Clovis Unified School District

June 14-15, 2016

by: **Graham Fletcher**
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Broken Squares

- Designate shape keeper
- Share the shapes as evenly as possible between the group
- All the shapes will make 6 congruent squares with no shapes leftover

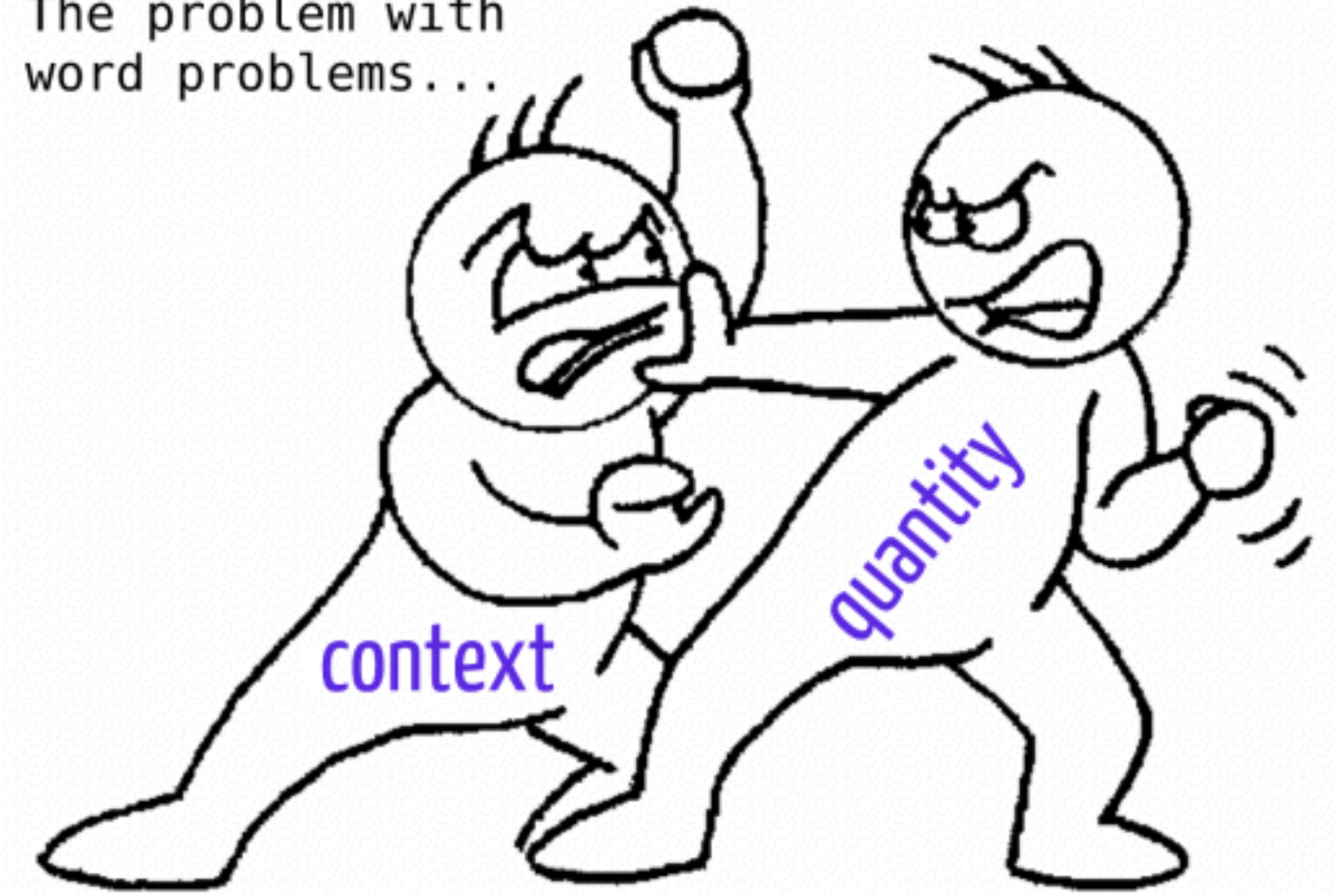
- Everyone is encouraged to **OFFER** a shape. No one may **TAKE** or **SNATCH**. You may RECEIVE a shape but only if it's **OFFERED**
- No "community square"

Joe had some playing cards in his bag. Ashley gave him 13 more cards. Joe now has 21 cards. How many cards did Joe have in his bag?

13

21

The problem with word problems...



@gfletchy

Joe had some playing cards in his bag. Ashley gave him 13 more cards. Joe now has 21 cards. How many cards did Joe have in his bag?

Joe had some playing cards in his bag. Ashley gave him [ ] more cards. Joe now has [ ] cards. How many cards did Joe have in his bag?

How many cards did Joe have in his bag?

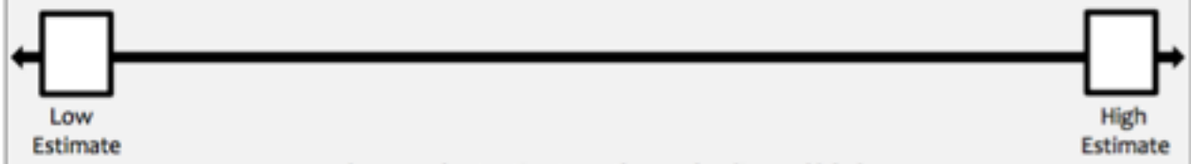
Name: _____ Date: _____

1. What did you notice?

2. What do you wonder?

3. Main Question:

4. Estimate



place your best estimate on the number line and label

5. What information would you like to know?

6. Answer

What do you notice?

What do you wonder?

4. Estimate

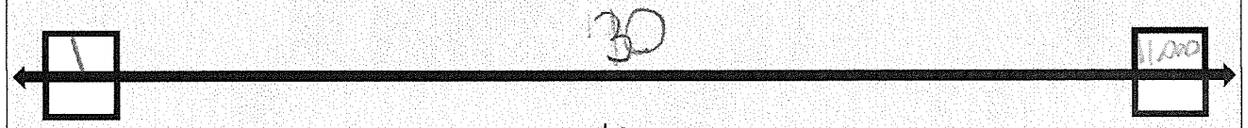
Name: [redacted] Date:

1. **What did you notice?** he put more and more wapers in the jar.

2. **What do you wonder?** how many wapers are in each pack?

3. **Main Question:** how many wapers are in the jar

4. **Estimate**



Low
High
Estimate
Estimate
place your best estimate on the number line and label

5. **What information would you like to know?** how many wapers are in each pack

?

Questions

Packages Used

The number of Whoppers that come in a package

3 minutes

individual work time

Standards for Mathematical Practice

Mathematically Proficient Students can……

1. **Make sense of problems and persevere in solving them**
   - *-doing mathematics means solving problems and discussing how they solved them*
   - *-plan a solution pathway and adjust as needed as they work through the problem*
   - *-persevere (" First, I drew a diagram, and it didn't help, so I tried to make a table. That worked much better because I found a pattern.")*
   - *-explain thinking through equations, verbal descriptions, tables, graphs, diagrams and search for trends in data*
2. **Reason abstractly and quantitatively**
   - *-numbers represent quantities and these quantities can be represented with symbols*
   - *-generalize based on what they observe*
   - *-"I know that rectangles are parallelograms with four right angles ….so that means this square must be a rectangle because . . ."*
3. **Construct viable arguments and critique the reasoning of others**
   - *-make conjectures with support and reason through the use of objects, drawings, diagrams and actions*
   - *-ask and respond to questions like, "How did you get that?" and "Why is that true?"*
4. **Model with mathematics**
   - *-put mathematics in the context of real world situations and identify those relationships*
   - *-use organizational strategies such as making a table, creating a number line, drawing diagrams, use objects, etc.*
5. **Use appropriate tools strategically**
   - *-use familiar, grade appropriate tools and know when they can be helpful*
   - *-recognize both the strengths and limitations of the tool being used*

6. **Attend to precision**
   - *-communicate precisely to others through my language, models and representations*
   - *-calculate accurately and efficiently, and show flexibility with strategies*
7. **Look for and make use of structure**
   - *-look closely at patterns and structure*
   - *-identify and understand the make-up and inclusion of number (commutative and distributive properties)*
8. **Look for and express regularity in repeating reasoning**
   - *-continually evaluate the reasonableness of intermediate results ("I notice when I divide 4 by 11, I get 0.36, then I keep dividing the same numbers over and over.")*
   - *-students continually check their work by asking themselves, "Does this make sense?"*

Mathematical Modeling

?

Modeling with Mathematics

What ISN'T mathematical modeling

- The use of manipulatives does not ensure that modeling with mathematics is taking place.
- If the mathematics is not contextualized, modeling with mathematics cannot exist.
- Modeling with mathematics does not mean, "I do, we do, you do."

Model with Mathematics

Mathematically proficient students can apply the mathematics they know to **solve problems arising in everyday life**, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. Mathematically proficient students who can apply what they know are comfortable **making assumptions and approximations** to simplify a complicated situation, realizing that these may need revision later. They are able to **identify important quantities** in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can **analyze those relationships** mathematically to draw conclusions. They routinely **interpret their mathematical results** in the context of the situation and **reflect on whether the results make sense**, possibly improving the model if it has not served its purpose.

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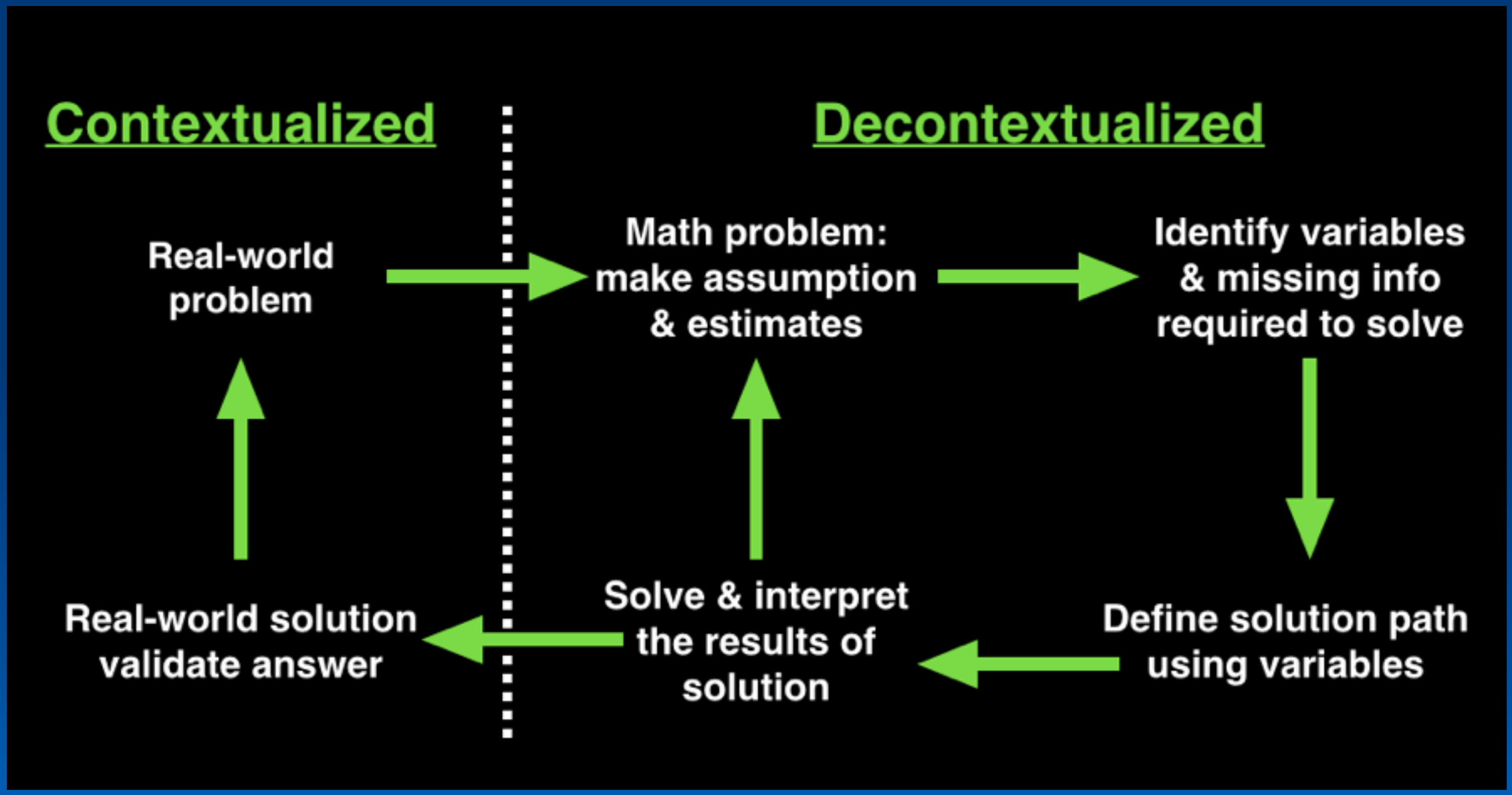
#4 Model with Mathematics in the Elementary Grades



3 Things on the road to modeling…

- Identify the problem, or pose a question.
- Make an estimate.
- Identify the variables needed to solve, and answer the problem or question posed.

Most asked questions:

- How often should we use 3-Act Tasks?
- When should we use 3-Act tasks? How do they fit into the scope of a unit?
- How long does one task usually take?
- What if we don't have the time?
- Any others?

NUMBER SENSE TRAJECTORY

1. **Cut and separate** all the headers and descriptors
2. **Match** the header to the correct descriptor
3. **Place** them in order and **glue** to chart paper
4. **Explain** the stage and what student thinking would look like in each stage (use number, pictures, and/or words).

Kindergarten  2nd Grade

Number Sense Trajectory –*Putting It All Together*

Trajectory	**Subitizing**	**Comparison**	**Counting**	**One-to-One Correspondence**	**Cardinality**	**Hierarchical Inclusion**	**Number Conservation**
	Being able to visually recognize a quantity of 5 or less.	Being able to compare quantities by identifying which has more and which has less.	Rote procedure of counting. The meaning attached to counting is developed through one-to-one correspondence.	Students can connect one number with one object and then count them with understanding.	Tells how many things are in a set. When counting a set of objects, the last word in the counting sequence names the quantity for that set.	Numbers are nested inside of each other and that the number grows by one each count. 9 is inside 10 or 10 is the same as 9 + 1.	The number of objects remains the same when they are rearranged spatially. 5 is 4&1 OR 3&2.

Each concept builds on the previous idea and students should explore and construct concepts in such a sequence

Number Relationships	Spatial Relationship Patterned Set Recognition	One and Two-More or Less	Understanding Anchors	Part-Part-Whole Relationship
	Students can learn to recognize sets of objects in patterned arrangements and tell how many without counting.	Students need to understand the relationship of number as it relates to +/- one or two. Here students should begin to see that 5 is 1 more than 4 and that it is also 2 less than 7.	Students need to see the relationship between numbers and how they relate to 5s and 10s. 3 is 2 away from 5 and 7 away from 10.	Students begin to conceptualize a number as being made up from two or more parts.

Developing Number Sense: The Big Picture

This trajectory is designed to show number sense development through the early years of elementary school. Although the graphic organizer flows horizontally left to right, it also aligns vertically. Each concept builds from the previous stage and is the foundation to developing the number sense required of all students.

Addition and Subtraction Strategies

One/Two More/Less	**Make a Ten**	**Near Doubles**
These facts are a direct application of the One/Two More/ Less than relationships	Use a quantity from one addend to give to another to make a ten then add the remainder.9 + 7 = 10 + 6	Using the doubles anchor and combining it with 1 and 2 more/less.
Facts with Zero	**Doubles**	
Need to be introduced so that students don't overgeneralize that answers to addition are always bigger.	Many times students will use doubles as an anchor when adding and subtracting.	

PURPOSEFUL WITH DOT CARDS

Subitizing war: one card is flipped over and the first player to say the card gets to keep it

More or less: each player flips over a cards and players must say the number on the card that is MORE or LESS

+/- 1 and 2: one card is flipped over and players must say the number that is 1 more

Addition war: 2 cards flipped over and students must say the sum of the 2 cards

Part-Whole-Head: 3 players needed. 2 players flip over a card and without looking at it they place it on their forehead. The third player says the sum of the cards and each player tries to solve for the number value that is on their head.

Grade Level	Count, write and represent numbers through…	Fluently automatized strategies for facts through….	Fluent through the use of strategies based on place value and number properties…	Building fluency using concrete models, representational models, and strategies based on place value; relate the strategy to a written method
K	Represent & write to 20 *Count to 100 (by 1 and 10)*	-Add/subtract through 5		-Add/subtract through 10
1st	120	-Add/subtract through 10	-Add/subtract through 20	-Add/subtract through 100
2nd	1000	-Add/subtract through 20	-Add/subtract through 100	-Add/Subtract 1000
3rd	1000	-Add/subtract though 100 -Multiply/Divide through 100	-Add/subtract through 1000	
4th	1,000,000		-Add/Subtract multi-digit whole numbers using the standard algorithm ***	-*Multiply* up to a 4-digit by 1 digit or 2-digit by 2 digit -*Divide* up to four-digit dividends by one-digit divisors
5th	Numbers through the hundredths (233.67)		-Multiply multi-digit whole numbers using the standard algorithm ***	-Add, subtract, multiply, and divide decimals to hundredths
6th	Any place value		-Fluently divide multi-digit numbers using the standard algorithm. ***	

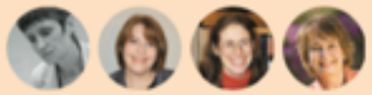
5 Practices for Orchestrating Productive Mathematical Discussions

548 MATHEMATICS TEACHING IN THE MIDDLE SCHOOL • Vol. 14, No. 9, May 2009

Orchestrating Discussions

Five practices constitute a model for effectively using student responses in whole-class discussions that can potentially make teaching with high-level tasks more manageable for teachers.

Margaret S. Smith, Elizabeth K. Hughes, Randi A. Engle, and Mary Kay Stein



Margaret S. Smith, pegs@pitt.edu, is an associate professor of mathematics education at the University of Pittsburgh. Over the past decade, she has been developing research-based materials for use in the professional development of mathematics teachers and studying what teachers learn from the professional development in which they engage. **Elizabeth K. Hughes**, elizabeth.hughes@uni.edu, recently finished her doctorate in mathematics education at the University of Pittsburgh. Her areas of interest include preservice secondary mathematics teacher education and the use of practice-based materials in developing teachers' understanding of what it means to teach and learn mathematics. **Randi A. Engle**, raengle@berkeley.edu, is an assistant professor of mathematics education and the social context of learning at the University of California Berkeley. She is interested in developing practical theories for how mathematics teachers can create discussion-based learning environments that promote strong student engagement, learning, and transfer. **Mary Kay Stein**, mkstein@pitt.edu, is a professor of learning sciences and policy and the director of the Learning Policy Center at the University of Pittsburgh. Her research focuses on instructional practice and the organizational and policy conditions that shape it.

Discussions that focus on cognitively challenging mathematical tasks, namely, those that promote thinking, reasoning, and problem solving, are a primary mechanism for promoting conceptual understanding of mathematics (Hatano and Inagaki 1991; Michaels, O'Connor, and Resnick forthcoming). Such discussions give students opportunities to share ideas and clarify understandings, develop convincing arguments regarding why and how things work, develop a language for expressing mathematical ideas, and learn to see things from other perspectives (NCTM 2000).

Although discussions about high-level tasks provide important

The **5** practices are:

1. **Anticipating** student responses to challenging mathematical tasks;

Anticipate student solutions for the Whopper Jar task.

Identify and record the types of strategies students will use to solve the task.

Task Planning Document

Task:		
Misconceptions:		
Strategy	**Who and What (highlight)**	**Order**

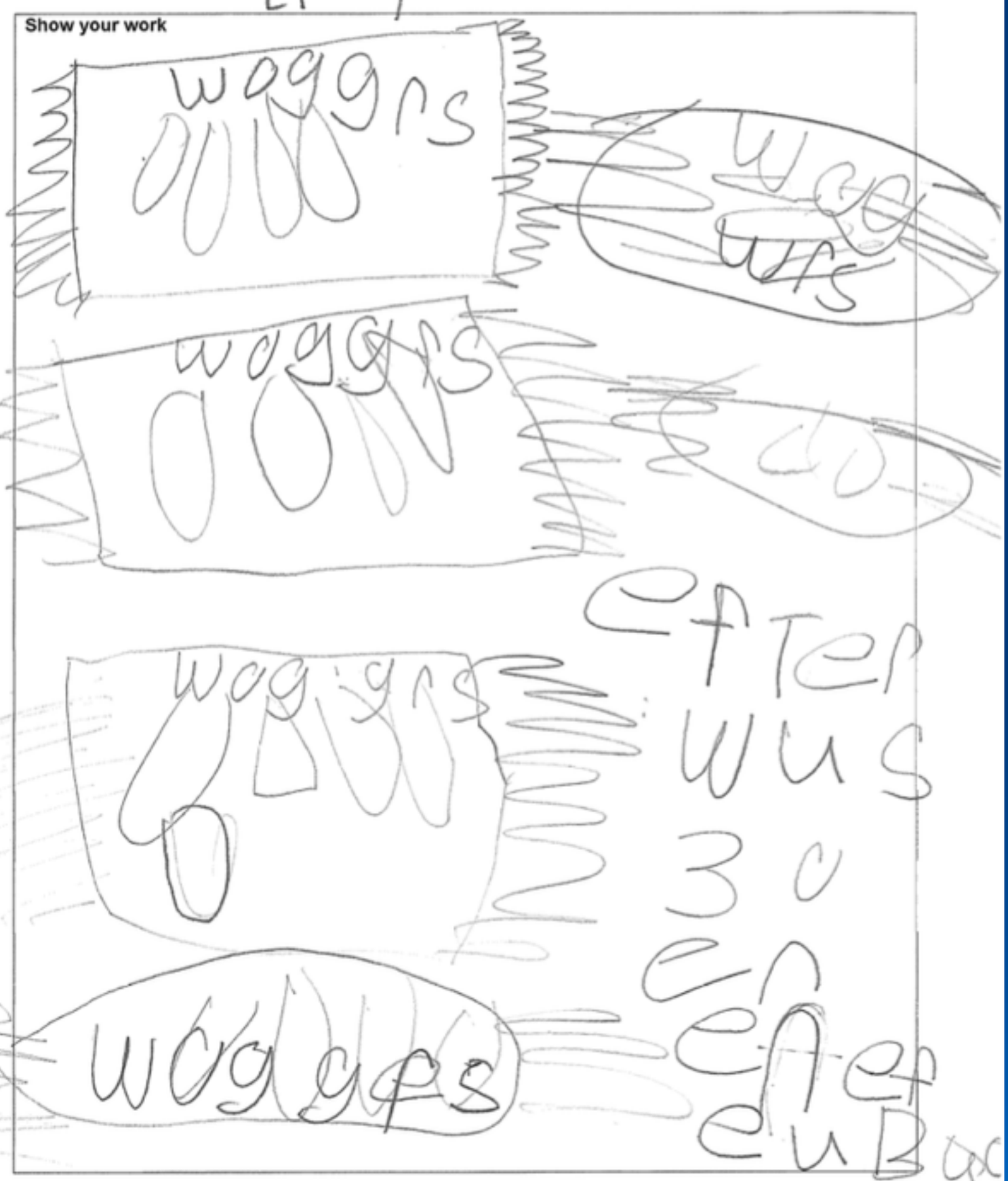
Anticipating → Monitoring → Selecting → Sequencing → Connecting

The **5** practices are:

1. **Anticipating** student responses to challenging mathematical tasks;
2. **Monitoring** students' work on and engagement with the tasks;
3. **Selecting** particular students to present their mathematical work;
4. **Sequencing** the student responses that will be displayed in a specific order and;
5. C**onnecting** different students' responses and connecting the responses to key mathematical ideas.

MTMS: Vol. 14, No. 9, May 2009-5 Practices for Orchestrating Productive Mathematics Discussions

Show your work



5 Moves Planning

- Look at the student work samples
- Select the solutions you want to highlight in the closing
- Sequence how you'll share them
- Discuss the connection focus you're after

S1

14+19=38
38+19=57
57+19=76
76+13=99
95+19=114

S2

10+10+10+9+10+10=59
19 19 19 19
3 6 9 12 15 18 21 24 27
70
73
83

S5

19
19 19 19 19
10+10=20
=40
40+10=50
50+10=60
60+9=72
9+9+9+9
8+8=16
16+4=20
10+60=70
70+5=75
75+3=78
19 19 19 19
10 and 10 2 10

S6

19 19
19 19
13
40
40+9=49
49+9=58
58+9=67
67+9=76
76+3=79

S3

19
18 18
19+19+19+19
20
30
40
50
60
70

S4

Noah
He put three whoppers In the jar 515e thar was a litte Spas.

23

S7

19+19=38
19+19=38
+19+
I knew 19+19=38 and then I use my number chart and I started on 38 and counted on 38 to get 76.
38
76
19+19+19+19=76
120
Ansome
76

S8

19+19=38+19=57+19=76+3=79

Strategy
One-More-Than Two-More Than
Facts with Zero
Doubles
Doubles plus One Doubles plus Two
Making Ten
Using Tens

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

Dominating Doubles

Materials: red/yellow counters, 10 sided dice and a transparency marker

Instructions: Player 1 rolls the dice and places the transparency marker in the box for the strategy the want to use. Player 1 applies the strategy to the number on the dice and covers the corresponding square. (Example: if 8 was rolled and the player 1 covered *doubles minus 2* they would cover 14 (8+8-2=14). Player 1 and 2 alternate turns until one player gets 4 in a row.

7	8	9	10	11	12
13	4	12	16	17	18
20	6	13	14	15	19
1	2	9	8	11	10
8	17	7	13	4	5
10	11	3	17	20	6

Place the counter in the box for the strategy you want to use and explain why

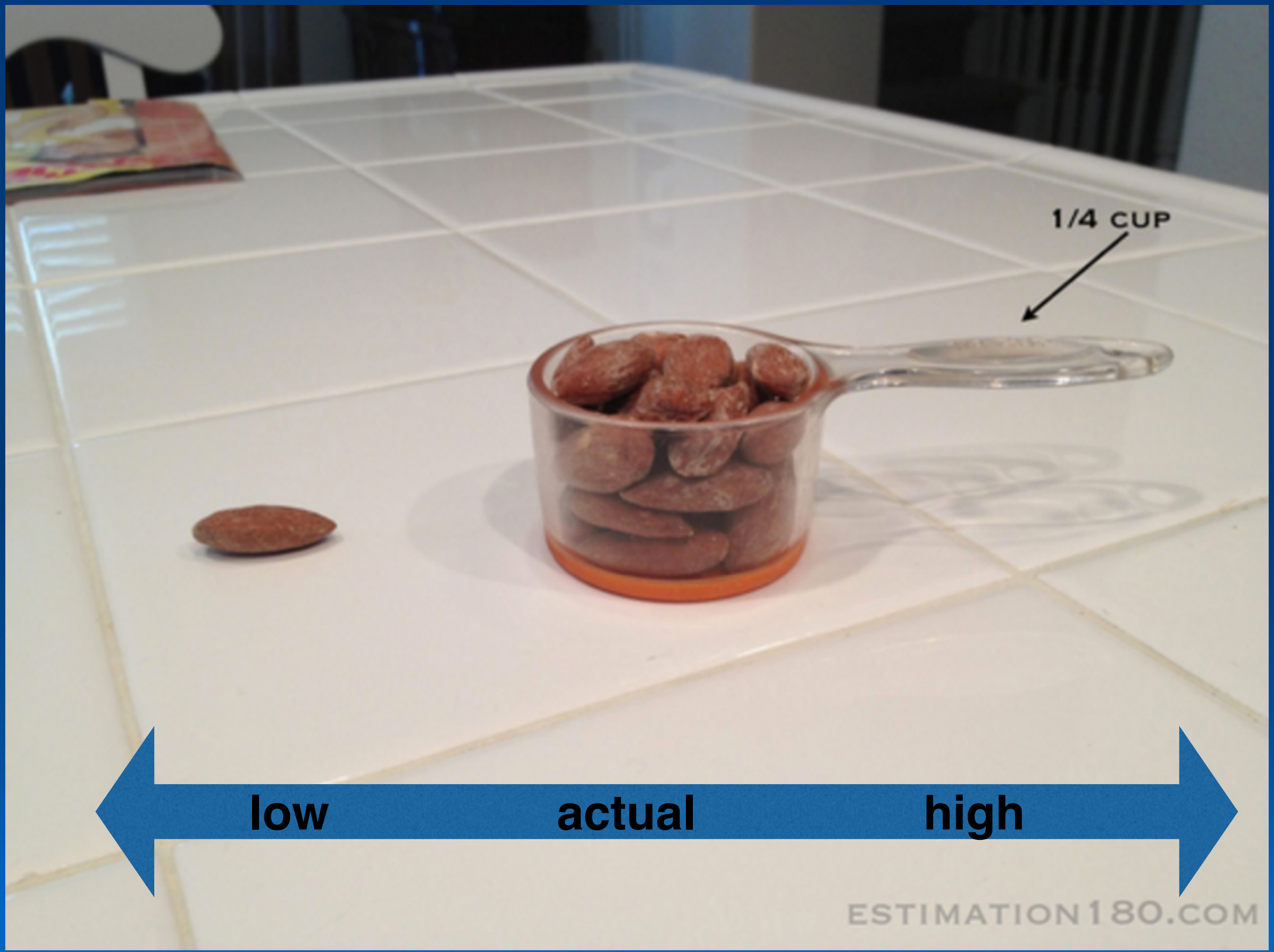
Doubles	Doubles plus 1	Doubles minus 1	Doubles plus 2	Doubles minus 2

Created by Graham Fletcher

Counting Circles

Becoming a good estimator takes practice

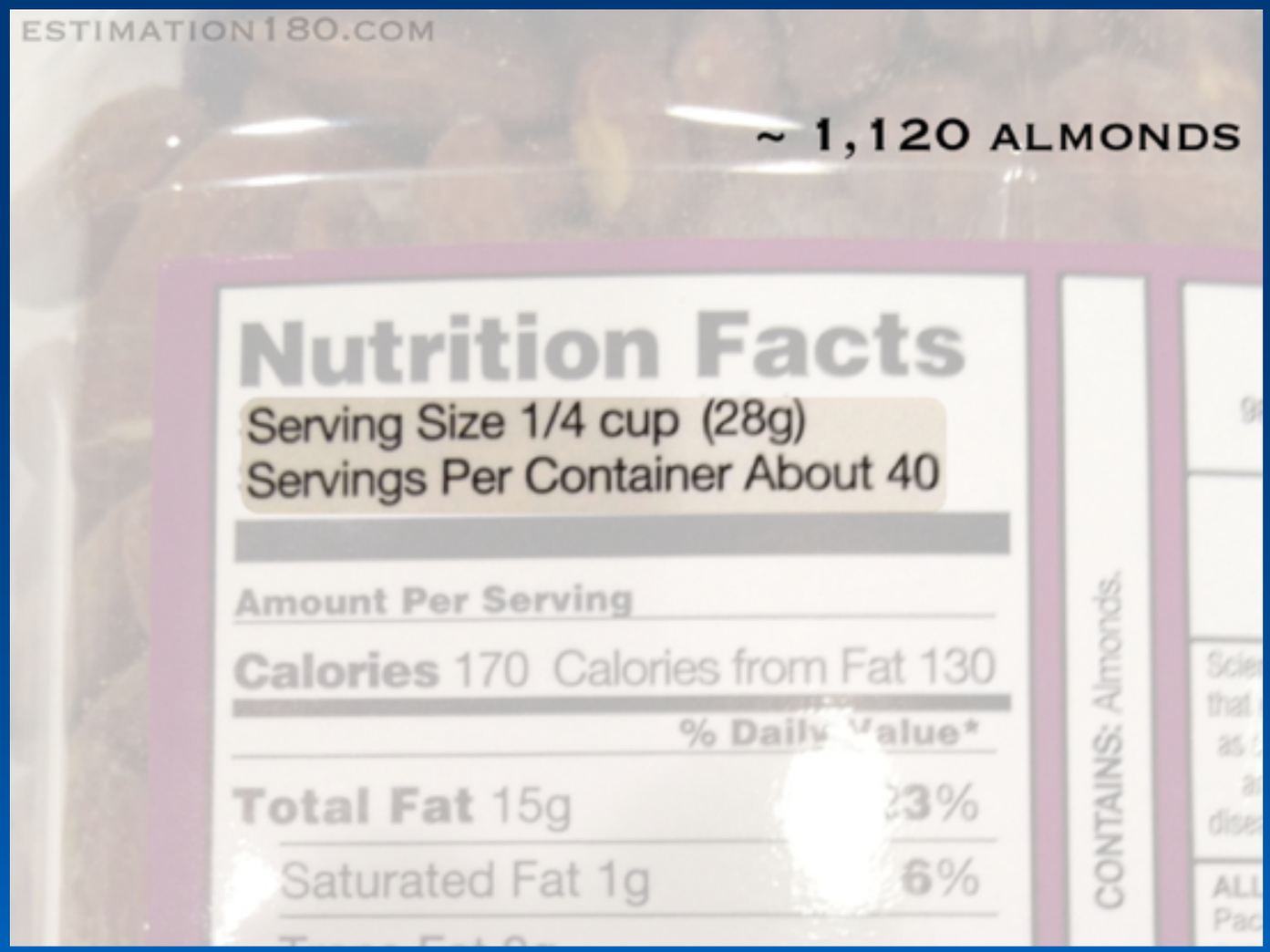
What are you currently doing to promote number sense through estimation in your classroom?


1/4 CUP
low
actual
high
ESTIMATION180.COM


KIRKLAND
Dry Roasted
ALMONDS
?
28
ESTIMATION180.COM

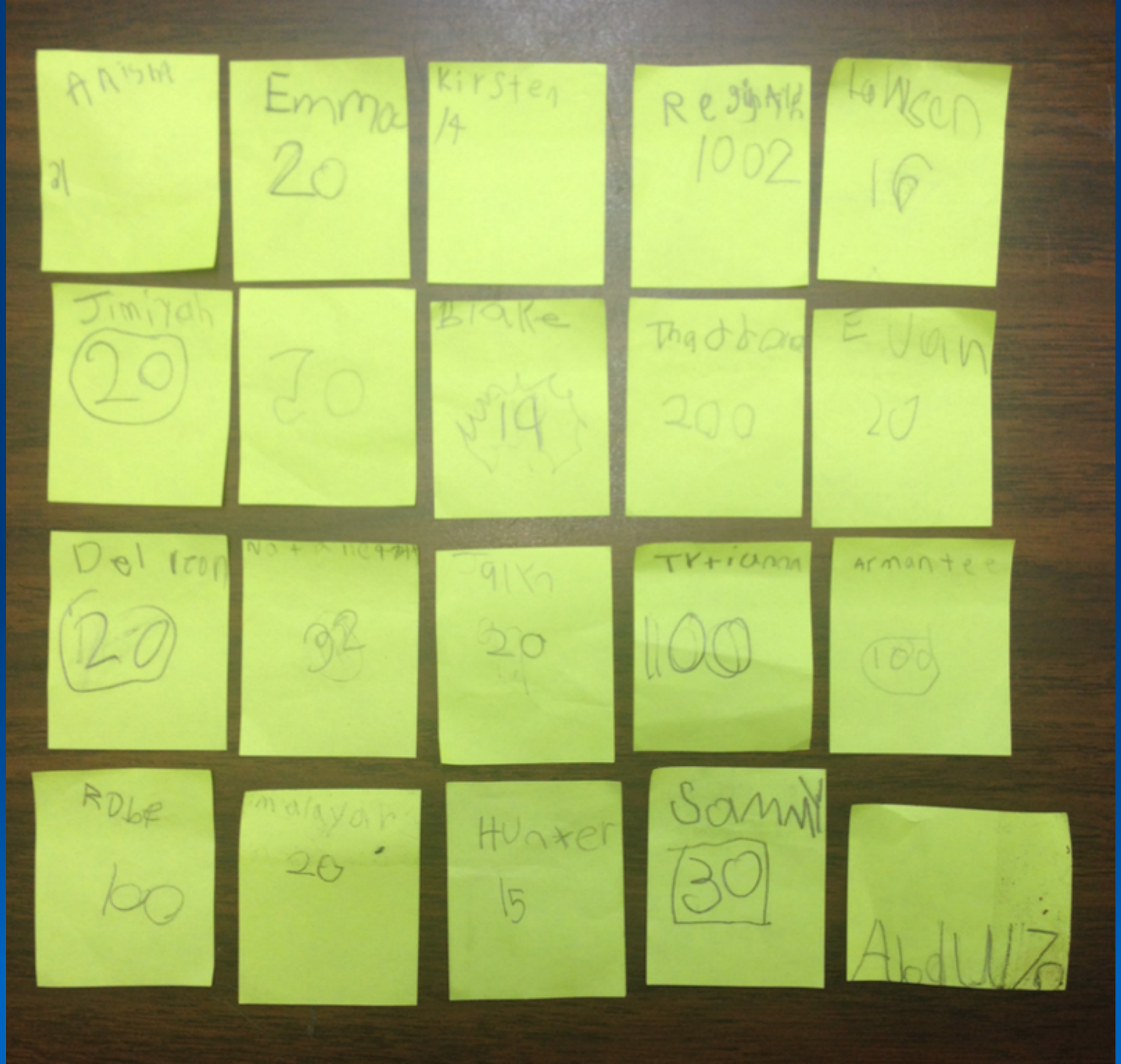
ESTIMATION 180

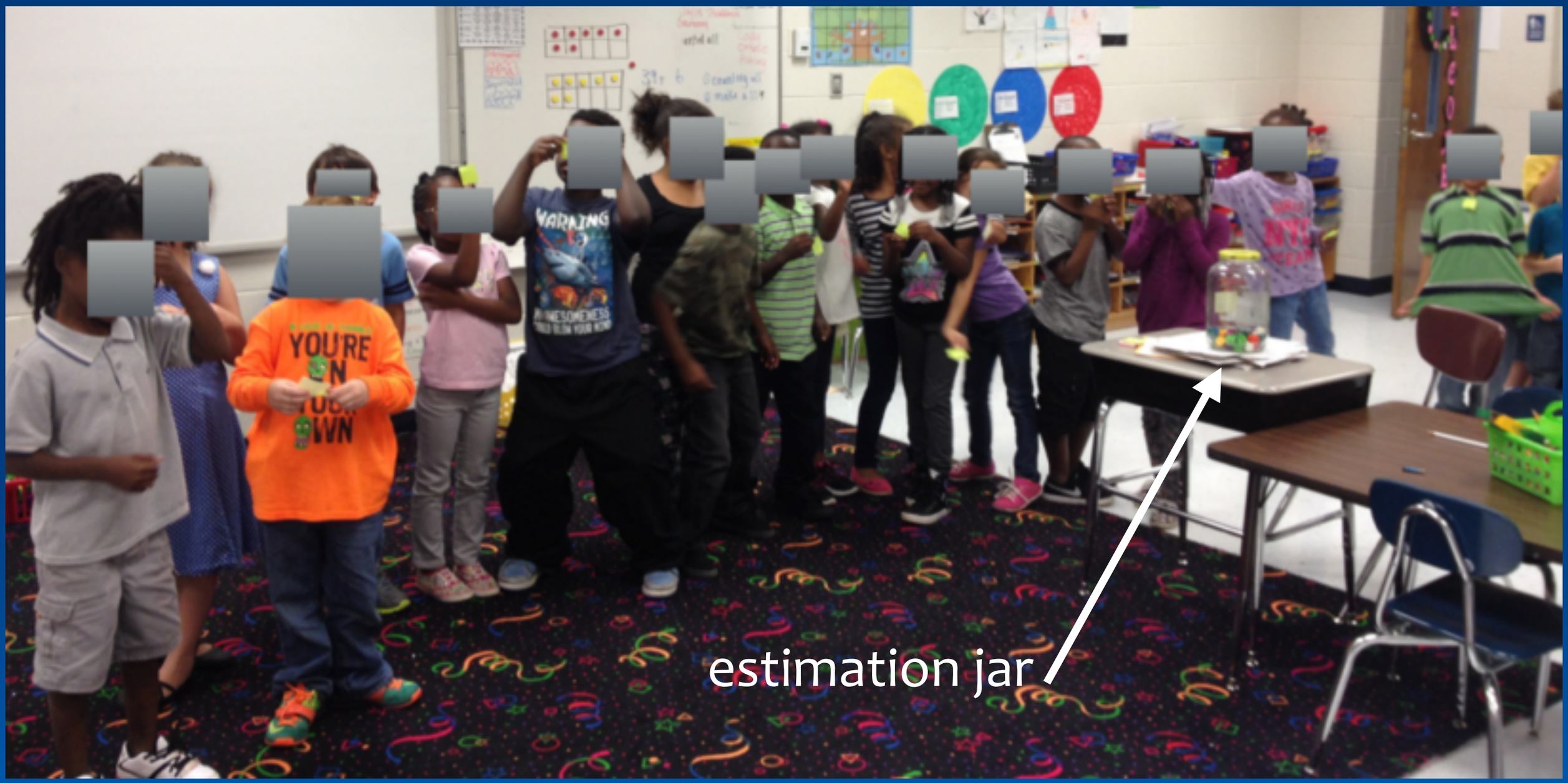
Building number sense one day at a time.

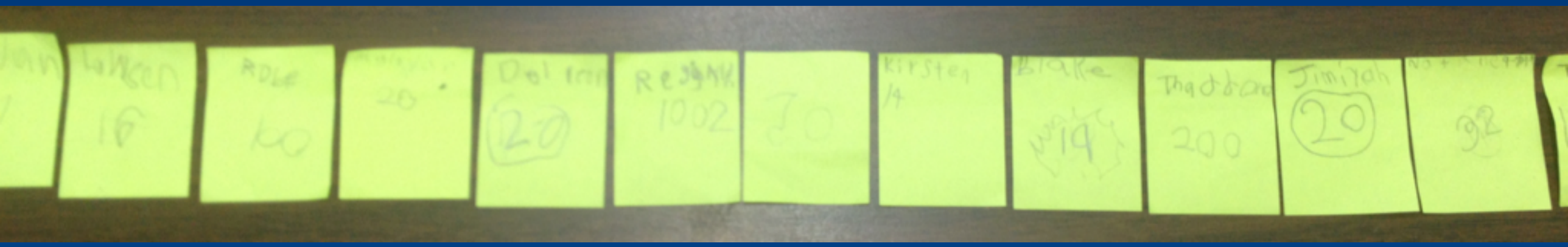


www.estimation.com

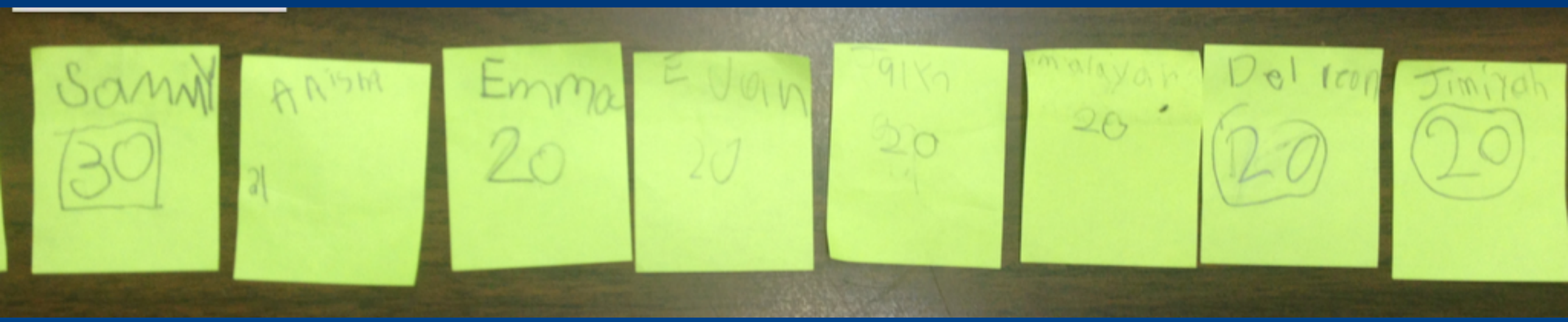
Estimation Station

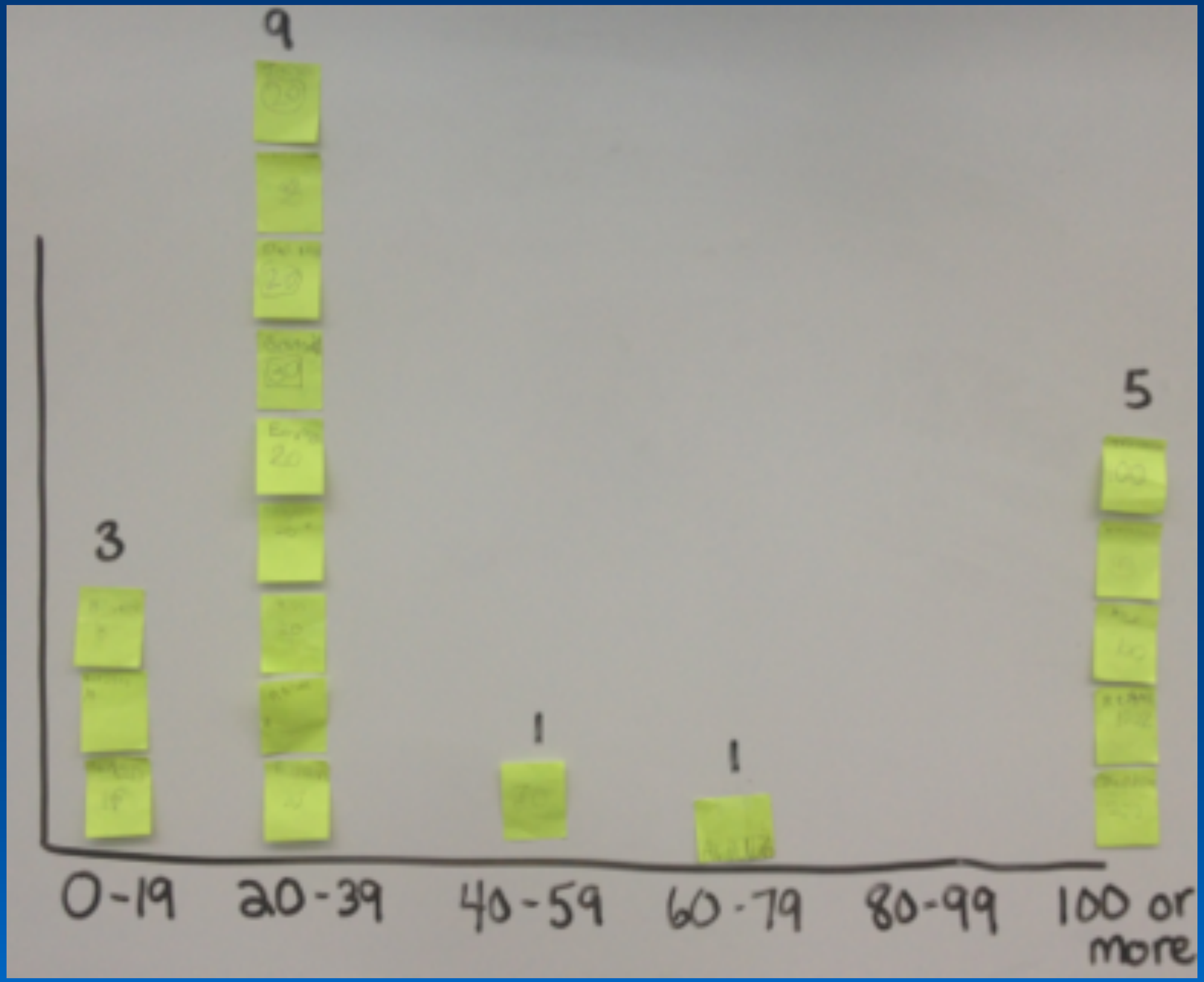

Emma
20
Kirsten
14
Jimiyah
20
Blake
19
Thaddaeus
200
Evan
20
100
armantee
100
Robert
100
Hunter
15
Sammy
30
Abdul
20


estimation jar



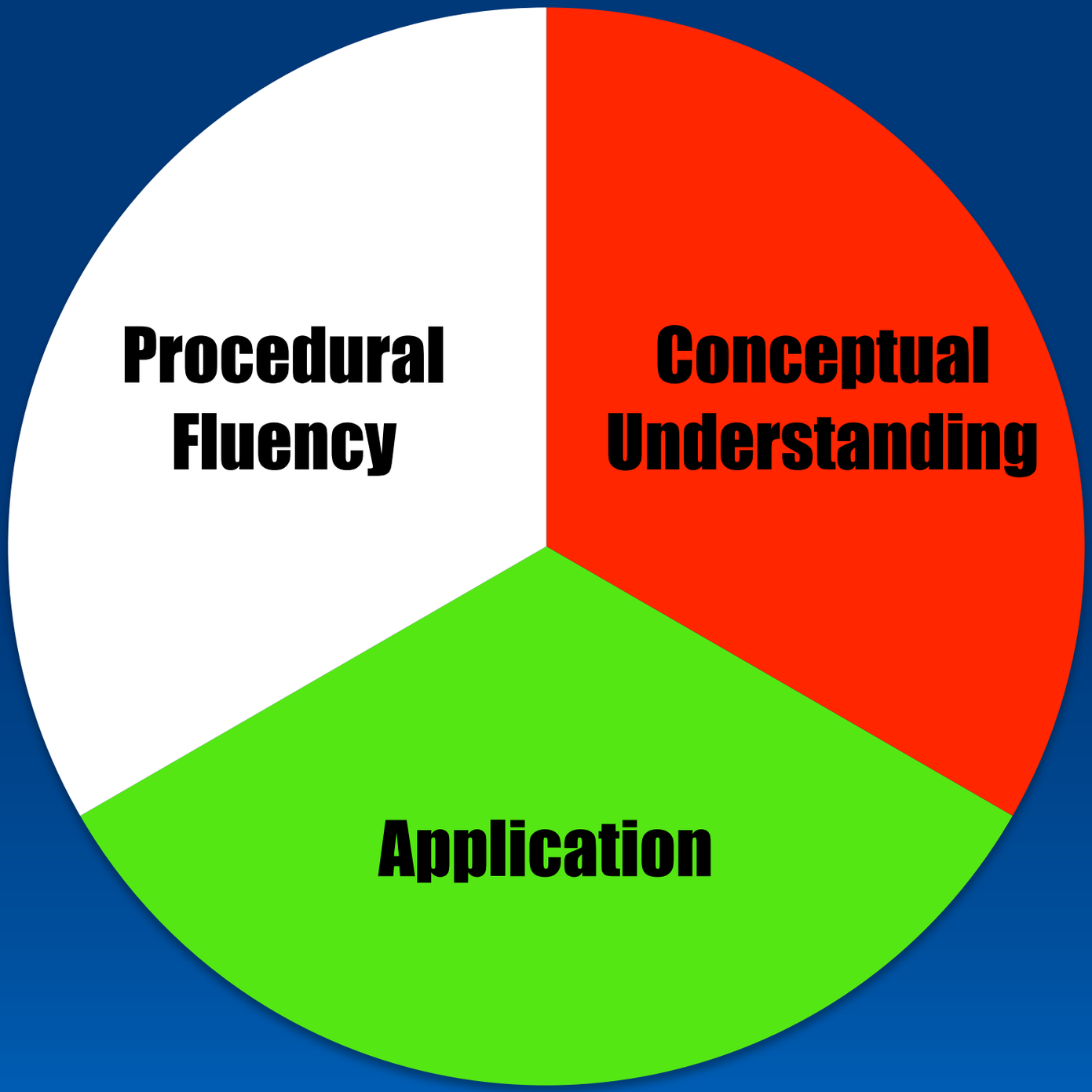
16 100 20 20 1002 50 14 19 200 20 32


Sammy
30
Anisha
21
Emma
20
Evan
20
Rikki
20
malayah
20
Delrone
20
Jimirah
20

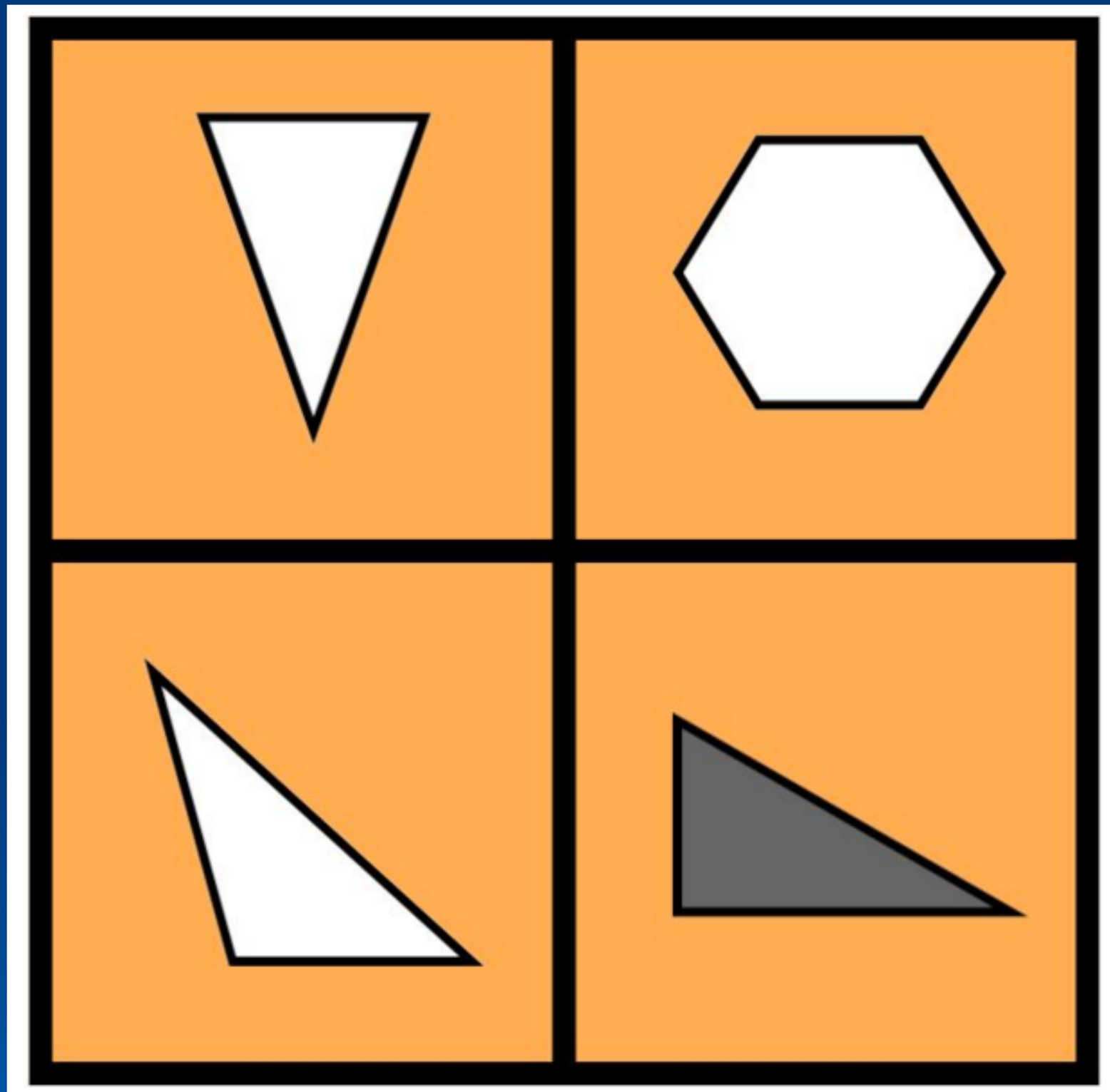

9
5
3
1
1
0-19
20-39
40-59
60-79
80-99
100 or more

Hundreds and 0-99 Charts

1-Minute Challenge


Procedural Fluency
Conceptual Understanding
Application

$$\begin{array}{r} 5\ 0\square 6 \\ -\ \square 4\ 8\square \\ \hline 1\ 6\square 8 \end{array}$$



SHAPE 1

from Mary Bourassa

2	5
8	10

wodb.ca

Which one doesn't belong?

1st grade HTeCV

L-"10 bc only number with a zero"

T –"10 bc only number with a 1 in it"

A – "10 bc only one with an oval shape"

O-"10 bc only one with two numbers:"

R- "2 bc only number with a question mark shape as part of it"

A-"10 bc it is the highest"

L-"2 bc it is the lowest"

L – "5 bc only odd number"

K-"8 bc only number with two circles in it"

L – "5 bc only one with a letter C in it (backwards)"

View original

Flag media

Matt Sheelen @mjsheelen 7h

First @WODBMath today inspired by @gfletchy @NCTM 16! So fun! Responses in picture #WODB #elemmathchat #MTBoS #HTeCV pic.twitter.com/hOUR0JDNIH

Open

ESTIMATION 180

Building number sense one day at a time.

Explore MTBoS

Which One Doesn't Belong?

The Math Forum @ Drexel
PEOPLE LEARNING MATH TOGETHER

Notice and Wonder

Open Middle

Challenging math problems worth solving

Would You Rather?

ASKING STUDENTS TO CHOOSE THEIR OWN PATH AND JUSTIFY IT

OPEN MIDDLE

Directions: Place any digit, 0 through 9, in the boxes below to make a true statement. Each digit can only be used once.

$$\square + \square = \square + \square = \square + \square = \square - \square = \square + \square$$

Open Middle

- Use the digits 0–9 and create four 2-digit numbers.
- Each digit can only be used once.
- Place the numbers in order from smallest to greatest.
- Create the smallest possible difference between the first and last number (range).

□□ , □□ , □□ , □□

What do you notice?

What do you wonder?

estimates?

need more?

Nutrition Facts/Datos de Nutrición

Serving Size 3 cookies (34g) / Porción: 3 galletas (34g)
Servings Per Container about 16
Porciones por Envase: Aproximadamente 16

Amount Per Serving/Cantidad por Porción

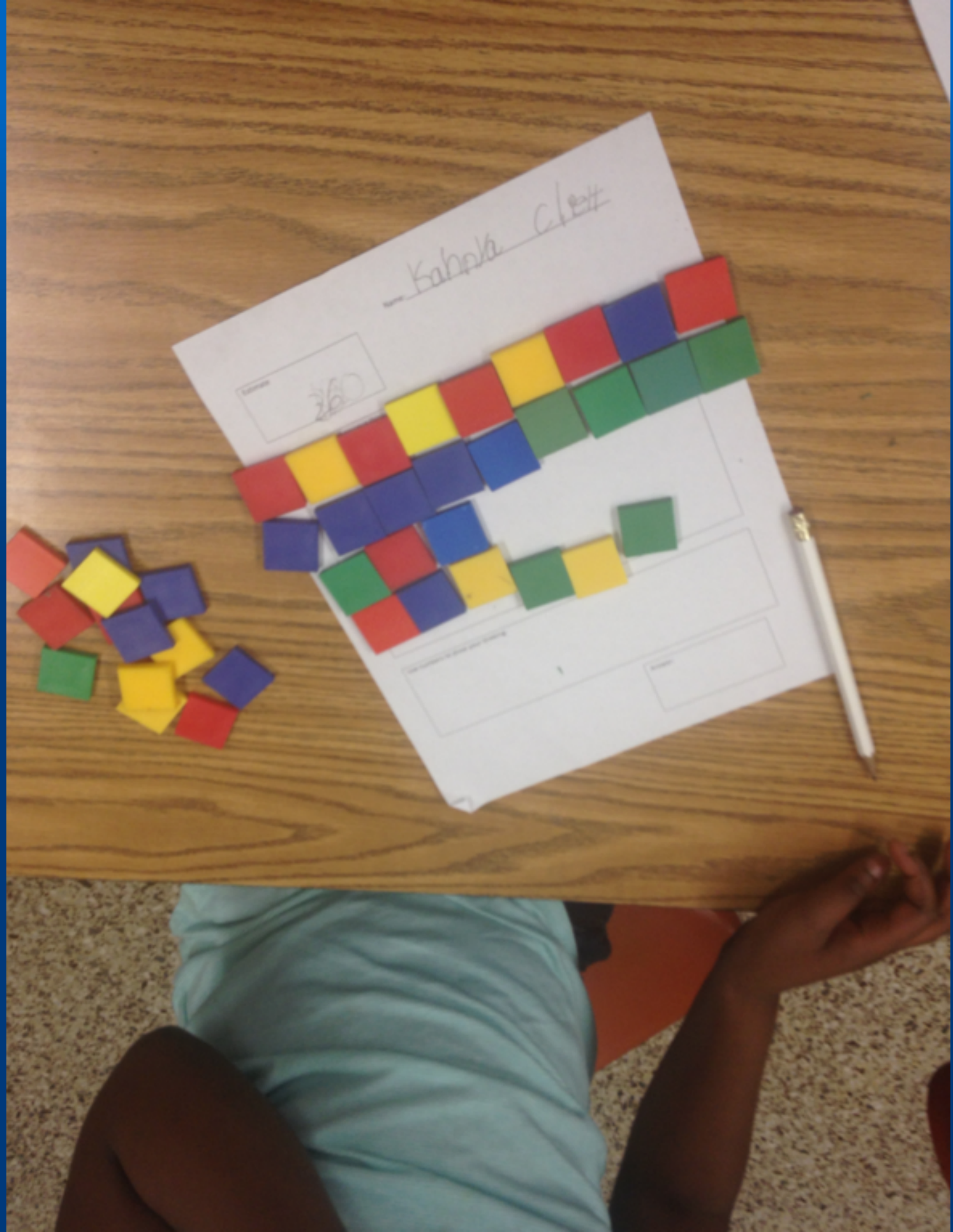
Calories/Calorías 160 — Calories from Fat/Calorías de Grasa 60

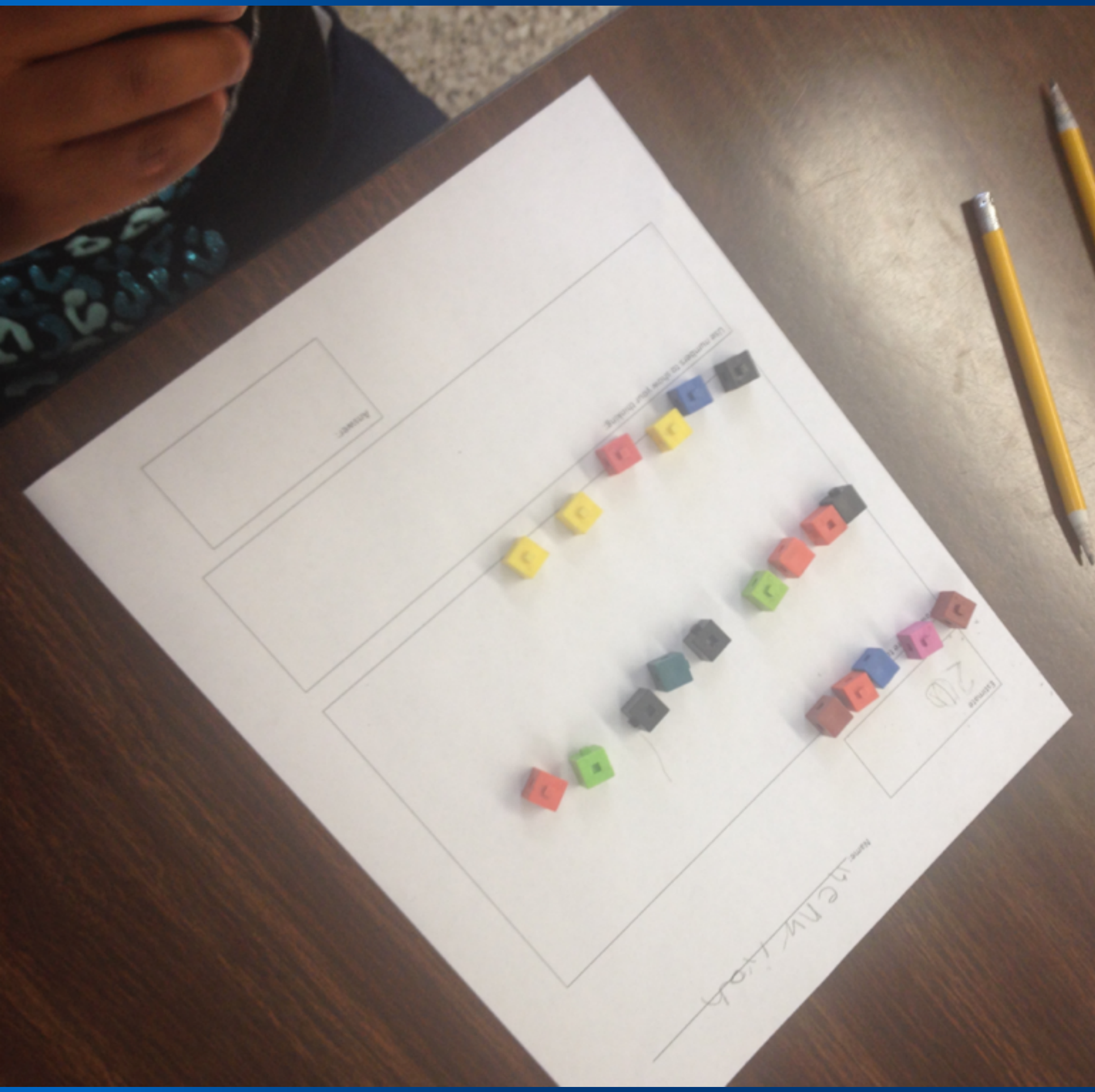
	%Daily Value*/%Valor Diario*
Total Fat/Grasa Total 7g	11%
Saturated Fat/Grasa Saturada 2g	10%
Trans Fat/Grasa Trans 0g	
Cholesterol/Colesterol 0mg	0%
Sodium/Sodio 135mg	6%
Potassium/Potasio 55mg	2%
Total Carbohydrate/Carbohidrato Total 25g	8%
Dietary Fiber/Fibra Dietética Less than/Menos de 1g	3%
Sugars/Azúcares 14g	
Protein/Proteínas 1g	

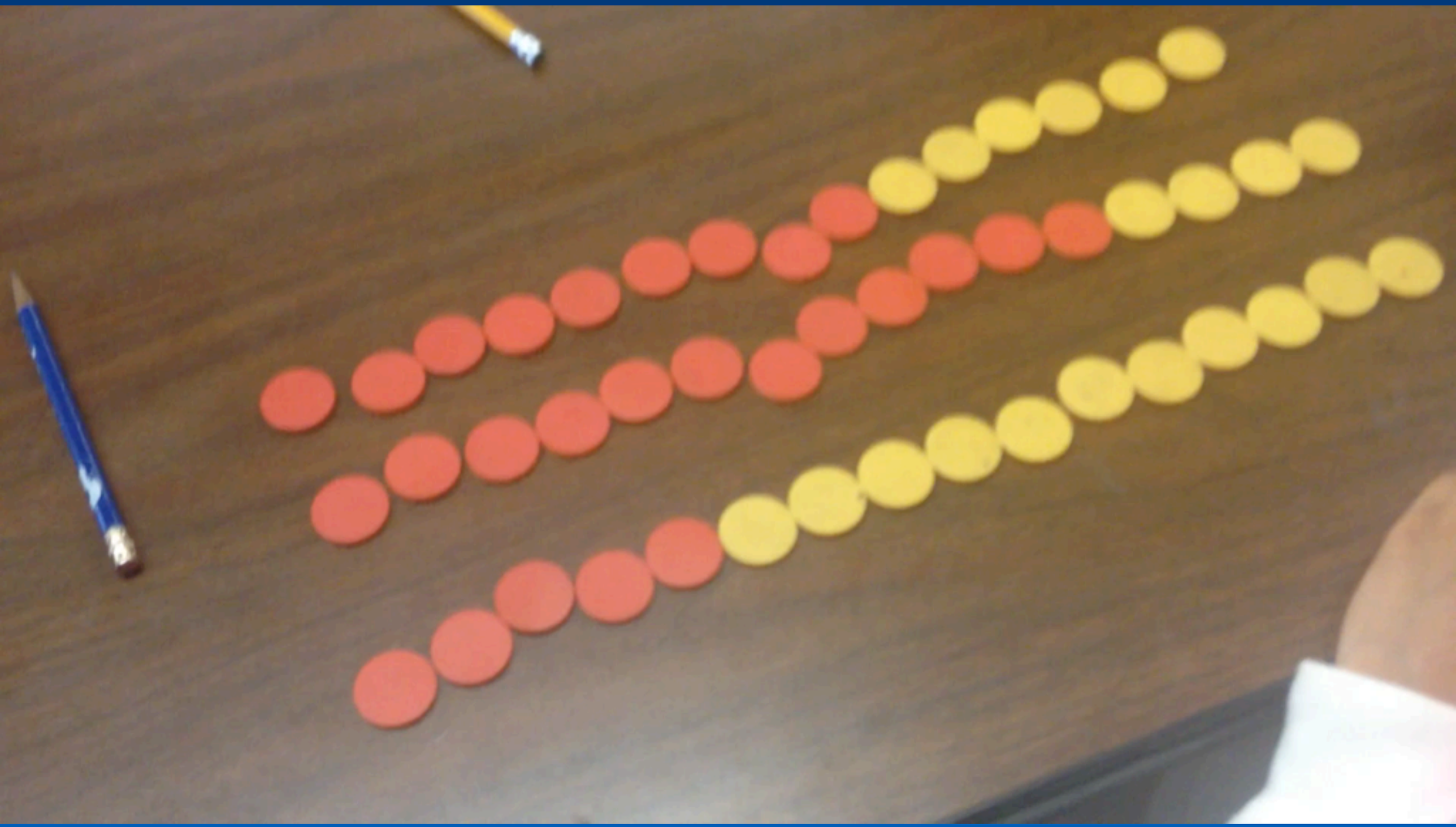
Vitamin/Vitamina A 0% • Vitamin/Vitamina C 0%
Calcium/Calcio 0% • Iron/Hierro 8%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be


7
5
10







Questioning My Metacognition

Trying to be a better teacher

Home | **3-Acts Lessons** | Virtual Filing Cabinet | Numeracy Project | Speaking and Workshops | About | Contact Me

3-Acts Lessons

Check out Dan's Blog or watch *Math Class Needs a Makeover*

Date Added	Lesson Title	Standard 1	Standard 2
4/17/2014	Peas in a Pod	K.NBT.1	K.CC.4
4/25/2014	Dotty	K.CC.1,2,3	K.CC.4,5
1/16/2015	Counting Squares	K.NBT.1	K.CC.4,5
1/16/2015	Stage 5 Series	K.NBT.1	K.CC.4,5
3/24/2015	Shark Bait	K.NBT.1	K.CC.4,5
3/4/2014	Lil' Sister	K.MD.2	K.CC.6
9/1/2015	Bag-O-Chips	K.OA.4	K.OA.5

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8. Elementary Teacher in Middle School
9. Exit 10A
10. Bridging The Gap
11. Robert Kaplinsky - Glenrock

www.gfletchy.com

Making Sense Series

the progression of addition AND subtraction
the standard traditional algorithm

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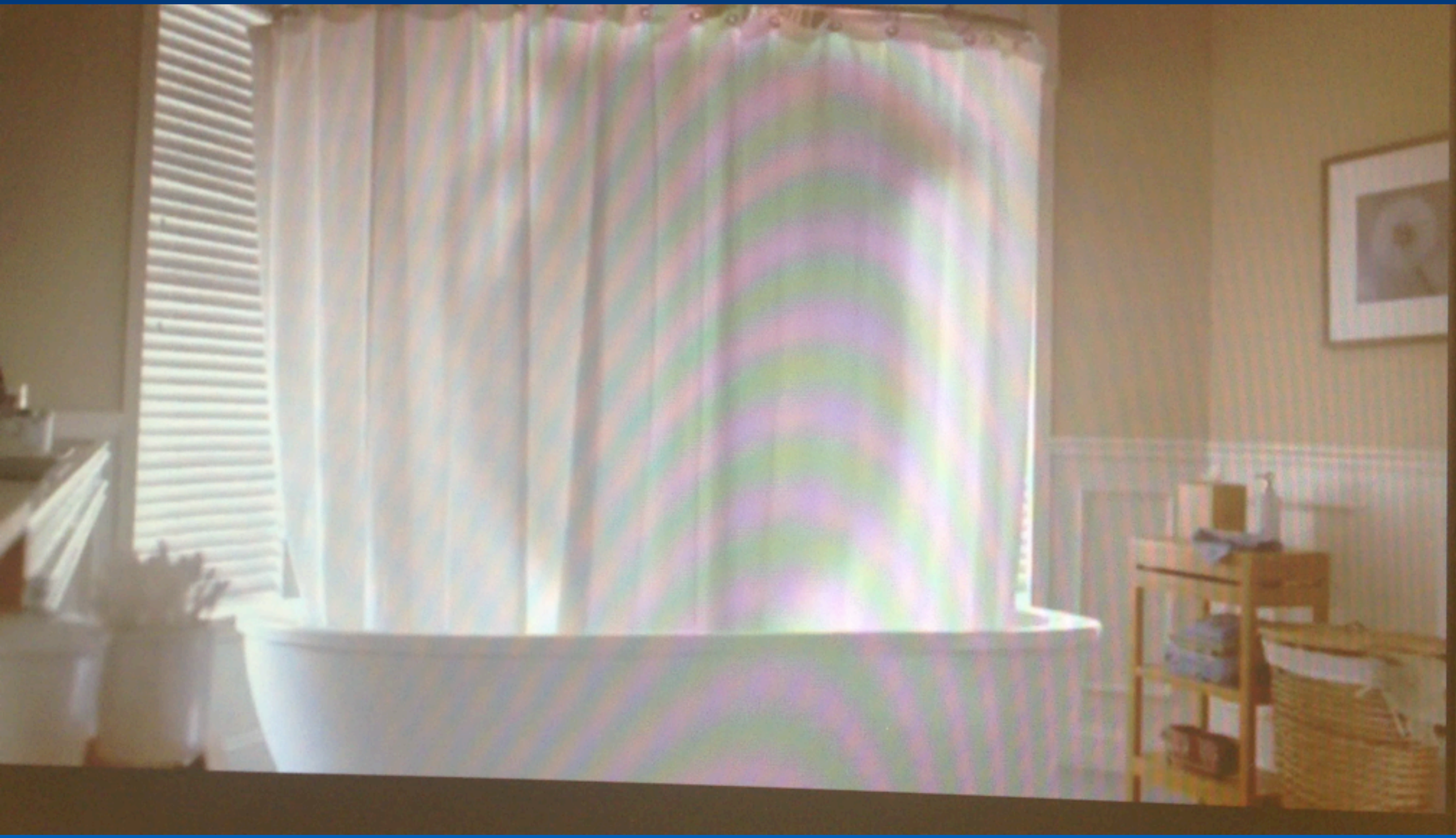

Parking Lot

+ positive	▲ change
? not sure going forward	 ah-ha!