Building Thinking Classrooms in Mathematics Through an Anti-Oppressive Lens

A Teacher's Reflection

Presented by:

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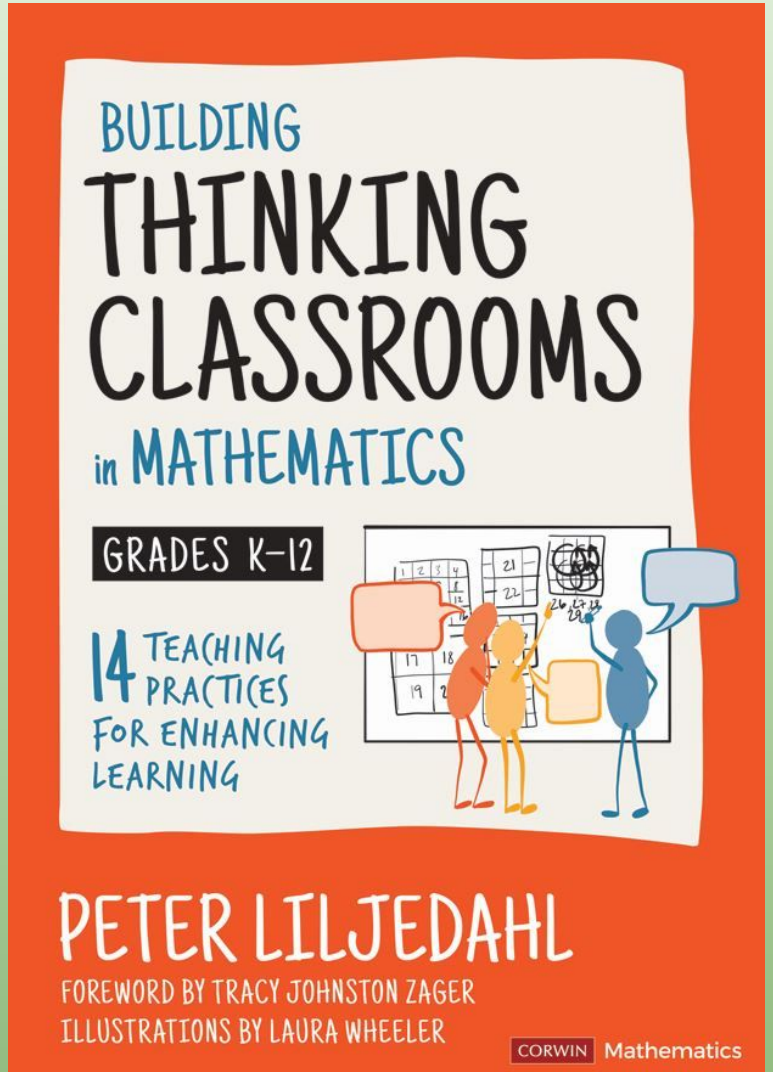
Thorncliffe Park Public School

Junior MART, SERT and Grade 4 P.O.R



Numeracy PD session

-4 sessions with our LN family of schools

-14 teaching practices demonstrated

-Interactive learning to help engage learners of all different learning styles and abilities

- Goals:

-build a culture of learning in our students through collaboration, developing social and group skills, develop questioning and allowing students to think critically without judgement in a non-threatening environment.

-to increase student or group talk time than teacher talk time. And to gauge the quality of that talk, by hearing and seeing the use of academic vocabulary by teacher and students.

BUILDING THINKING CLASSROOMS

RESEARCH: @pgliljedahl
SKETCHNOTE: @wheeler_laura

① Begin w/ a Problem

Give a problem-solving task

To start:

Problems should be
- ☐ engaging
- ☐ non-curricular
- ☐ collaborative

↳ promote talking

Later:

Problems can be curricular
eg textbook problems

② Visibly Random Groups

- ☐ Randomly assigned eg playing cards
- ☐ Daily & in front of students
- ☐ 2 or 3 students / group

- ☐ Sit & stand together

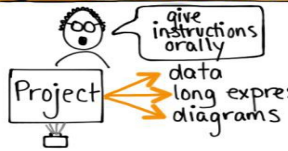
③ Vertical Non-Permanent Surfaces

- ☐ Vertical
- ☐ Erasable

- ☐ 1 marker or chalk per group

↳ promotes discussion

④ Oral Instructions

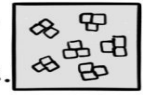


→ groups will discuss (instead of decoding text)

⑤ Defront the room

Desks
- orient in various directions
- pull away from wall (room to stand @ VNPS)

Teacher addresses the class from a variety of locations.

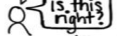


⑥ Answering Questions

Acknowledge, but don't answer:

✗ Proximity questions (b/c teacher is close by)

✗ Stop thinking questions



Answer:

✓ Keep thinking questions

↳ give HINTS not answers

⑦ Meaningful Notes

Student created:
- select
- synthesize → ideas
- reorganize

Based on their or others' boards

Provide time for this after levelling.

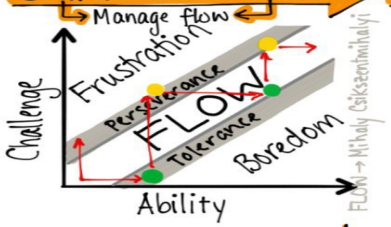
⑧ Build Autonomy

- ☐ Model how groups can visit other groups when they are stuck or done.
- ☐ Hints & extensions come from peers (not just the teacher).

→ Helps manage flow

⑨ Hints & Extensions

↳ Manage flow



⑩ Level to the Bottom

- debrief
- class discussion
- direct teaching
- the "lesson"

Once all groups pass a minimum threshold.

Debrief 1 or more groups' solutions!

Work through a new problem w/ whole group

⑪ Check Understanding

Assign 4-6

"check for understanding" questions

Students choose to work
- individually
- in groups

at desks or VNPS

Purpose: self-evaluation (NOT ~~marks~~)

⑫ Formative Assessment

~~measure~~ → communicate

where student is currently ↔ where student is going

Multiple & varied opportunities to demonstrate learning

⑬ Summative Assessment

PROCESS > product

Evaluate what you value!

Include:

⑭ Reporting

Based on data (NOT ~~points~~)

~~One aggregated mark~~

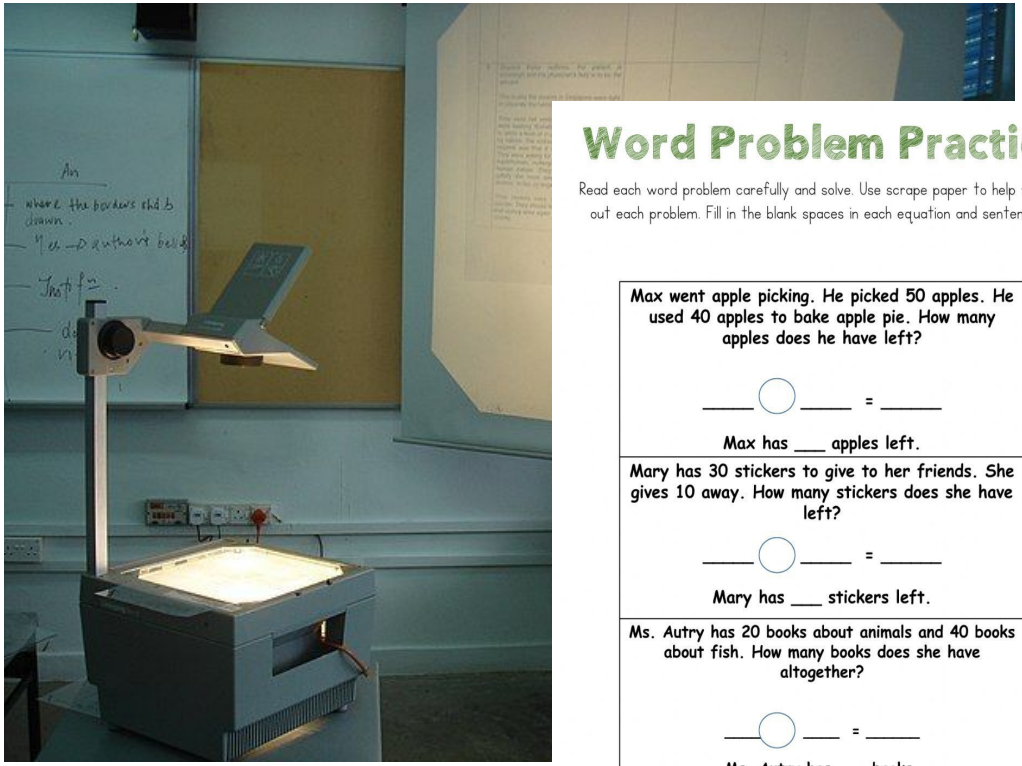
↳ disaggregated evidence

Analysis of data > Counting of points

What has this student learned?

What can they improve?

How we give tasks to students



Word Problem Practice

Read each word problem carefully and solve. Use scrape paper to help work out each problem. Fill in the blank spaces in each equation and sentence.

Max went apple picking. He picked 50 apples. He used 40 apples to bake apple pie. How many apples does he have left?

____ ◯ ____ = ____

Max has ___ apples left.

Mary has 30 stickers to give to her friends. She gives 10 away. How many stickers does she have left?

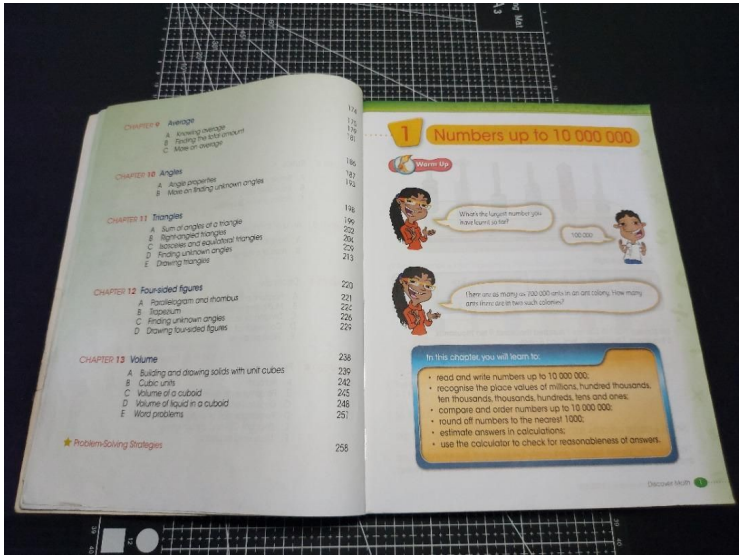
____ ◯ ____ = ____

Mary has ___ stickers left.

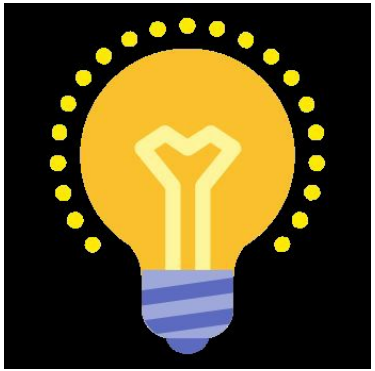
Ms. Autry has 20 books about animals and 40 books about fish. How many books does she have altogether?

____ ◯ ____ = ____

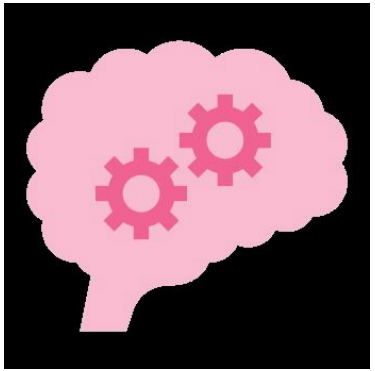
Ms. Autry has ___ books.



Student Learning Goals

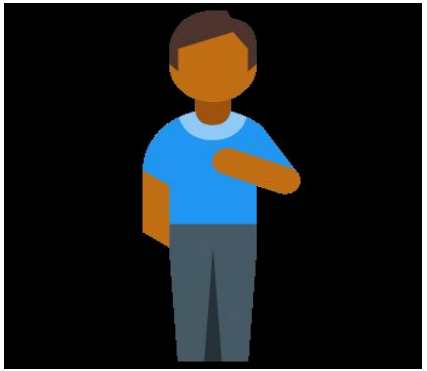


Build strong conceptual understanding of key concepts



Use and develop the seven mathematical Processes

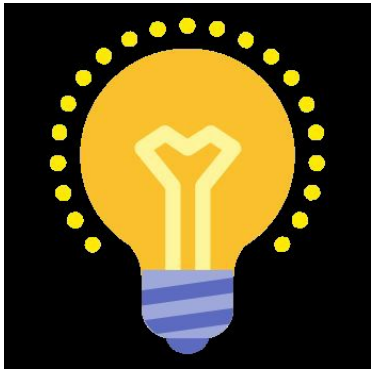
Experience the joy & wonder of math in a risk-free environment



Build, repair, or strengthen student identities as math learners

problem solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, and communicating.

Student Learning Goals



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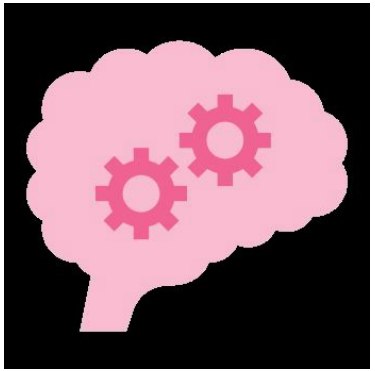

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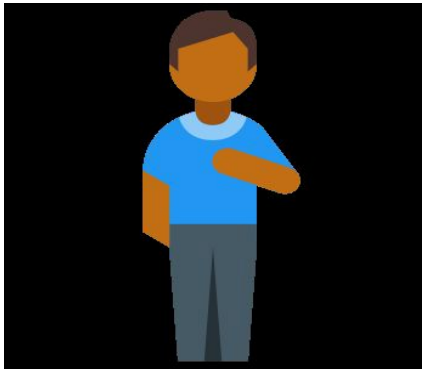


Build, repair, or strengthen student identities as math learners

Mr. Gill
Mag
focuse

problem solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, and communicating

Thorncliffe Park Public School SIP Goals:

Goal 2: If educators incorporate practices of Building and Thinking in Math Classrooms into mathematics instruction, then students will show increased engagement and perseverance in mathematical thinking

Goal 4: If educators use proactive strategies to support student relationships and regulation, then students will demonstrate improved use of strategies in academic and social situations.

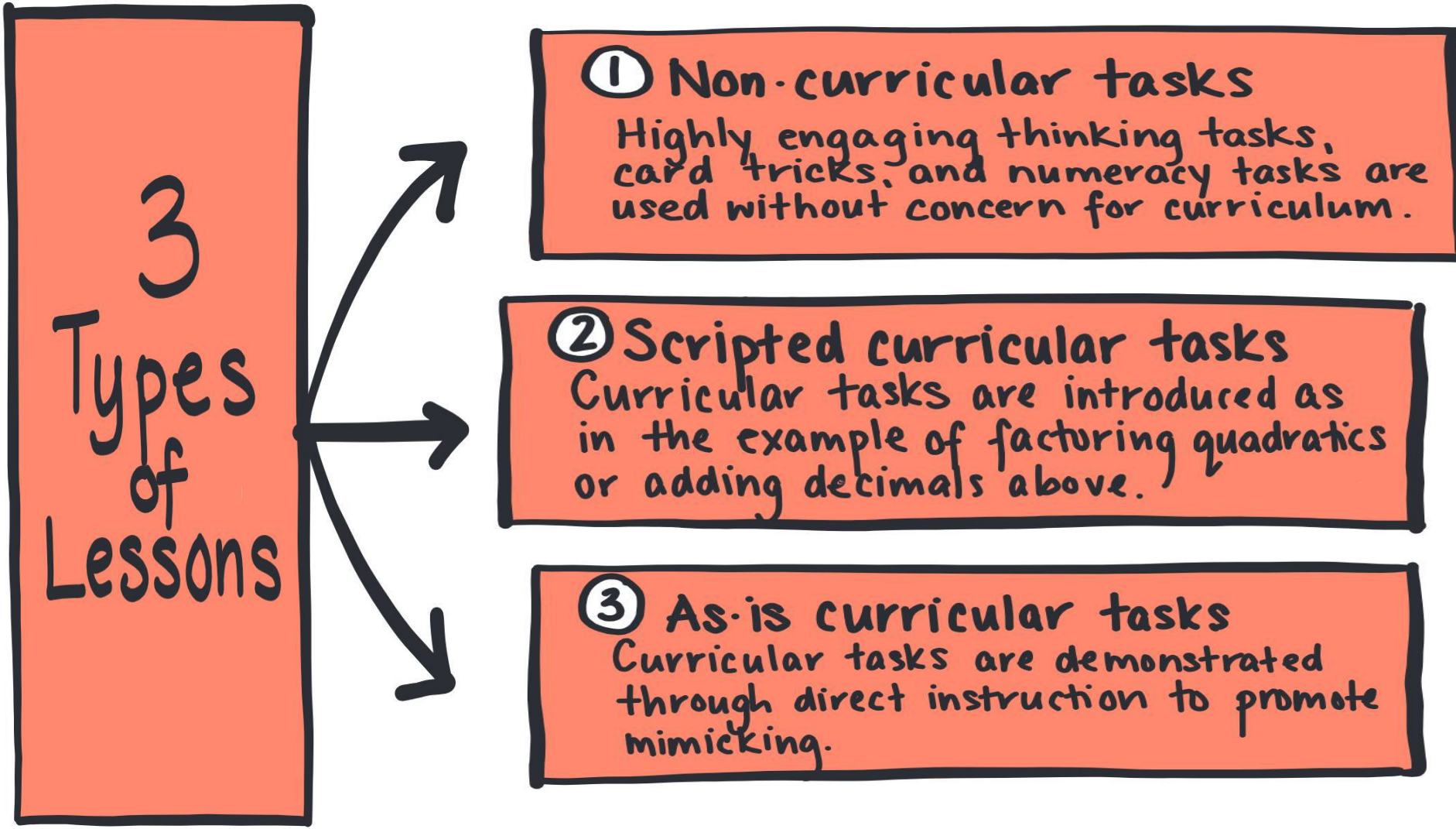
Class Composition:

12 students with modified literacy and numeracy programs, ranging from grades 1-3

14 students in the regular CORE program: levels 3-4.

2 Teachers (1 CORE, 1 SERT teacher - half day)

Primary Goal: to support and integrate students into inclusive numeracy program that promote thinking, increased engagement and problem solving in a supportive, nurturing environment


3 Types of Lessons
1 Non-curricular tasks
Highly engaging thinking tasks, card tricks, and numeracy tasks are used without concern for curriculum.
2 Scripted curricular tasks
Curricular tasks are introduced as in the example of factoring quadratics or adding decimals above.
3 As-is curricular tasks
Curricular tasks are demonstrated through direct instruction to promote mimicking.

Mr. Gill/Ms. Magno's lesson goal: Increase Thinking Tasks

Problem Solving:

Engaging in a task for which the solution is not obvious or known in advance.

To solve the problem, students must draw on their prior knowledge, try out different strategies, make connections, and reach conclusions.

Ontario Ministry of Education (2020)

“To build a thinking classroom, we need to be able to get students into, and keep them in, flow.”
P- Liljedahl (pg. 148)

How do we form student groups?

- Teacher- directed
- Student-directed
- Co-created groups
- Random groupings

RESPONSIBLE AND COLLABORATIVE Thinking Groups
L👀k, Feel, and Sound 👂 like

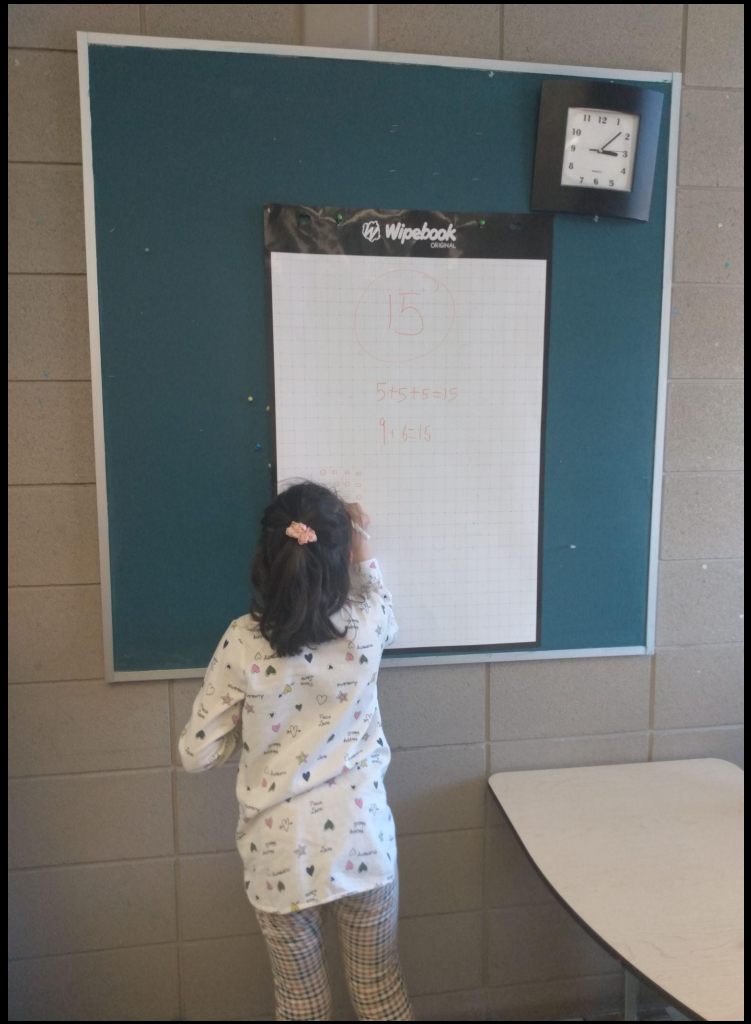
- LOOKS LIKE:
  - All group members are FOCUSED on the task
  - Group members are STANDING IN FRONT of their own whiteboard.
  - The marker is PASSED AMONG ALL MEMBERS
  - Work and thinking is CLEARLY SHOWN on board.
  - Groups WORK THE ENTIRE TIME and are persistent (keep working even if they are struggling).

- FEELS LIKE:
  - All members have TIME TO THINK
  - The group MAKES A PLAN before beginning the task.
  - All members ideas are LISTENED TO
  - Group members support each other (HELP AND ENCOURAGE)

- SOUNDS LIKE:
  - Group members TAKE TURNS TALKING with an inside voice.
  - Group members are ALL COMMUNICATING (asking questions and explaining ideas)
  - Group members SPEAK TO EACH OTHER RESPECTFULLY.
  - Conversations STAY ON THE MATH TASK

Task # 1:

Show me the number 35 in as many ways as you can.



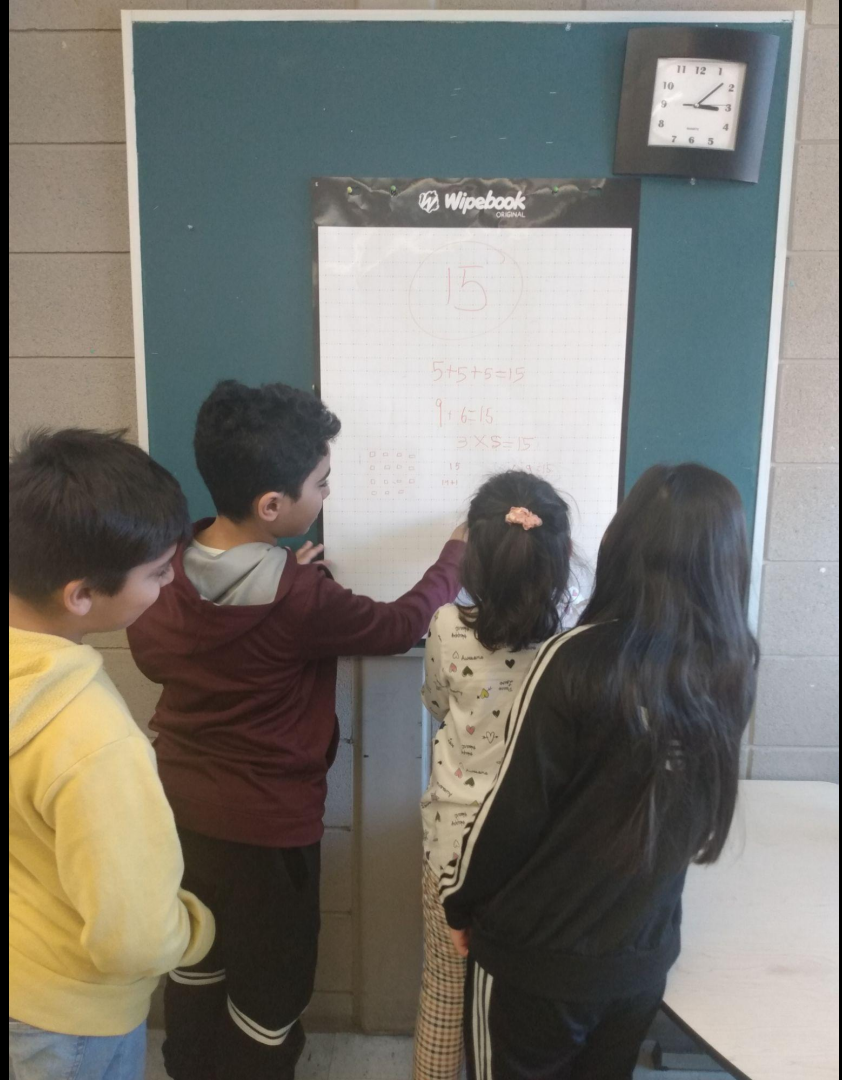
As we began the task, students were unsure of the open ended expectation. However, this particular student did not mind trying. Although she felt her numeracy skills were not a strength, she was more responsive when another student suggested to change the value to a lower number. Students were unsure at first of the number 35, so they chose the number, 15 first.

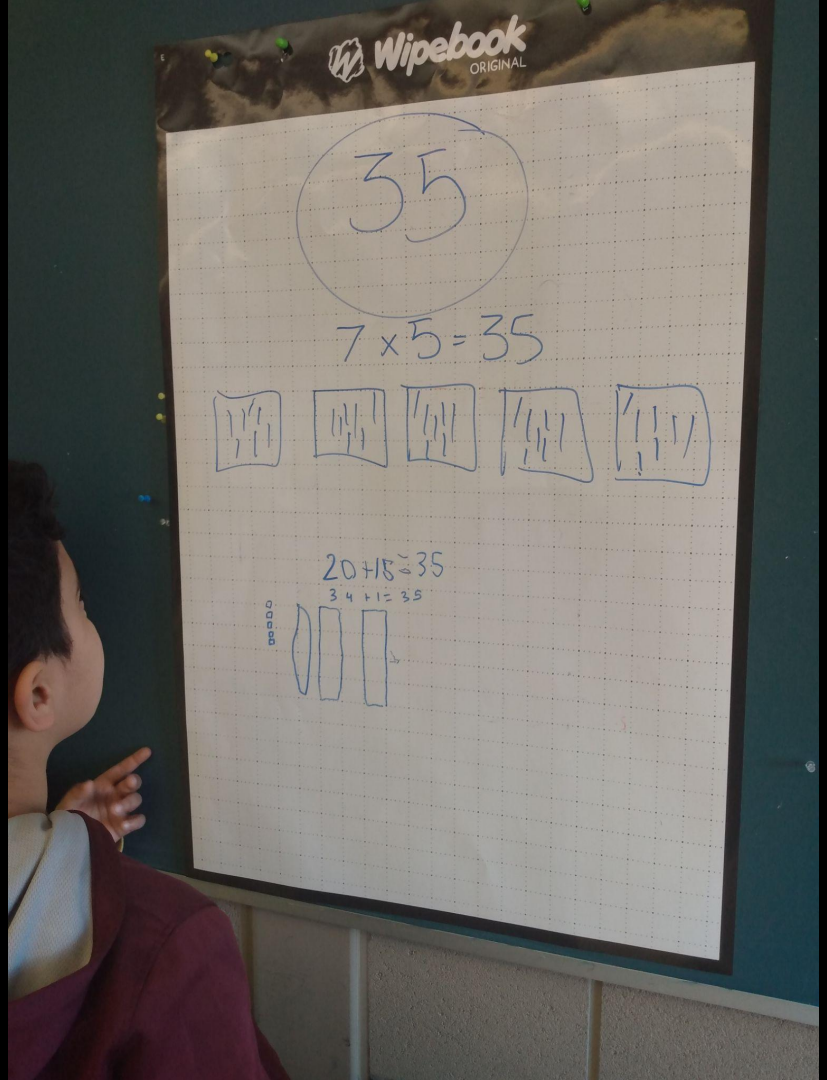
Initial Comments:

- “I’m thinking…. to draw pictures instead of numbers?”
- “Can I write it in words?”
- “ Can I help?”
- “ I know one way that I can share.”
- “Why do we have one marker?”

Eventually, after seeing one group member participate, others began to show an interest. They wanted to share their ideas and felt more open to work on the task. More students moved to the board.

Some of the students took the initiative to help support responses, once they were given the opportunity .



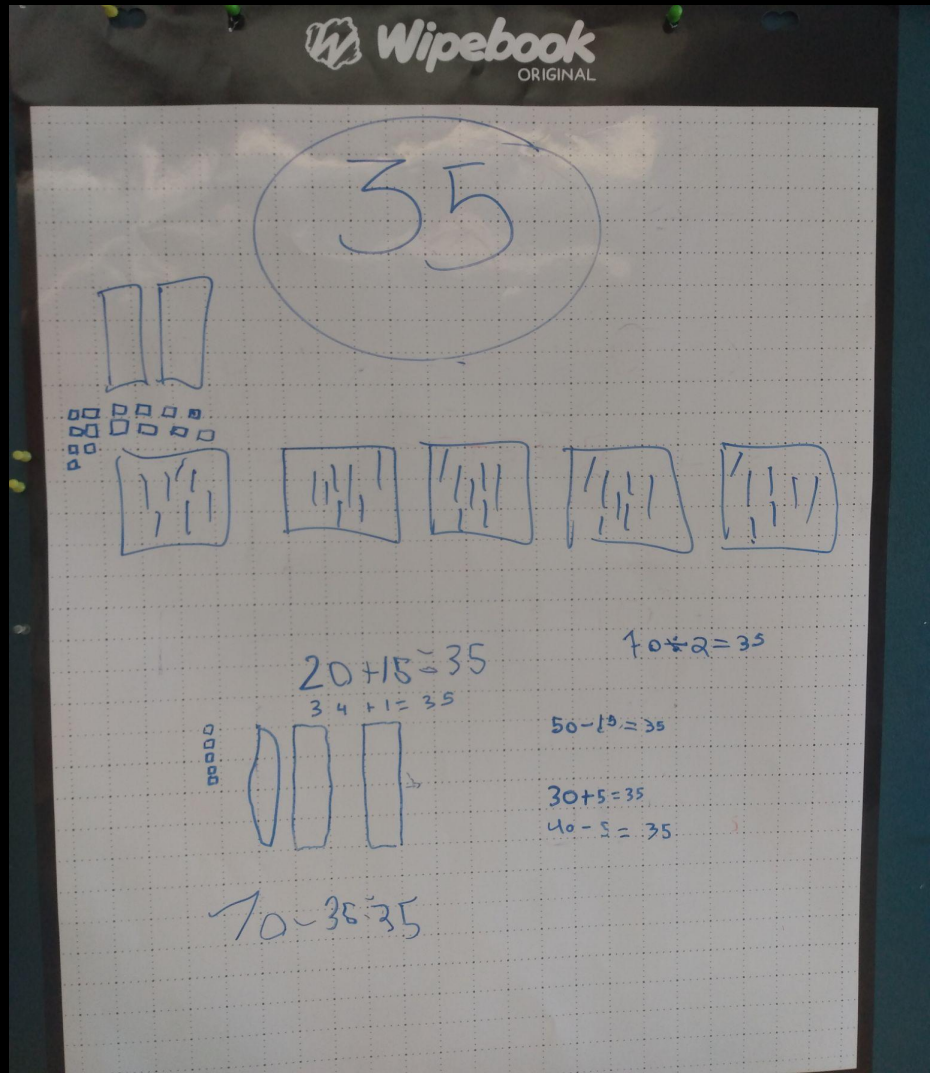


After the initial warm up, the students were willing to work on the number 35, once they felt they understood the expectation.

Some of the students wanted to work more independently but warmed up to the idea of sharing the marker.

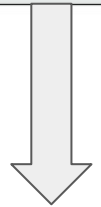
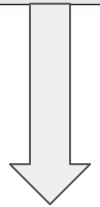
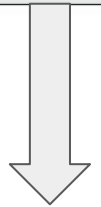
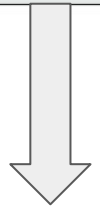
Some students took an extended period of time to think about how to display their information.

Eventually, after reviewing the expectations, the first attempt was successful and worked towards expanding ideas through student encouragement, collaboration and responses.



VERALL EXPECTATION B1. demonstrate an understanding of numbers and make connections to the way numbers are used in everyday life

PECIFIC EXPECTATIONS

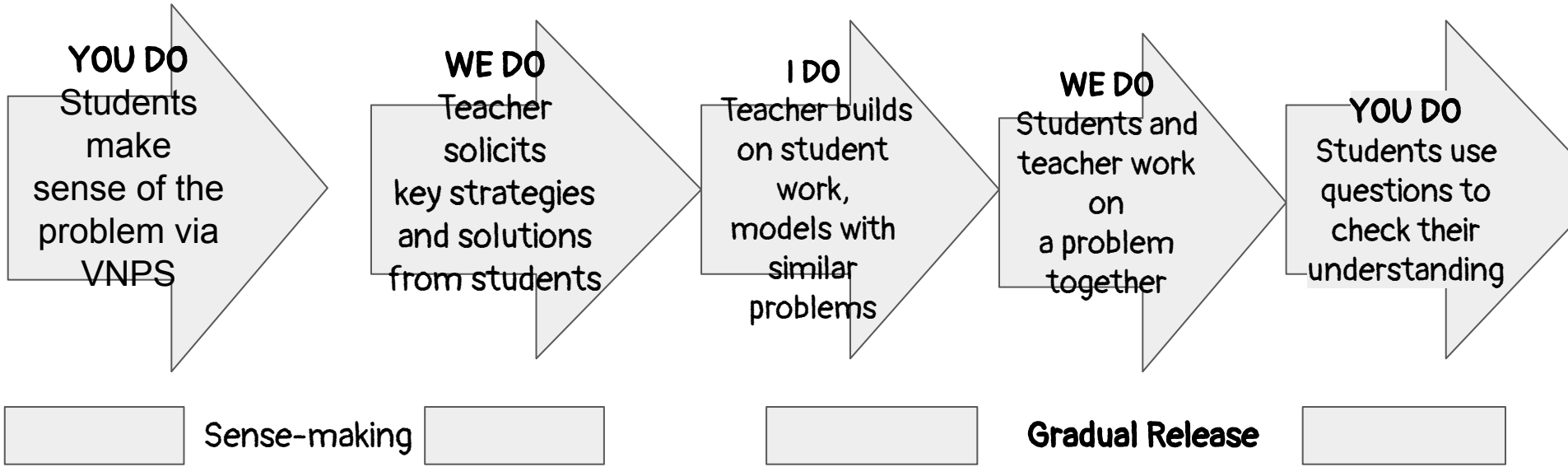
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade
ole Numbers					Rational Numbers		Rational and Irrational Nu
1 read and resent whole nbers up to including 50, describe various ys they are used veryday life							
2 compose and ompose whole nbers up to and uding 50, using a ety of tools and tegies, in various texts	**B1.1** read, represent, compose, and decompose whole numbers up to and including 200, using a variety of tools and strategies, and describe various ways they are used in everyday life	**B1.1** read, represent, compose, and decompose whole numbers up to and including 1000, using a variety of tools and strategies, and describe various ways they are used in everyday life	**B1.1** read, represent, compose, and decompose whole numbers up to and including 10 000, using appropriate tools and strategies, and describe various ways they are used in everyday life	**B1.1** read, represent, compose, and decompose whole numbers up to and including 100 000, using appropriate tools and strategies, and describe various ways they are used in everyday life	**B1.1** read and represent whole numbers up to and including one million, using appropriate tools and strategies, and describe various ways they are used in everyday life	**B1.1** represent and compare whole numbers up to and including one billion, including in expanded form using powers of ten, and describe various ways they are used in everyday life	**B1.1** represen compare very and very small numbers, inclu through the us scientific notat and describe v ways they are in everyday life
3 compare and er whole numbers to and including in various texts	**B1.2** compare and order whole numbers up to and including 200, in various contexts	**B1.2** compare and order whole numbers up to and including 1000, in various contexts	**B1.2** compare and order whole numbers up to and including 10 000, in various contexts	**B1.2** compare and order whole numbers up to and including 100 000, in various contexts	**B1.2** read and represent integers, using a variety of tools and strategies, including horizontal and vertical number lines	**B1.2** identify and represent perfect squares, and determine their square roots, in various contexts	

Results:

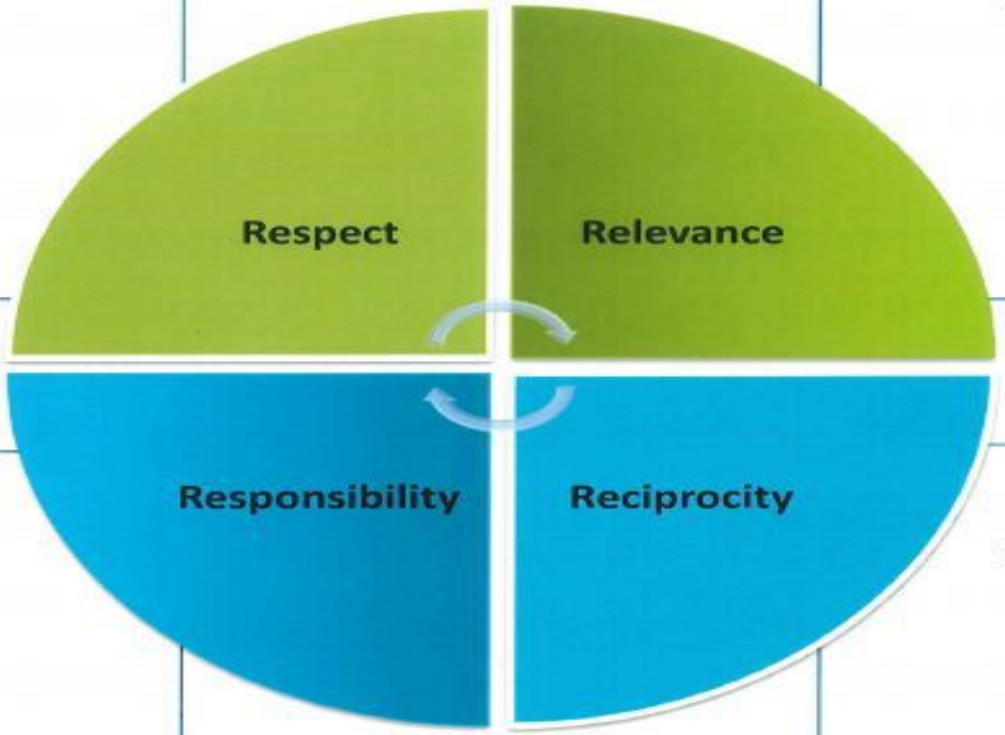
- Although the first task was teacher directed in forming groups, students were getting acquainted with the idea of thinking and writing vertically.
- The use of turn taking (for writing) was helpful with just ONE marker per group, allowing for collaboration of ideas, time to listen and observe each other's responses.
- Student collaboration was gradually increasing as they got used to the idea of vertical learning, empowering them to, 'write on the board', frequently

"Once your students are thinking-both individually and collaboratively - a sequence such as this, used asynchronous to maintain the balance between ability and challenge, allows you to cover a huge amount of content in a single lesson".
P- Liljedahl (pg. 148)

Instructional Progression for Math



The Four (4) Rs



- Cultural knowledge, traditions, values and activities that individuals bring with them.

- Occurs when respect is embedded in the curricula, instruction and policies.

- Demands that instructor shares responsibility for change even if not personally disadvantaged by the barriers of the learner.

- Refers to the revising of relationships between student and instructor from a hierarchy to that of a relationship focused on mentorship. In this way both individuals are viewed as learners.

Verna K. Kirkness and Ray Bernhardt, "First Nations and Higher Education: The Four Rs," *Journal of American Indian Education* 30 (3), May 1991.

Thinking – The use of critical and creative thinking skills and/or processes				
Categories	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	The student:			
Use of planning skills *(e.g., interpreting and expressing problems, identifying unknown(s), making conjectures and estimates, identifying steps to take, considering the use of models and representations, selecting strategies and tools)*	uses planning skills with limited effectiveness	uses planning skills with some effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
Use of processing skills* *(e.g.,* carrying out plans*: collecting data, questioning, testing, revising, modelling, solving, inferring, forming conclusions;* looking back at solutions*: reflecting, evaluating reasonableness, reasoning, justifying, proving)*	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness
Use of critical/creative thinking processes* *(e.g., making and testing conjectures, posing and solving problems, critiquing solutions, providing mathematical reasoning)*	uses critical/ creative thinking processes with limited effectiveness	uses critical/ creative thinking processes with some effectiveness	uses critical/ creative thinking processes with considerable effectiveness	uses critical/ creative thinking processes with a high degree of effectiveness

Task #2:

Making Connections through Hexagonal Learning

Using the words provided, try to make as many connections as possible to form a complete figure.

What is hexagonal thinking?

"Hexagonal thinking is a classroom strategy borrowed from the business world. Concepts are placed on hexagons, and then moved around to build a web of connected ideas. The most interesting part comes in the debate about where to connect what, and why. In the classroom, students can build hexagonal webs in groups or alone, online or off. No two webs will ever look the same, and neither will the explanations of the connections students have made, whether given in writing or aloud." - We are Teachers (2023)

Math Vocabulary

add
subtract
all
combine
digit
double
equal

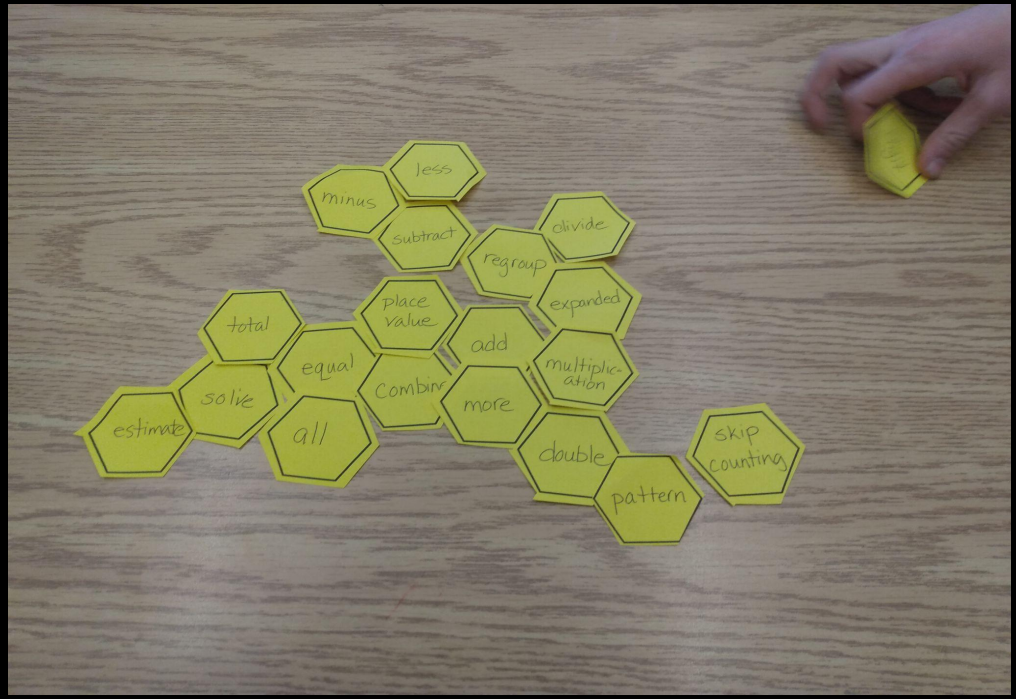
expanded
less
minus
multiplication
place value
solve
skip counting

sum
total
rounding
more
regroup
estimate
divide

Group #1 "The Motorbike"

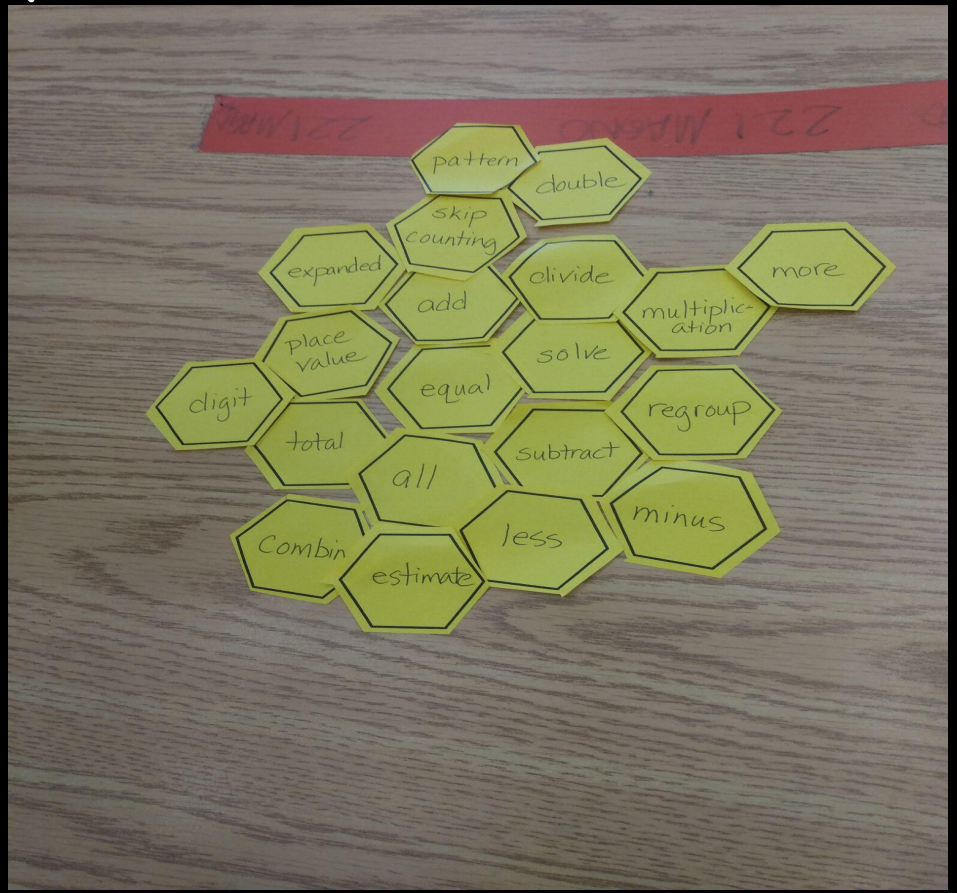
6 groups (in groups of 3)

Some teacher prompting was needed at first. However, the design of the final product was what intrigued students



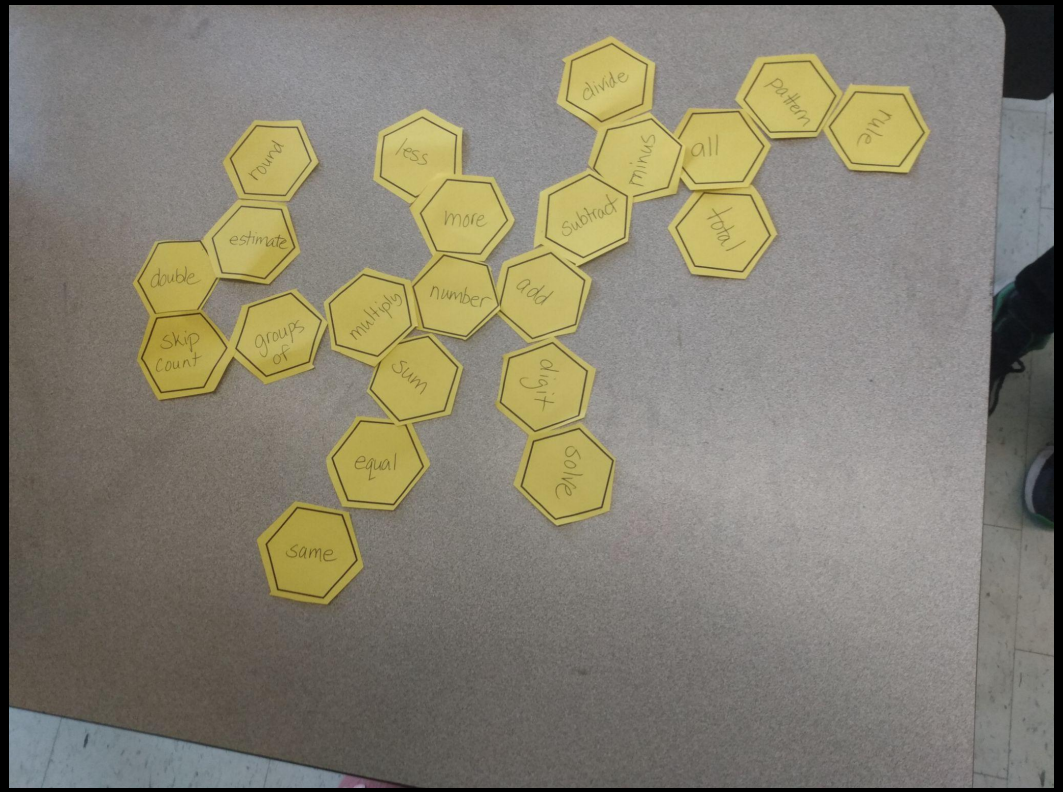
Group #2 - "The Fish"

Students were discussing and questioning each other's opinions and reasoning. This allowed them to develop different perspectives of how they can go about completing this task.



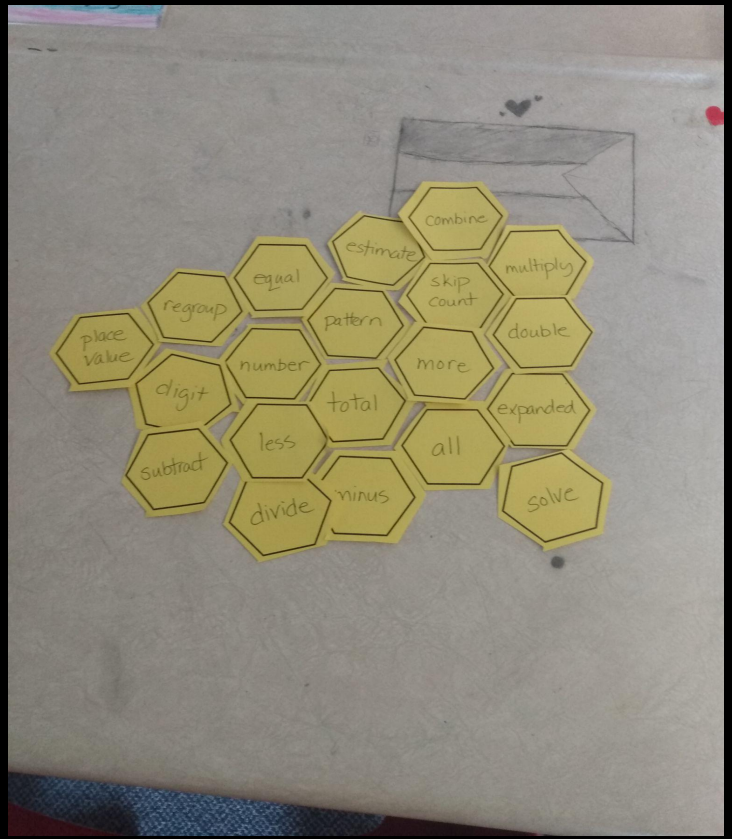
Group #3- The Spider

This opportunity provided students to improve their communication skills, collaboration and provides a larger capacity for brainstorming different ideas. This activity provided the opportunity to promote group productivity and creating a thinking culture.



Group #4 - "Animal Paw"

Some challenges that arose:
-prior knowledge of math vocabulary
-how to handle disagreements
- experiencing conflict in a more controlled setting, students learned about communication skills and how to resolve interpersonal issues more safely



Results/Takeaways from this exercise

- justifying connections was an emerging goal, especially when other students were not able to understand others' rationale
- however, common words such as minus, subtraction and less were more simpler to justify *(daily common language)* vocabulary was chosen in various complexities
- collaboration increased with the students especially when they questioned each other
- student groups were randomly chosen
- building upon students' personal word bank. (with new words)

Strategies that we used for all tasks:

-vertical boards - Wipe Books

-student math inventories

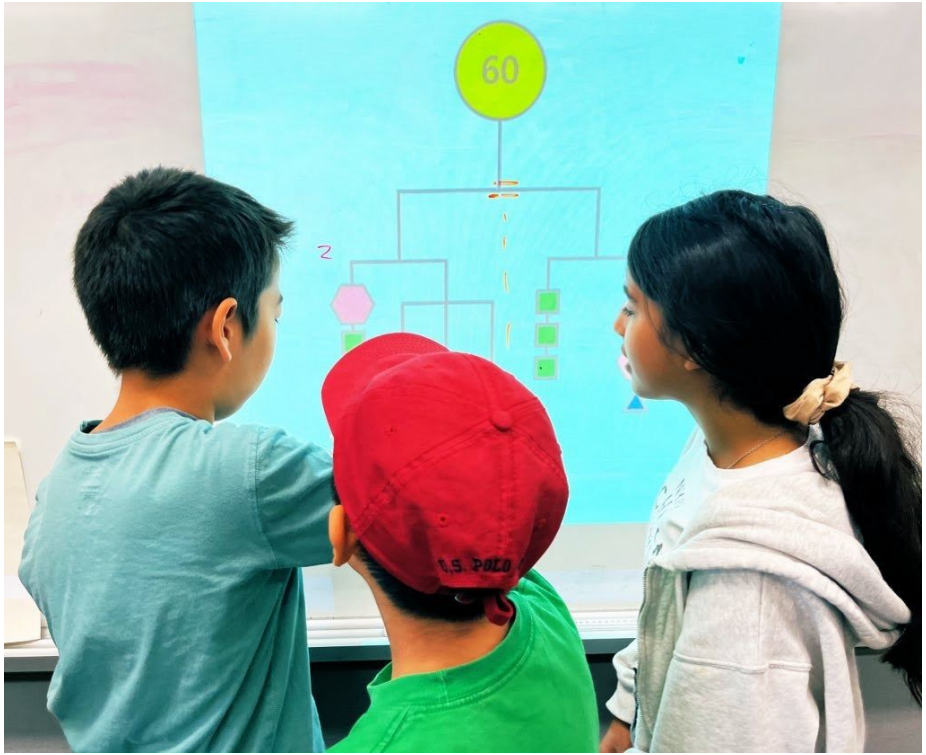
-student voice and choice

- various forms of student groupings

- graphic organizers

Random Group Generator

Redundancy

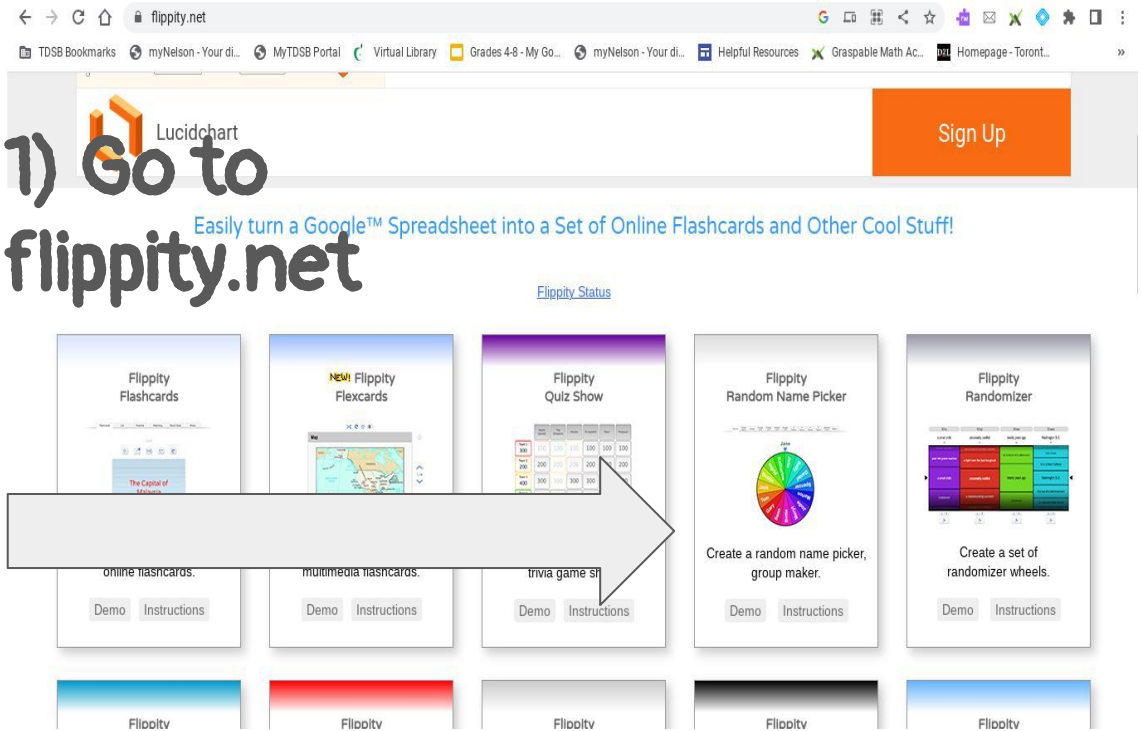


Diversity

Benefits of Visibly Random Groups

- Greater willingness to collaborate
- Elimination of social barriers
- Increased knowledge mobility
- Increased enthusiasm for math learning
- Reduced social stress

1) Go to flippity.net



2) Click "Instructions"

"The goal of building, thinking classrooms is not to find engaging tasks for students to think about. The goal of thinking classrooms is to build engaged students that are willing to think about any task." - P. Liljedahl

Summary

- The role of the educator has not changed, rather it is evolving towards a more innovative and explorative direction to support a building and thinking classroom

- When we create a building and thinking environment, students are thinking about math in ways that are purposefully sequenced, that highlight connections and underlying ideas, and builds off of their prior knowledge.

- Choosing the right problem, taking meaningful notes and checking for understanding are essential tools towards our approach with students in a building and thinking environment.

Presentation has now concluded!

Thank you for taking the time to listen to my reflections