A Coach's Experience Building a Thinking Classroom Lab in an Elementary School

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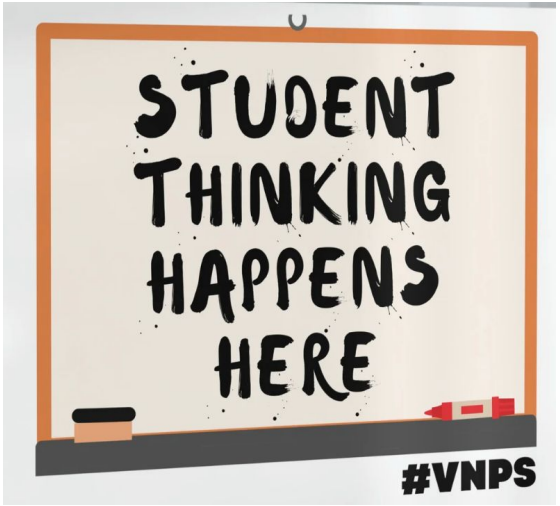
Agenda



- Overview of BTC philosophy
- Daniels Farm Teacher Learning
- Launch with non-curricular tasks
- Discourse
- Student Work
- Thoughts from students, teachers, and administrators
- Reflections

Early Set-Up of Math Lab

2022-2023 School Focus Statement

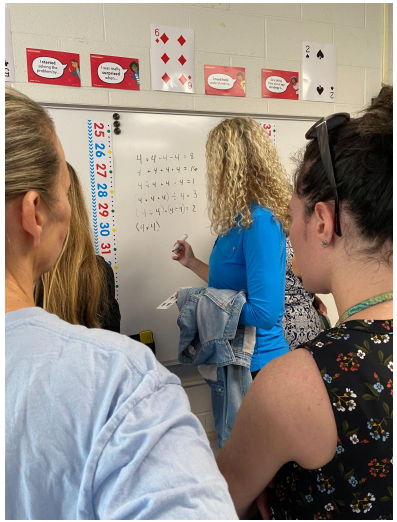
“Thinking is a necessary precursor to learning, and if students are not thinking, they are not learning.”

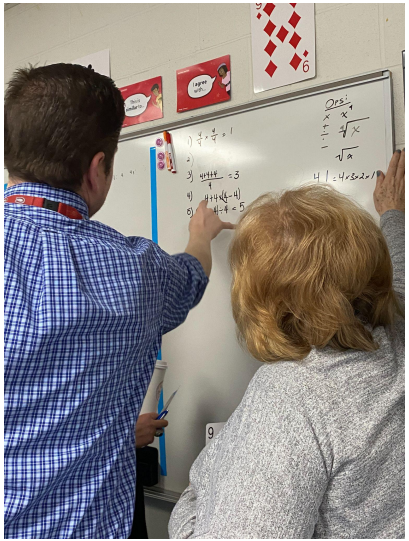
- Peter Liljedahl

Building Thinking Classroom		Traditional Classroom
Defronted classroom	→	Teacher's desk is in front of the room
Students work at VNPS (vertical non-permanent surfaces)	→	Students work at desks, seated
Knowledge mobility	→	Teacher has all the knowledge
Assignments given orally	→	Assignments are taken out of the book
Visibly random groups	→	Students work independently
Work starts w/in 5 minutes	→	Students work after the "I do, we do" portion of the lesson

2022-2023
Math Lab Data

- Trimester 1 we had 92 lab visits
- Trimester 2 we had 87 lab visits
- All grades have been to the lab at least 6 times
- The work in the lab includes tasks & thin sliced lessons

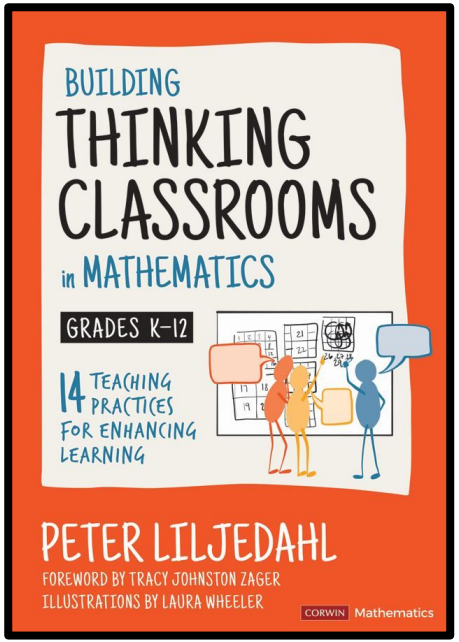




Teacher Learning

Task

Find every number between 1 and 20 using only four 4s and any operation.



Thinking is the Goal

- Thinking vs. Studenting
  - **Trying it on their own** – attempting to work through a problem, regardless of whether they got it right or not
  - **Slacking** – not attempting to work at all
  - **Stalling** – doing legitimate off-task behavior
  - **Faking** – pretending to do the task but really doing nothing
  - **Mimicking** – mindlessly repeating what they have in their notes

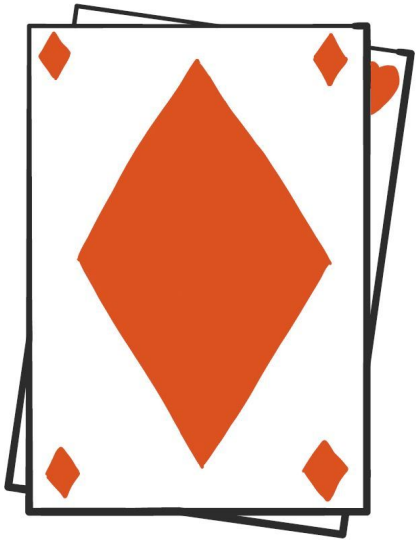
The Fourteen Practices - What Teachers Do

1. What types of tasks we use
2. How we form collaborative groups
3. Where students work
4. How we arrange the furniture
5. How we answer student questions
6. When, where, & how tasks are given
7. What homework looks like
8. How we foster student autonomy
9. How we use hints and extensions
10. How we consolidate a lesson
11. How students take notes
12. What we choose to evaluate
13. How we use formative assessment
14. How we grade

1. Types of Tasks We Use

- “Problem solving is what we do when we don’t know what to do.” - Peter Liljedahl
- Begin with non-curricular tasks to establish norms
- **Low-floor task** – anyone can get started with the problem
- **High-ceiling task** – they have enough complexity to keep people engaged
- **Open-middle** – while there is a single correct answer, there are multiple ways to solve the problem

2. How We Form Collaborative Groups

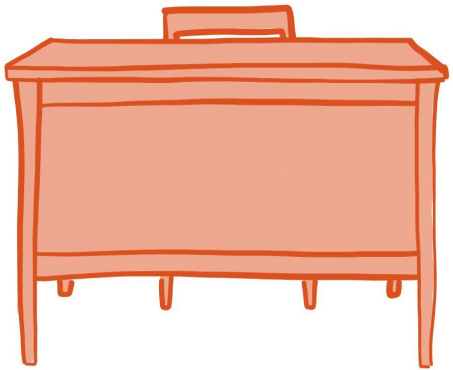


- The groupings have to be visibly random
- Grades 2+ - Three students is the ideal group size
- Grades K & 1 - Two students is ideal group size
- We like to say, “The cards have spoken.”

3. Where Students Work

- Sitting at desk writing in notebook is the LEAST conducive to thinking
- Vertical Non-Permanent Surfaces (VNPS)
- Non-permanent surface promoted more risk taking
- Transformed passive environment into a thinking learning space

4. How We Arrange the Furniture



- Defront the classroom
- Teacher at front = teacher is knowledge
- “Thinking is messy….. It turns out that in super organized classrooms, students don’t feel safe to get messy in these ways. The message they are receiving is that learning needs to be orderly, structured, and precise.” - Peter Liljedahl

Getting students started with non-curricular tasks

Grade K

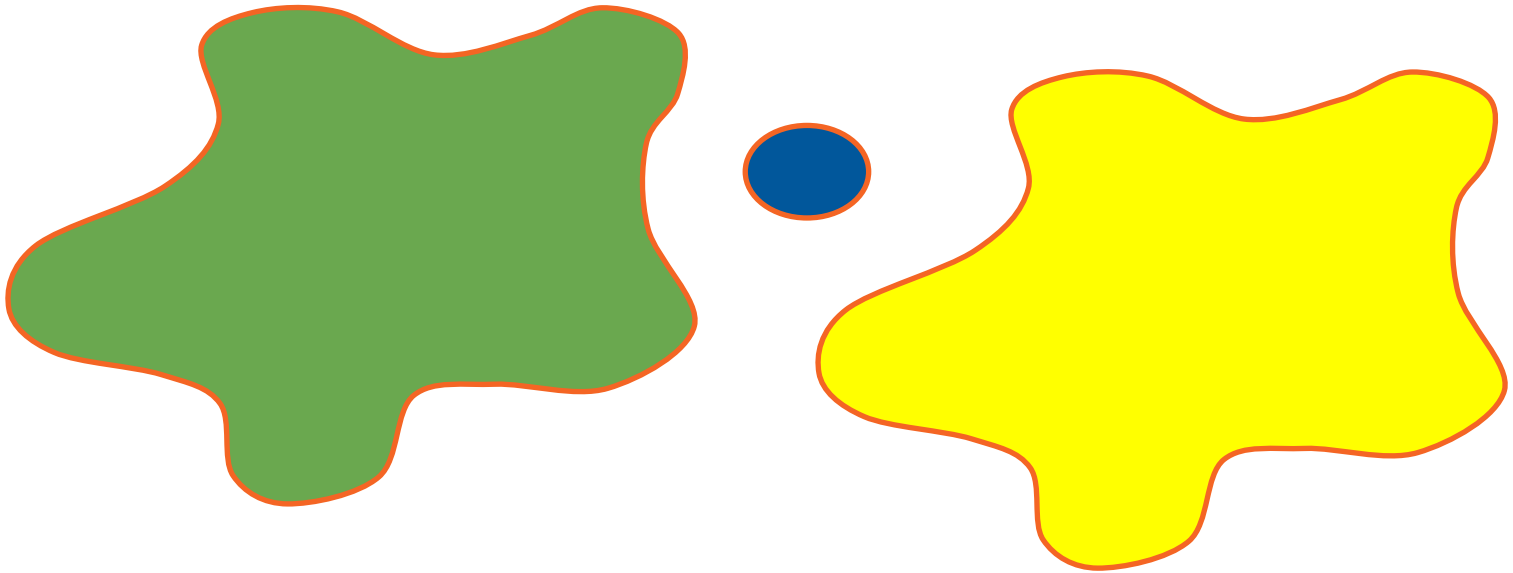
Presented to the kindergarteners orally:

- What do you notice?
- What do you wonder?

Your job today is to draw 5 flowers with your partner.

9

Grade 1



Task: How many blue dots are under the green splat?
How many blue dots are under the yellow splat?

Grade 2

Take 10 cards numbered 0 to 9.

Pick 3 cards with a total of 12.
You can do it in 10 different ways.
How many can you find?

YOHAKU PUZZLE

Grade 3

You will need three addends to make each sum.

You can only use the numbers

1, 2, 3, 4, 5, 6, 7, and 8

How many solutions can you find?

			12
			13
			11
10	12	14	+

SOLVE ME MOBILES

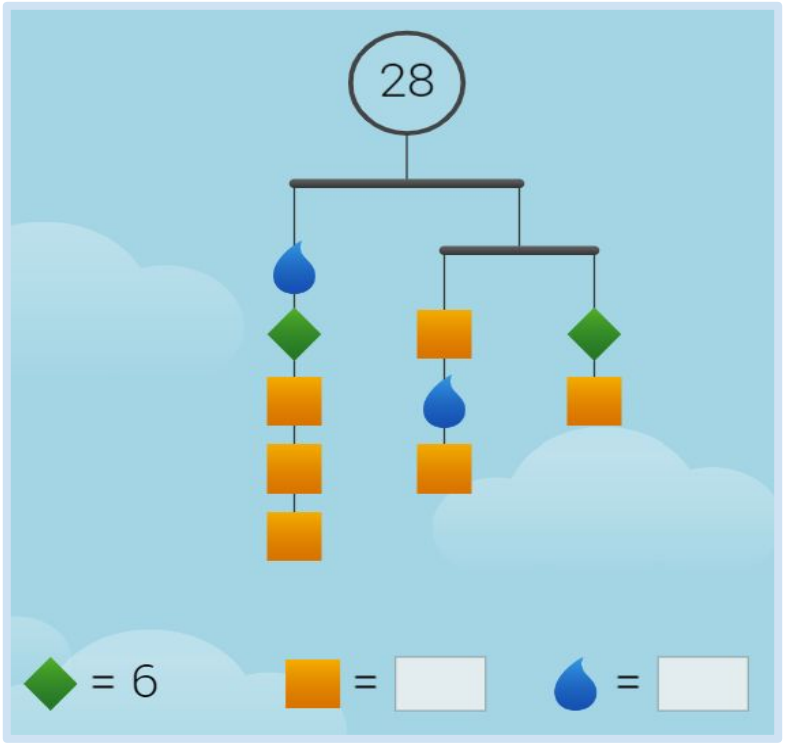
Grade 4

How do these Mobile Puzzles work?

The Mobile is balanced which means each side of the mobile is the same value. You need to figure out what each shape is worth in order to get the total. Each shape is a different whole number.

THERE IS ONLY 1 SOLUTION.

What is the value of the following:

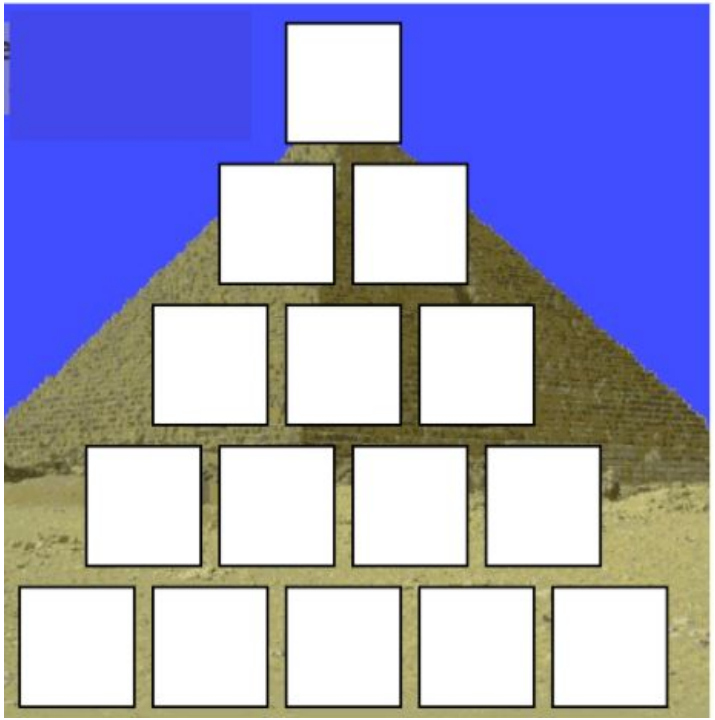


https://solveme.edc.org/Mobiles.html?toosmall=no

Pyramid Puzzle - Building Up

Grade 5

You are going to put the numbers 1 to 5 in the bottom row of this pyramid. They can be arranged in any order. The numbers in the other bricks are found by adding the two bricks immediately below together. The challenge is to find the arrangement of the numbers 1-5 in the bottom row that gives the largest total in the top brick of the pyramid.



Using Curricular Materials

Focusing on the standard you are teaching helps you identify the task.

Grade 5 Example

The Eureka book suggested teachers call on students one operation at a time to provide an example of how they would use each operation in the situations they had brainstormed as a class.

The teacher fills in the anchor chart while student provide word problems. Repeat for 2 or 3 situations.

Situation	Add	Subtract	Multiply	Divide
Baking cookies	Find the total number of cookies.	How many cookies are left after you eat some?	There are _____ times as many chocolate chip cookies as sugar cookies.	How many cookies can each person have?
Organizing pencils	Find the total number of pencils.	How many pencils are left after another class borrows some?	There are _____ times as many purple pencils as blue pencils.	How many pencils can go in each bin?
Counting money	How much money do you have in all?	If you spend some money, how much money is left?	Find the amount of money it costs to buy _____ sandwiches.	Find the amount of money each person gets if it is divided equally.
Riding the subway	Find the total number of people in the subway car.	How many people are still on the subway car after _____ people get off?	If there are _____ people in each car of the train, how many people are on _____ cars?	If there are _____ people altogether in _____ cars, and the same number of people are in each car, how many people are in each car?

Instead.....

I put the students into random groups using the playing cards. They were asked to create word problems for one situation across all four operations.

We came back together and I called on groups to share one specific story for each situation. I had preselected some of the stories I wanted to be shared.

Situation	Add	Subtract	Multiply	Divide
Baking Cookies				
Riding the Subway				
Counting Money				

Grade 2 Example

Grade 4 Example

Folding chairs are set up for a school play.

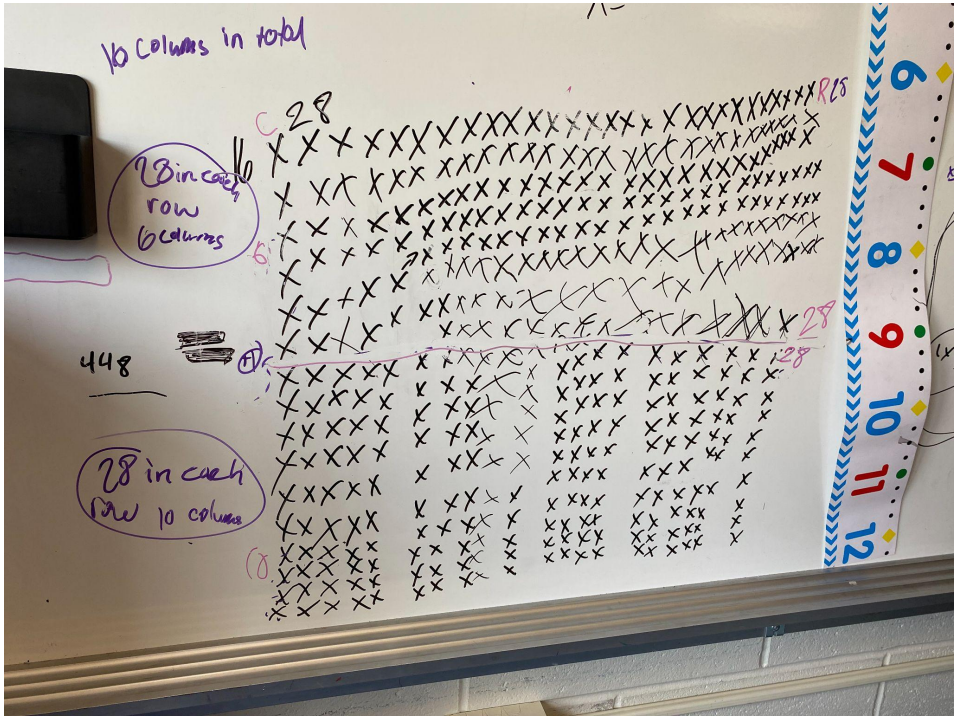
There are 16 rows of chairs, each with 28 chairs.

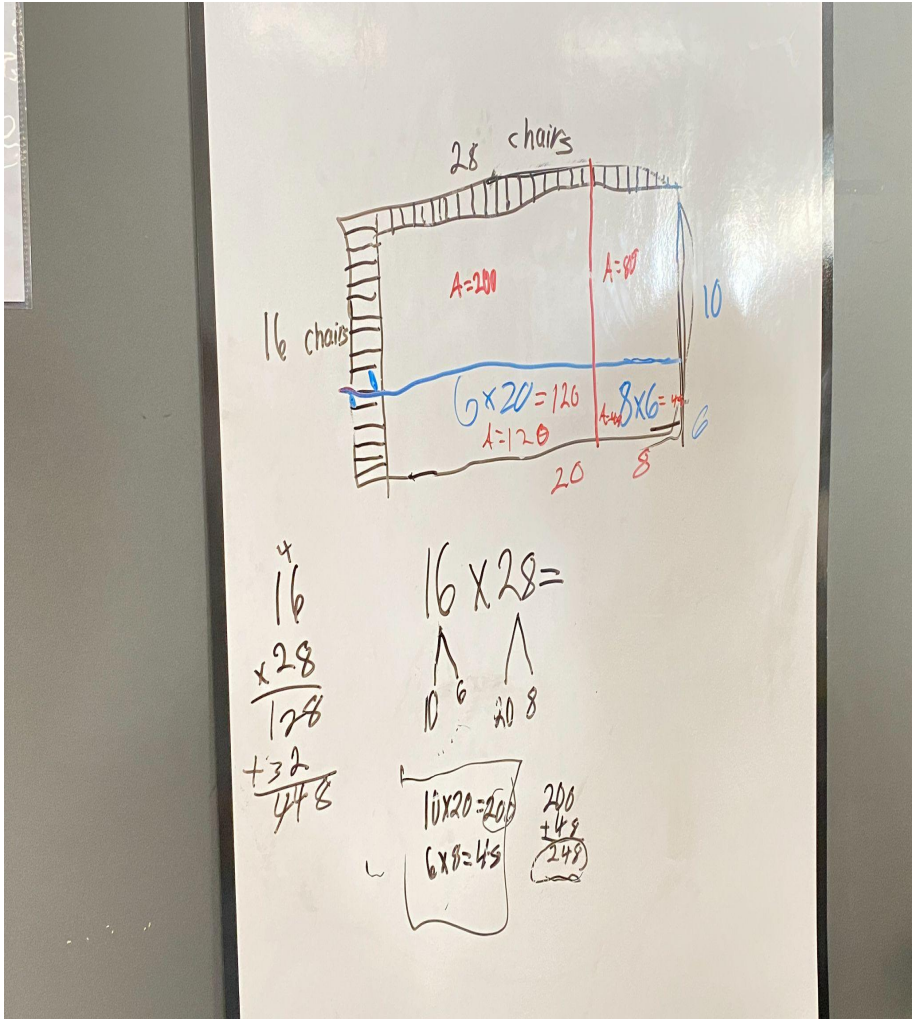
How many folding chairs are there?

The answer is 448 chairs.

Can you use only multiplication to prove the answer is correct?

Grade 4 students “discover” the area model





Discourse

Talking helps people think and helps students learn to think.

WHEN A STUDENT RECOGNIZES THEY DON'T KNOW SOMETHING, IT SHOULD BE A TRANSITION TO KNOWING, NOT A TERMINATION OF THINKING.

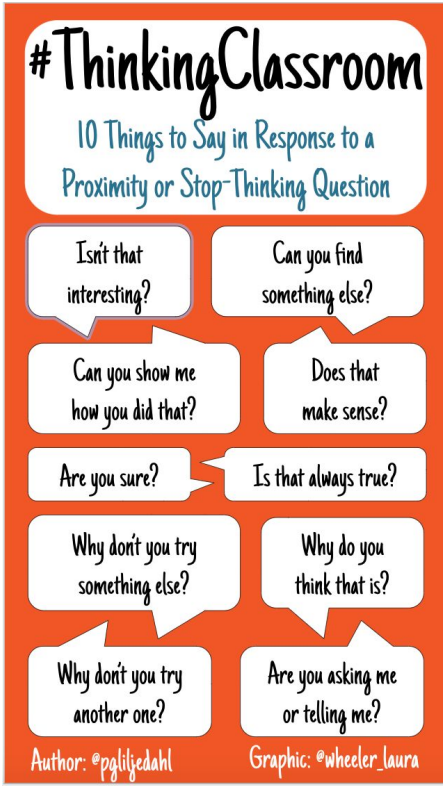
Connie Hamilton

NCTM Definition

Discourse is the **mathematical communication** that occurs in a classroom. Effective discourse happens when **students articulate their own ideas** and seriously **consider their peers' mathematical perspectives** as a way **to construct mathematical understandings.** Encouraging students to **construct their own mathematical understanding through discourse** is an effective way to teach mathematics, especially since the role of the teacher has transformed from being a **transmitter of knowledge to one who presents worthwhile and engaging mathematical tasks.**

Does this create engagement?

In the traditional classroom, students **answer questions**; they **don't usually ask them**. For years, students have sat in classrooms where the **teachers ask the questions to which they already know the answer**.

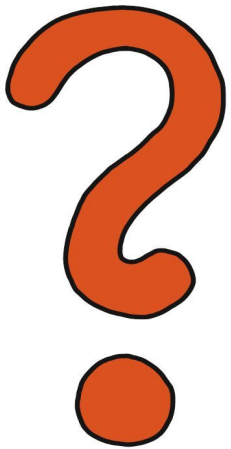


Questioning: Who is doing the asking?

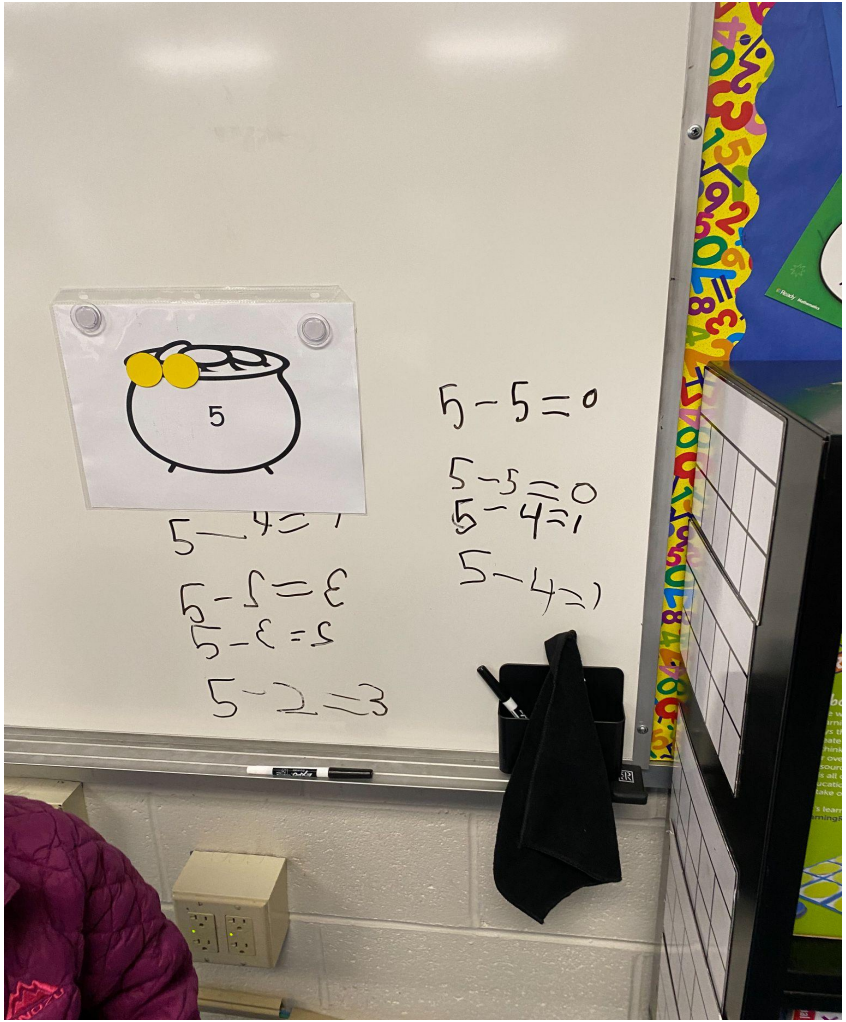
Good thinkers are good **questioners,** and with many students, this skill does not happen automatically or by accident. In a thoughtful classroom, the **encouragement of student questions** is very important.

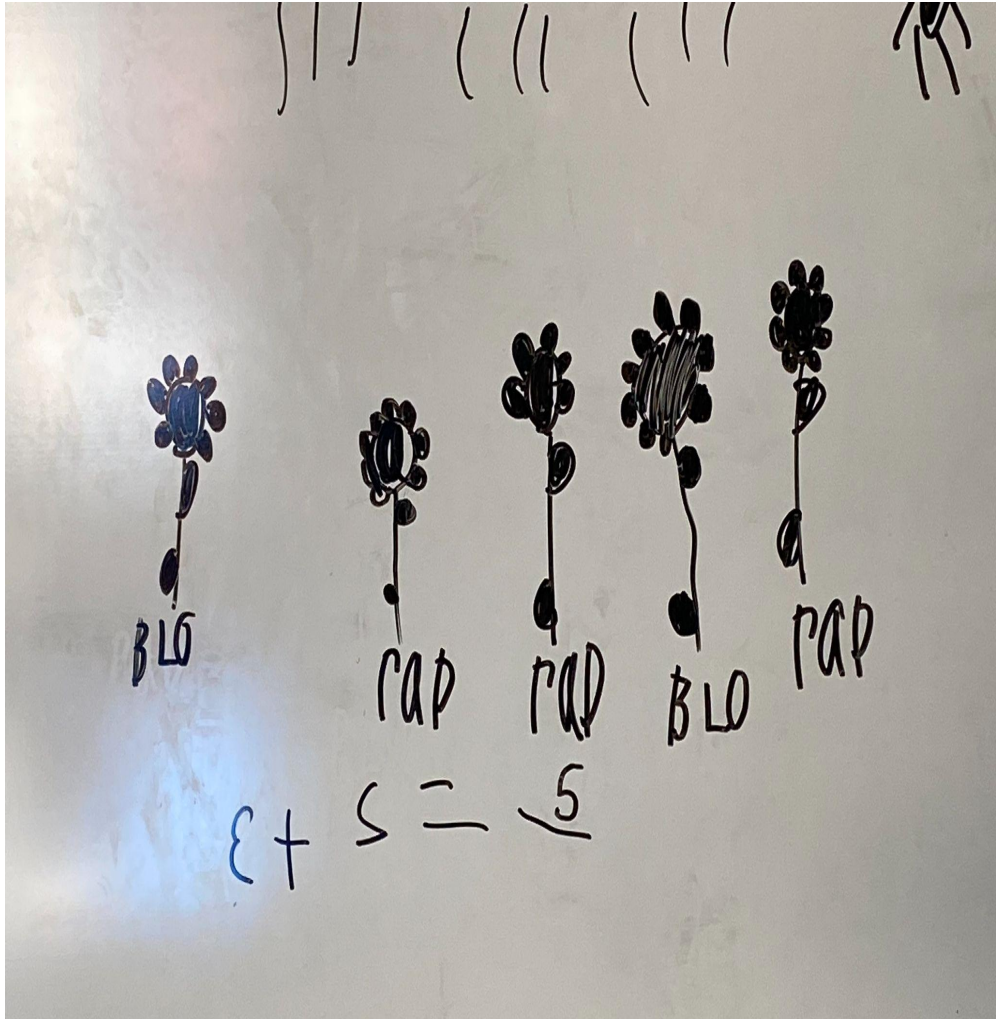
Productive Struggle

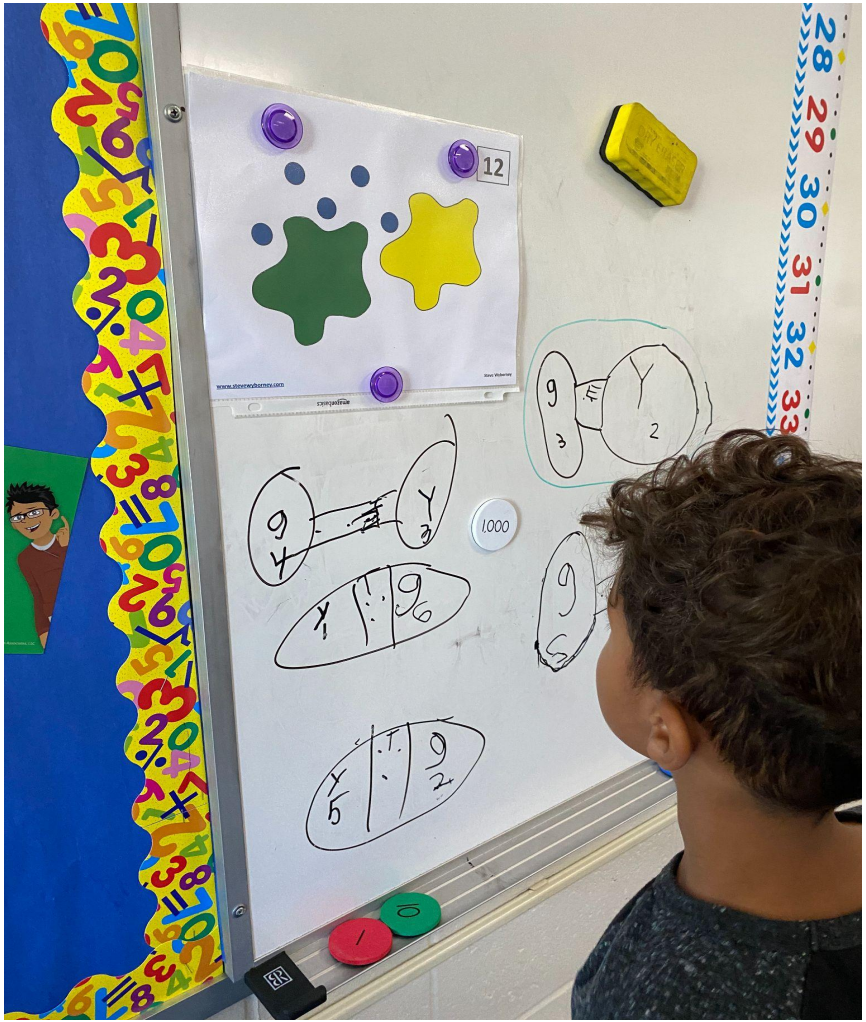
Genuine perplexity, which is at the **root of all learning,** is rarely admitted by students. **Risk** is involved in **caring about something enough to confess lack of knowledge about it**. Creating an environment in which students **freely question** subject matter, the teacher, and each other is **critical for developing thinking.**

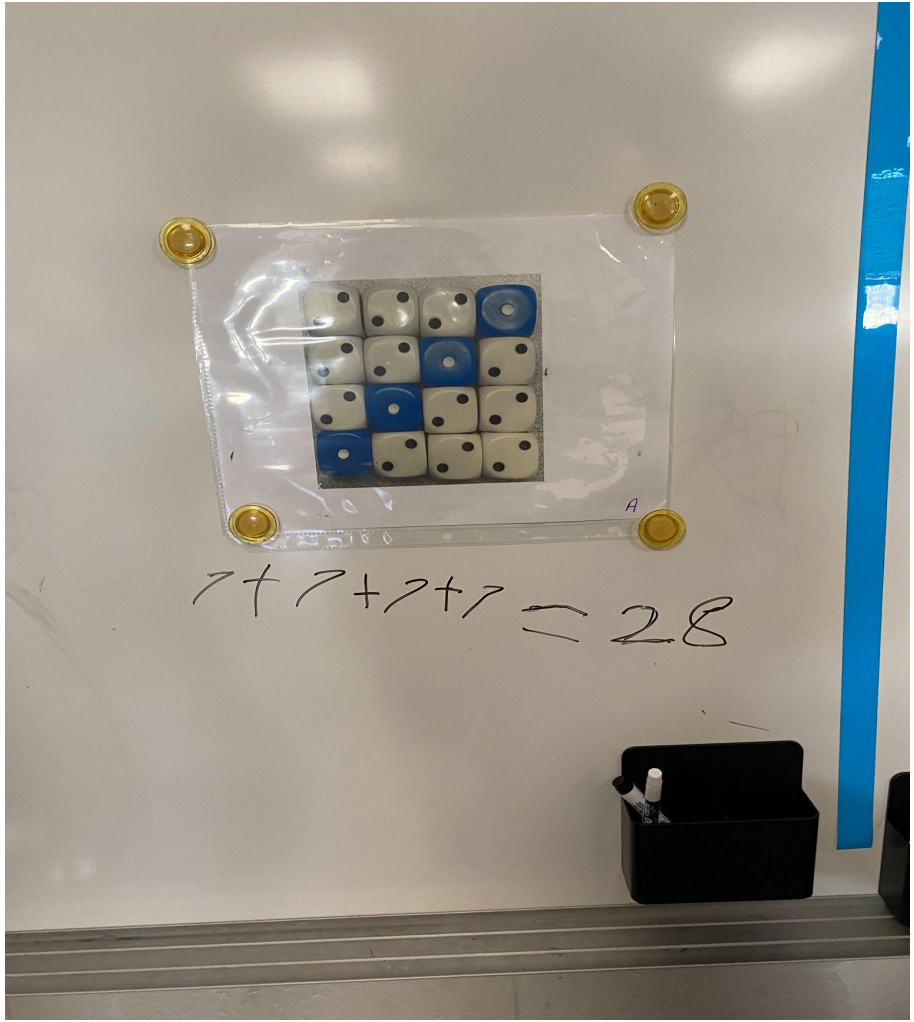


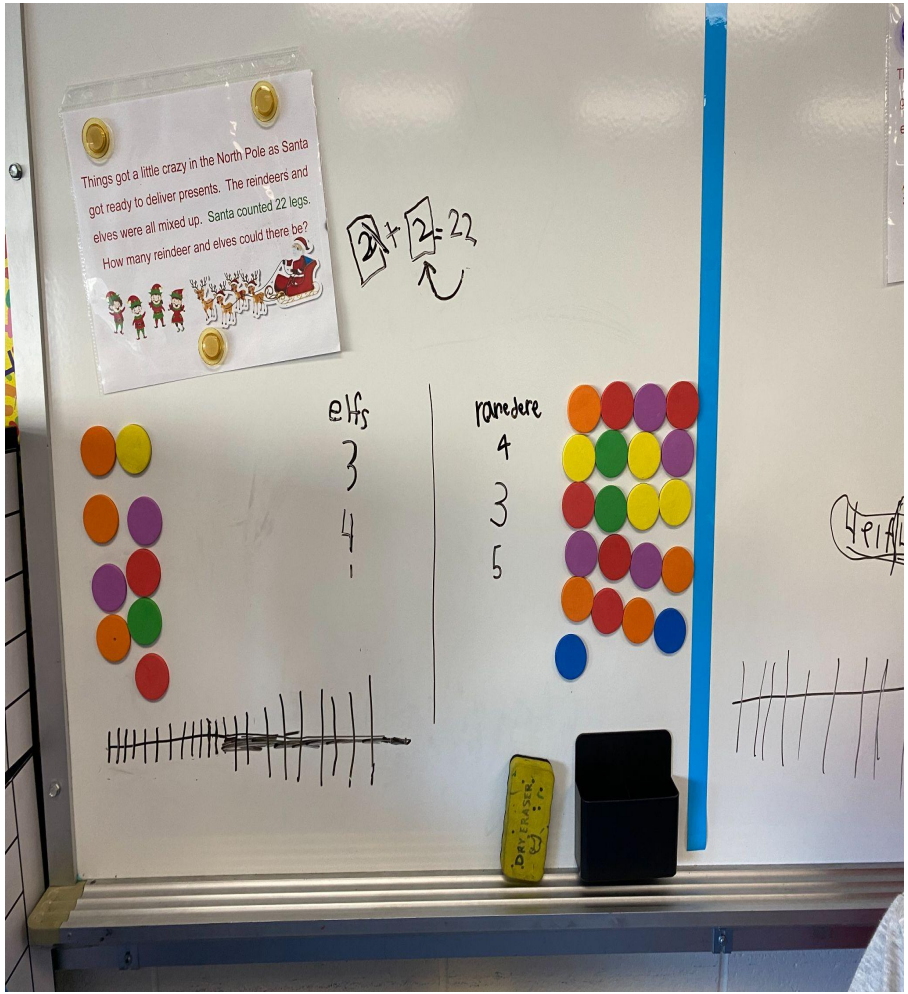
Student Work Examples

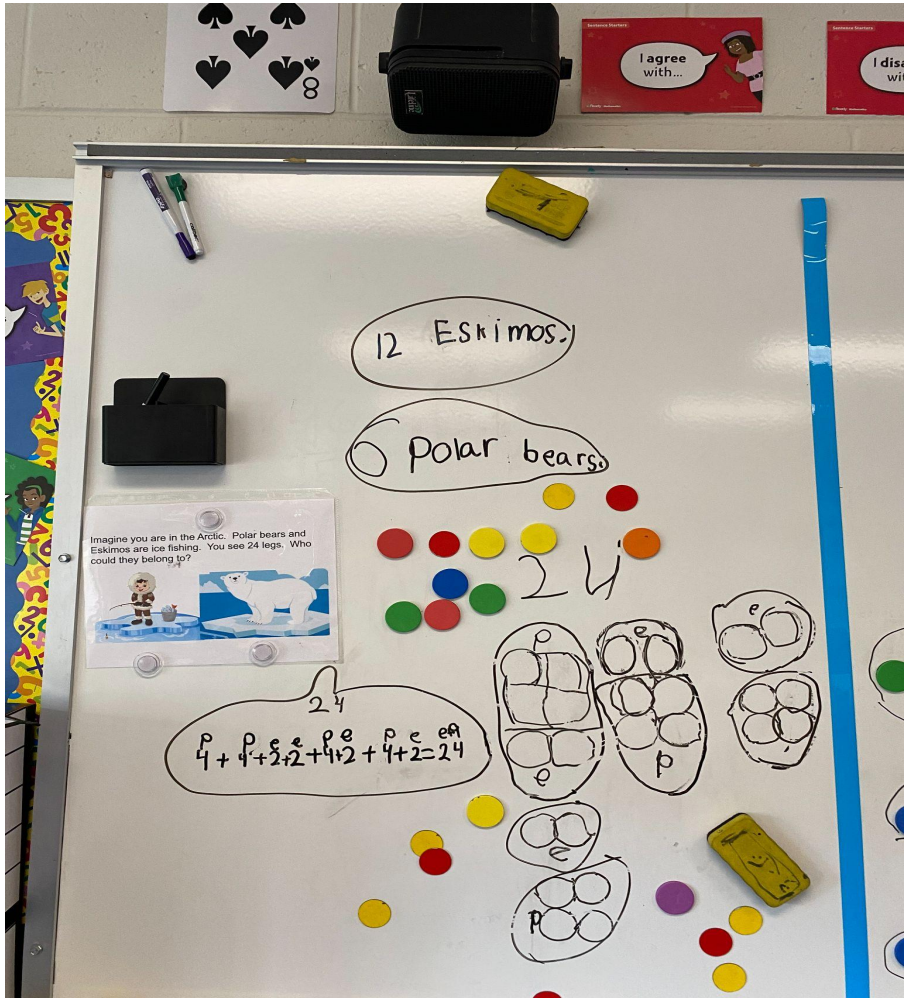

5
5-5=0
5-4=1
5-4=1
5-2=3


BLO
rap
rap
BLO
rap
3+2=5


12
1000


7+7+7+7=28


Things got a little crazy in the North Pole as Santa got ready to deliver presents. The reindeers and elves were all mixed up. Santa counted 22 legs. How many reindeer and elves could there be?
elfs
3
4
reindeer
4
3
5


I agree with...
12 Eskimos.
Polar bears.
Imagine you are in the Arctic. Polar bears and Eskimos are ice fishing. You see 24 legs. Who could they belong to?
24

150 banana 50¢

Apple 50¢ number jump

-60

-50 25- -15

150 90 80 65 0 zero

ninety fourty fifteen

Peppermint Patty 25¢

Use the Read, Draw, Write process to solve.

64 kids have milk with lunch.

27 kids have punch.

How many more kids have milk than punch?

c

There are 37 Milk with lunch Then Punch

60-20=40

4-7=-3

40-3=37

-30

-3 -4

27 30 64

Graphic Organizer 1: Change Problems (Add To or Take From)

Beginning Change + or − Ending

64 − ? 27

Equation:

Graphic Organizer 1: Change Problems (Add To or Take From)

Beginning Change + or − Ending

Equation:

16 x 10 = 160

16 x 6 =

A strawberry patch has 4 rows with 6 strawberry plants in each row.

How many strawberry plants are in the patch?

To grow strawberries the best way, the rows should be 4 feet apart. Each plant in the row should be 2 feet apart. How long and wide is the strawberry patch?

You can harvest 12 strawberries from each plant. How many strawberries will grow in each row?

6 x 4 = 24

Better Farms

One way to help endangered animals is to make better farms. When land is cleared for farming, it is taken away from wild animals. Alex wants to help farms grow more food so new farms are not needed.

The Wildlife Protectors raise money to buy farming supplies.

COMPOST 3

Compost: $10 each bag

Wooden Planters: $5 each box

Garden Washing Station: $40

Wooden Raised Bed: $79

Alex wants to know what the money from a $99 animal adoption kit can buy. The kit costs $8 to make. The rest of the money can buy farming supplies.

Alex has $273 to buy farming supplies.

$0 left

180 − 91 − 91 − 91 = 2 + 3

273 − 40 = 233 (Washer)

233 − 79 (Bed) = 154

154 − 10 (compost) = 144

144 − 5 = 139

139 − 10 = 129 (Wooden Planters)

129 − 79 = 50 (Wooden raised Bed)

50 − 40 = 10 (Washing station)

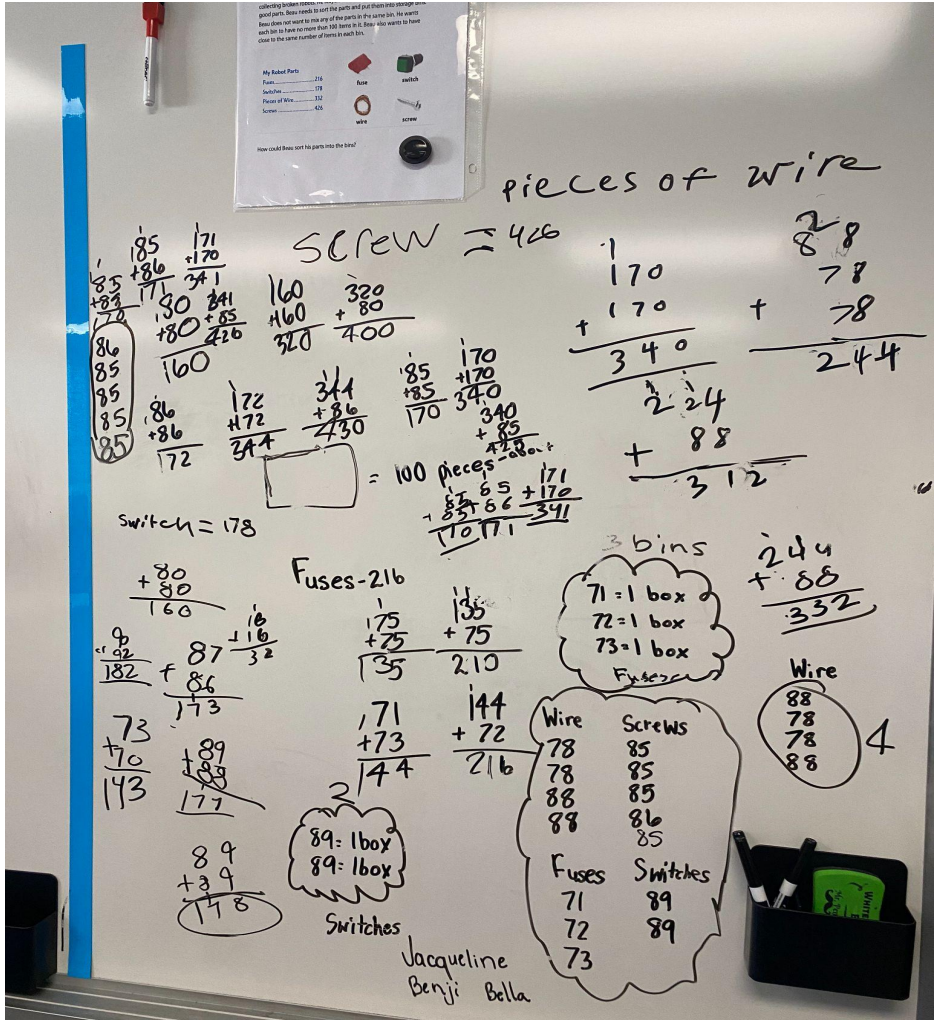
10 − 10 = 0 (compost)

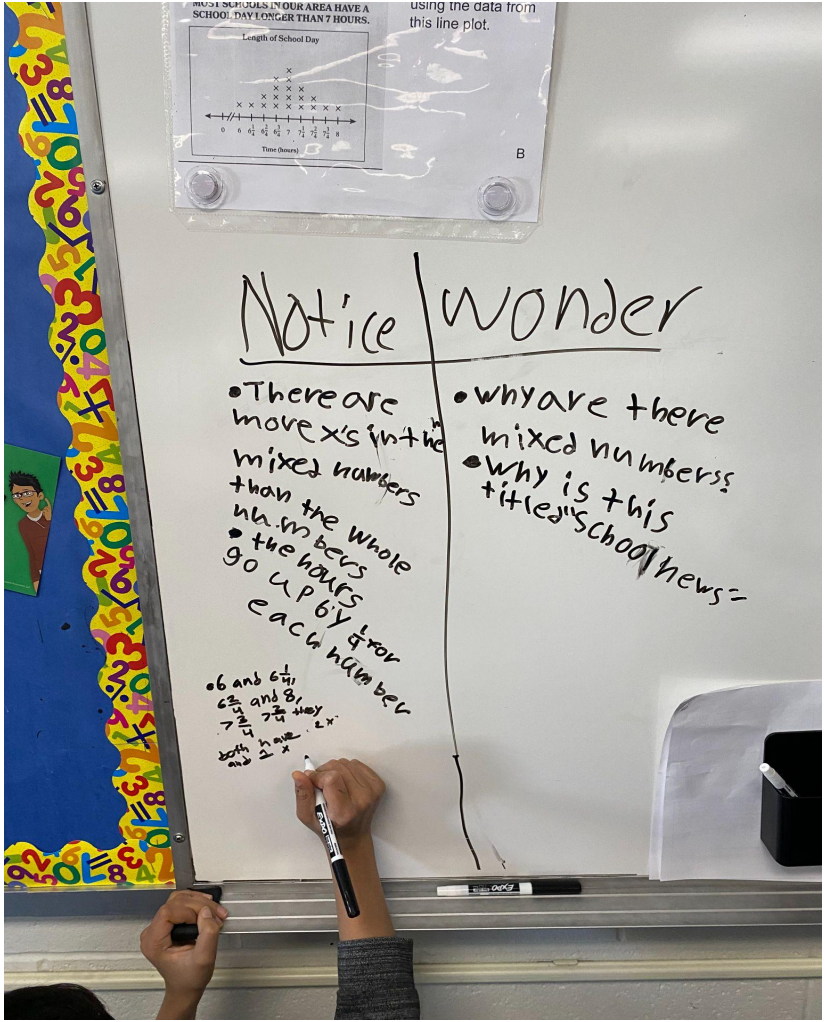
Page 1

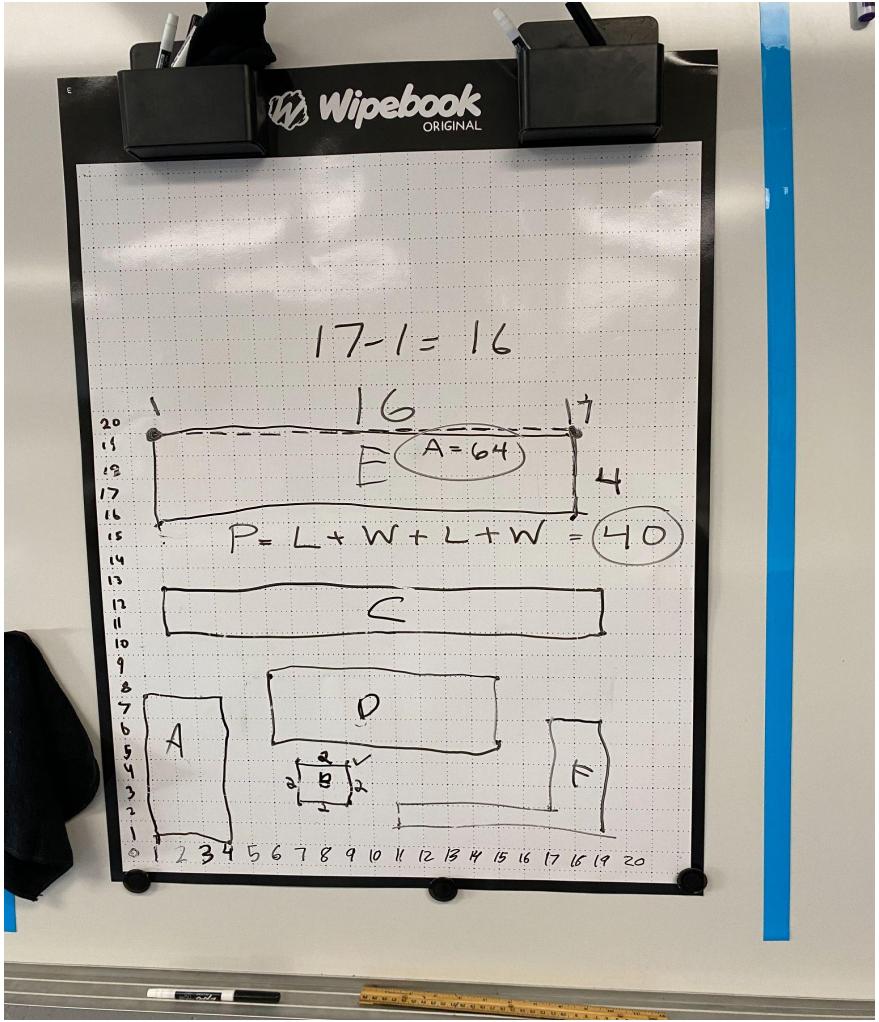
- Garden washer
- wooden raised Bed
- compost
- wooden Planters
- compost

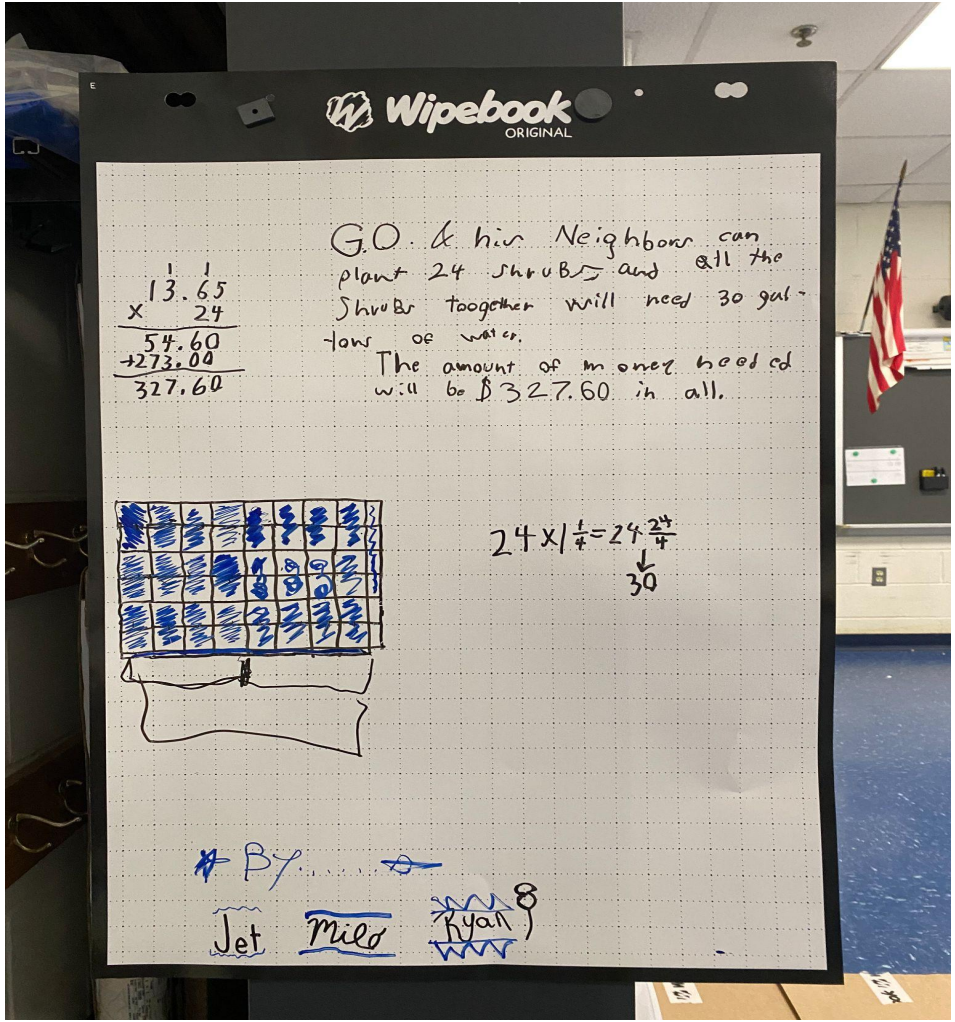
Page 2

- Wooden raised Bed
- Washing station
- COMPOST


pieces of wire
screw = 426
switch = 178
Fuses-216
3 bins
71 = 1 box
72 = 1 box
73 = 1 box
Wire
88
78
78
88
Wire Screws
78 85
78 85
88 85
88 86
Fuses Switches
71 89
72 89
73
89 = 1 box
89 = 1 box
Switches
Jacqueline
Benji Bella


Length of School Day
Time (hours)
Notice | wonder
• There are more x's in the mixed numbers than the whole numbers
• the hours go up by 1 for each number
• why are there mixed numbers
• why is this titled "school news"


Wipebook
ORIGINAL
17-1=16
16
1
17
A=64
4
P=L+W+L+W=40
C
D
A
B
E


Wipebook
ORIGINAL
13.65
x 24
54.60
+273.00
327.60
G.O. & his Neighbors can plant 24 shrubs and all the shrubs together will need 30 gallons of water.
The amount of money needed will be $327.60 in all.
24 x 1/4 = 24 24/4
30
By.....
Jet
Milo
Ryan

Thoughts from Students

What I like about coming to the math lab is.....

- “doing the math that challenges my mind and brain.”
- “doing problems with friends,”
- “that I can work with new people and if I make a mistake the other people in my group will help me so I don't get the whole question wrong.”
- “all the math. It make me HAPPY HAPPY HAPPY.”
- “I get to see what other people think about the problem cause everyone has a different brain and different strategies. Also, when I share my answer and strategies most of the time they agree with me and sometimes they don't.”
- “it's way more fun in the math lab than math in the classroom.”


THE BEST ANGLE
FROM WHICH
TO APPROACH
A PROBLEM IS THE
TRY ANGLE

Thoughts from Teachers

Teachers share their new learnings & reflections

- “I have always paired students with so much thought behind each pairing, but in the lab, I was amazed as to how the **random partnerships showed different abilities**. Students showed skills that I may not have noticed if not for the lab.”
- “The math lab has really taught me to **stand back and give more think/wait time.** I often want to jump in and help “teach” the students the way to solve problems, but I’ve learned how valuable it is to stand back and let the students work it out. **They are capable of SO much!”**
- “I am blown away by the skills that I have seen Kindergarten students use in the math lab. The children have **expanded their critical thinking skills beyond what I have ever seen in past years.** They work well together and learn so much from each other! They get so excited when I say we are going to the math lab!”
- “**As a teacher I have grown in my ability to sit back and let thinking happen**. By giving the students time to figure it out, they continue to surprise me with what they do, how they get to an answer, and **how they communicate their thinking.** They come up with ways to show their thinking that I would not have thought of. “

Instructional Rounds

Observer Noticings

Capturing Student Thinking & Discourse

- Student: “You don’t have to use a math tool, you can visualize it.”
- All students did not always agree, but considered the mathematical perspective of each other.
- Students were critical of each other’s work: “Wait, but it’s not equal.”
- “What should we write next?” “Thirds” “We could do that” “We can do whatever we want in our work space.”
- Student: “We won’t have enough room if we draw it this way.”
- Students were able to ask other groups clarifying questions. One student thought her thinking was clear and realized that others needed more clarifications.
- Student : “We don’t have to be too complex.” (When considering which denominators to use.)

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Capturing Teacher Moves & Facilitation

- The teacher highlighted students who made mistakes to showcase learning opportunities.
- Teacher: “What does it mean when I say show more ways to do it?” Student: “There’s more than one way so everyone can be right.”
- Teacher: “Do you want to go back and revise this?”
- Teacher : “What are some things we do as mathematicians if we are stuck?”
- Teacher asked questions that allowed students to go back to the task and evaluate their thinking.
- To initiate the task, the teacher gave some examples to give all students access to the context.
- Teacher as a facilitator – open-ended questions/rephrasing.

Reflections/Suggestions

Some things I learned along the way

- Consider the students in your class/building and their needs
    - Student(s) in wheelchairs
    - Student(s) who might need to work in a quieter space
- Busy yourself away from the students for the first 5-7 minutes so they can talk through the task and get started without interruption
- Even our youngest students can work for 45-minutes if the task is engaging
- Always plan an extension
- Handing out the cards after the task was delivered worked better than when they came in the door
- Purchase plenty of expo markers and erasers
- Magnetic manipulatives are a must

Questions & Answers

Contact

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