

Creating a multiplier effect with Coaches and Teachers: Accessing Ambitious Math Instruction

Building Students' Agency, Ownership and Identity as Math Doers and Thinkers

Jennifer Suh, Associate Professor of Mathematics Education
jsuh4@gmu.edu

URL for talk: <http://mathhappenings.onmason.com/>



HIGH ROLLER in Las Vegas

What do you wonder about? What do you notice? Posing Problems:



HIGH ROLLER in Las Vegas

What do you wonder about? What do you notice? Posing Problems:



a) What's the "Math Happening"?

What do you wonder about?
What do you notice?)
Problem Posing:

b) What do we already know?
(What do we already know that can help us?)

c) What do we need to know?

If I knew _____ then, I can figure out _____.
(Make assumptions.)

d) What Math Pathways could you take?

HIGH ROLLER in Las Vegas

What do you wonder about? What do you notice? Posing Problems:

diameter; 520 feet

28 pods

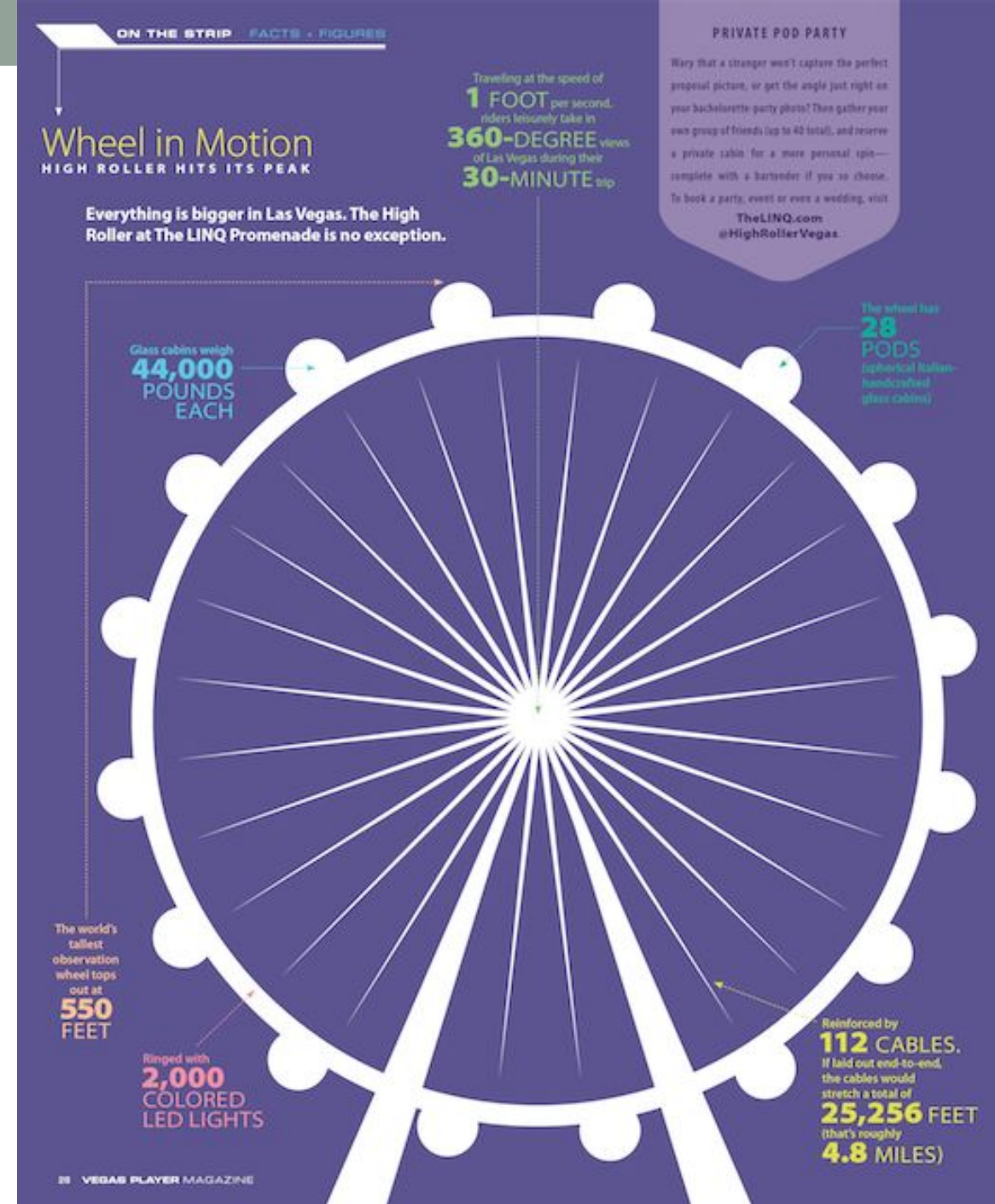
550 feet high

40-person cabins

moves 1 foot per second

\$19.99 discount

\$35.49 Happy half hour



73

Creating a Multiplier Effect with Coaches and Teachers: Accessing Ambitious Math Instruction

Elementary Professionals as Advocates

Coaches and teachers can create a multiplier effect in our school and be our most impactful change agents to provide high-quality mathematics for all students. Facilitators will engage participants and school teams to work through a professional development model that promoted culturally responsive mathematics teaching (CRMT) through problem solving and math discourse.

Jennifer **Suh**

George Mason University, Fairfax, Virginia

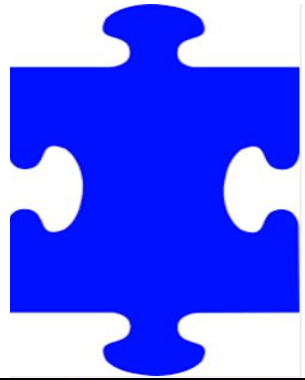
Sara Birkhead

George Mason University, Fairfax, Virginia

Padhu Seshaiyer

George Mason University, Fairfax, Virginia

Brasilia 4-7, Rio All-Suite Hotel & Casino



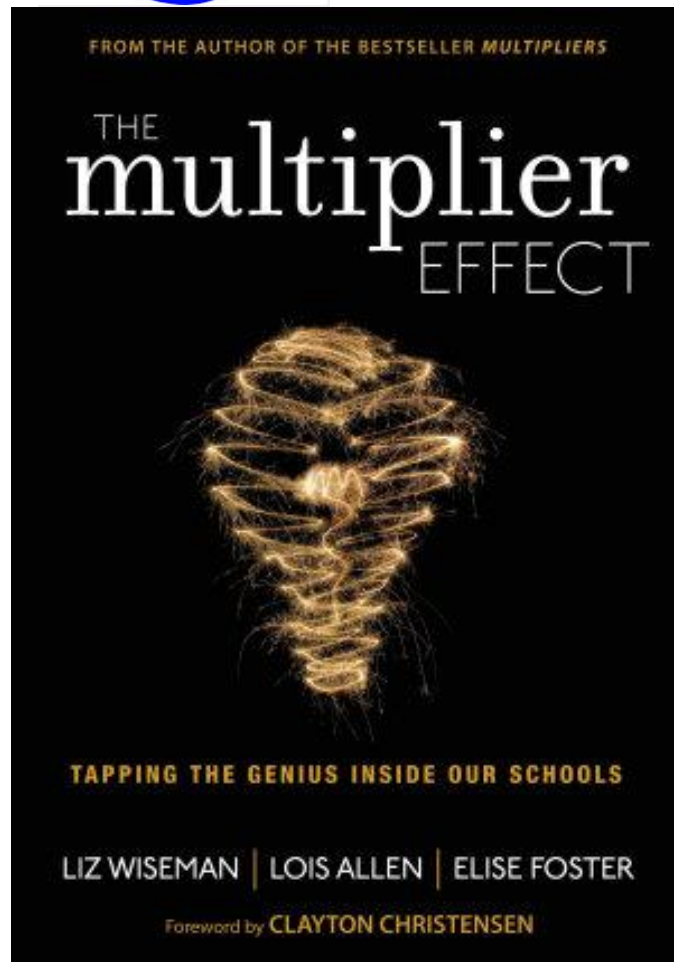
Leadership to Create the Multiplier Effect

How can our instructional leaders sustain the professional learning?

“Multipliers recognize the intelligence in others, provoke it, and cultivate it to its fullest. The leader’s own intelligence and curiosity become the catalyst...”

*Wiseman, Allen, and Foster
The Multiplier Effect*

Where do you see this approach in your school, district, or organization? What is the impact on student learning?



2 issues that need to be addressed in the efforts to provide high quality mathematics education to ALL students are:

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graph TD; A[2 issues that need to be addressed in the efforts to provide high quality mathematics education to ALL students are:] --> B[WHAT should practicing mathematics teachers focus on?]; A --> C[HOW do practicing mathematics teachers continue to learn?];
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WHAT should practicing mathematics teachers focus on?

HOW do practicing mathematics teachers continue to learn?

YOUR THOUGHTS???

WHAT should practicing mathematics teachers focus on?	HOW do practicing mathematics teachers continue to learn?

Connects to INNOV8 Theme on Access, Equity and Empowerment

- Marilyn Strutchens- Nine Equitable Teaching Practices included Connecting to **Students' Interests** and **Lived Experiences**
- Julia Aguirre asked teacher to do a “Community Walk” to connect with families and the community and promote Curriculum that is both **“mirror”** and a **“lens”** through students eyes!

Our focus for our PD Coach- facilitated lesson study and coaching- **Math Modeling as a way to provide leverage students interests and bring relevance so they **access the rich, rigorous and relevant mathematics****

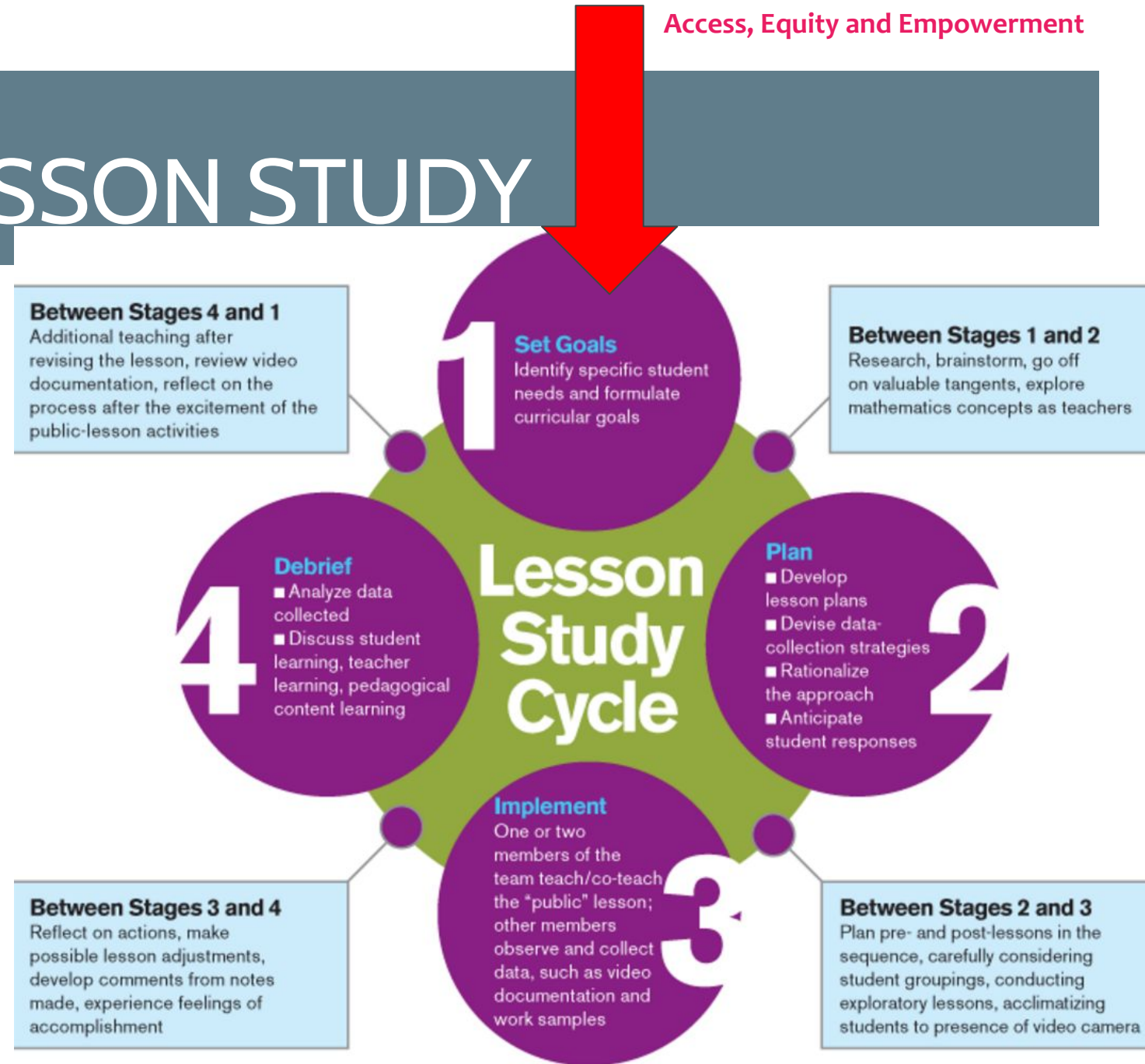
HOW DO TEACHERS LEARN?

HOW do practicing
mathematics
teachers continue
to learn?



CONDUCTING LESSON STUDY

- Collaborative coach & teacher led
- Pre-meeting-set goals
- Focus on content goals
- Authentic Task development
- Debrief with team



FOCUS

Mathematics Teaching Practices

Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.

Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.

Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.

Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.

Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.

Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.

Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.

Elicit and use evidence of student thinking. Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

Standards for Student Mathematical Practice

1 **Make sense of problems and persevere in solving them.**

Keep on going!

2 **Reason abstractly and quantitatively.**

Write a story for the mathematical equation

$$\frac{1}{2} \times 4$$

Debra exercises $\frac{1}{2}$ hour a day for 4 days. How many total hours does she exercise?

Think what makes sense.

3 **Construct viable arguments and critique the reasoning of others.**

Talk and explain.

4 **Model with mathematics.**

Show your thinking.

5 **Use appropriate tools strategically.**

Use the right tools.

6 **Attend to precision.**

symbolic equals (the same as)

$$120 \text{ minutes} = 2 \text{ hours}$$

units of measure

Check your work.

7 **Look for and make use of structure.**

$$8 + 4 = 12$$

See the pattern or connection.

8 **Look for and express regularity in repeated reasoning.**

See the pattern or connection.

WHAT should mathematics teachers focus on?

Teachers
Empowered to
Advance
CHange in
MATHematics

	Category	Reflection Prompts
1	Cognitive Demand	<i>How does my lesson enable students to closely explore and analyze math concepts(s), procedure(s), and reasoning strategies?</i>
2	Depth of Knowledge & Student Understanding	<i>How does my lesson make student thinking/understanding visible and deep?</i>
3	Mathematical Discourse	<i>How does my lesson create opportunities to discuss mathematics in meaningful and rigorous ways (e.g. debate math ideas/solution strategies, use math terminology, develop explanations, communicate reasoning, and/or make generalizations)?</i>
4	Power and Participation	<i>How does my lesson distribute math knowledge authority, value student math contributions, and address status differences among students?</i>
5	Academic Language Support for ELL	<i>How does my lesson provide academic language support for English Language Learners?</i>
6	Cultural/Community-based funds of knowledge	<i>How does my lesson help students connect mathematics with relevant/authentic situations in their lives?</i> <i>How does my lesson support students' use of mathematics to understand, critique, and change an important equity or social justice issue in their lives?</i>

Cultural Responsive Mathematics Teaching Lesson Tool-TEACH MATH Aguirre, Turner, Bartell, Drake, Foote & McDuffie (2012). (2012) Culturally Responsive Mathematics Teaching Lesson Analysis Tool. Unpublished Instrument Adapted from National Center for Research in Mathematics Education. (1992). Wisconsin Center for Educational Research. Madison, WI: University of Wisconsin-Madison. Also adapted from Aguirre & Zavala (In Press) CEMELA (2007), Kitchen (2005) and Turner, Drake, Roth McDuffie, Aguirre, Bartell, & Foote (2012). Aguirre, Turner, Bartell, Drake, Foote & McDuffie (2012).

<http://www.mathconnect.hs.iastate.edu/documents/CRMTLessonAnalysisTool.pdf>

WHAT should practicing mathematics teachers focus on?

Teaching for Robust Understanding (TRU)

The Five Dimensions of Powerful Classrooms				
The Content	Cognitive Demand	Equitable Access to Content	Agency, Authority and Identity	Formative Assessment
<i>The extent to which classroom activity structures provide opportunities for students to become knowledgeable, flexible, and resourceful disciplinary thinkers. Discussions are focused and coherent, providing opportunities to learn disciplinary ideas, techniques, and perspectives, make connections, and develop productive disciplinary habits of mind.</i>	<i>The extent to which students have opportunities to grapple with and make sense of important disciplinary ideas and their use. Students learn best when they are challenged in ways that provide room and support for growth, with task difficulty ranging from moderate to demanding. The level of challenge should be conducive to what has been called "productive struggle."</i>	<i>The extent to which classroom activity structures invite and support the active engagement of all of the students in the classroom with the core disciplinary content being addressed by the class. Classrooms in which a small number of students get most of the "air time" are not equitable, no matter how rich the content: all students need to be involved in meaningful ways.</i>	<i>The extent to which students are provided opportunities to "walk the walk and talk the talk" – to contribute to conversations about disciplinary ideas, to build on others' ideas and have others build on theirs – in ways that contribute to their development of agency (the willingness to engage), their ownership over the content, and the development of positive identities as thinkers and learners.</i>	<i>The extent to which classroom activities elicit student thinking and subsequent interactions respond to those ideas, building on productive beginnings and addressing emerging misunderstandings. Powerful instruction "meets students where they are" and gives them opportunities to deepen their understandings.</i>

Baldinger, E. M., Louie, N., & the Algebra Teaching Study and Mathematics Assessment Project.(2014).The TRU Math conversation guide: A tool for teacherlearning and growth.Berkeley, CA & E. Lansing, MI: Graduate School of Education, University ofCalifornia,Berkeley & College of Education,Michigan State University. Retrieved from: <http://TRU.berkeley.edu>.

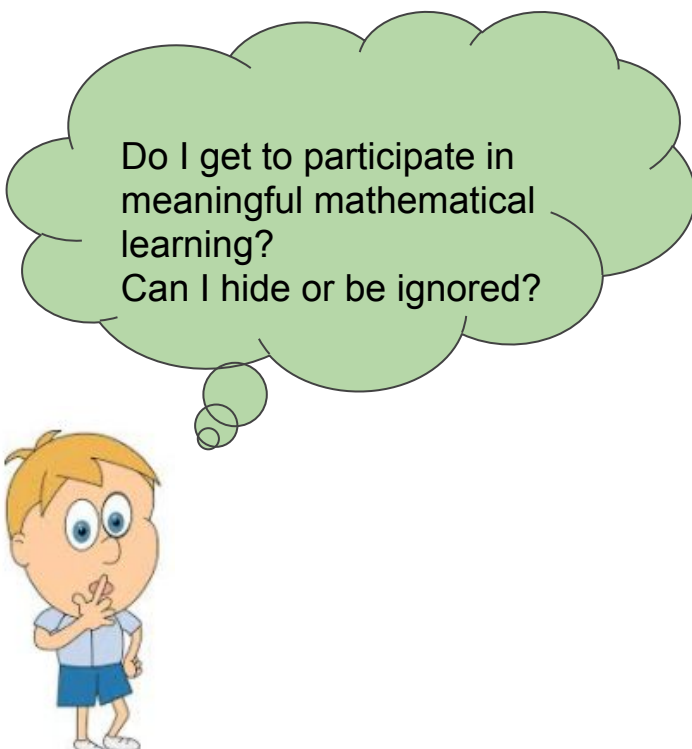
Observe the lesson through a student's eyes

The Mathematics	<ul style="list-style-type: none">• What's the big idea in this lesson?• How does it connect to what I already know?
Cognitive Demand	<ul style="list-style-type: none">• How long am I given to think, and to make sense of things?• What happens when I get stuck?• Am I invited to explain things, or just give answers?
Equitable Access to Mathematics	<ul style="list-style-type: none">• Do I get to participate in meaningful mathematical learning?• Can I hide or be ignored?
Agency, Ownership, and Identity	<ul style="list-style-type: none">• Do I get to explain, to present my ideas? Are they built on?• Am I recognized as being capable and able to contribute in meaningful ways?
Formative Assessment	<ul style="list-style-type: none">• Do classroom discussions include my thinking?• Does instruction respond to my thinking and help me think more deeply?

Figure 2. Observing a mathematics lesson from the student perspective

Equitable Access to Content

Who does and does not participate in the mathematical work of the class, and how? How can we create more opportunities for each student to participate meaningfully?



Do I get to participate in meaningful mathematical learning?
Can I hide or be ignored?

Planning

What opportunities exist for each student to participate in the intellectual work of the class? How can we create more opportunities for more students?

Reflecting

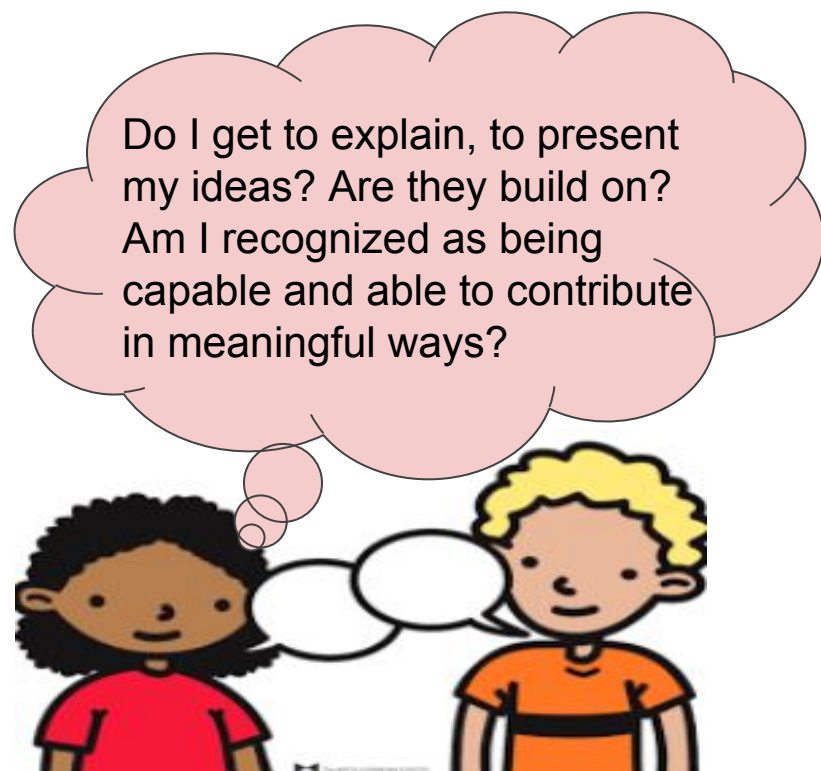
Who have we seen participate in the intellectual work of the class? How has this participation looked and sounded in specific cases?

Things to think about

- What is the range of ways that students can and do participate in the mathematical work of the class (talking, writing, leaning in, listening hard; manipulating symbols, making diagrams, interpreting text, using manipulatives, connecting different ideas, etc.)?
- Which students participate in which ways?
- Which students are most active, and when?
- In what ways can particular students' strengths or preferences be used to engage them in the mathematical activity of the class?
- What opportunities do various students have to make meaningful mathematical contributions?
- What are the language demands of participating in the mathematical work of this class (e.g., academic vocabulary, mathematical discourse practices)?
- How can we support the development of students' academic language?
- How are norms (or interactions, lesson structures, task structure, particular resources, etc.) facilitating or inhibiting participation for particular students?
- What teacher moves might expand students' access to meaningful participation (such as modeling ways to participate, holding students accountable, point out students' successful participation)?
- How can we support particular students we are concerned about (in relation to learning, issues of safety, participation, etc.)?
- How can we create opportunities for more students to participate more actively?

Agency, Ownership, and Identity

What opportunities do students have to see themselves and each other as powerful mathematical thinkers? How can we create more of these opportunities?



Planning

What opportunities might exist for students to generate and explain their own ideas? To respond to each other's ideas? How can we create more opportunities?

Reflecting

How have we seen students explain their own and respond to each other's ideas? What has that looked and sounded like in specific cases?

Things to think about

- Who generates the ideas that get discussed?
- What kinds of ideas do students have opportunities to generate and share (strategies, connections, partial understandings, prior knowledge, representations)?
- Who evaluates and/or responds to others' ideas?
- How deeply do students get to explain their ideas?
- How does (or how could) the teacher respond to student ideas (evaluating, questioning, probing, soliciting responses from other students, etc.)?
- How are norms about students' and teachers' roles in generating ideas developing?
- How are norms about what counts as mathematical activity (justifying, experimenting, connecting, practicing, memorizing, etc.) developing?
- Which students get to explain their own ideas? To respond to others' ideas in meaningful ways?
- Which students seem to see themselves as powerful mathematical thinkers right now?
- How might we create more opportunities for more students to see themselves and each other as powerful mathematical thinkers?

Three tenets of Mathematical Modeling

I. Become Problem Posers and Problem Solvers to Tackle Rigorous and Complex Problems in our World.

Students use math to take complex real world problem and mathematize the situation and apply the math they are learning to come up with creative solutions. How do we create more opportunities for students to *deeply engage with important mathematical ideas* and practice?

II. Build Powerful Math Thinkers and Doers to Promote Student Math Identities

Math Modeling helps students see themselves participating as Powerful Math Thinkers and Doers. What opportunities might exist for students to generate and explain their own ideas? To respond to each other's ideas? How might we create more opportunities for more students to see themselves and each other as *powerful mathematical thinkers and doers*?

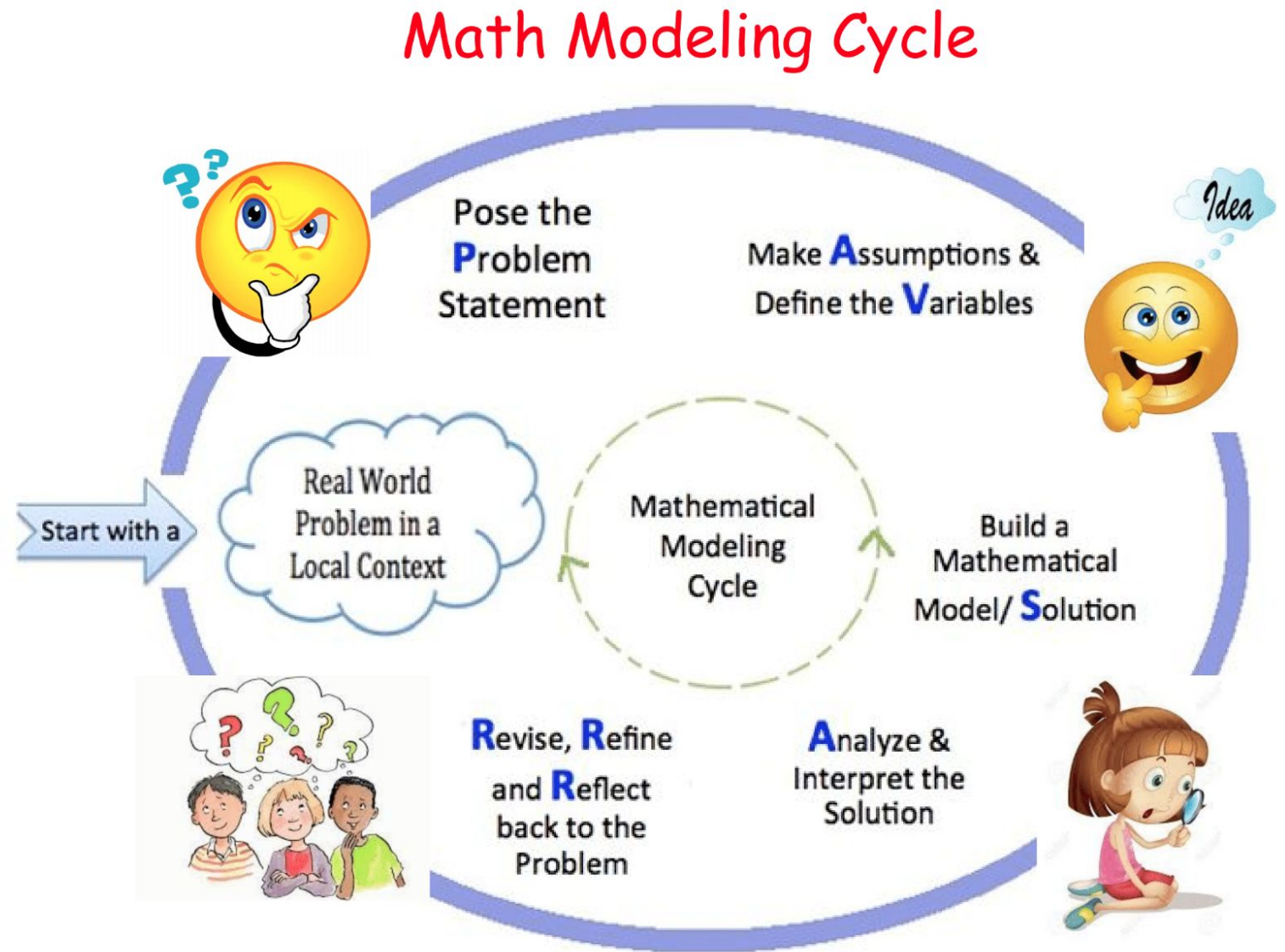
III. Make math Personally Relevant, Community Engaged, Empowering and Useful!

Students use their background knowledge and are engaged in problems have *relevance*. Place based education and service learning contexts have been rich sources for meaningful math modeling contexts. Through these connections, students build a closer relationship with mathematics. How might we use real world problems that are community based, personal math happenings, school events and context that are of interest to students?



Math Happenings!

A math routine to introduce students to **mathematical modeling** as they build a relationship with mathematics. Students to see themselves as math doers and thinkers. They see the utility of mathematics and the relevance to their lives. Empowers our students as they see that mathematics can serve them



Math Happenings....Math Modeling Contexts

Rich, Rigorous and Relevant Math

Coin Drive

We have a Coin Drive this month to buy meals for Thanksgiving. Coins are coming in and we need to find the best way to count them.

Planning a Field Trip

Each year, I plan a field trip for my class. This year, it's your turn!

School Supplies

School supplies either run out or are unused. We need to find out the right amount of supplies for our class.

Reviving & Running School Store

This year, we revived the School Store. We moved all our stock, except our No.2 Pencils that everyone had on the "must have" list. We need to move this deadstock before the end of school.

Math Happenings....Math Modeling Contexts

Coin Drive

We have a Coin Drive this month to buy meals for Thanksgiving. Coins are coming in and we need to find the best way to count them.

Problem Posing -What is the best way to count coins?

Planning a Field Trip

Each year, I plan a field trip for my class. This year, it's your turn!

Problem Posing -How can you plan your field trip for this year? What do you need to consider?

School Supplies

School supplies either run out or are unused. We need to find out the right amount of supplies for our class.

Problem Posing- How much supplies do we need and use for the school year?

Running School Store

This year, we revived the School Store. We moved all our stock, except our No.2 Pencils that everyone had on the "must have" list. We need to move this deadstock before the end of school.

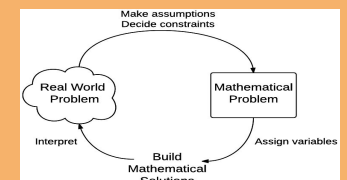
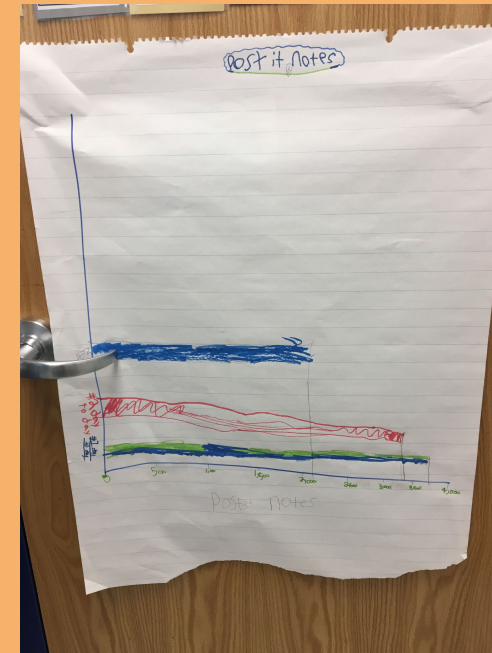
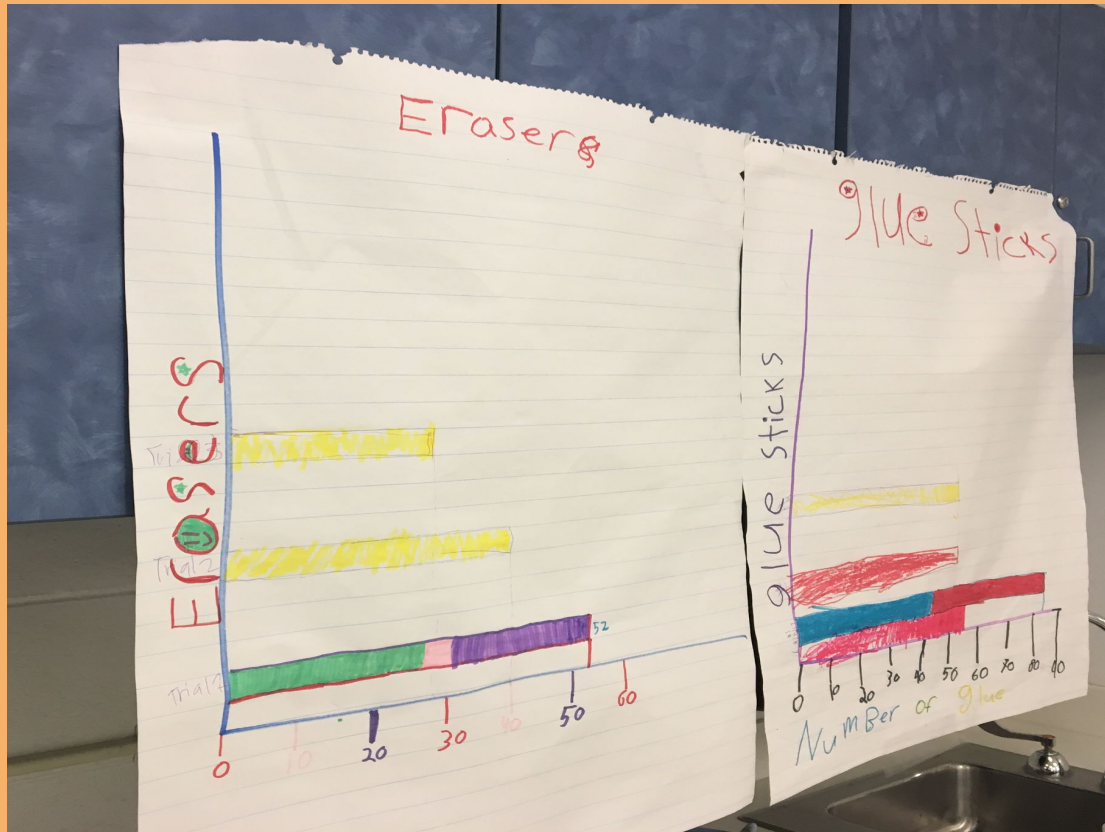
Problem Posing- What is the "best way" to move the deadstock?

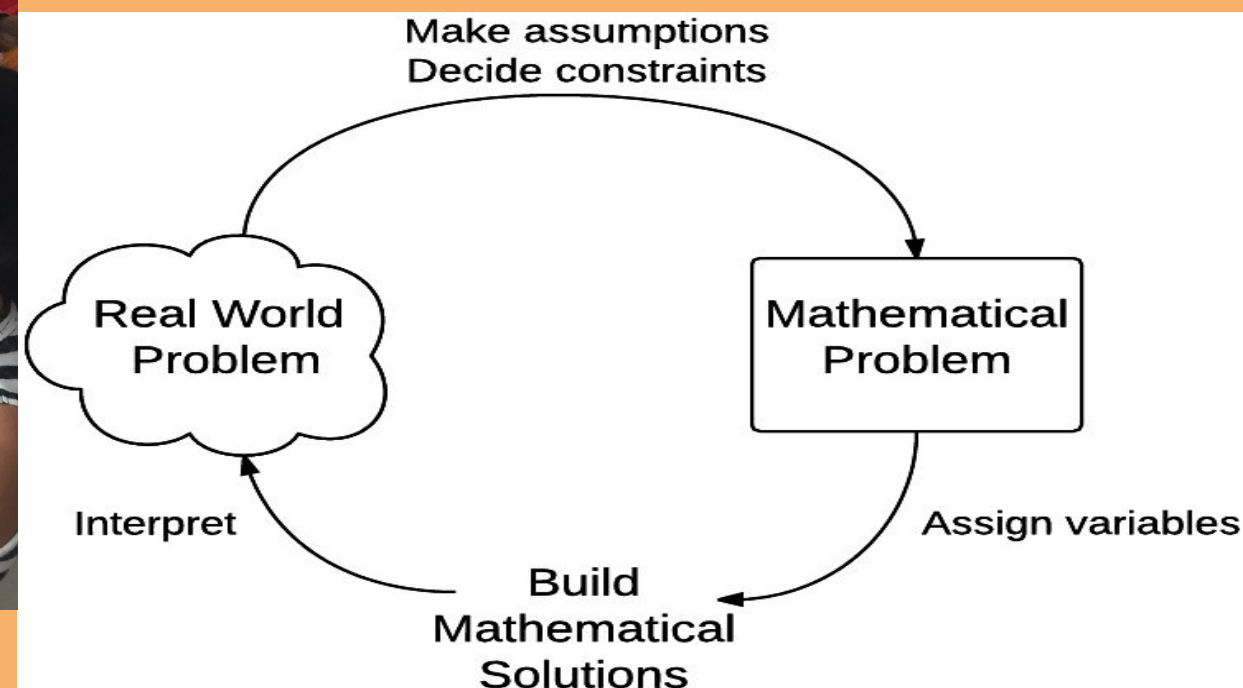
School Supplies- Will we run out????

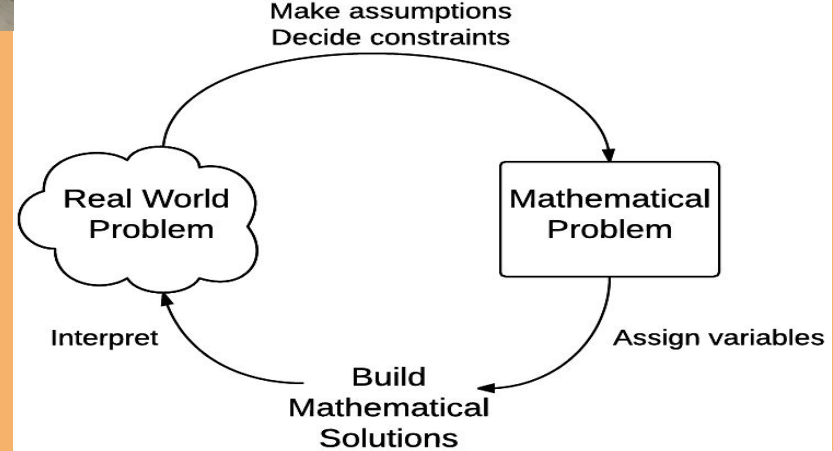
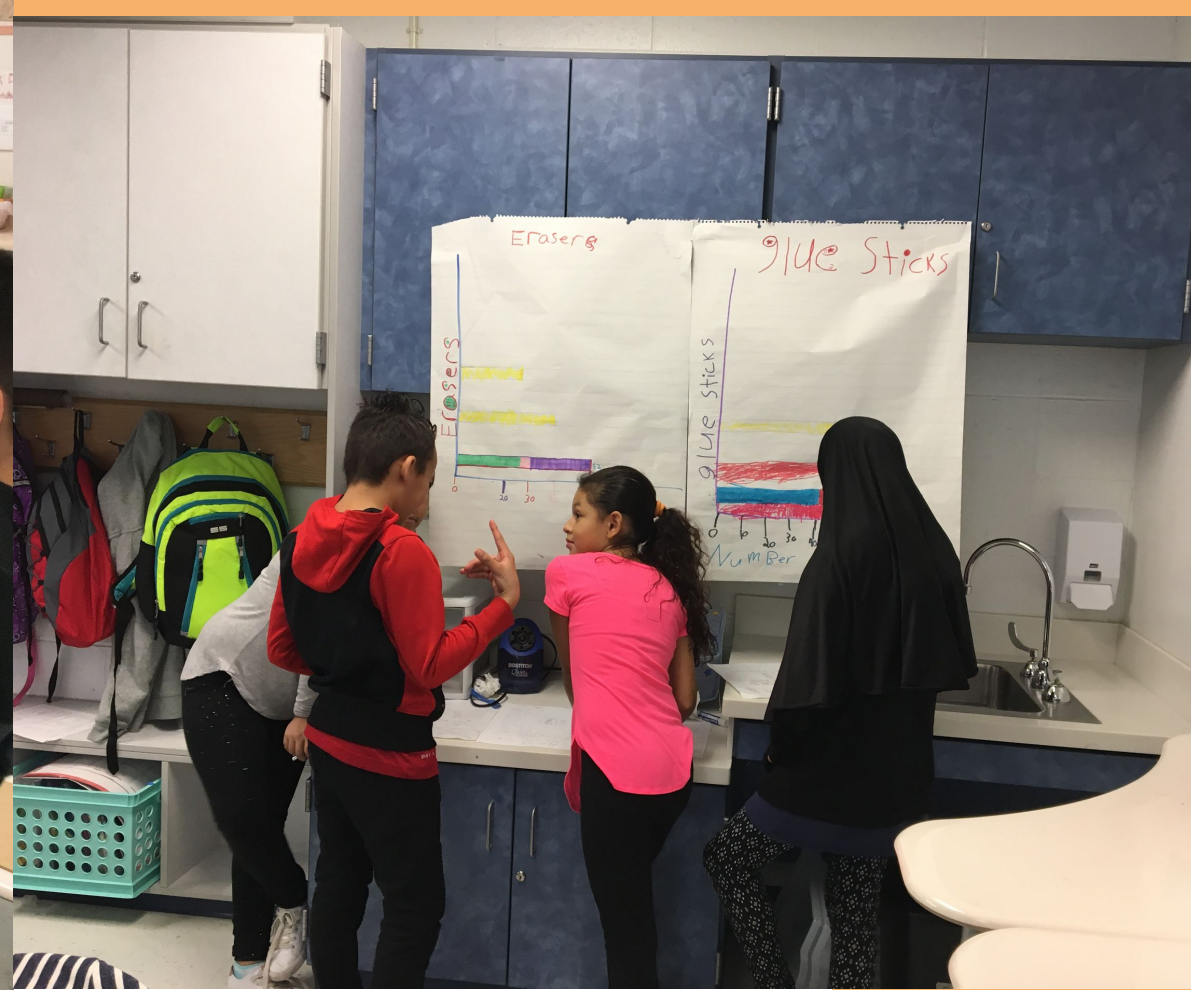
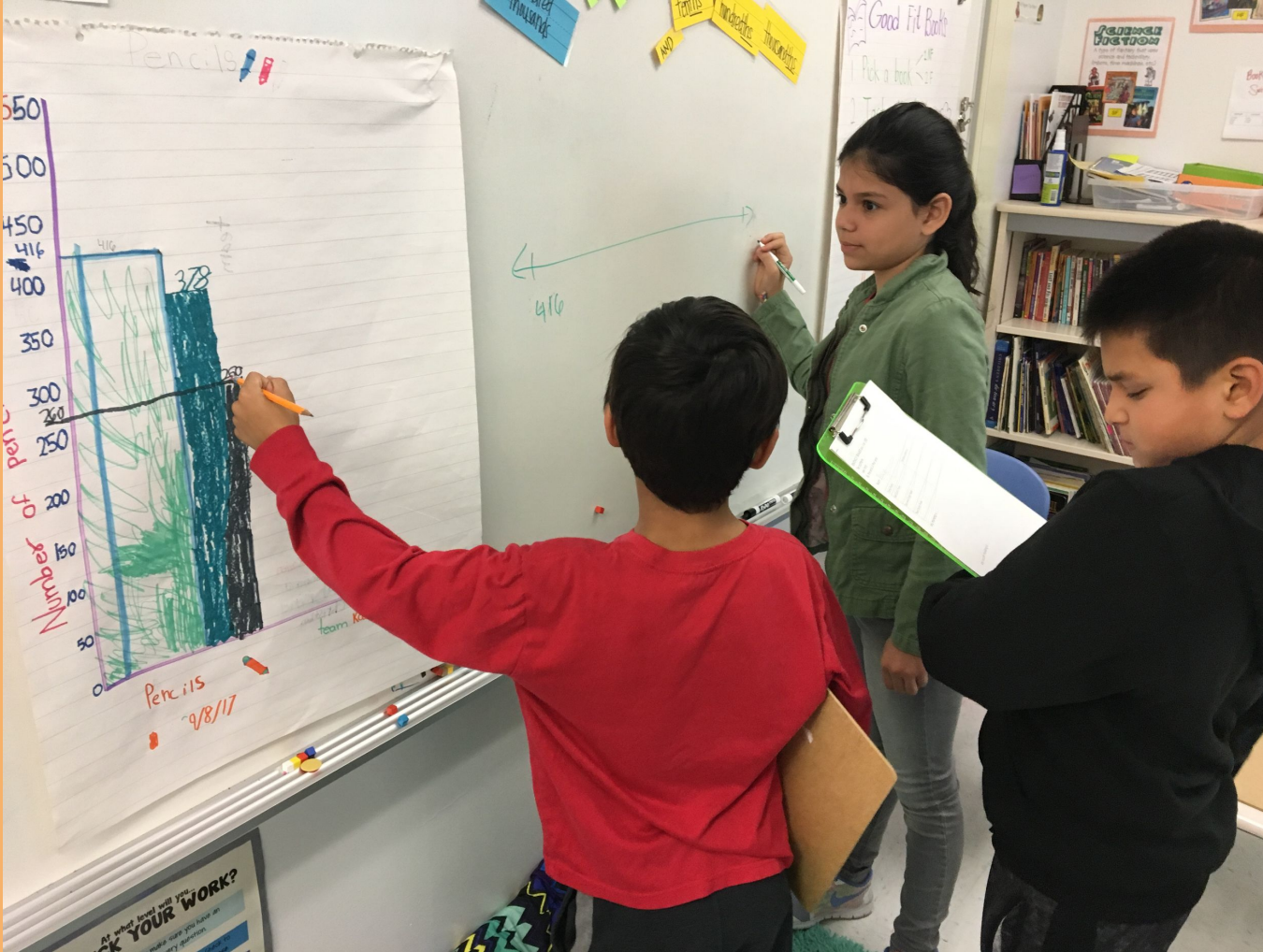
School supplies either run out or are unused. We need to find out the right amount of supplies for our class.

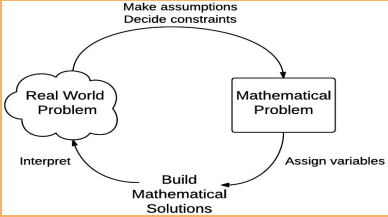
Problem Posing- How much supplies do we need and use for the school year?

What is the best way to organize and maintain classroom supplies to last until the end of the year?





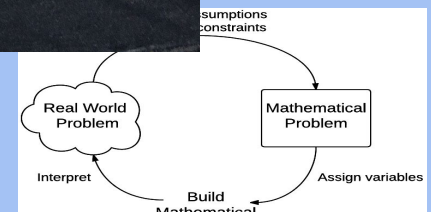
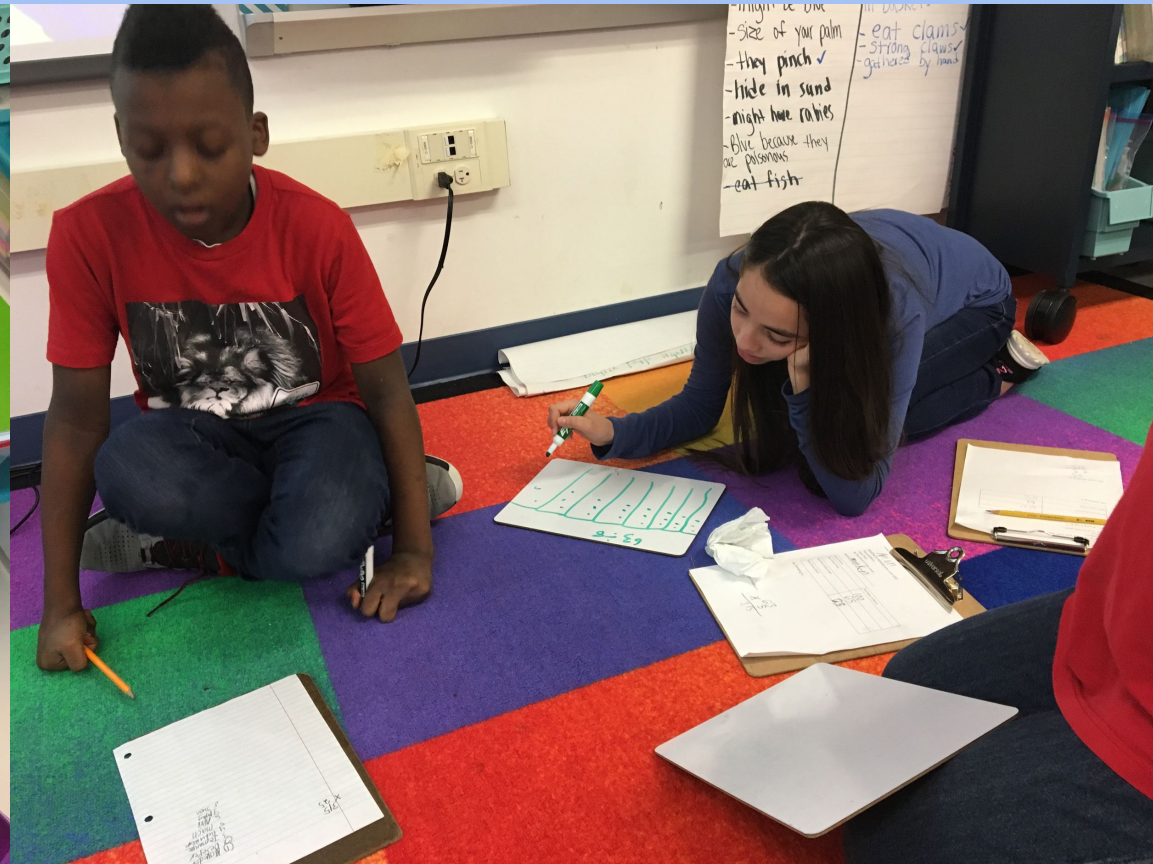
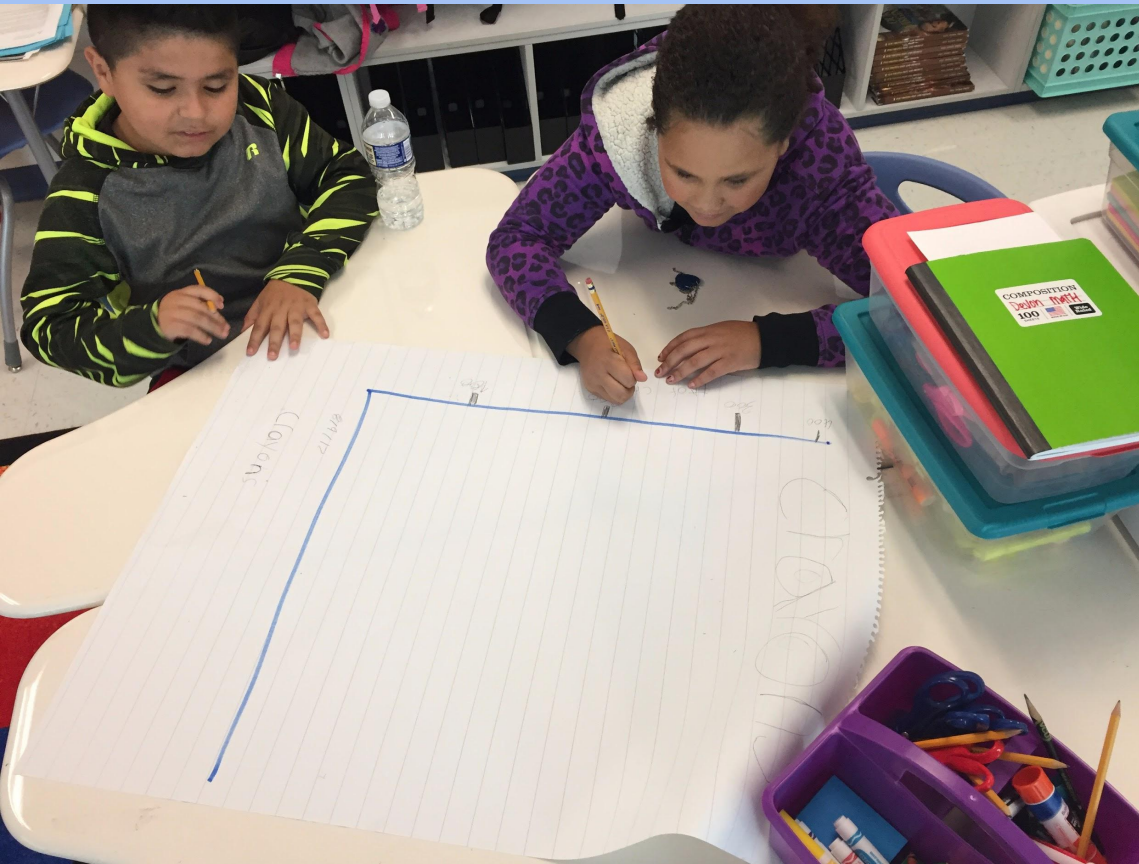




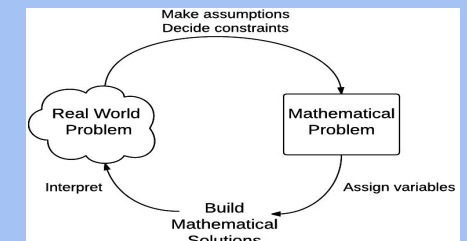
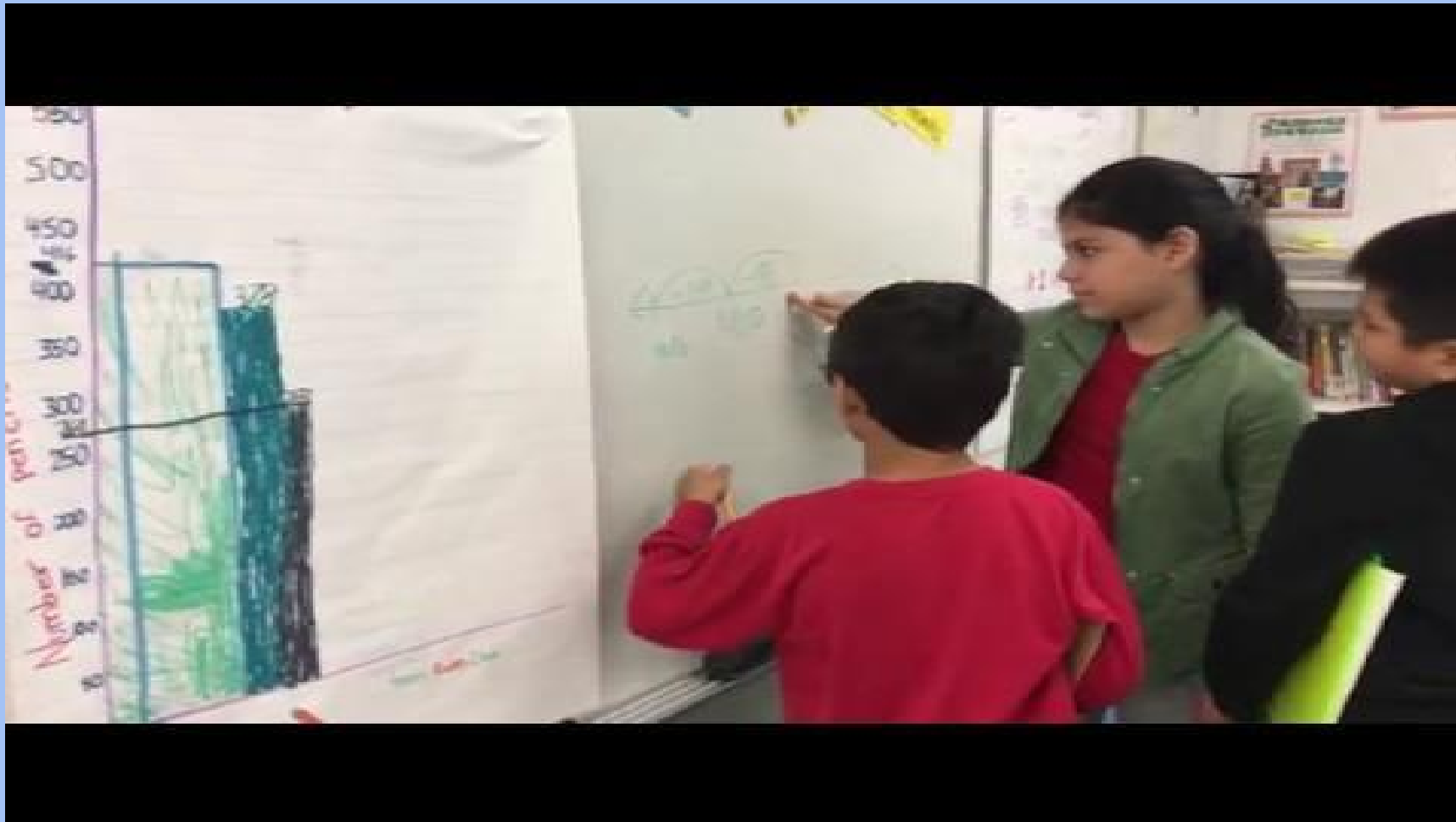
Our Overarching Research Question



Do Math modeling tasks lead to advanced academic discourse across ability levels in students?



Misconceptions



Coin Count - Making Harvest Basket

Coin Drive

We have a Coin Drive this month to buy meals for Thanksgiving. Coins are coming in and we need to find the best way to count them.

Problem Posing -What is the best way to count coins?

“A social justice approach to math is
the appropriate type of math for
these unjust times.”

~Eric (Rico) Gutstein and Bob Peterson

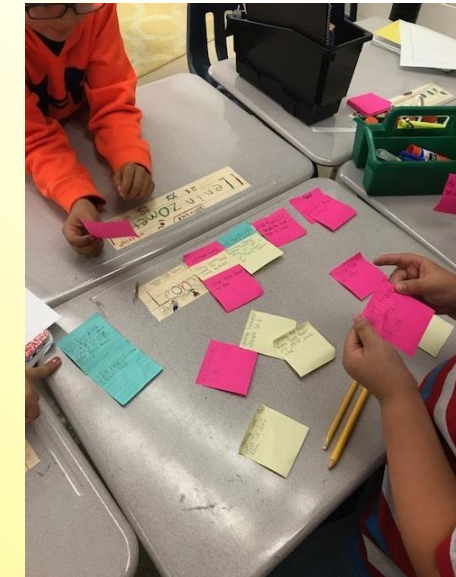
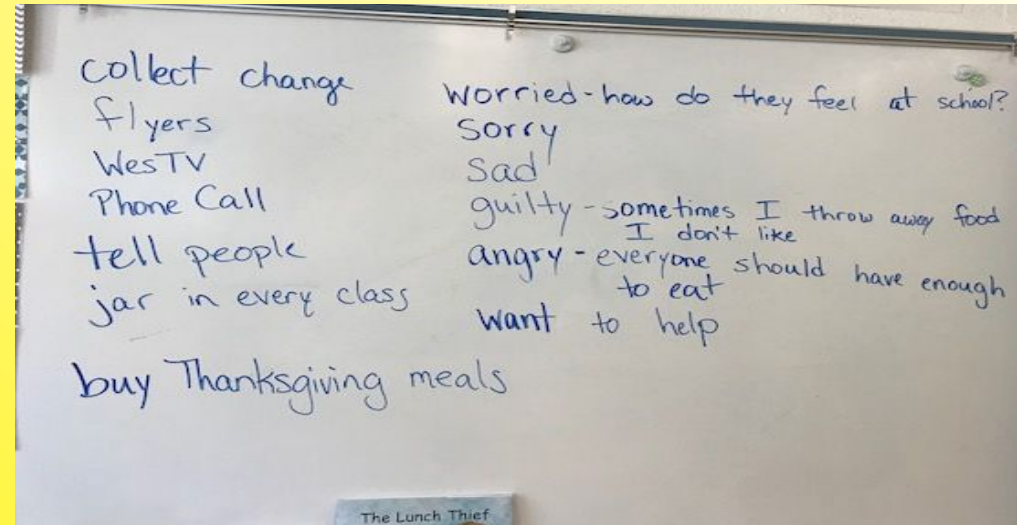
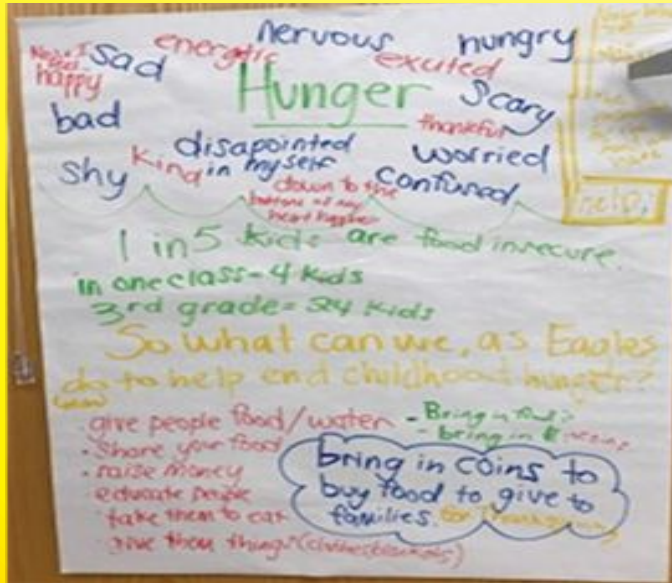
Rethinking Mathematics: Teaching Social Justice by the Numbers

Choosing the Question

- Real world context with personal significance to many students
 - Free and reduced lunch 70% (school) vs. 28% (county)
 - Mobility rate 20% (school) vs. 12% (division)
- Rich math with cross-curricular connections
- Opportunities for differentiation
- Empower students to be change makers

Presenting the Problem

1 in 5 kids are hungry in the U.S.
How can we help?



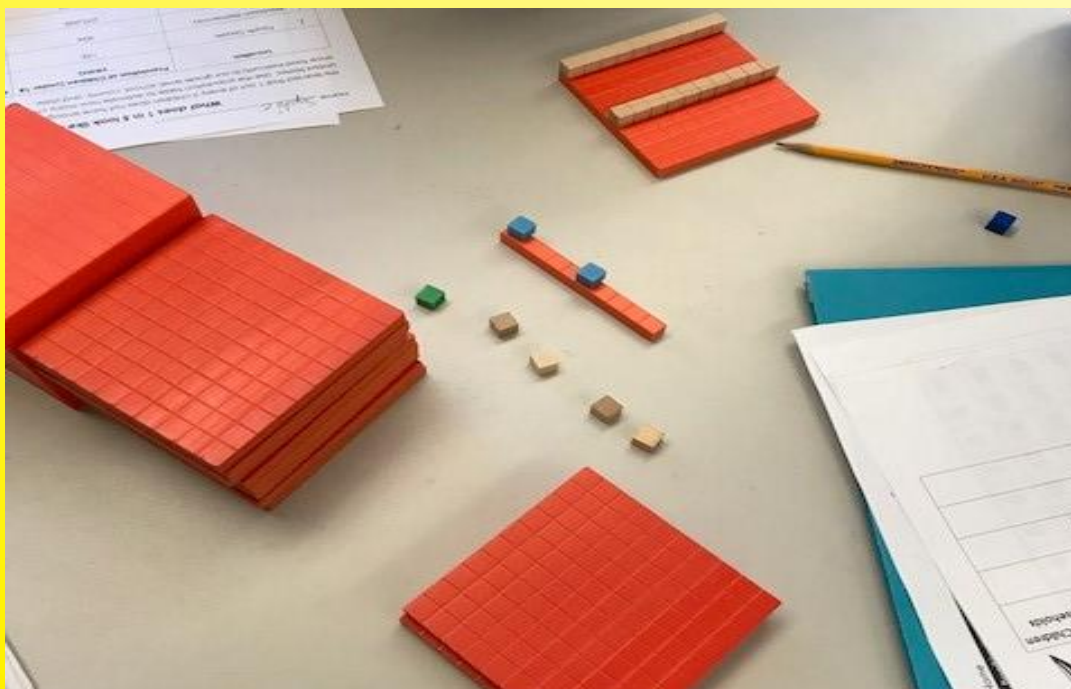
3rd graders brainstorm character traits from a Read Aloud about hunger

4th graders' reactions and ideas for implementation of Coin Harvest

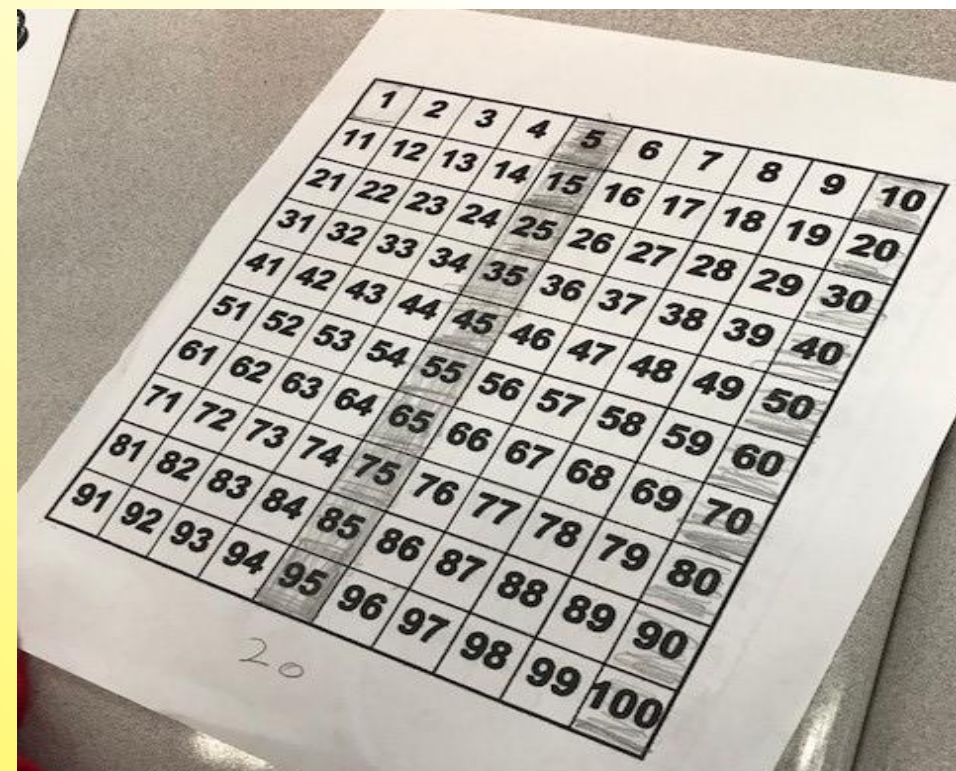
5th graders brainstorm solutions

What does 1 in 5 look like?

Students were asked to find $\frac{1}{5}$ of various populations (class, grade level, Westlawn, Falls Church, Virginia)



Base 10 blocks



Coloring multiples of 5 on a 100s chart

More Strategies

Name Steven #9

What does 1 in 5 look like?

We learned that 1 out of every 5 children does not have enough food to eat here in the United States. Use the population table to estimate how many children might experience food insecurity in our grade level, school, county, and state.

Location	Population of Children (under 18 years)	Approximate Number of Children in Food Insecure Households
Fourth Grade	126	$\frac{100}{100 \div 5 = 20}$ 25 Kid's
Westlawn Elementary	834	$\frac{160}{160 \div 5 = 32}$ Kid's
Fairfax County, VA	270,000	$\frac{54,000}{54,000 \div 5 = 10,800}$
Virginia	1,867,421 $\approx 2,000,000$	$\frac{400,000}{400,000 \div 5 = 80,000}$

$10 = 2$ $70 = 14$ $120 = 24$ $180 = 36$
 $20 = 4$ $80 = 16$ $130 = 26$ $190 = 38$
 $30 = 6$ $90 = 18$ $140 = 28$ $200 = 40$
 $40 = 8$ $100 = 20$ $150 = 30$ $210 = 42$
 $50 = 10$ $110 = 22$ $160 = 32$ $220 = 44$
 $60 = 12$ $120 = 24$ $170 = 34$ $230 = 46$
 $130 = 26$ $180 = 36$ $240 = 48$
 $140 = 28$ $190 = 38$ $250 = 50$
 $150 = 30$ $200 = 40$ $260 = 52$
 $160 = 32$ $210 = 42$ $270 = 54$
 $170 = 34$ $220 = 44$ $280 = 56$
 $180 = 36$ $230 = 46$ $290 = 58$
 $190 = 38$ $240 = 48$ $300 = 60$

Extending number patterns

Westlawn

$$\begin{array}{r} 1,000 \\ - 1,000 \\ \hline 0,000 \end{array}$$

Check: $\frac{200}{5} = 40$

Answer: There are 200 kids in Westlawn that are hungry

Prediction: 20, 200, 200,000
 grade Westlawn Fairfax

200
 200
 200
 200

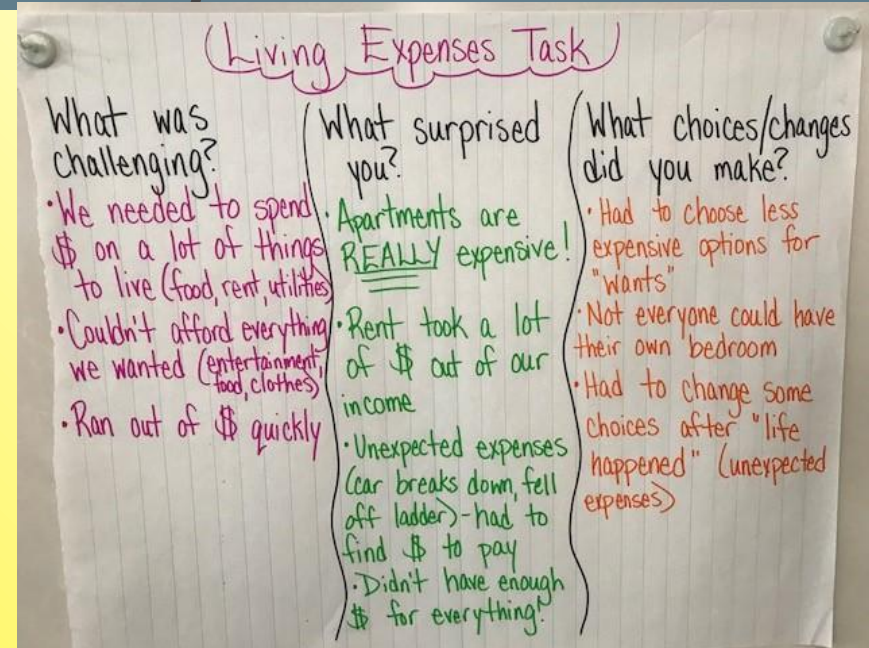
Fractions of a set

Who is the face of hunger in our community?



"Apartments are expensive. REALLY EXPENSIVE!"

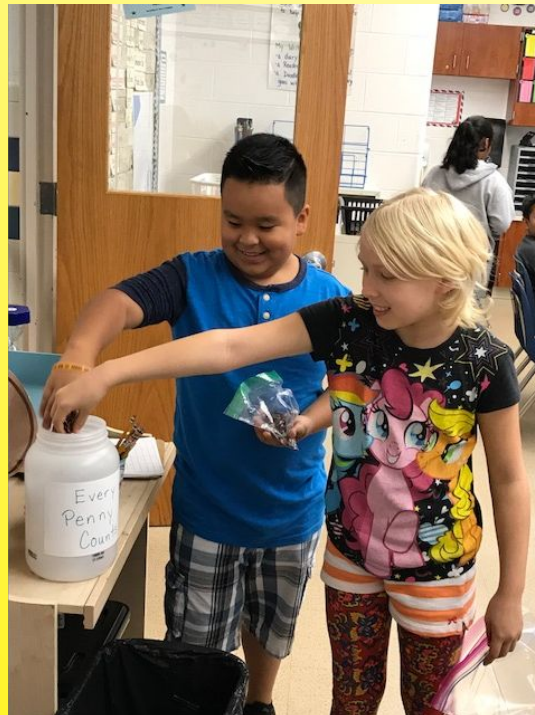
"My mom is a house cleaner too!"



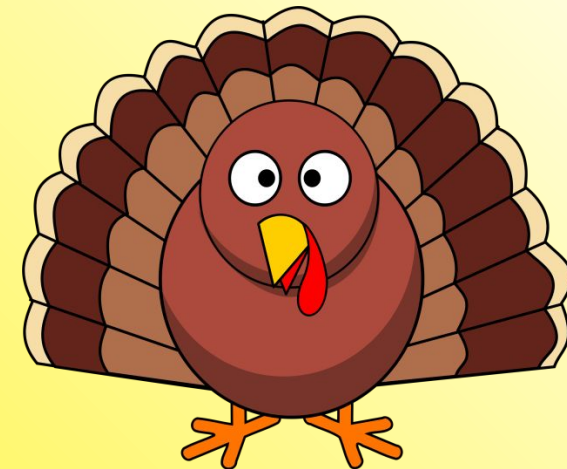
"Money disappears like dust in the wind."












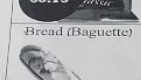






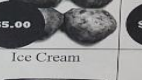
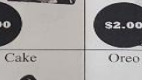



The Task

Based on the money we raised in our Coin Harvest, how can you plan the best Thanksgiving meal? Justify why you feel like your meal plan is the *best*.



GMU COMPLETE Center



 \$4.25 Chips	 \$2.50 Pasta Sauce	 \$3.00 Pasta	 \$2.00 Butter	 \$17.50 15 Pound Turkey	 \$28.25 20 Pound Turkey
 \$3.75 Bread (Baguette)	 \$2.50 Potatoes	 \$2.00 Crescent Rolls	 \$5.50 Corn	 \$1.00 Canned Corn	 \$1.00 Canned Green Beans
 \$2.25 Pumpkin Pie	 \$5.00 Ice Cream	 \$2.00 Cake	 \$2.00 Cranberry Sauce	 \$5.00 Apples	 \$4.00 Grapes
 \$5.50 Pumpkin Pie	 \$4.00 Ice Cream	 \$7.25 Cake	 \$3.00 Oreo Cookies	 \$4.00 Cheese	 \$1.50 Salad Dressing

“WOW!! Is this real?!”- said after an audible gasp



3rd Grade

**Meal planning sheet,
beginning
of multiplication**

How many meals could you buy with \$500? Show your work below in pictures, numbers, and words.

$$\begin{array}{r} 116 \\ + 58 \\ \hline 174 \end{array}$$

$$\begin{array}{r} 174 \\ + 58 \\ \hline 232 \end{array}$$

$$\begin{array}{r} 158 \\ + 58 \\ \hline 216 \end{array}$$

$$\begin{array}{r} 464 \\ + 58 \\ \hline 522 \end{array}$$

$$\begin{array}{r} 290 \\ + 58 \\ \hline 348 \end{array}$$

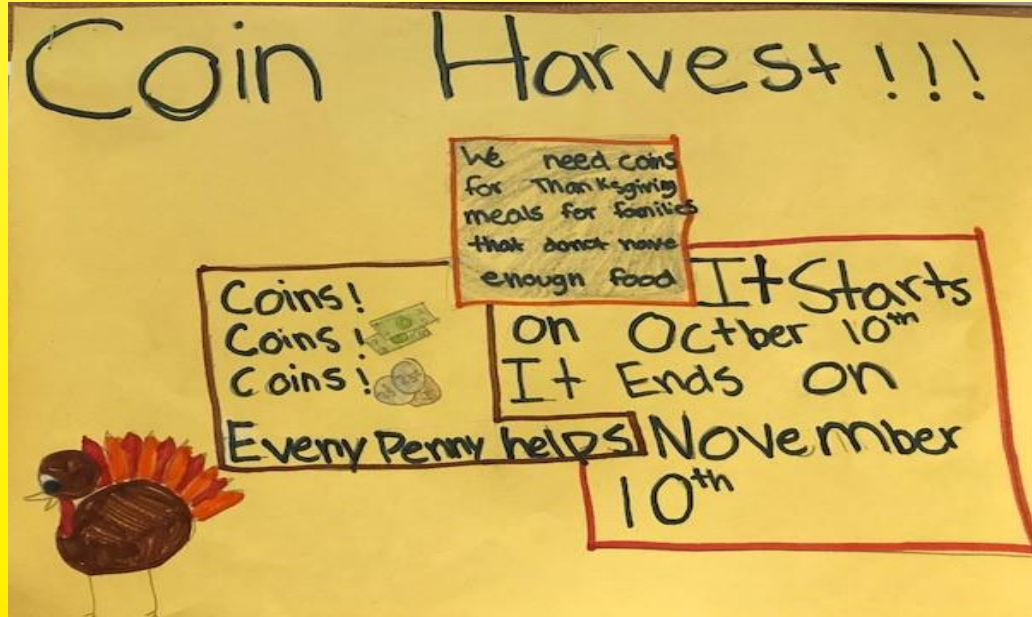
I can buy 5 full meals plus a little more 348

**Day 2: How many meals can we purchase with \$500?
Students used a range of strategies to solve the math!!**

Meal Planning Worksheet:
Budgeter's Name: Shafiq Anderson

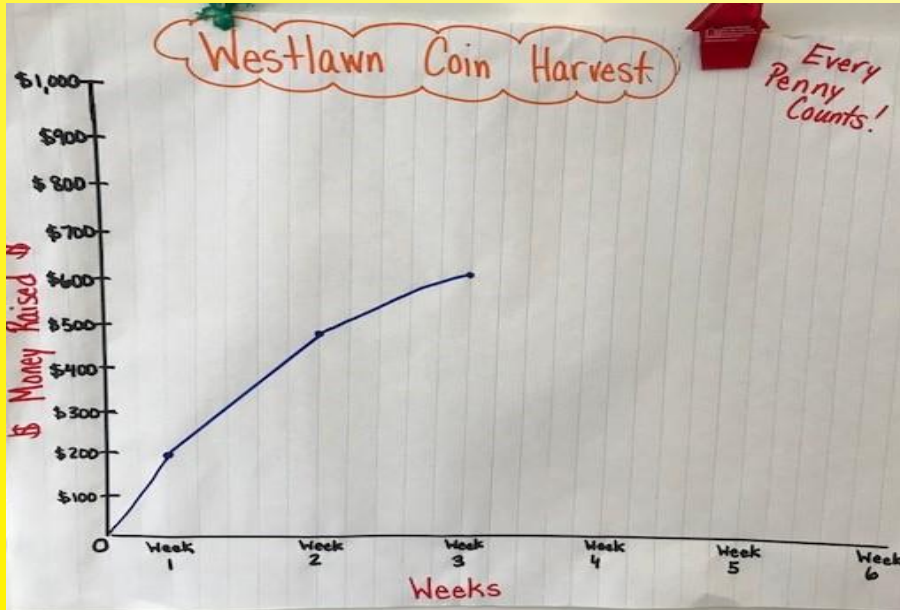
Food Item	Cost of Food Item	Total
Macaroni Cheese 3	\$ 12.75	\$ 12.75
20 Pound Turkey	\$ 28.25	\$ 41.00
canned Corn 4	\$ 4.00	\$ 55.00
Pumpkin Pie 2	\$ 5.00	\$ 50.00
Apples 3	\$ 15.00	\$ 71.00
Grand Total	n/a	\$ 71.00 71.00

Raising Awareness



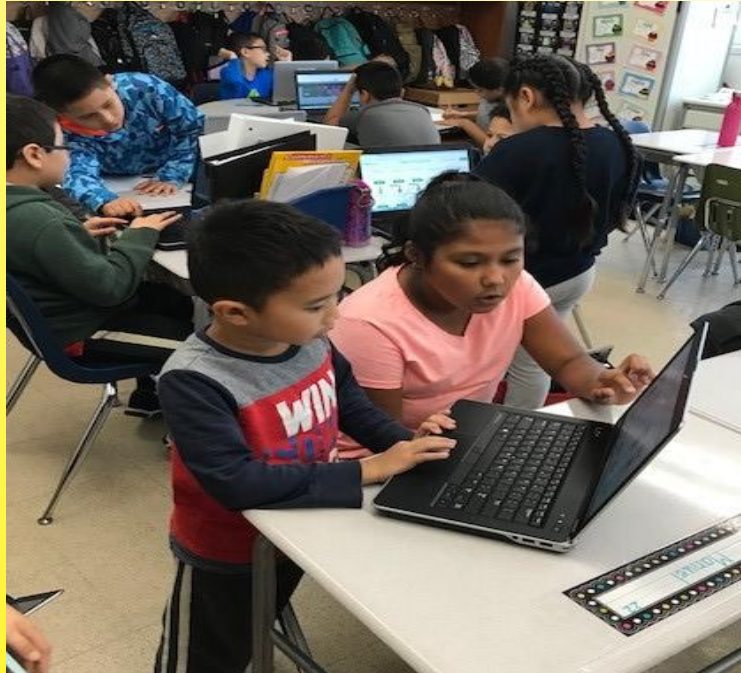
Students decided on how to implement the Coin Harvest school-wide

4th Grade



Graphing our collection, and analyzing the data to make estimates

Collaborating to research prices and quantities of food items for their meals

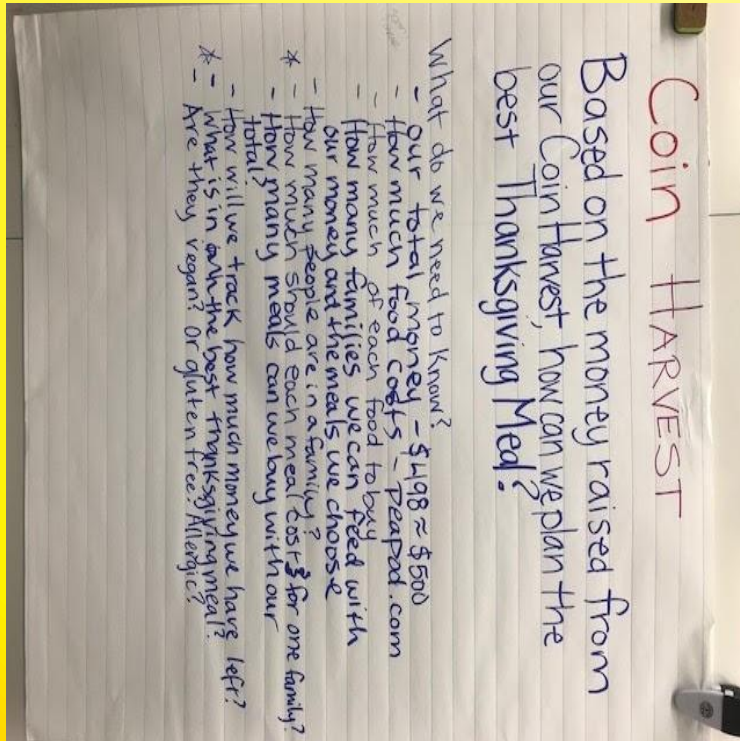


GMU COMPLETE Center

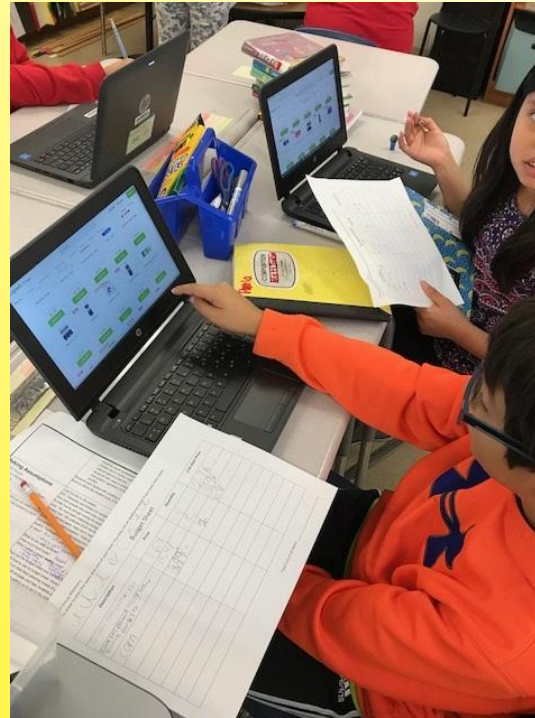


Working together on decimal calculations

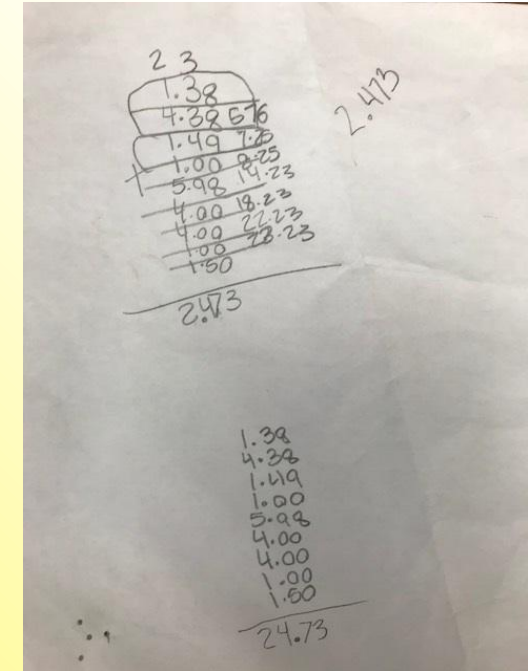
5th Grade



Thoughtful questions as they start planning

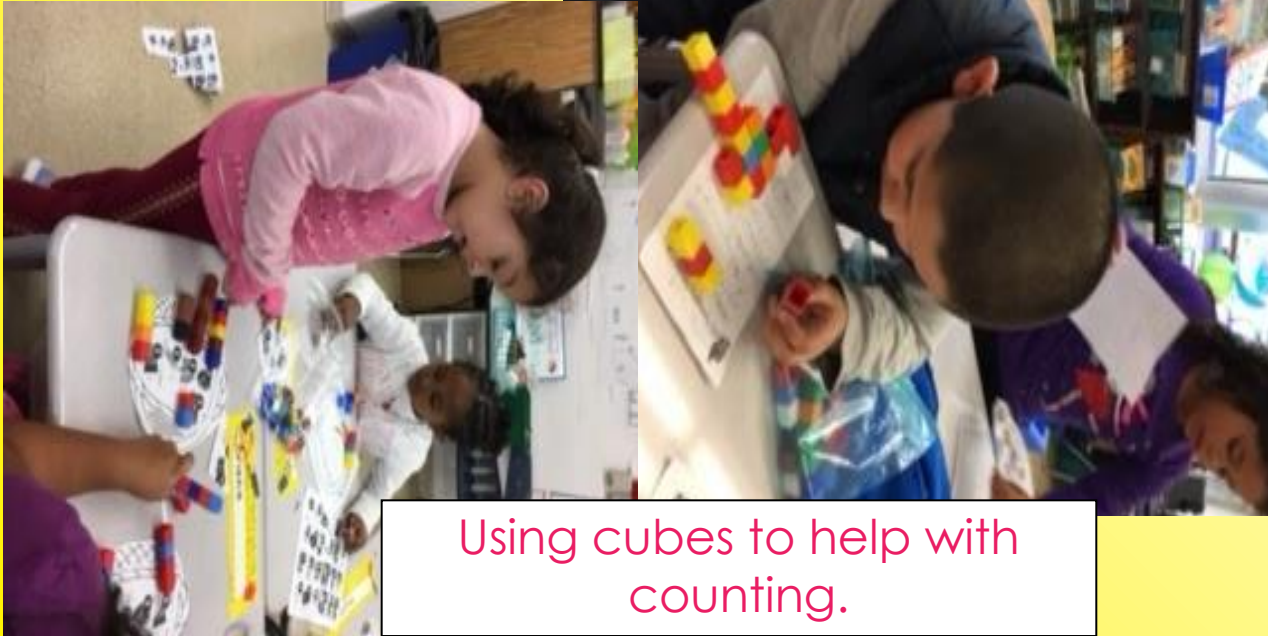


"I just don't think we need soda in a meal."



Using reasoning to determine decimal place.

Ms. Burke's 1st grade class



Using cubes to help with counting.



Many students chose both pictures and lists to show their thinking!



Starting with \$20, and counting out fake money to see what we can afford.



Reflections

- Increased math engagement
- Collaborative classroom atmosphere
- Activating empathy
- Students became change makers
- Accessible by any grade level
- Opportunities for rich conversations
- Extensions abound!

Westlawn Coin Harvest Grand Total...

\$781!!!
(and counting!)



The Elementary Mathematics Planning and Pacing Guide is a teacher resource which includes the Virginia Standards of Learning, the FCPS Program of Studies, a Yearly Overview identifying curriculum pacing and sequencing, Correlated Standards among grade levels, and Teacher Notes. The Teacher Notes provide instructional suggestions and best practices for teaching learning mathematics. The planning guide includes...

Teacher Begins: Designing the Problem

America in a Day
Kathleen McLane and Laura Maldonado
<http://americainaday.blogspot.com/>

...on both the
...level Program of Studies
... Teachers of Advanced Mathematics
Grade 5 should use the Grade 6 Planning and Pacing
Grade



Undergraduate STEM Scholars Inspiring Young Math Modelers

Use of MM to optimize travel and create America-in-a-Day blog

In March of 2016, trying to come up with something to do for Spring Break

Constraints

- Had from 6am to midnight
- Total of \$250
- Wanted to travel outside of the state of Virginia

Started a blog showcasing our ideas
www.americainaday.blogspot.com



The Washington Post



Assumptions

24 hours,
1 city,
\$250 each

Variables

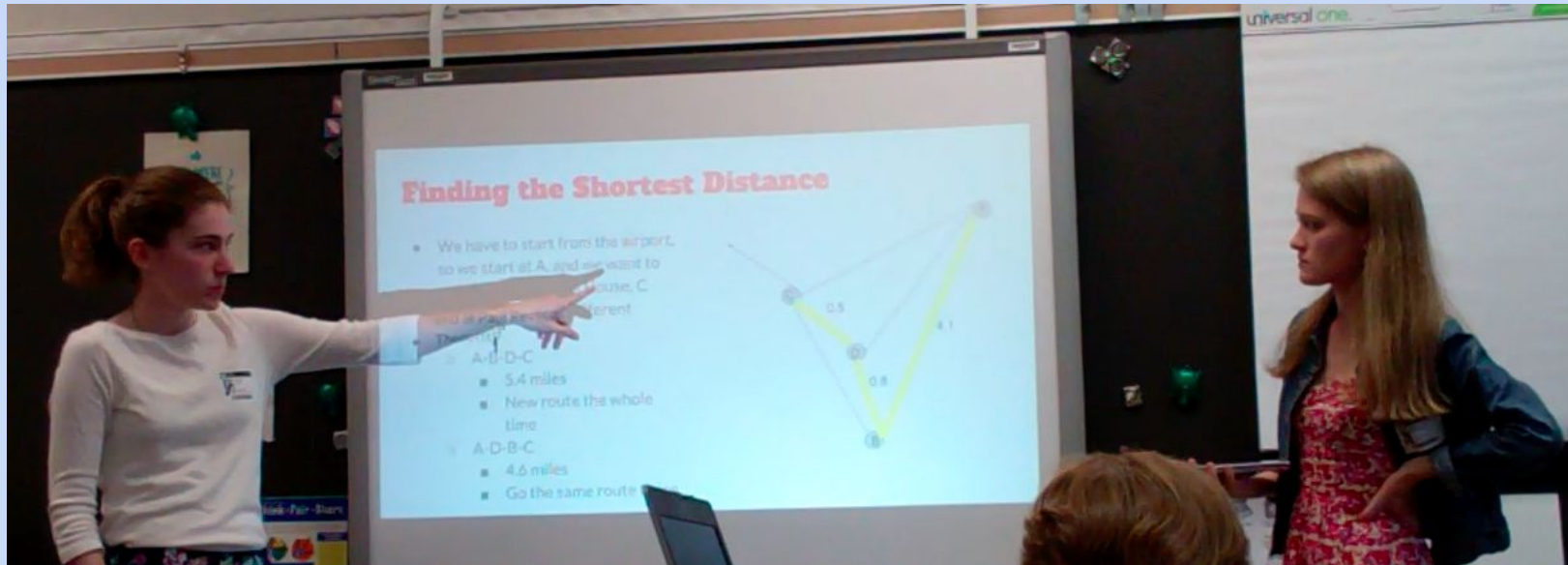
Your
Question

Build a Model

Math Opportunities

MM Launch: Students Dive In & Define the Problem

Guest speakers were brought in to show how this a REAL problem that people solve EVERYday.



Parameters are set and students begin discussing how to stay within a budget.

- We will see everything between 6:30am and 11:59pm
- My budget is \$250 for my family
- We will see 3 attractions



Students take the class problem
and write their own problem.

My BEST City Trip

Class Problem:

Your family is going on vacation this summer and you want to convince them to go to the city of your choice. What is the best way to get your family to visit this city in only one day?

My Problem:

The City I choose is: D.C.

The problem in my own words:

How to get to D.C. and see all the sites, pay for the food we need, and get around with only \$250.

What do I KNOW?	What do I NEED to know?	How can I find the answers?
We only have \$250.	using only \$250 how	use computers.
leave no earlier than 6:30.	are we going to get transportation/2. get meal/3. only use \$250/4. Explain how	find out how much gas it take to go from X to X.
Return no later than 11:59.	You will get from: one place to another/5. do the vacation in between 6:30 and 11:59.	use an atlas.
I have to pick one of the following cities: Pennsylvania, Delaware, Maryland, Virginia or D.C.		look up different restaurants.

3 words that describe how you felt doing this lesson:

Frustrating

mathematical

Great

2 difficulties or things that were hard:

Finding out how

many minutes are

in 17 hours and

29 minutes.

Finding the

amount of time

between attractions

1 thing you ~~still do not completely~~ understand

have learned

I was introduced to Google Sheets.

The Steps

1. Day One: Define My Problem: Determining my city and list of possible attractions a.k.a. MY Best
2. Day Two: Having Fun: Choosing attractions, travel, food
3. Day Three: Getting around: Distance and cost of travel
4. Day Four: Budget Day: Organize information into a budget
5. Day Five: Final calculations and result sharing

Making
Assumptions
(Do the Math)

Defining Variables (Do the Math)

What is the best way to get your family to visit this city in only one day?

adding min. where we go
thinking about prices for parking
and gas \rightarrow figuring out cost

Time

COST

TRAVEL
Time

$A1 + A2 + A3 + (\text{parking} + \text{drive time})$

PBJ + apples + water + bread

4 tickets in a package = x

Solution: Declare Victory & Demonstrate the Solution

Traveling TIME

Home to A1: 3 hours 7 min

A1 to A2: 5 min

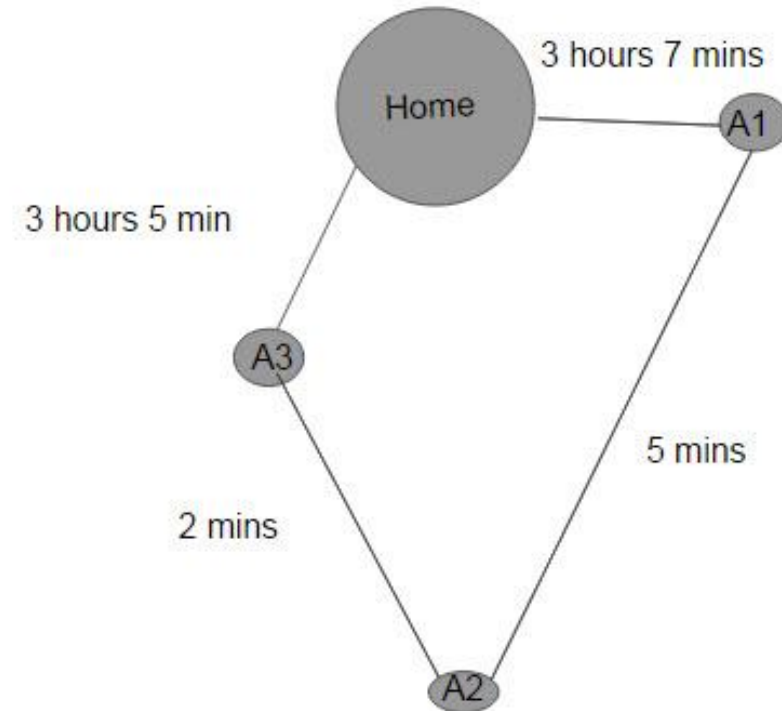
A2 to A3: 2 min

A3 to Home: 3 hours 5 min

TOTAL Travel Time: 6 hours 19 min



We will be driving



Mathematical Modeling: CHANGE in Mindset

I like this project
and it's fun i think i'd
actually do this



Every day, millions of children go home to find out t
for dinner...



Food For Thought

We will fight and defeat hunger together!

By: Mrs. Rossbach's sixth grade class



Nickels Go A Long Way...

By the contributors: Raakin (Our Goal, math, materials) Will (What we found, people we need) Danielle (Title, thanks for watching page), Sydney (our plan, superiorness) Dr.WS

5 cents a day keeps the hunger away!!!!!!



**How can we have a
positive impact on our
school and community?**

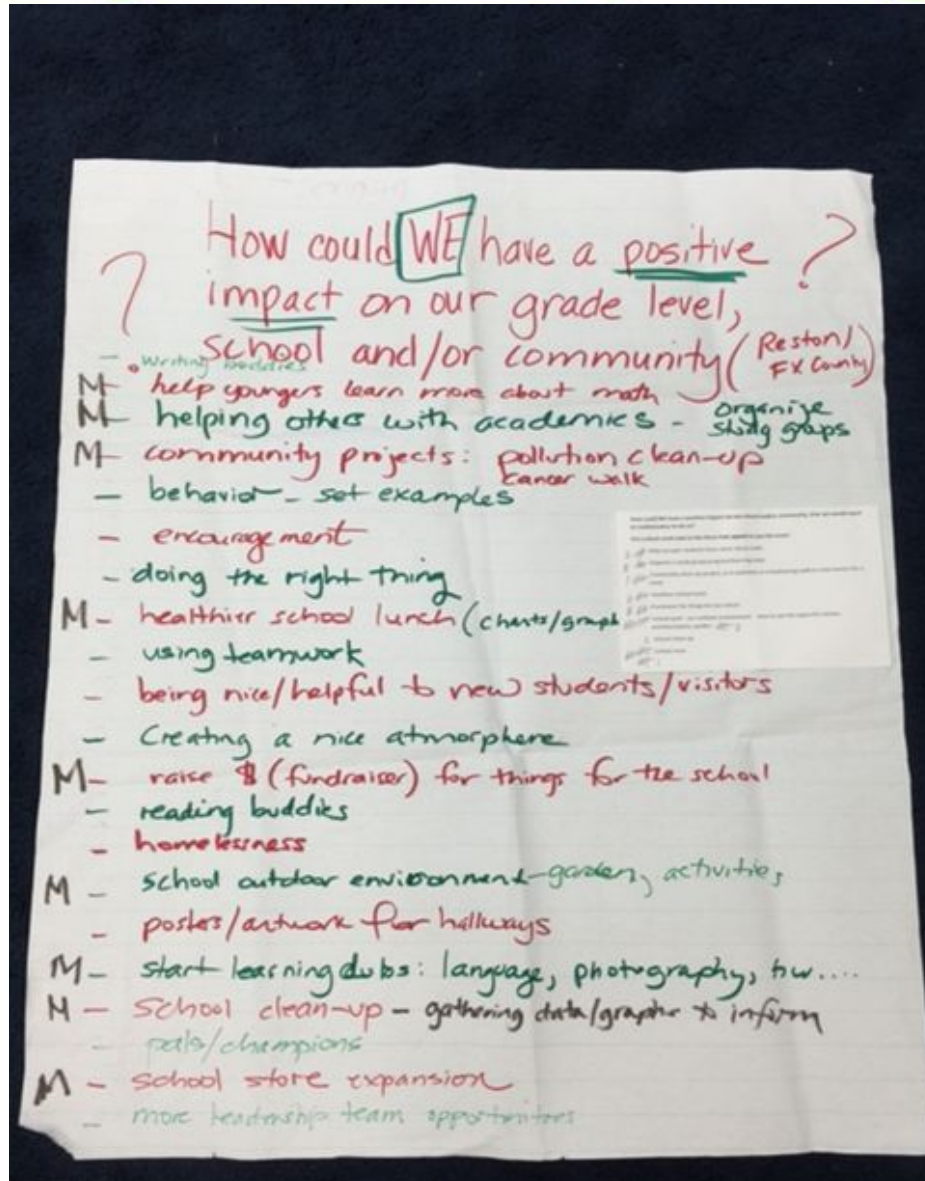
A year-long MM journey



**Mrs. Rossbach's 6th grade class
Sunrise Valley ES**

Our journey began...

Developing and Anticipating



The Essential Mathematics Skills and Processes

Rational Numbers

- 6.1 - **describe and compare data, using ratios**, and use appropriate notations
- 6.2 - investigate and describe fractions, decimals, and percents as ratios; identify a given fraction, decimal, or percent from a representation; demonstrate equivalent relationship among fractions, decimals, and percents; and **compare and order fractions, decimals, and percents**

Computation and Estimation:

- 6.6 - multiply and divide fractions and mixed numbers, estimate solutions and then solve single-step and multi-step practical problems involving addition, subtraction, multiplication, and division of decimals
- 6.7 - **solve single-step and multi-step practical problems** involving addition, subtraction, multiplication, and division of decimals
- 7.4 The student will solve single-step and multistep practical problems, using **proportional reasoning**

Probability and Statistics:

- 6.15 describe mean as a balance point; and decide which measure of center is appropriate for a given purpose
- 7.11 compare and contrast histograms with other **types of graphs** representing information from the same data set

Essential Language Arts Skills and Processes

- contribute to small group activities
- and express opinions in oral presentations
- the meanings of unfamiliar words and phrases
- in various texts
- demonstrate comprehension of a variety of texts
- narrative, description, exposition, persuasion
- writing for correct grammar, capitalization, spelling, sentence structure, paragraphing
- evaluate, and select appropriate resources
- in a product

Reviving the School Store

This year, we revived the School Store. We moved all our stock, except our No.2 Pencils that everyone had on the “must have” list. We need to move this deadstock before the end of school.

Problem Posing- What is the “best way” to move the deadstock?

Sunrise Store!

Come to Our Opening

Yellow
Red!

We will be

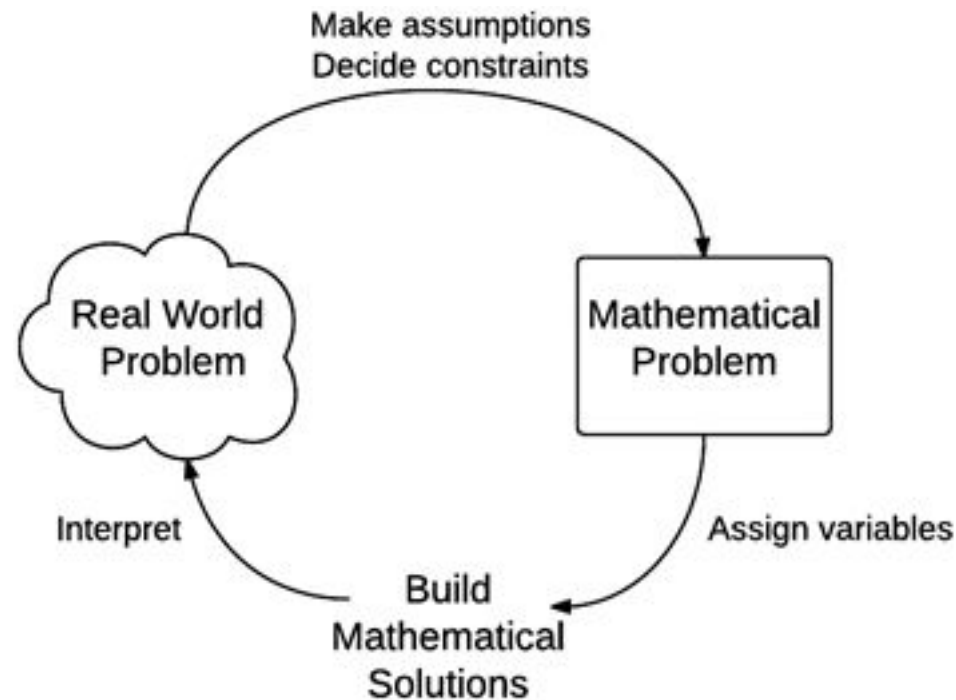
Grand
Opening

9:00 - 5:30

Monday
Tuesday

Driving Question:

How can we solve the problem of hunger in our community?

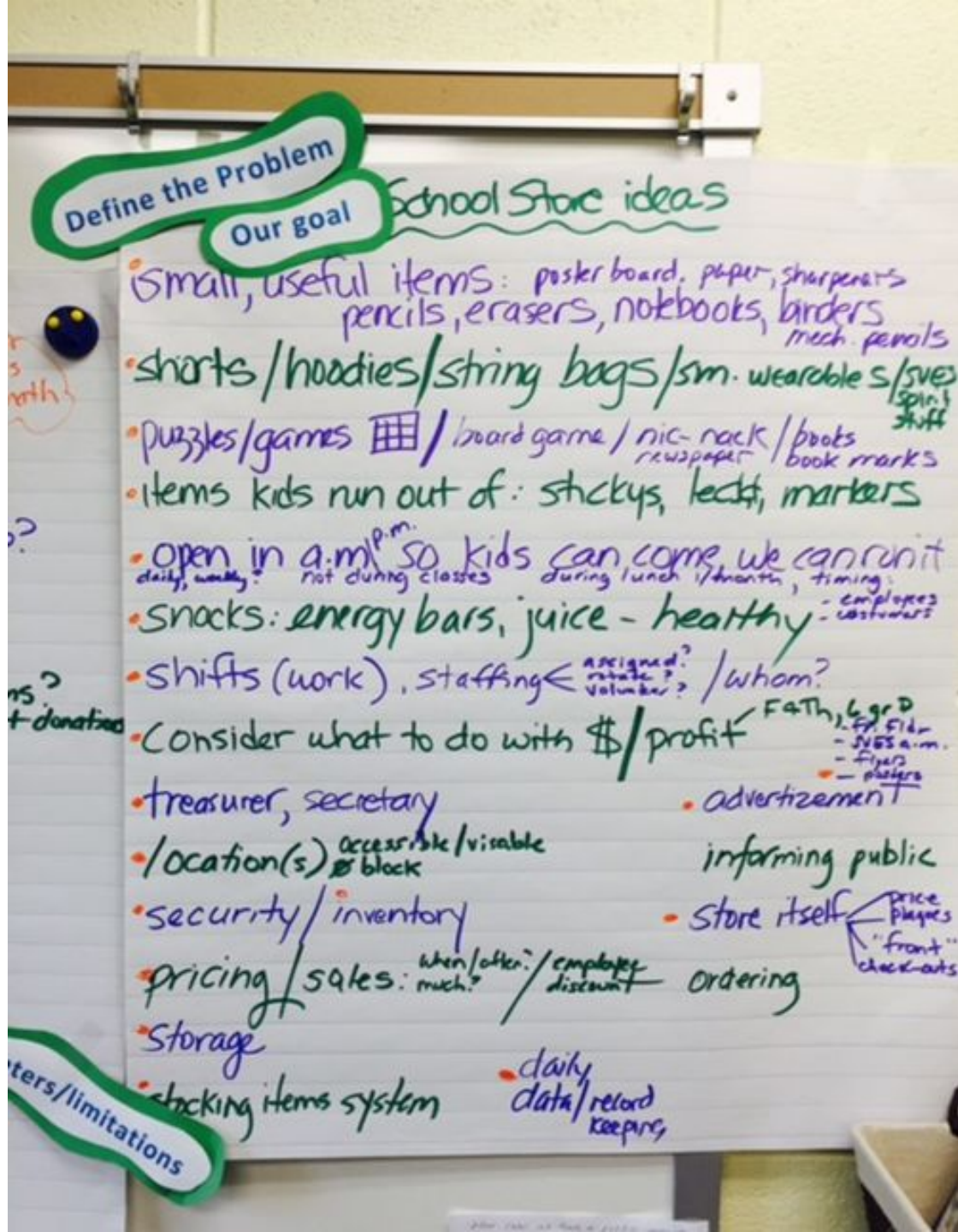


1 out of every 5
children in
America are
hungry.



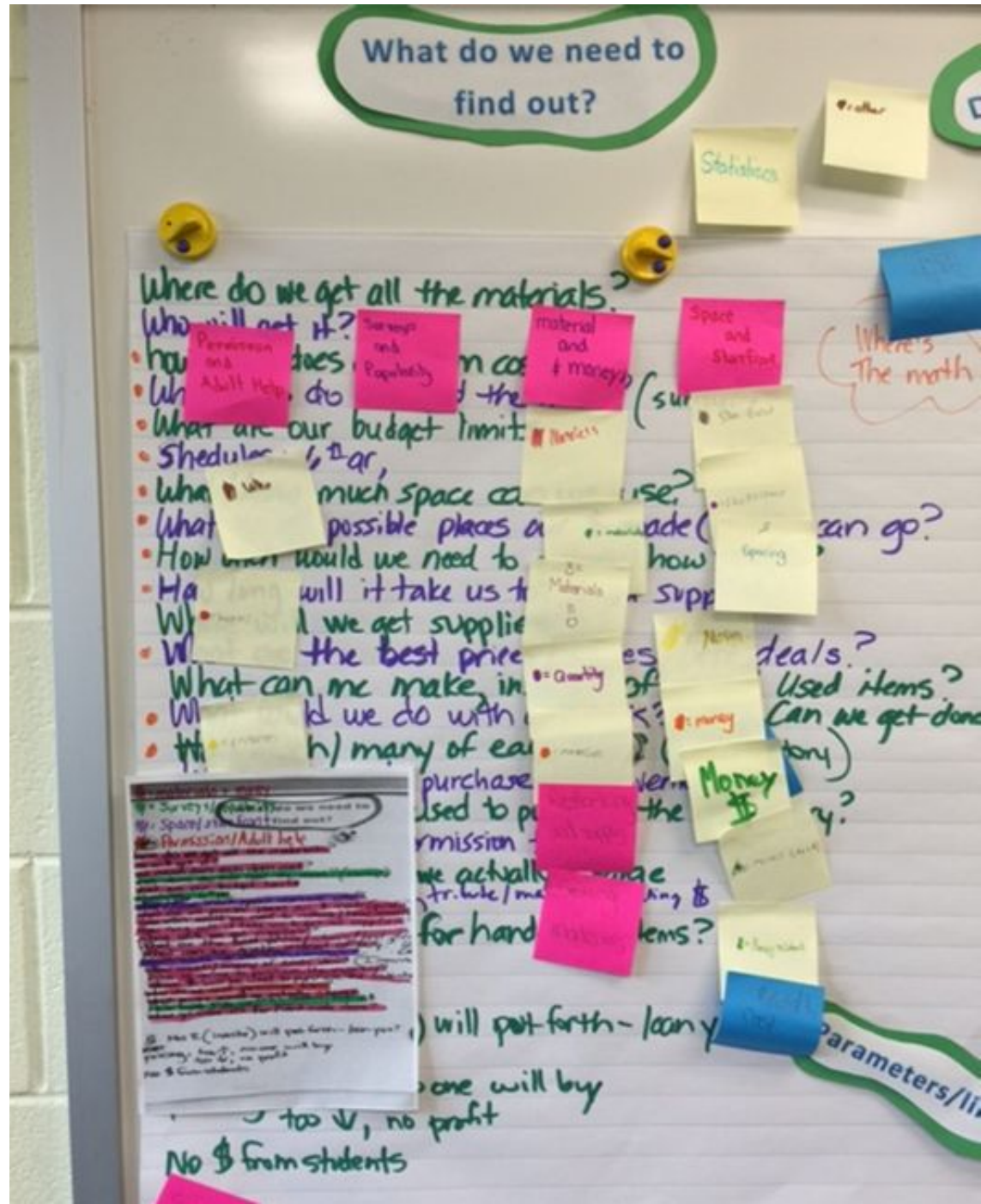
Developing and Anticipating

How can we start up and run
a school store to serve the
needs of our school AND
raise money for the hungry
in our community?



**What do we
need to
know?**

**What do we
need to find
out?**



School Store Departments

Marketing : Mercer, Ethan, Sydney, Gwyn
Riley

Product/Merch : Liam, Erik, Hayden
Danielle, Gideon, Will
Allison

Accounting : Kevin, Aaron, Raakin, Isky
Gavin

Sales/Personnel : Sake, Mia, Krishan,
Ashley, Maddie

Security/Storage : Kyle, Justin

Customer : TJ, Justin

Enacting AND
revisiting!

Design survey(s). Seek feedback.
Make plan for administering them,
do it! **km, 2-3, 4-6**

Research products, pricing for our purchase
List of probable items, acceing approval

Set up all accounting spreadsheets/system

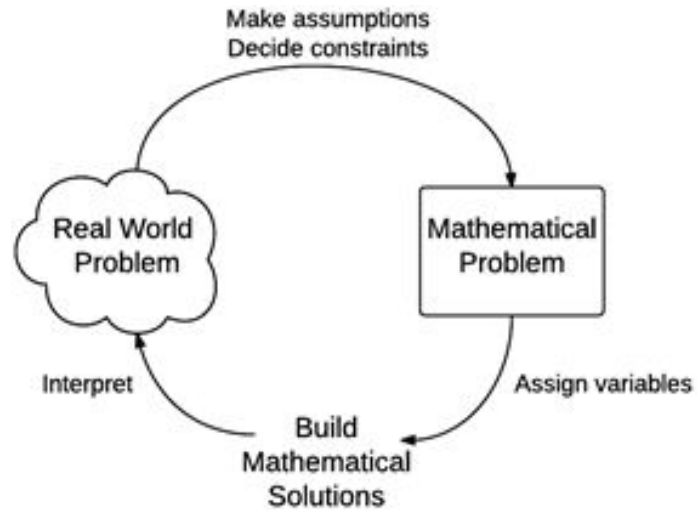
location(s), hours of operation, staffing.
Letter to Mr. West.

system

Customer satisfaction survey, refund policy,
press for taking care of dissatisfied customers



Driving “?”: What can we do to alleviate long lines?





Solve ^{I purchased 2 boxes}
Problem # 1

- ✓ Too many customers at once -
- ✓ long lines

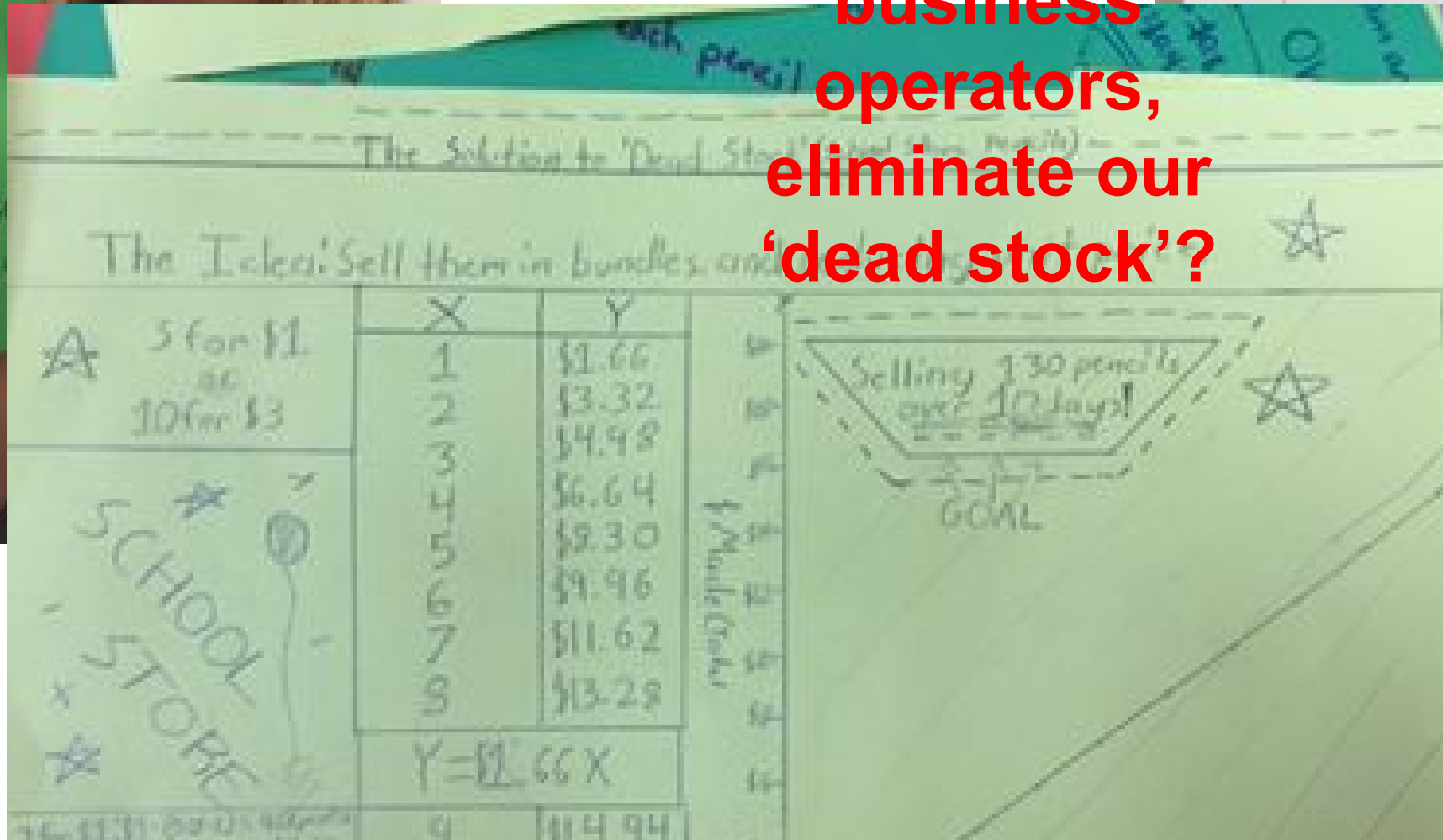
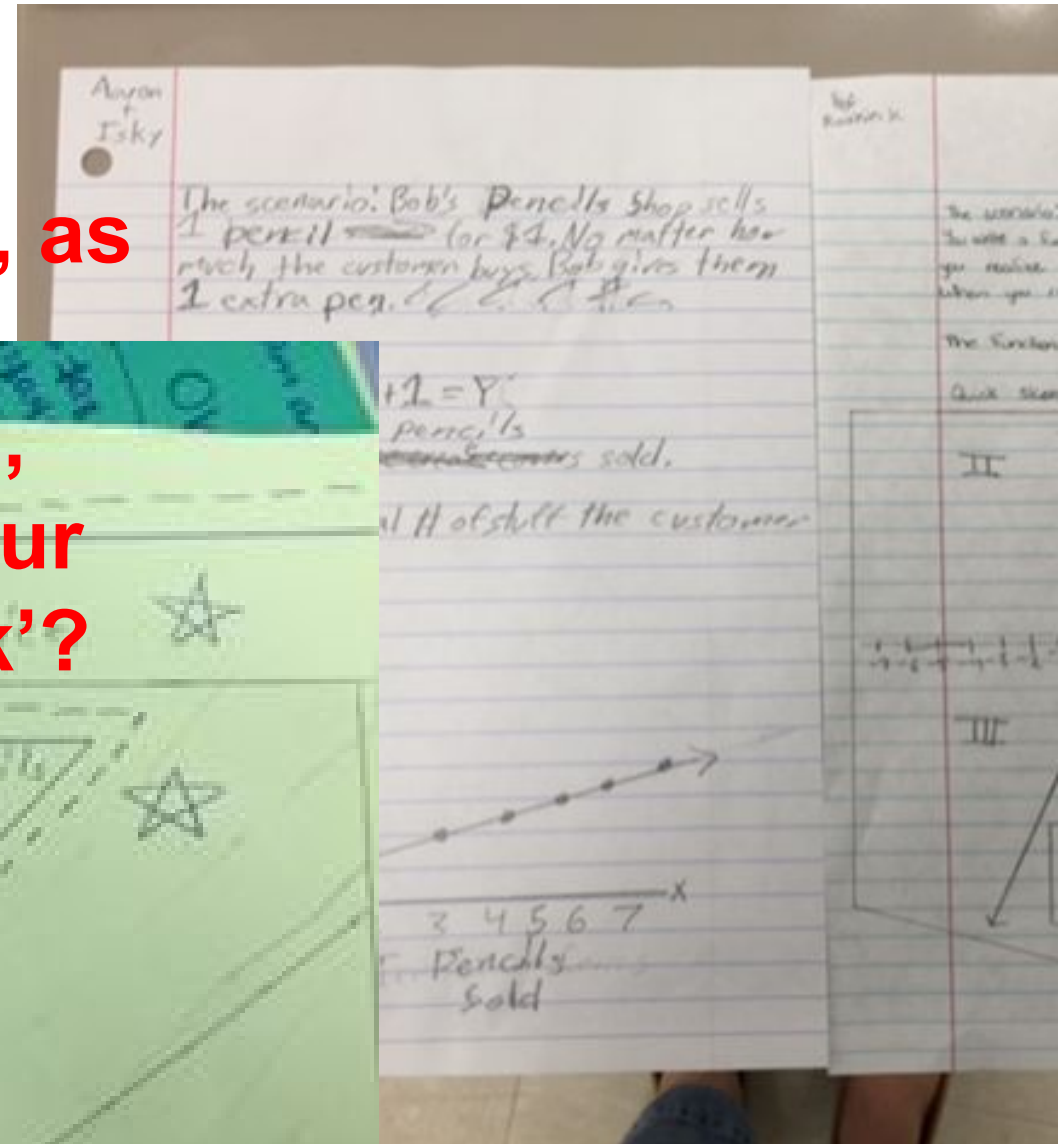
Constraints

- 9:20 time limit
- Mrs. R: only 1 place at a time
- We are available: 9:05-9:20
10:30-1:10
2:10-3:30
- customers wouldn't want an appointed single
day or time.

**Enacting AND
revisiting!**

Enacting AND revisiting!

How can we, as business operators, eliminate our 'dead stock'?



Make an
Decide

Real World
Problem

WHAT should mathematics teachers focus on?

Teachers
Empowered to
Advance
CHange in
MATHematics

	Category	Reflection Prompts
1	Cognitive Demand	<i>How does my lesson enable students to closely explore and analyze math concepts(s), procedure(s), and reasoning strategies?</i>
2	Depth of Knowledge & Student Understanding	<i>How does my lesson make student thinking/understanding visible and deep?</i>
3	Mathematical Discourse	<i>How does my lesson create opportunities to discuss mathematics in meaningful and rigorous ways (e.g. debate math ideas/solution strategies, use math terminology, develop explanations, communicate reasoning, and/or make generalizations)?</i>
4	Power and Participation	<i>How does my lesson distribute math knowledge authority, value student math contributions, and address status differences among students?</i>
5	Academic Language Support for ELL	<i>How does my lesson provide academic language support for English Language Learners?</i>
6	Cultural/Community-based funds of knowledge	<i>How does my lesson help students connect mathematics with relevant/authentic situations in their lives?</i> <i>How does my lesson support students' use of mathematics to understand, critique, and change an important equity or social justice issue in their lives?</i>

Cultural Responsive Mathematics Teaching Lesson Tool-TEACH MATH Aguirre, Turner, Bartell, Drake, Foote & McDuffie (2012). (2012) Culturally Responsive Mathematics Teaching Lesson Analysis Tool. Unpublished Instrument Adapted from National Center for Research in Mathematics Education. (1992). Wisconsin Center for Educational Research. Madison, WI: University of Wisconsin-Madison. Also adapted from Aguirre & Zavala (In Press) CEMELA (2007), Kitchen (2005) and Turner, Drake, Roth McDuffie, Aguirre, Bartell, & Foote (2012). Aguirre, Turner, Bartell, Drake, Foote & McDuffie (2012).

<http://www.mathconnect.hs.iastate.edu/documents/CRMTLessonAnalysisTool.pdf>

Mathematical Modeling: Inspiring Our Students to Love Math

What is a math happening that your students would care about?



Thank you!

Project funded by the National Science Foundation
Integrating Mathematical Modeling, Experiential learning and
Research through a Sustainable Infrastructure and an Online
Network for teachers in the elementary grades. 2014 – 2017

IMMERSION: A National Science Foundation Sponsored STEM-C
Program (NSF-1441024) through George Mason University,
Montana State University, and Harvey Mudd College

