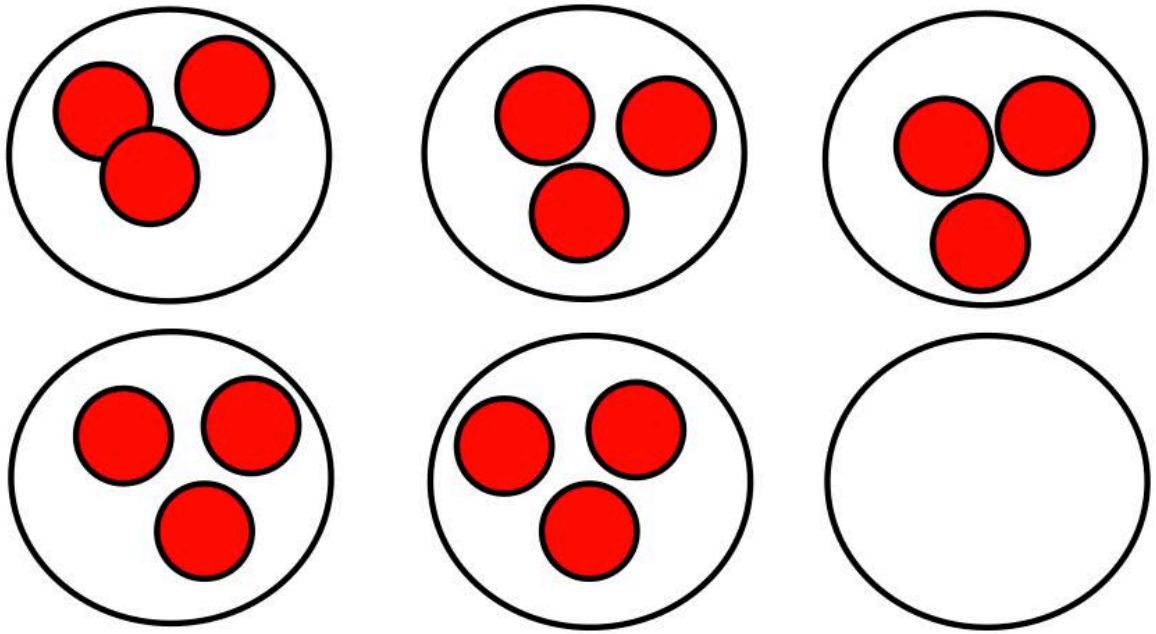
X + 11 = 36

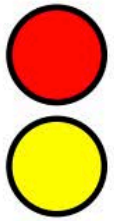


3x - 5 = 22

Build 5 sets of 3.

Roll two dice to find the numbers for the blanks.



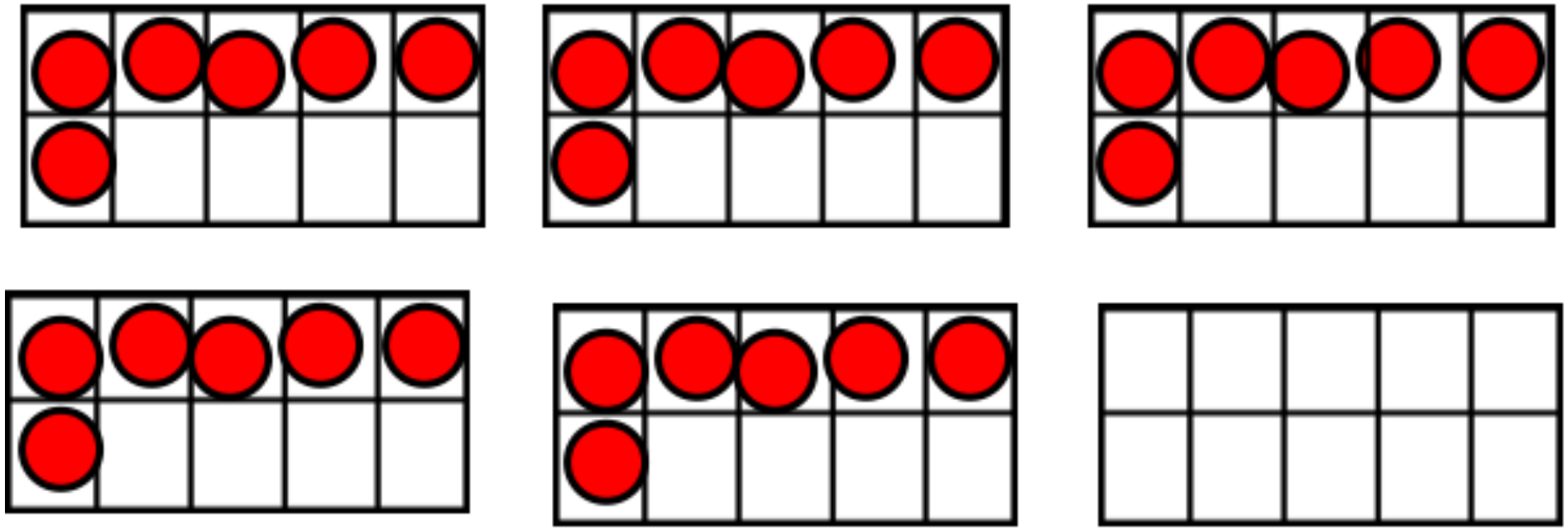


Record your results on the recording sheet.

5 sets of 3 is 15.

Build 5 sets of 6.

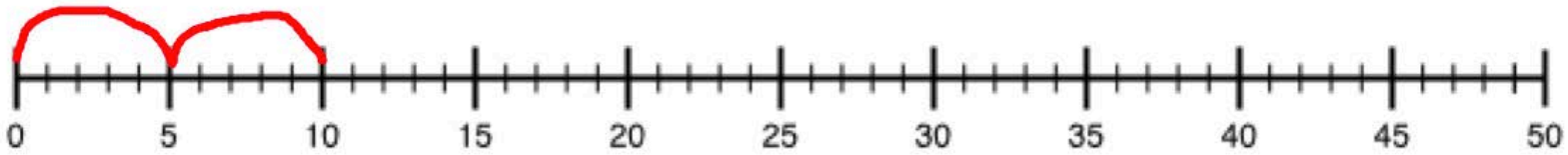
Roll two dice to find the numbers for the blanks.



Record your results on the recording sheet.

Take 2 jumps of 5.

Roll two dice to find the numbers for the blanks.

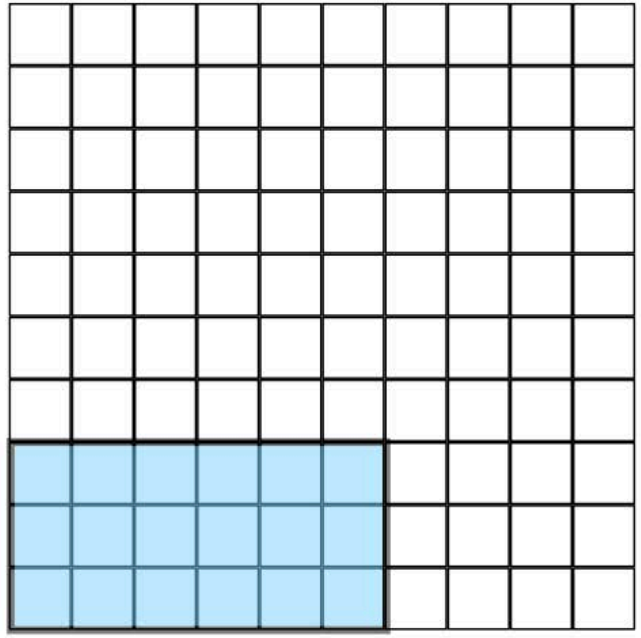


2 jumps of 5 is 10.

Record your results on the recording sheet.

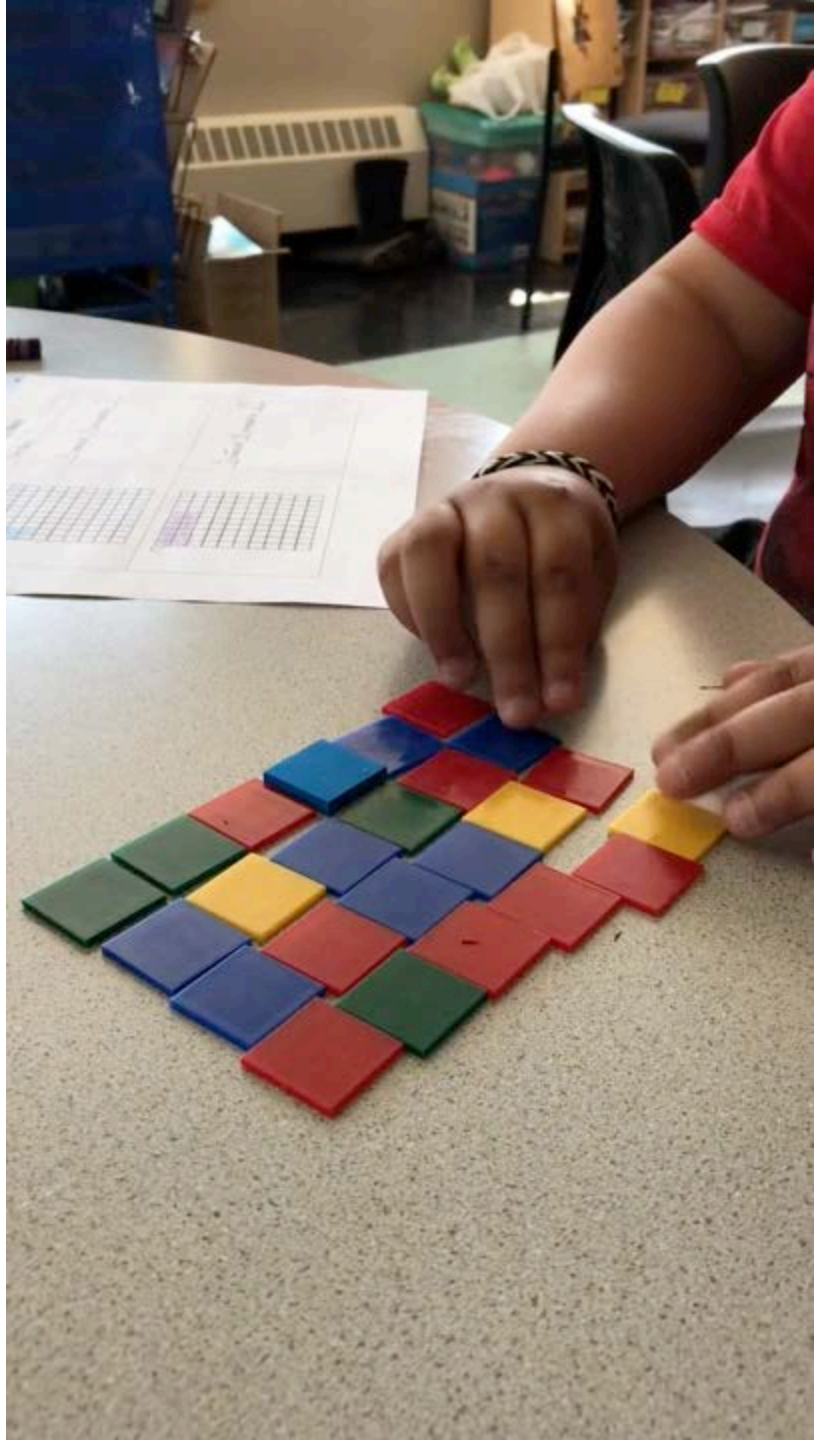
Shade 3 rows of 6.

Roll two dice to find the numbers for the blanks.



Record your results on the recording sheet.

3 rows of 6 is 18.



https://photos.app.goo.gl/4gRnSeNBhzeZW8vw5

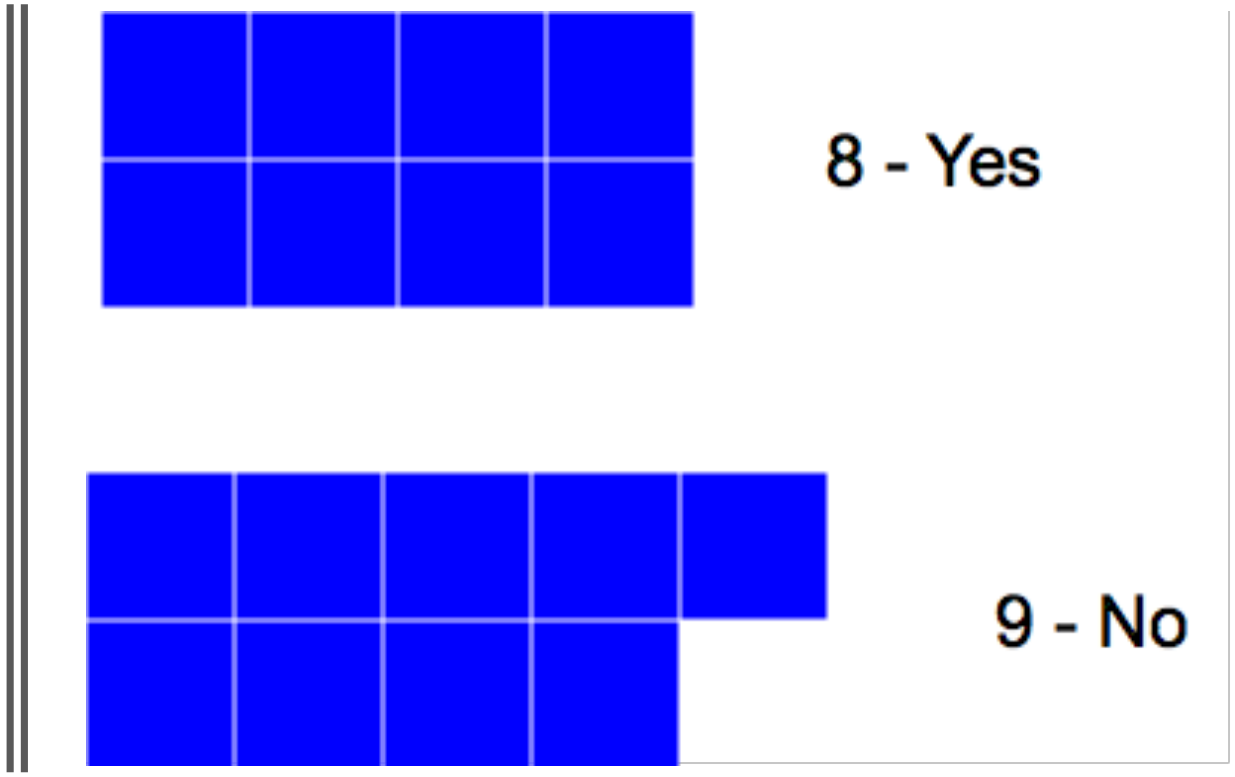
https://photos.app.goo.gl/XYpS3uQZkrRLo3Nh6

Findings from this series of tasks

- Using the “of” language with actions of building allowed students to engage with the tasks and allowed us to see strategies for working with multiplication concepts;
- Transferred building approach from sets of to story problems;
- Coming to know in their own ways, using their own descriptions
  - “I built it 4 times, I built this 3 times…wait, this is just times…You guys! This is just times!”
- When we figure it out we name it!
- Teacher designed similar tasks for introducing multiplication
- Centres allow for exposure to various strategies; Story problems allow for selection of preferred or efficient strategies & appropriate models tofir the story context

Can you organize it in two equal rows?

14	24	19
25	17	28
18	21	32



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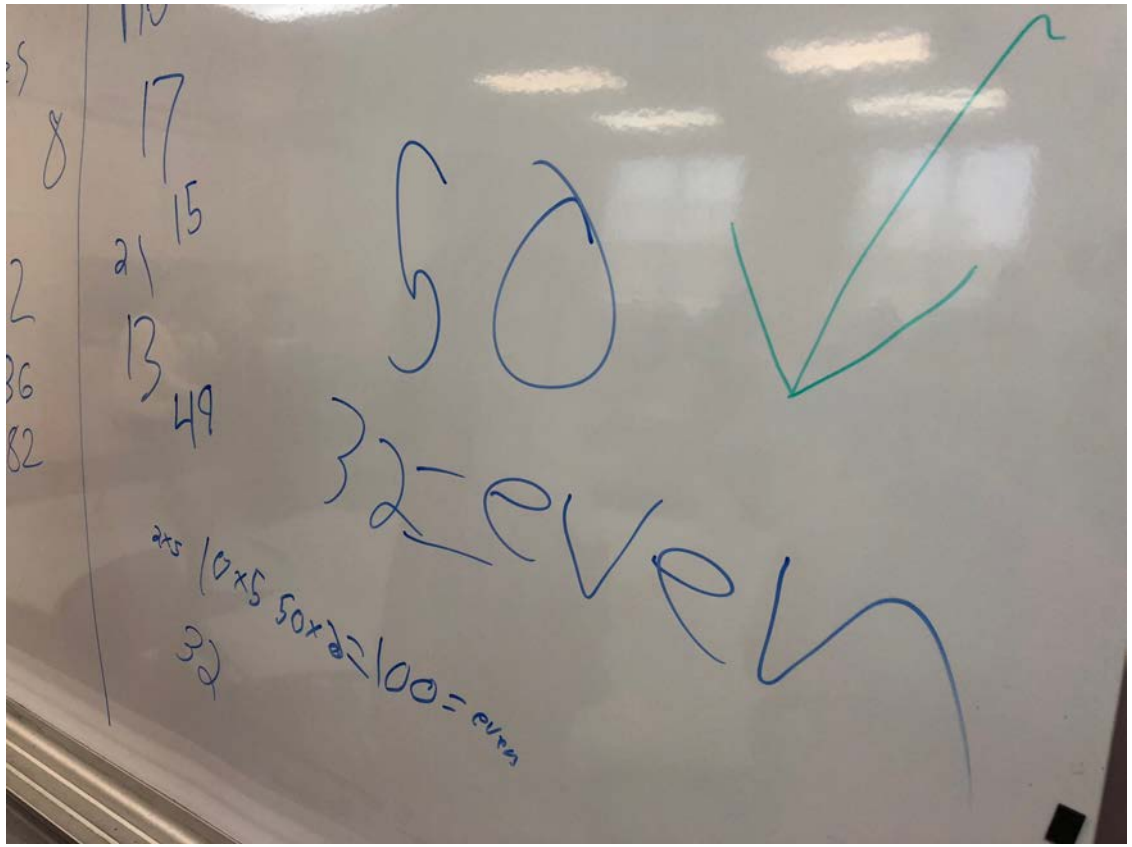
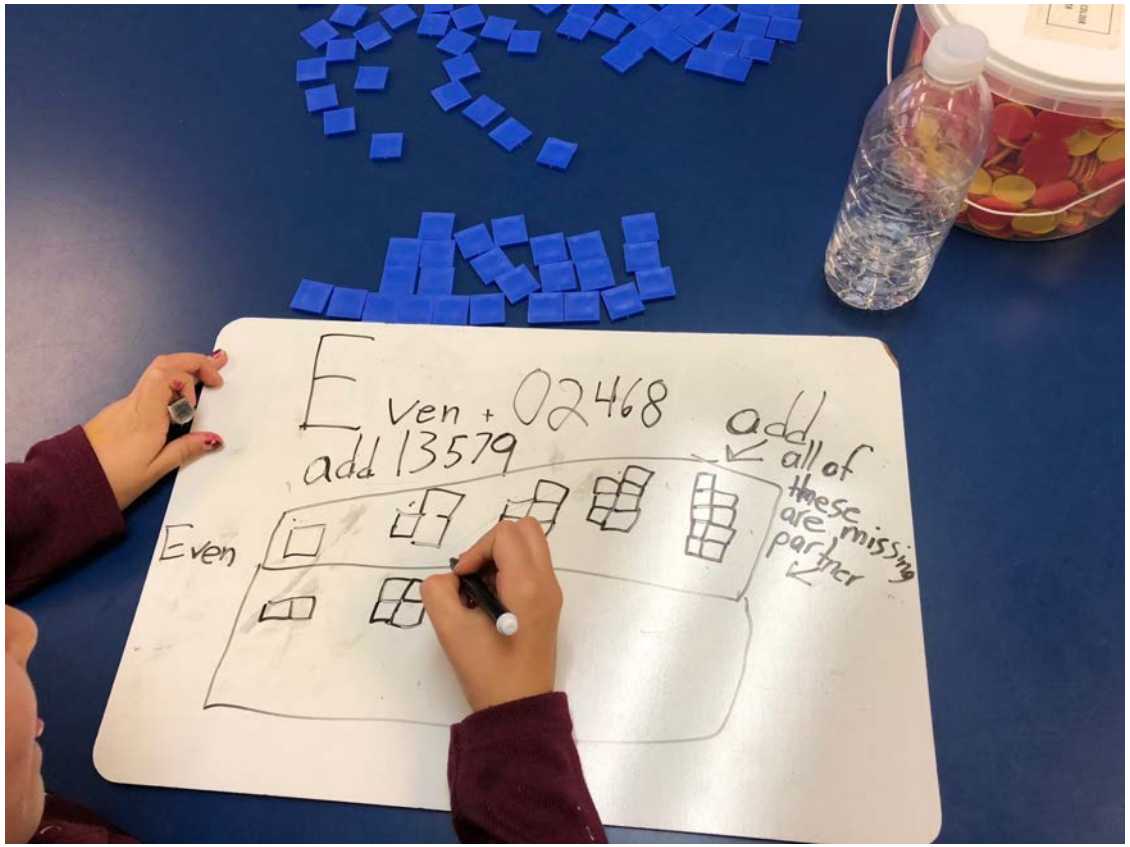
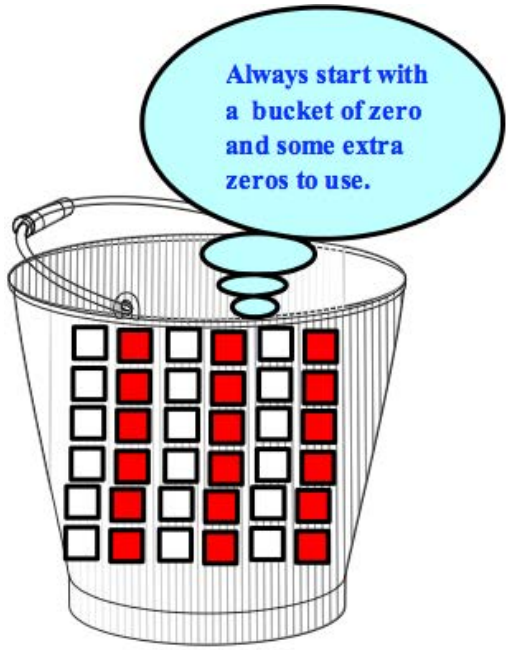
Proof and Conjecture

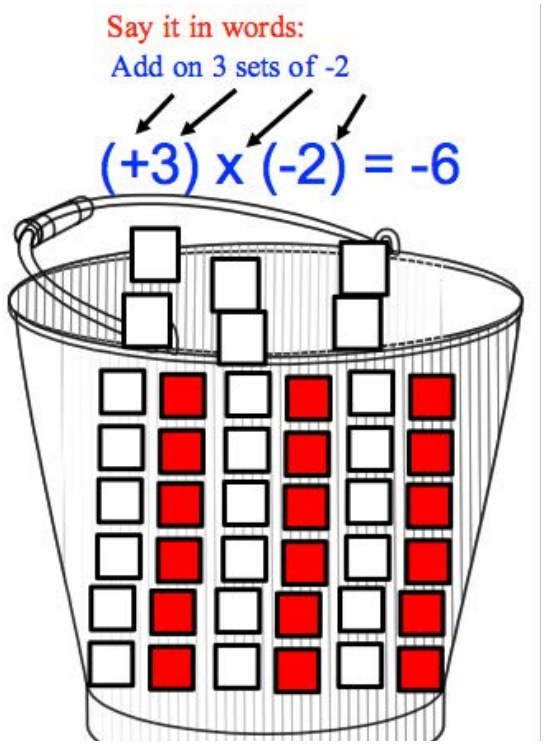




Multiplying Integers

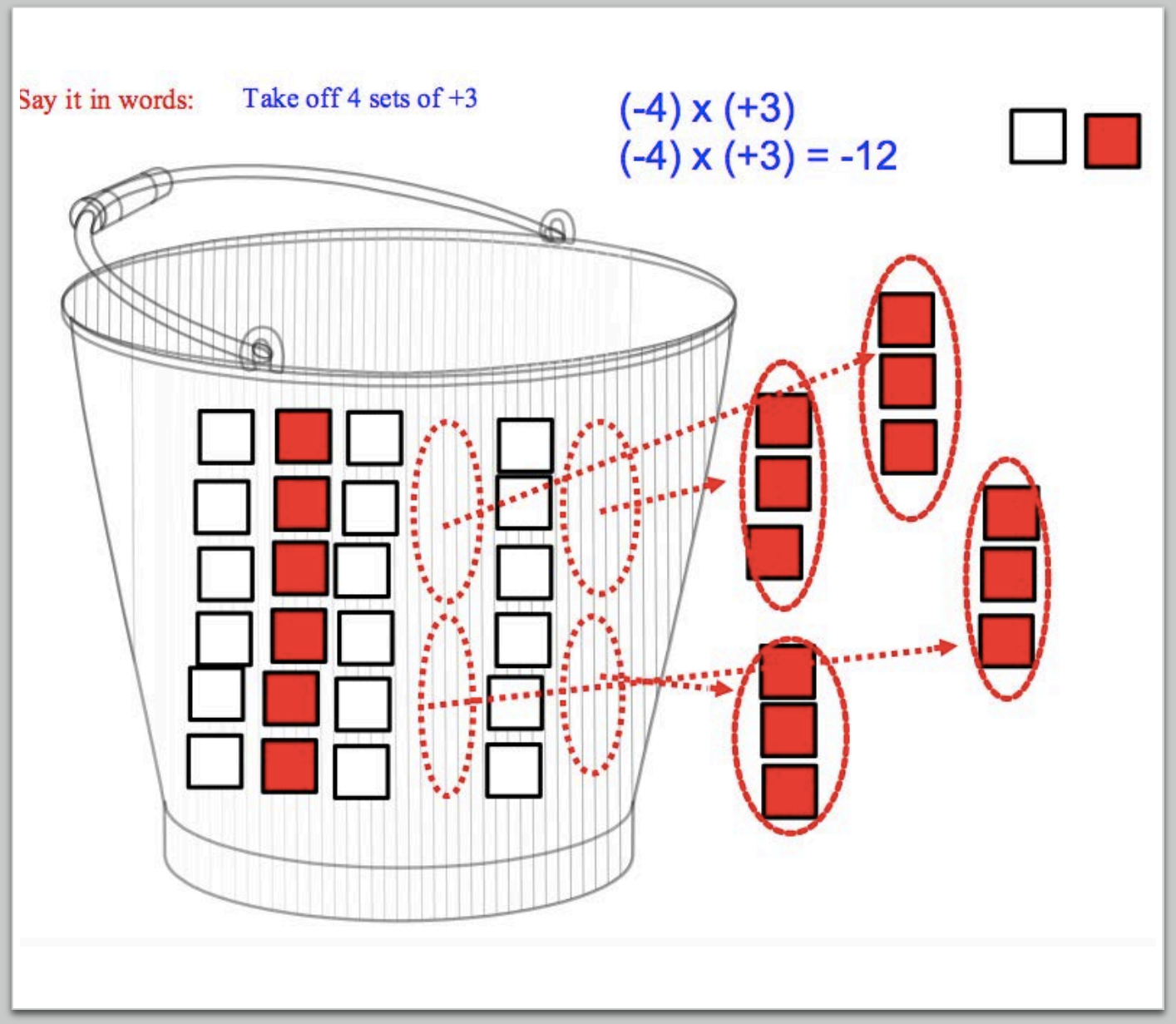
- The Bucket of Zero
- Adding to or taking from zero

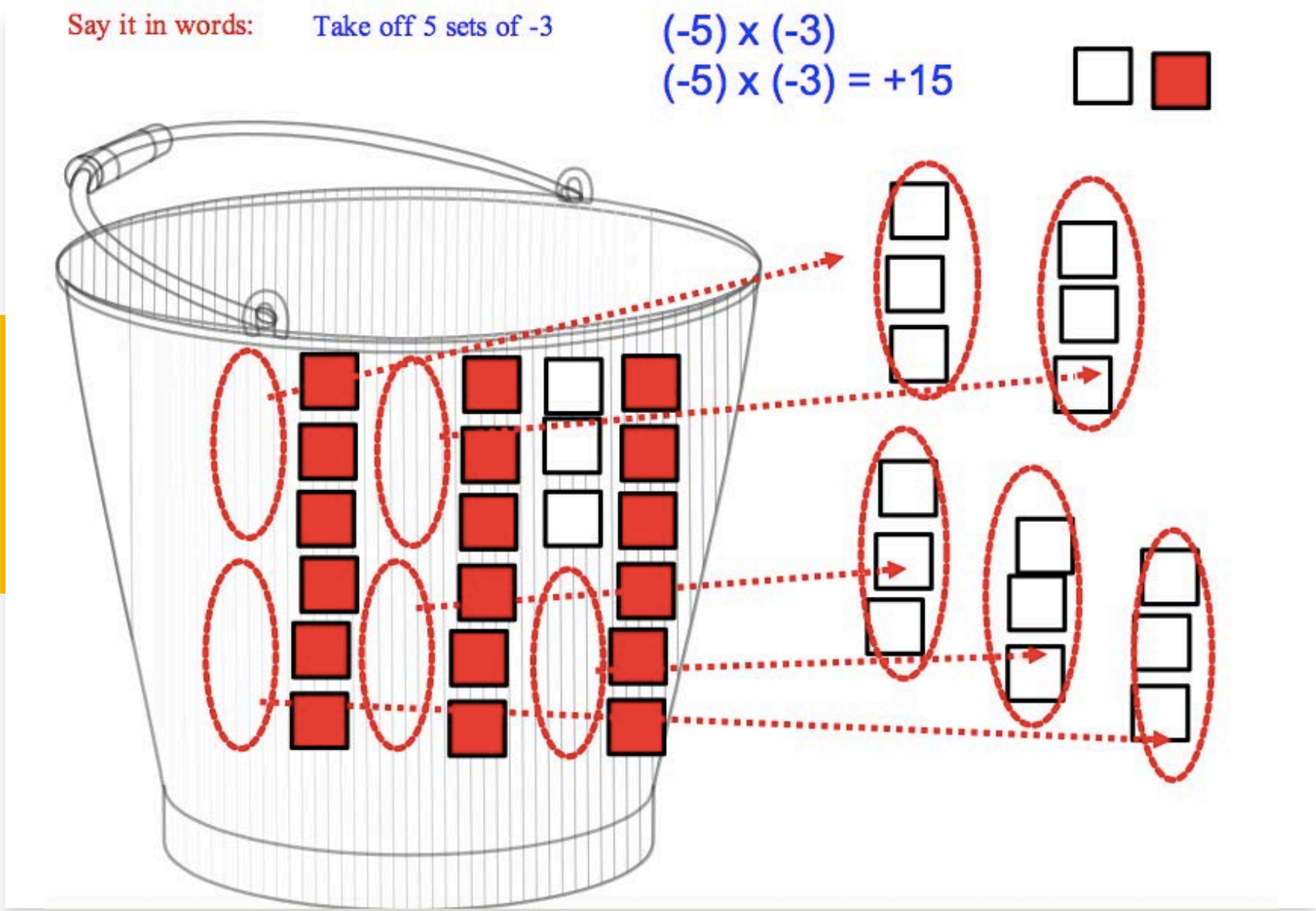




The bucket of zero

Taking away positives, leaves the bucket negative

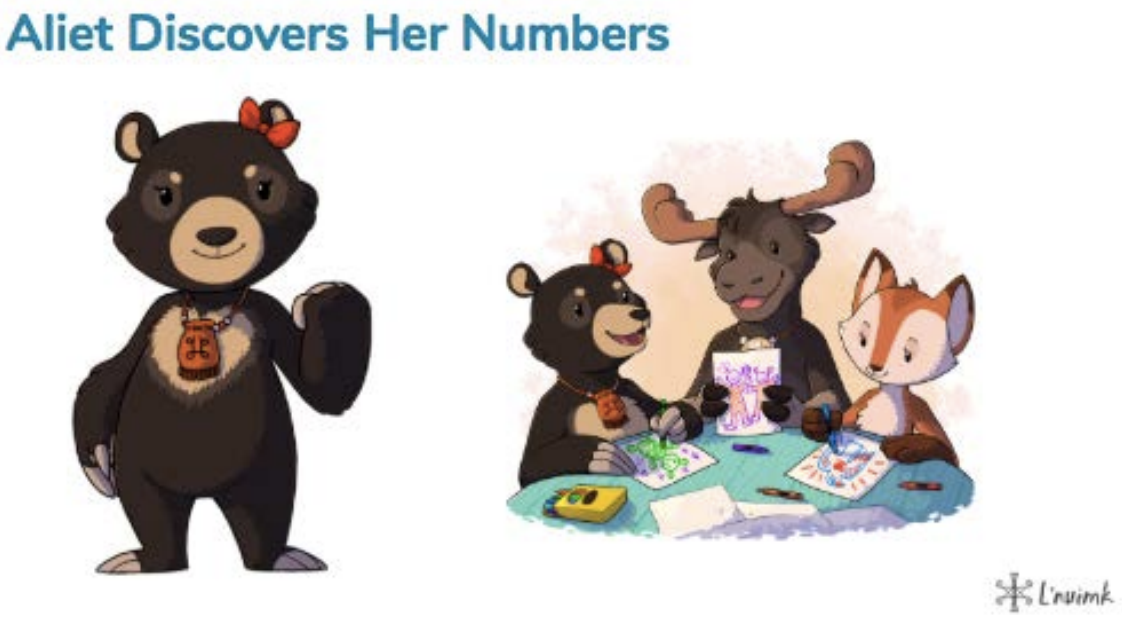




The bucket of Zero

Taking away negatives, leaves the bucket positive

Current work: Holistic Math Assessments

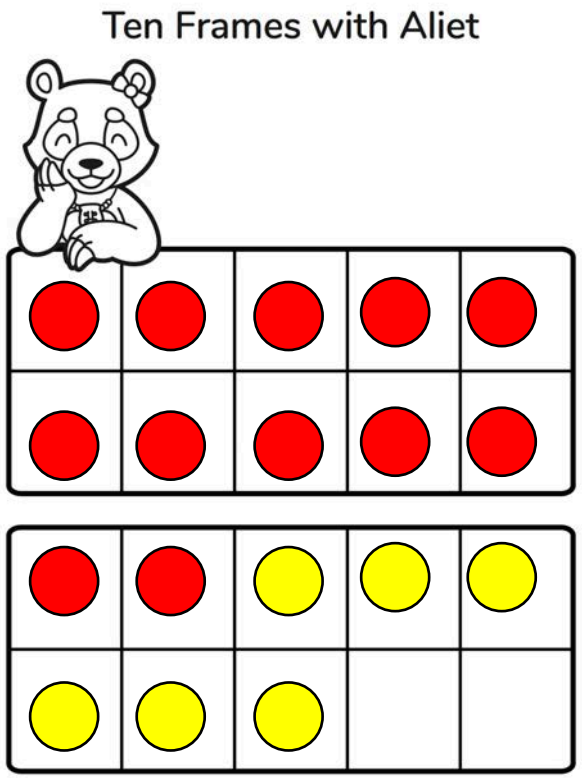


Whole	
 Part	 Part

Whole	
 Part	 Part

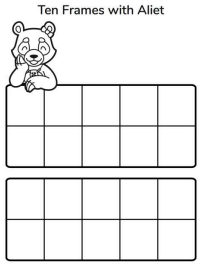
Making sets with 2 colours

I built 18 on my ten frame. I used 12 red and 6 yellow. What can you build?

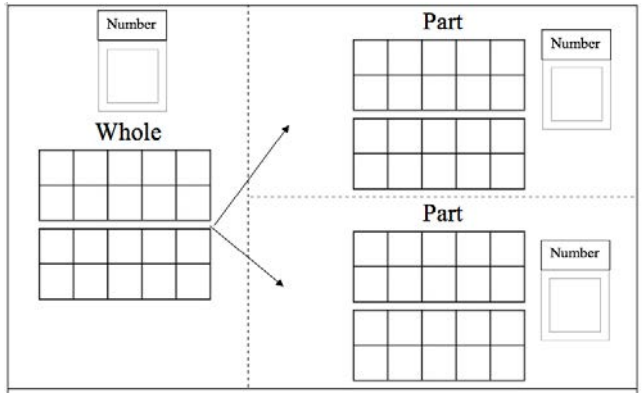


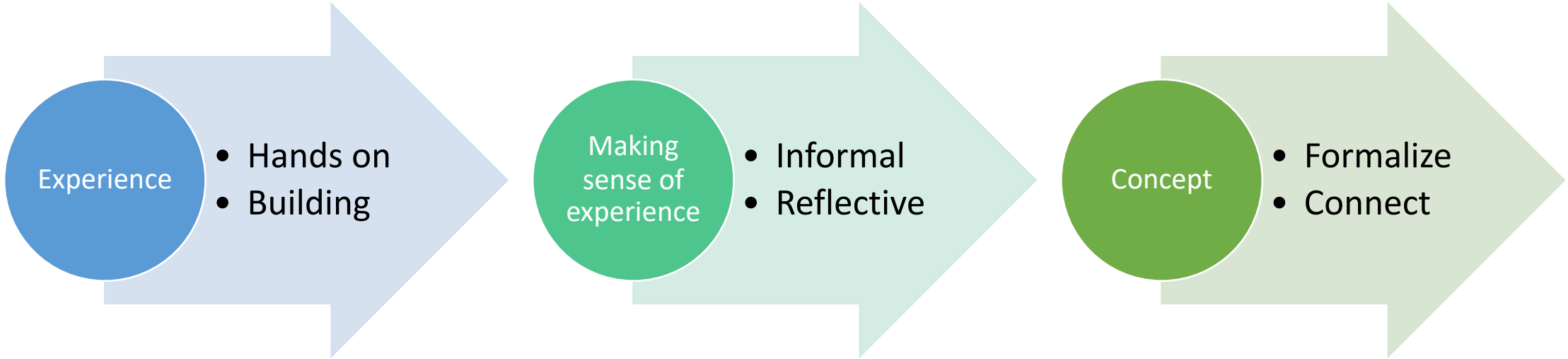
Roll for a number!

Build it on the ten frame using yellow and red!



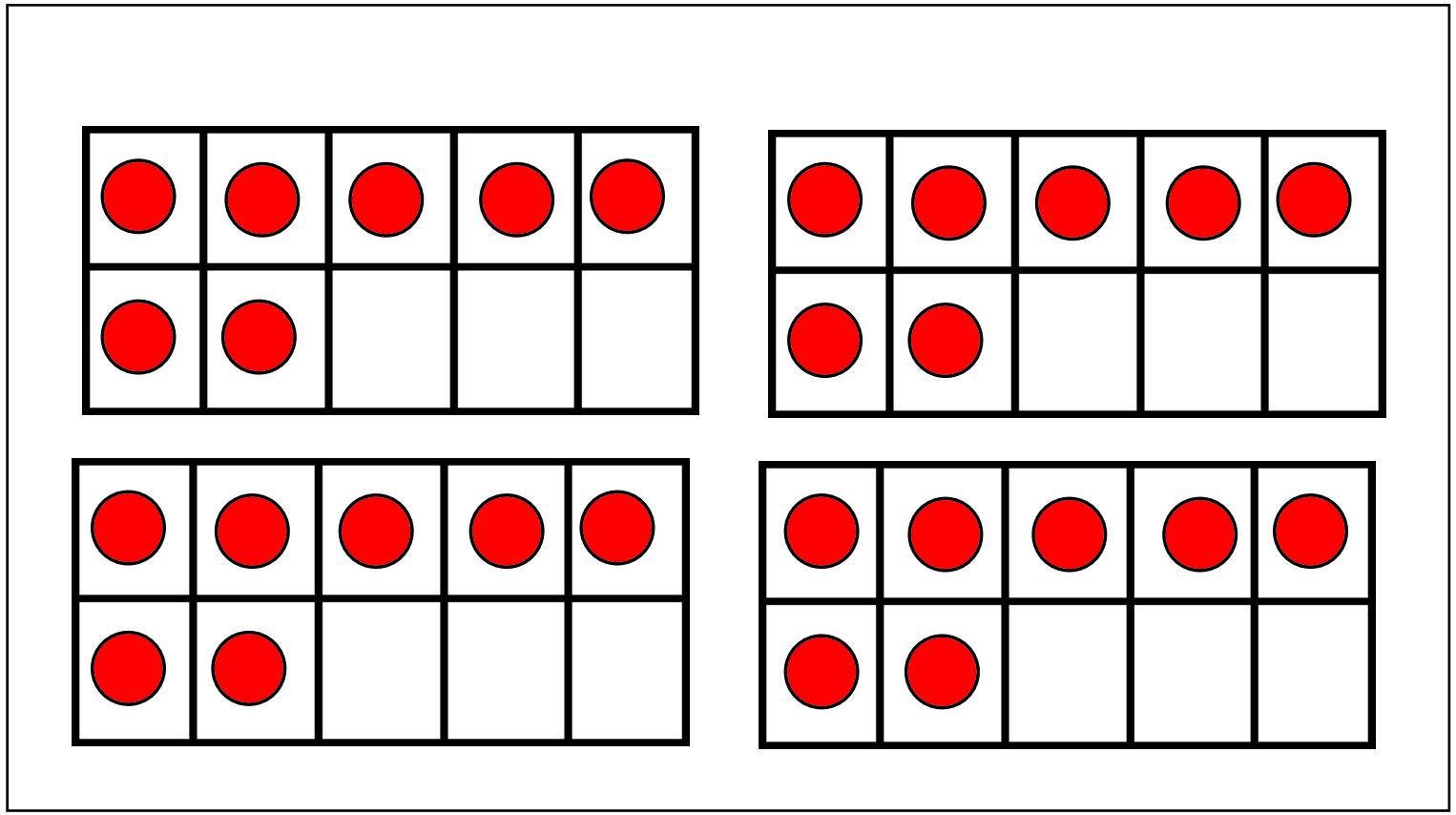
Record what you built!



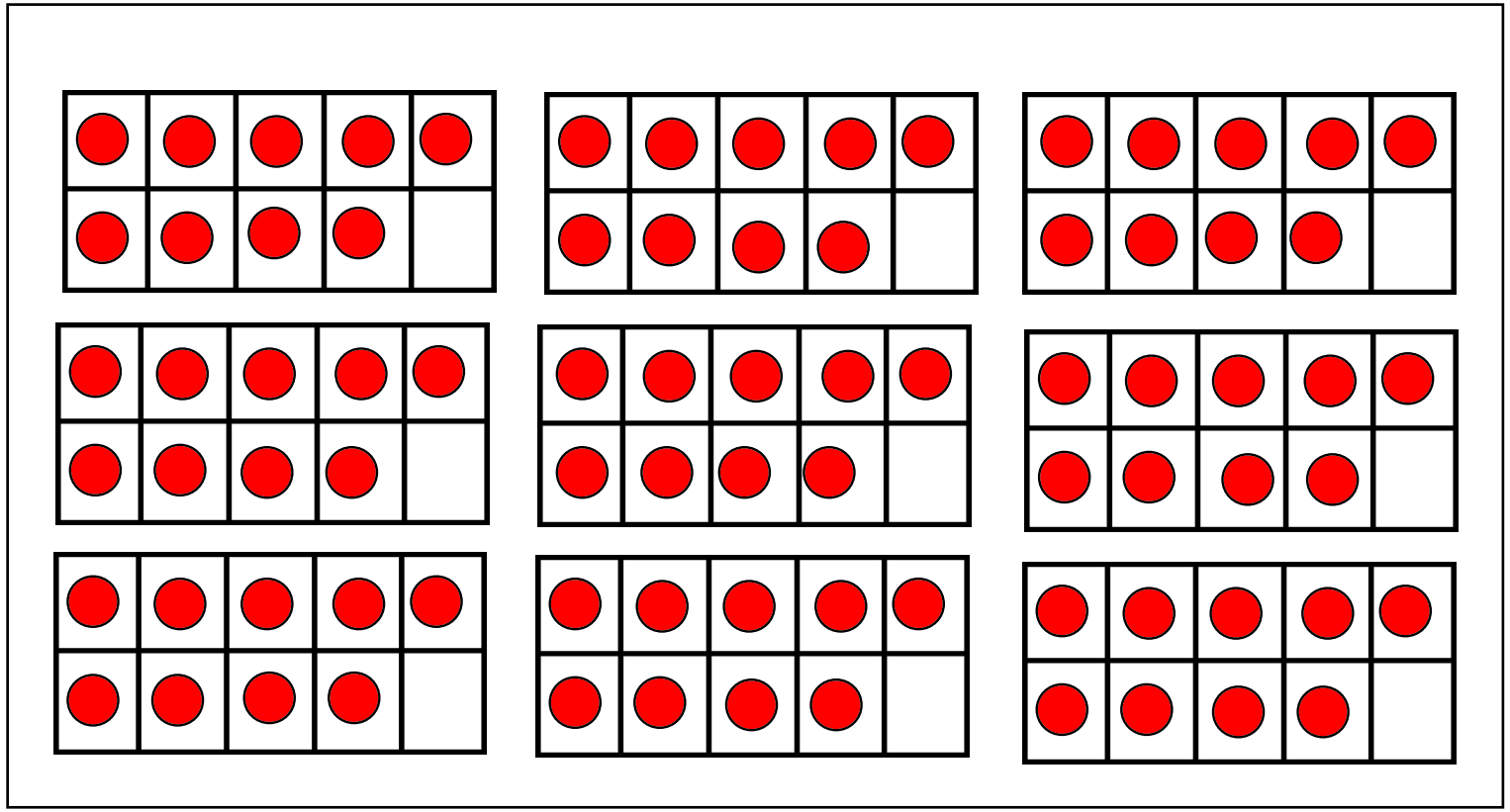


When we figure it out, we name it…

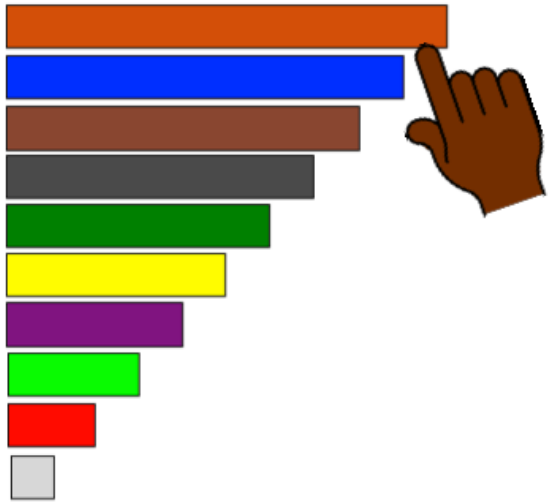
HOW CAN THIS HELP US WITH OUR 7S FACTS?



NOW LET'S EXPLORE OUR 9S FACTS!

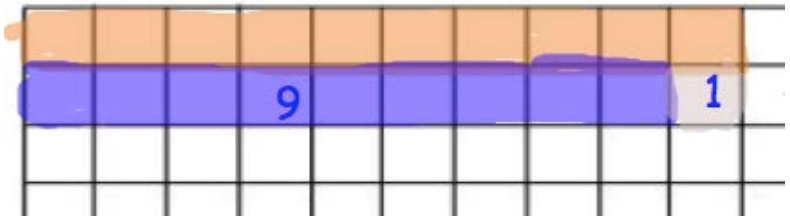


Choose the orange rod.



Find two rods that make the same length as the orange rod.

Record on grid paper.

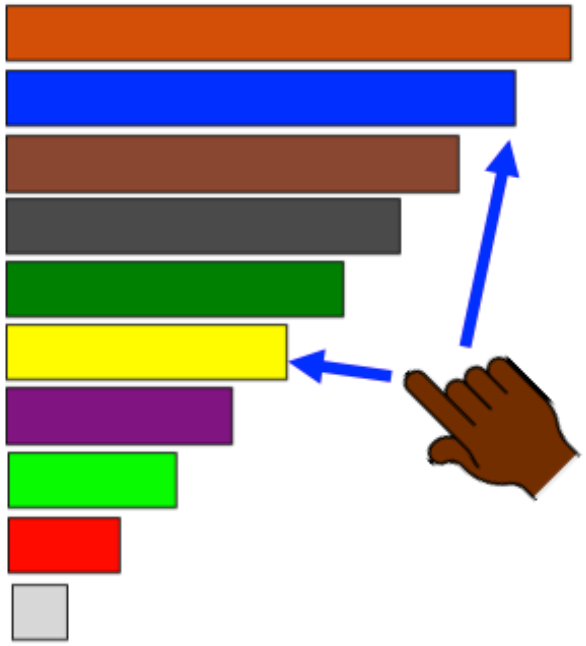


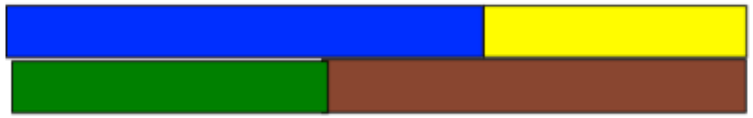
Making Trains – Partners for Orange

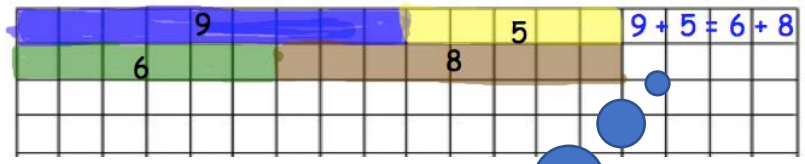
Choose two rods.

Find two different rods that make the same length.

Record on grid paper.







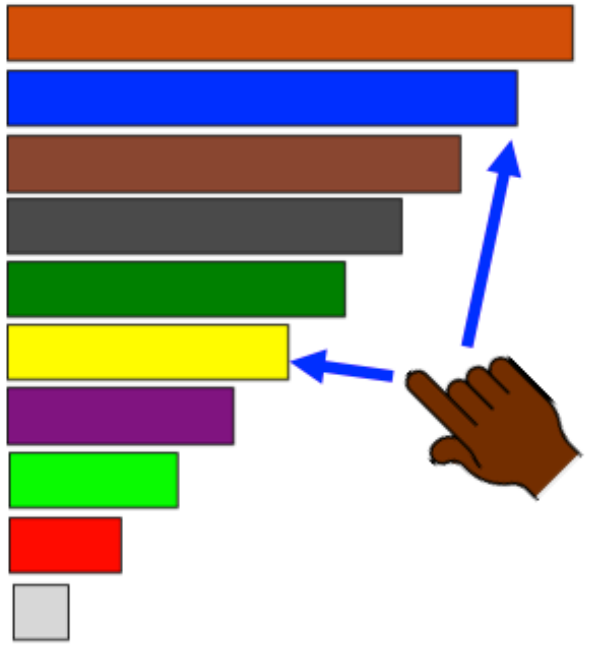
Write the number sentence that describes the equal lengths.

Making Trains – Two Rods

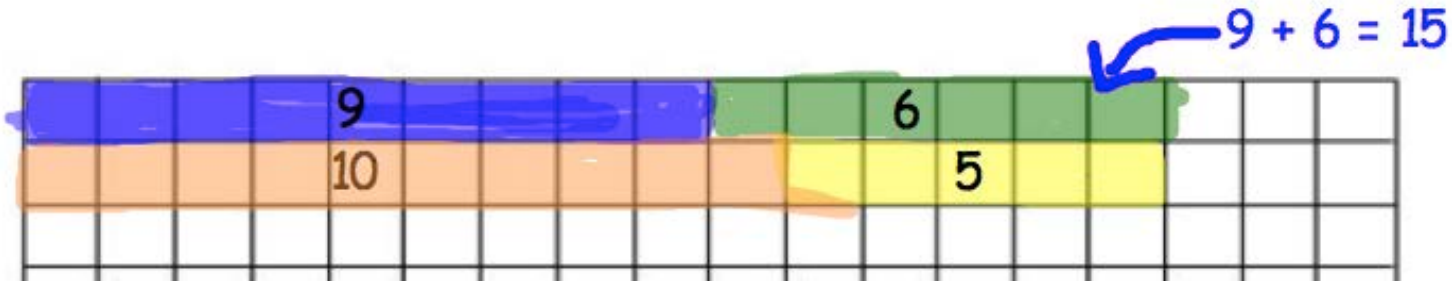
Choose two rods

Combine them to make a long train.

Use the orange to find the total length.



Record on grid paper.



Making Trains – Helpful Orange

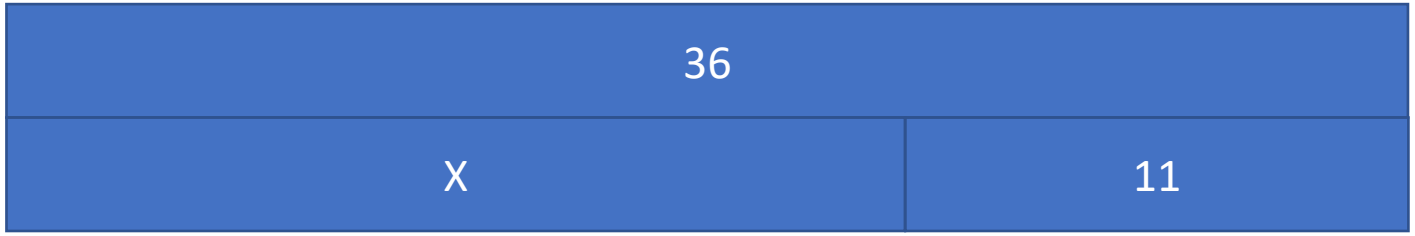
Multiplying and Dividing

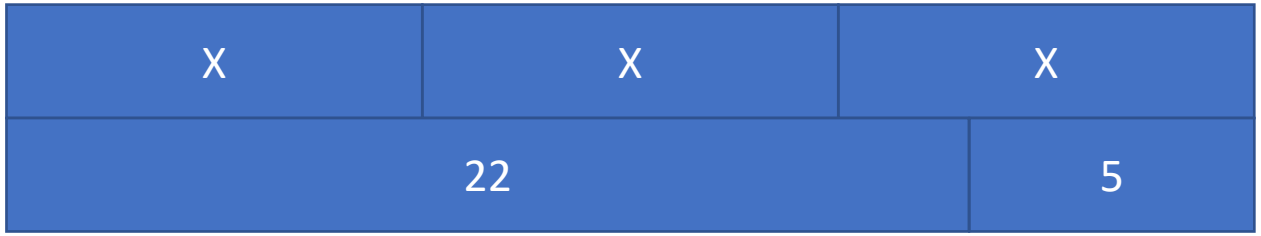
$4 \times 5 = 2 \times 10 = 20$

$19 \div 6 = 3 \text{ R } 1$

From rods to strip diagrams

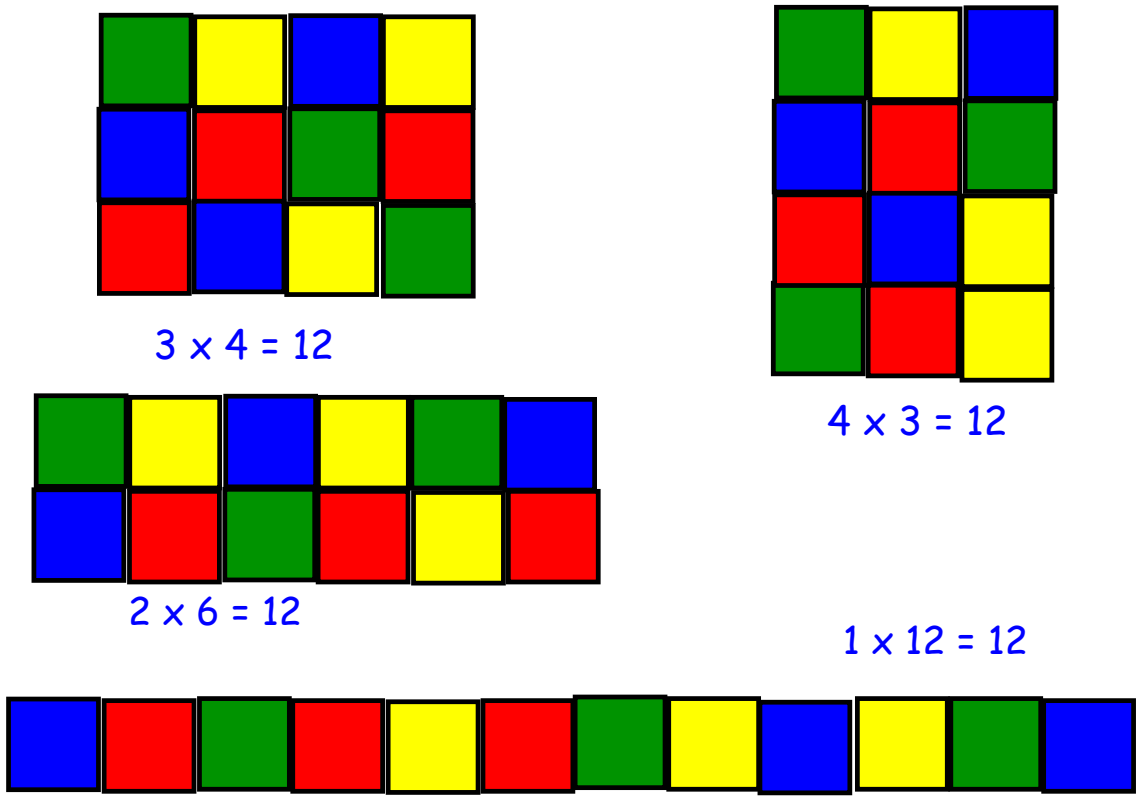
$$X + 11 = 36$$





$$3x - 5 = 22$$

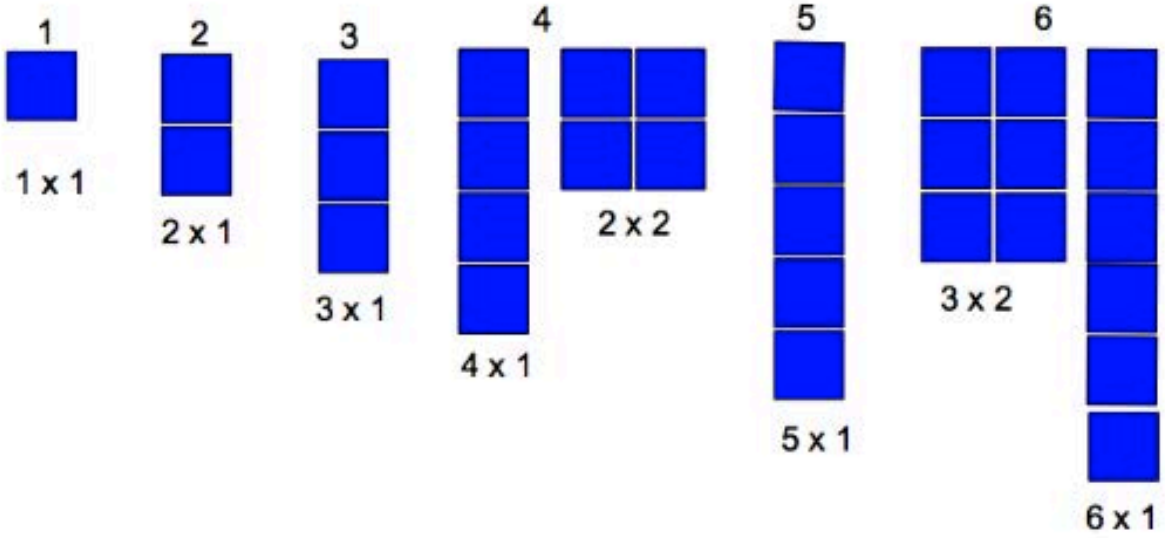
Arrays and Areas



The Shape of a Number

Use square colour tiles to make rectangles with areas from 1 to 20. Record the dimensions of these rectangles on grid paper and complete a chart similar to the one below.

Note: When we talk about whether it make a rectangle in more than one way we will consider any rotation of a rectangle to be the same rectangle (i.e. a 2 by 1 and 1 by 2 will be considered as only one rectangle so 2 can be made in only one way).



	Makes a rectangle		Makes a square	
Number	Only one way	More than one way	Yes	No
1	X		X	
2	X			X
3	X			X
4		X	X	
5	X			X
6		X		X
7				

Explore…

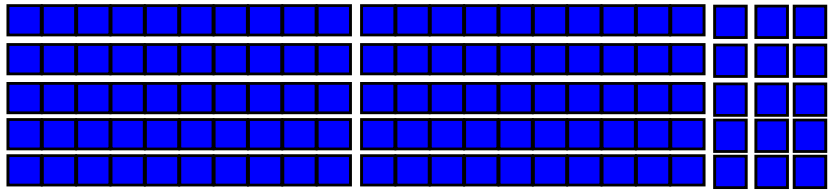
- Look for patterns in the table. Do you notice anything about the numbers that can make a rectangle in only one way? Explain anything you notice about these numbers.

- Can you find numbers between 20 and 100 that can be made in only one way as well? What are they? How can you be sure their rectangles can be made in only one way?

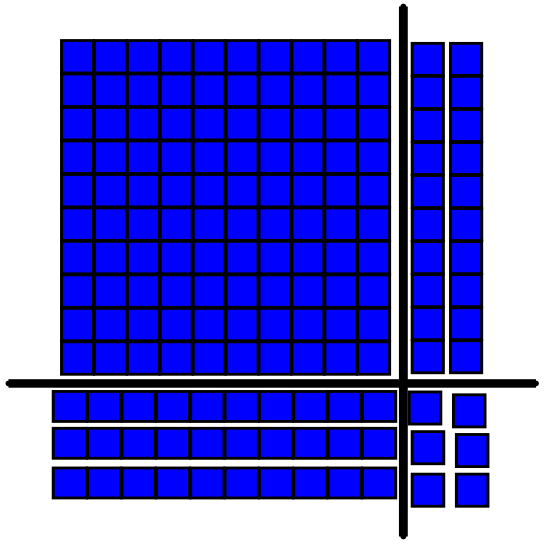
- Look for patterns in the table. Do you notice anything about the numbers that can make a square? Explain anything you notice about these numbers.

- Can you find numbers between 20 and 100 that can a square as well? What are they? How can you be sure you have found all the square numbers up to 100? Explain.

Multi-Digit Calculations with Area



5 rows of 23
5 x 10 = 50
5 x 10 = 50
5 x 3 = 15
5 x 23 = 115



13 rows of 12
10 x 10 = 100
3 x 10 = 30
2 x 10 = 20
2 x 3 = 6
13 x 12 = 156

Area models

The area model can become a regional model to do 1 digit by 3 digit

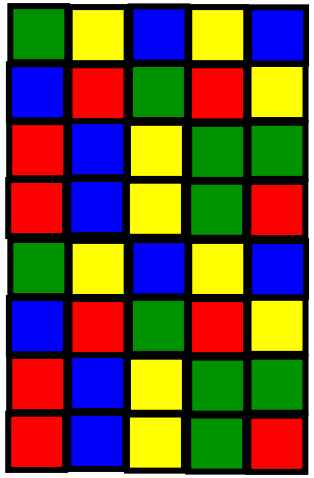
	300	20	6
4	1200	80	24

$4 \times 326 = 1200 + 80 + 24 = 1304$

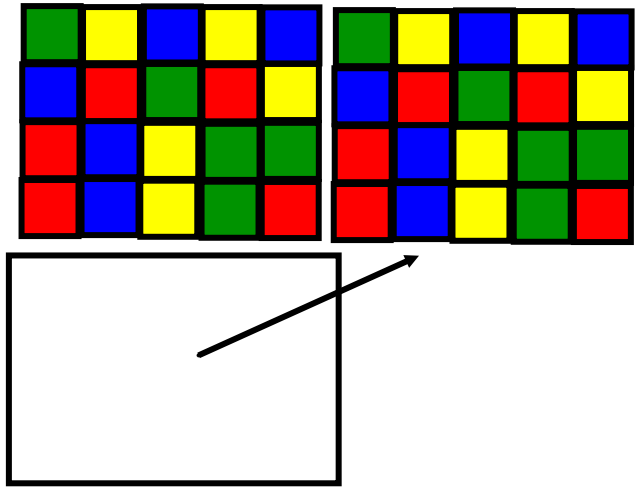
Halving and Doubling: The Associative Property

Show 8 x 5 = 4 x 10

8 x 5 = 4 x 2 x 5 = 4 x 10

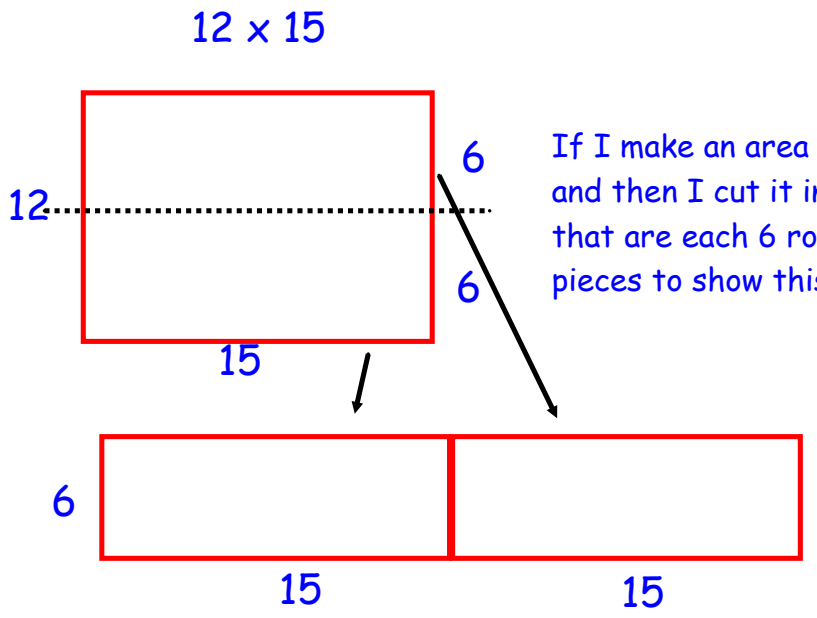


When I build 8 rows of 5 squares, I need 40 squares in all.

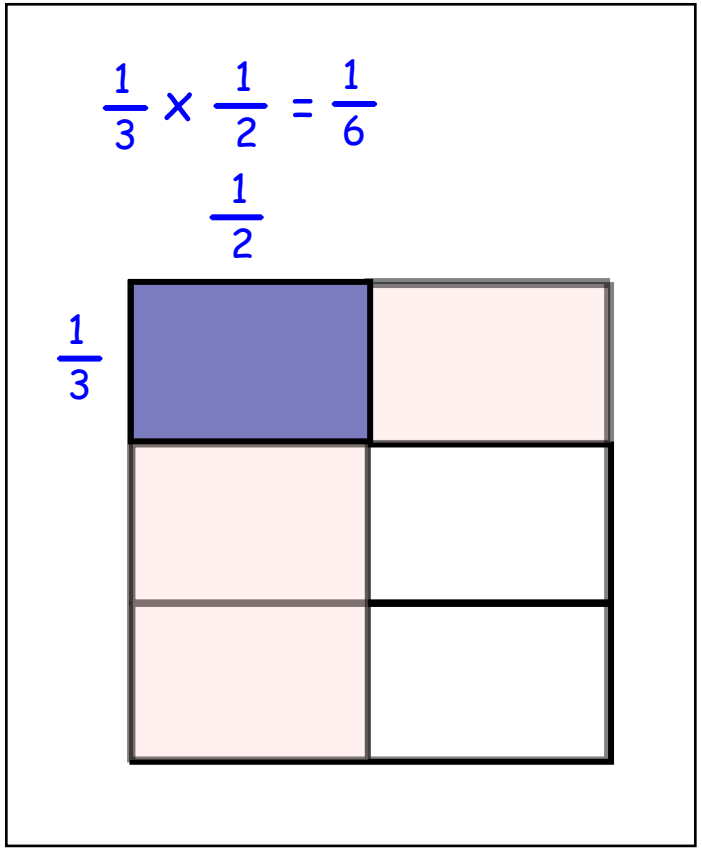


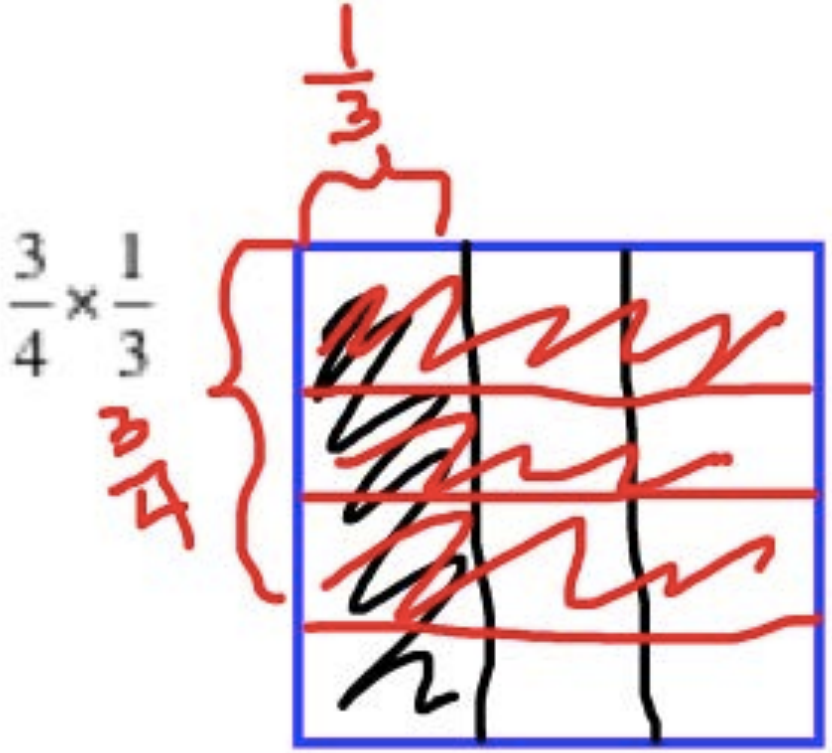
If I take off the 4 bottom rows and move them beside the 4 top rows, now I have 4 rows of 10, but it is still 40 squares in all.

Halving & Doubling



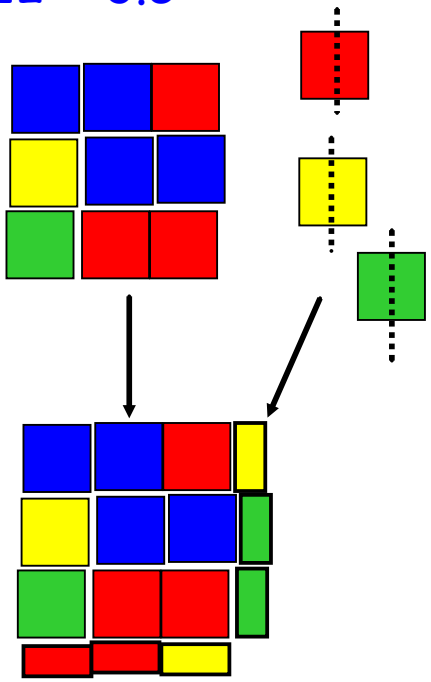
If I make an area model that is 12 rows of 15 and then I cut it in half to make two rectangles that are each 6 rows of 15, I can rearrange the pieces to show this is 6 rows of 30 so 180 in all.



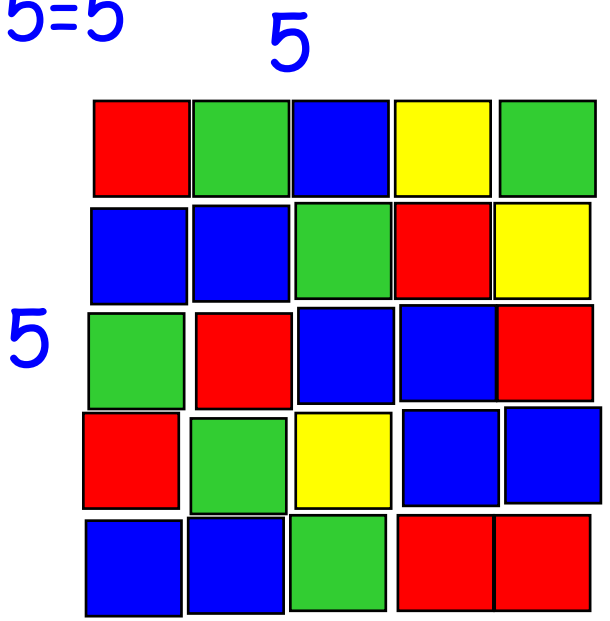


Multiplying Fractions with area…

$\sqrt{12} \approx 3.5$

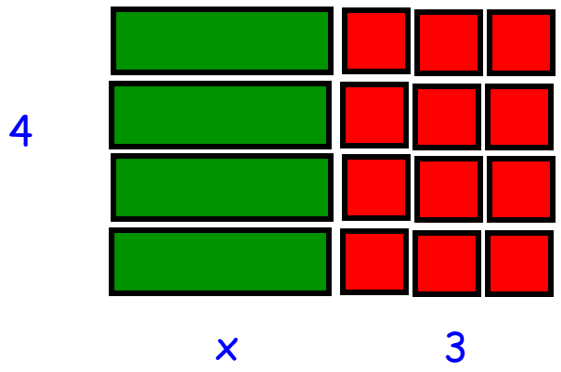


$\sqrt{25}=5$

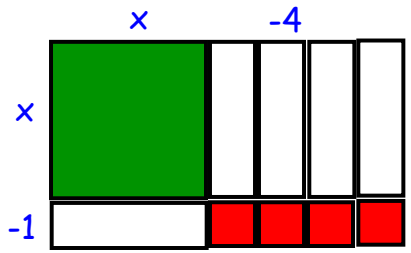


Square Root

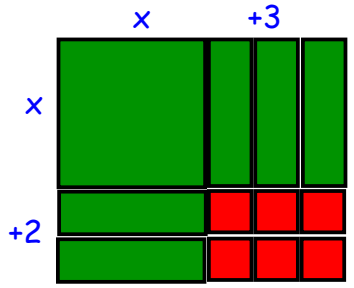
$4(x + 3) = 4x + 12$



$(x - 1)(x - 4) = x^2 - 5x + 4$



$x^2 + 5x + 6 = (x + 2)(x + 3)$



MODELING WITH ALGEBRA TILES

Algebra


wisdom
Shelby 30 | Carleigh 35 | Savannah
skip count by 10's
Shelby | Carleigh | Savannah


mouse
lock
kite
Mm
Ll
Kk
Jj
13
12
11
10

A Time of Reconciliation

It will never happen again!

Questions?

Twitter: @LLB_315

lborden@stfx.ca

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