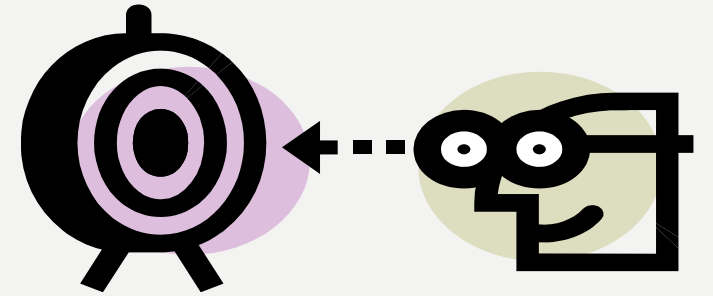


TRICKS ARE NOT FOR KIDS!

**SHIFTING FROM “ANSWER GETTING” TO
THINKING AND UNDERSTANDING**

DR. ALISON J. MELLO – NCTM ANNUAL 2018

GOALS OF THIS SESSION



- Explore how common tricks undermine student understanding
- Discover how to use math tools to help students make sense of math
- Ditch the tricks for good!

EVERYDAY CHALLENGES.... SOUND FAMILIAR???

- **MINDSET:** Students give up too easily
- **CULTURE:** Students expect everything to be explained
- **APPLICATION:** Students struggle to apply knowledge

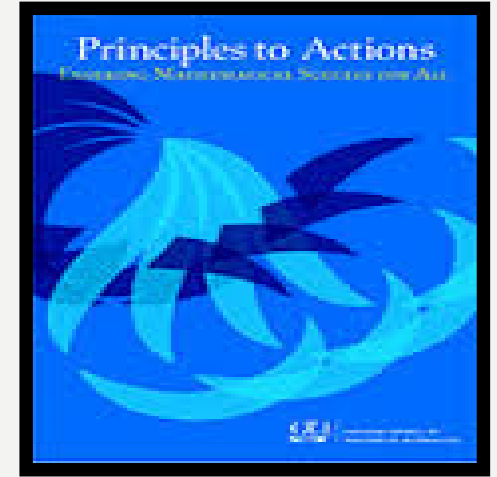


REFRAMING THE WAY WE SUPPORT STUDENTS IN MATH



[Dan Meyer](#)

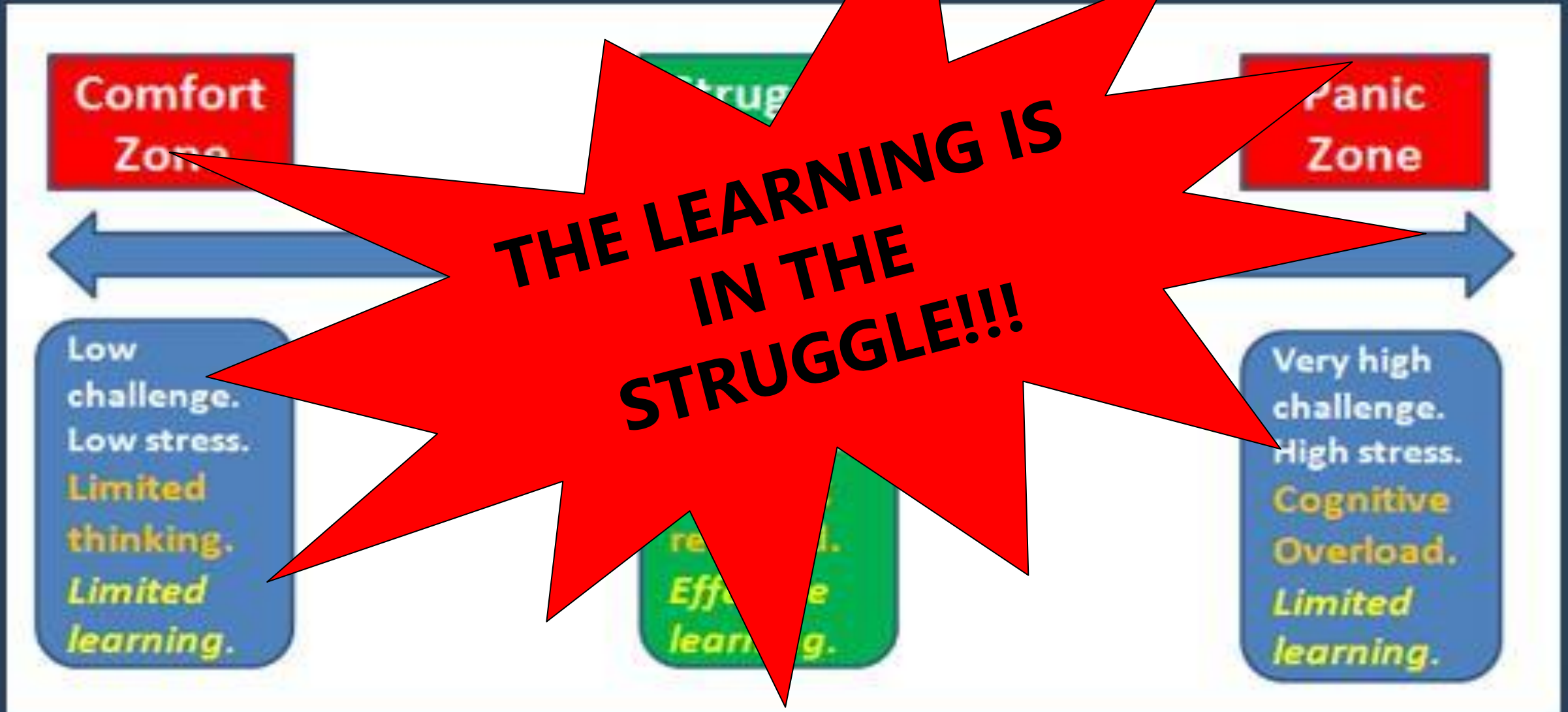
PRINCIPLES TO ACTIONS: ENSURING MATHEMATICAL SUCCESS FOR ALL



Mathematics Teaching Practices

- Establish mathematics goals to focus learning.
- Implement tasks that promote reasoning and problem solving.
- Use and connect mathematical representations.
- Facilitate meaningful mathematical discourse.
- Pose purposeful questions.
- Build procedural fluency from conceptual understanding.
- Support productive struggle in learning mathematics.
- Elicit and use evidence of student thinking.

Keep them in the struggle zone



“The difficulty lies not so much in developing new ideas as in escaping from old ones.”

~ John Maynard Keynes

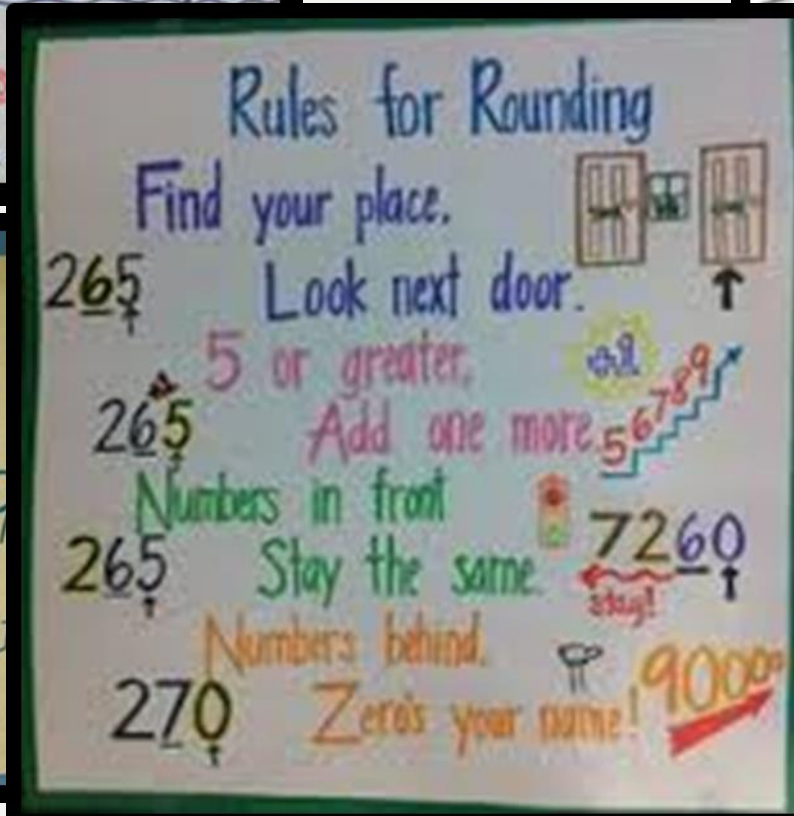
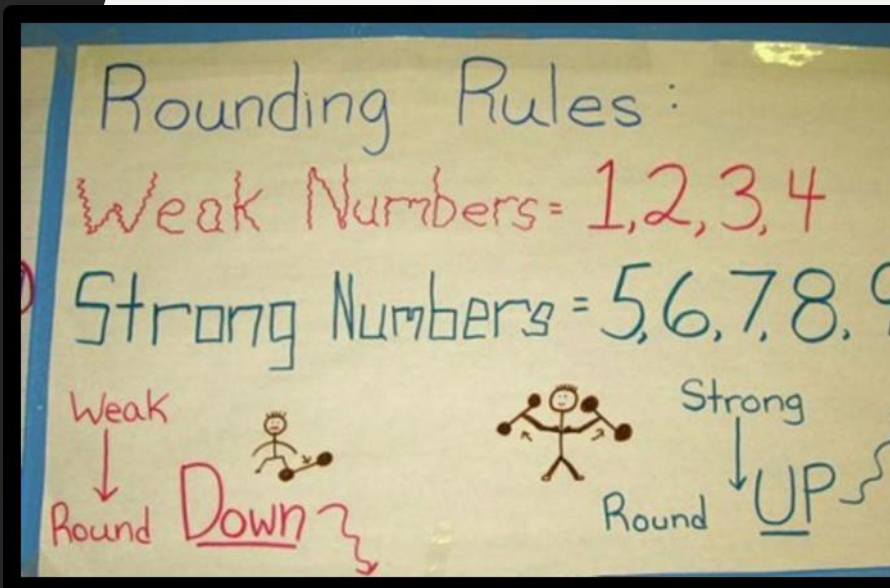
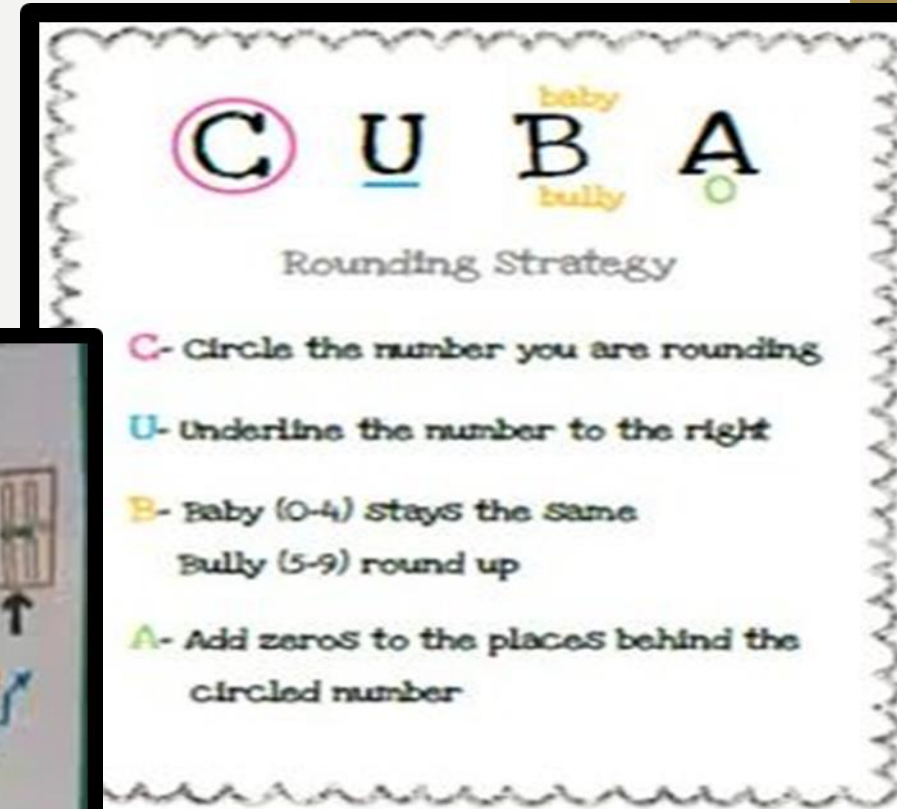
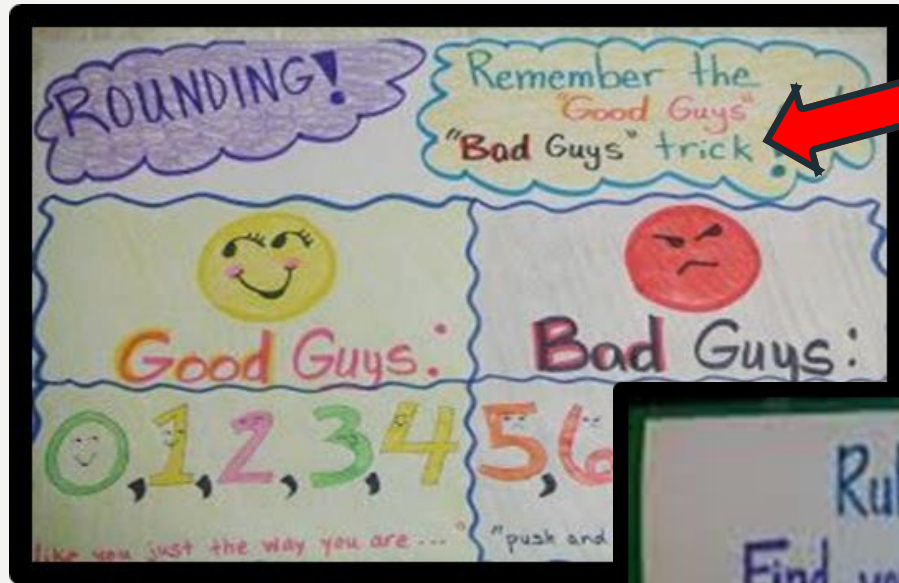
WHAT ARE SOME TRICKS THAT YOU KNOW?

(WE WON'T TELL ANYONE....IT'S OKAY!)

TURN and TALK



LET ME GUESS.....ROUNDING TRICKS?



DON'T FORGET ABOUT THE 9 TRICK(S)



The 9's Trick

When you multiply a number by 9:

1. Point to the number that is NOT 9.
2. Subtract one from that number. Write down the difference. This is the first digit of your answer.
3. Think: "What can I add to this number to make 9?" This number is the second digit of your answer.

$9 \times 5 = \underline{\quad}$

$9 \times 5 = 4 \underline{\quad}$

$9 \times 5 = 45$

The digits in the product add up to 9!

© Shelley Gritz
www.TeachingWithaMountainView.com



9's hand trick

$9 \times 2 = ?$ flip 2nd finger down

Tales of a Tenacious Teacher

THE BUTTERFLY METHOD??

Are These Fractions Equivalent?

★ Shortcut: Butterfly Method

$\frac{4}{6} = \frac{2}{3}$

$\frac{2}{3} \neq \frac{3}{4}$

Butterfly Method 🦋

$\frac{4}{6} \neq \frac{3}{4} = \frac{1}{2}$

IS THIS WHAT WE'RE GOING FOR?



[Butterfly Method](#)

WHAT MESSAGES ARE WE SENDING?

When students share a correct answer do we validate and immediately move on?

Do we set the expectation that students will explain their reasoning and defend their solutions?

Do we teach for conceptual understanding using concrete objects and models, or do we defer to tricks and shortcuts?

**DO WE WANT ANSWER GETTERS OR THINKERS?
UNDERSTANDING REQUIRES THINKING!!
LACK OF THINKING = LACK OF UNDERSTANDING.**

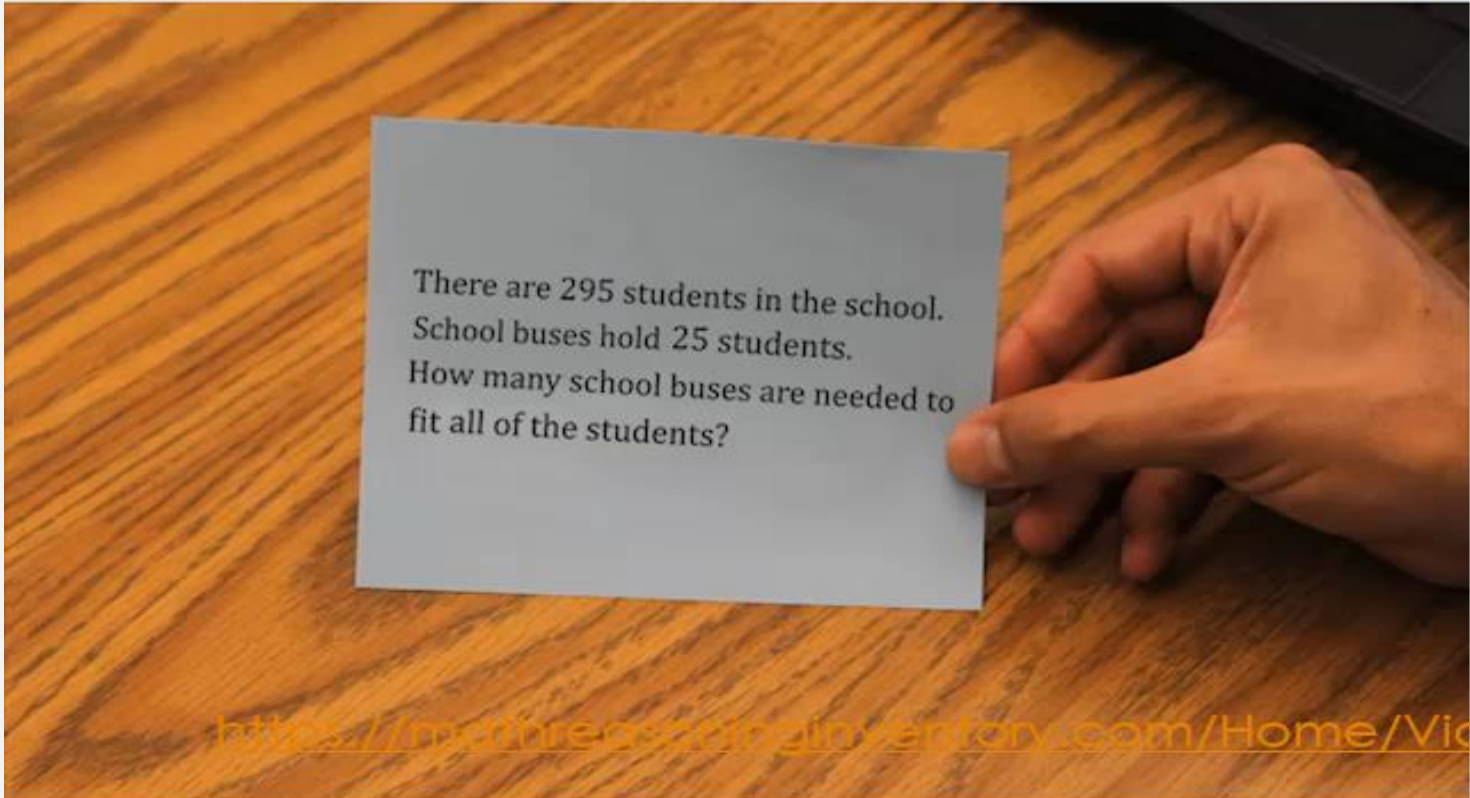
Constructed Response

Mike saw 17 blue cars and 25 green cars at the toy store. How many cars did he see? Write a number sentence with a for the missing number. Explain how the number sentence shows the problem. (CC.2.OA.1, CC.2.NBT.5)

$17 + 25 = \boxed{42}$ I got the answer by
talking in my brain and I agreed
of the answer that my brain got.

SIGNAL WORDS (UNDERCOVER TRICKS)

SEARCH VIDEOS Search by Interview Question Search by Student



There are 295 students in the school.
School buses hold 25 students.
How many school buses are needed to
fit all of the students?

<https://mathreasoninginventory.com/Home/VideoLibrary>

295 students, 25 on each bus	00:48
Jasmina	
295 students, 25 on each bus	00:58
Marisa	
295 students, 25 on each bus	01:03
Zakari	

00:08 00:48

<https://mathreasoninginventory.com/Home/VideoLibrary>

A WELL-KNOWN CLASSIC.....



How to Divide!



Does

÷ (divide)

McDonald's

X (multiply)

Serve

- (subtract)

Burgers?

↓ (bring down)

LOOK AT ALL OF THIS EFFORT! WHAT HAPPENS WHEN STUDENTS FORGET THE 'STEPS'??

The worksheet is titled "Does McDonalds Sell Cheese Burgers?" and is divided into four columns by vertical lines. The columns are labeled with the words "Divide", "Multiply", "Subtract", and "Check" written vertically. The first column contains the word "Divide" and a drawing of a flower. The second column contains the word "Multiply" and a drawing of a McDonald's fries container. The third column contains the word "Subtract" and a drawing of a McDonald's burger. The fourth column contains the word "Check" and a drawing of a McDonald's burger. The student has written "LONG" above the "Multiply" column and "Division" above the "Subtract" column. The student has written "Ex:" followed by a multiplication problem:
$$\begin{array}{r} 19 \\ \times 3 \\ \hline 57 \end{array}$$
 and a division problem:
$$\begin{array}{r} 19 \\ 3 \overline{)57} \\ \underline{-3} \\ 27 \\ \underline{-27} \\ 00 \end{array}$$
 The student has also written "you can check your work" and "Follow the steps and you won't go wrong!". A large red arrow points to the student's work.

Does McDonalds Sell Cheese Burgers?

Divide

Multiply

Subtract

Check

LONG

Division

Ex:

$$\begin{array}{r} 19 \\ \times 3 \\ \hline 57 \end{array}$$

$$\begin{array}{r} 19 \\ 3 \overline{)57} \\ \underline{-3} \\ 27 \\ \underline{-27} \\ 00 \end{array}$$

you can check your work

* Follow the steps and you won't go wrong!

✓ 2 is less than 3

FEELING LIKE THERE ARE LOTS OF 'STEPS' TO REMEMBER OR LOTS OF WORDS AND NAMES FOR METHODS?



That's because when we use tricks, there is **WAY more to remember. Consider how special education students are often given tricks to 'help' them....aren't they often students who struggle with memory issues?**

Wouldn't helping students make sense of math be more effective than tricks that will be forgotten??

FIX: USE TOOLS INSTEAD OF TRICKS

When we use tricks, we ROB students of the ability to make sense and make connections.



TOOLS HELP STUDENTS TO MAKE SENSE OF MATH.

THE USUAL SUSPECTS...AND THE TOOLS TO FOIL THEIR TRICKS!

- Rounding...ditch those riddles for THE BEADED NUMBER LINE!
- Adding zeros....think about that for a minute and then grab your PLACE VALUE SLIDER!!
- 'Borrowing', 'Carrying'....what????.....um...it's place value and we have DIGI BLOCKS AND BASE TEN BLOCKS AND MONEY....OH MY!
- Cheeseburgers? How about precise place value language and visual models.
- The 'nine' trick(s)? How about decomposing and equal groups?
- Butterfly method.....is this science or math? WHY BUTTERFLY WHEN YOU CAN USE PAPER FOLDING, TOWERS, CIRCLES, PATTERN BLOCKS, NUMBER LINES



LET'S GET STARTED!



BYE-BYE BUTTERFLY!!!



BIG IDEA #1: VISUALS ARE ESSENTIAL

Begin with **CONCRETE** move to **PICTORIAL**



• *Way more than pizzas and pies!!*

CONCRETE: Pattern blocks, fraction squares, fraction bars, fraction circles, fraction towers, Cuisenaire rods, paper folding

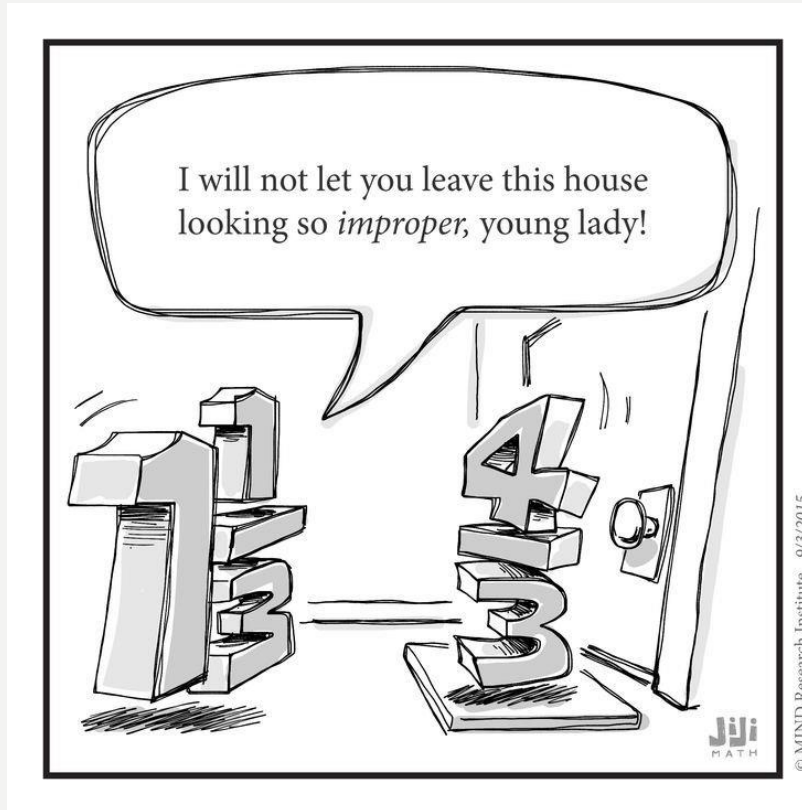
PICTORIAL: Bar models...tape diagrams...number lines...double number lines

BIG IDEA #2: MATH IS ABOUT CONNECTIONS

Think about PARTS and WHOLES

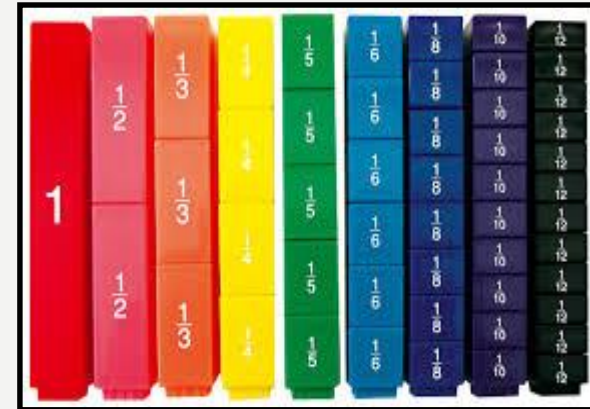
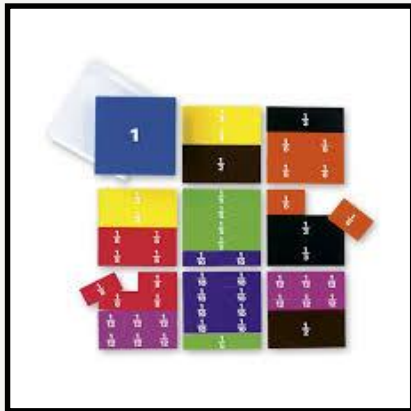


BIG IDEA #3: LANGUAGE IS A CRITICAL PIECE OF SENSE MAKING



LET'S THINK ABOUT FRACTIONS. LOTS OF RULES AND TRICKS... WHERE'S THE UNDERSTANDING??

EXPLORE THE TOOLS.....



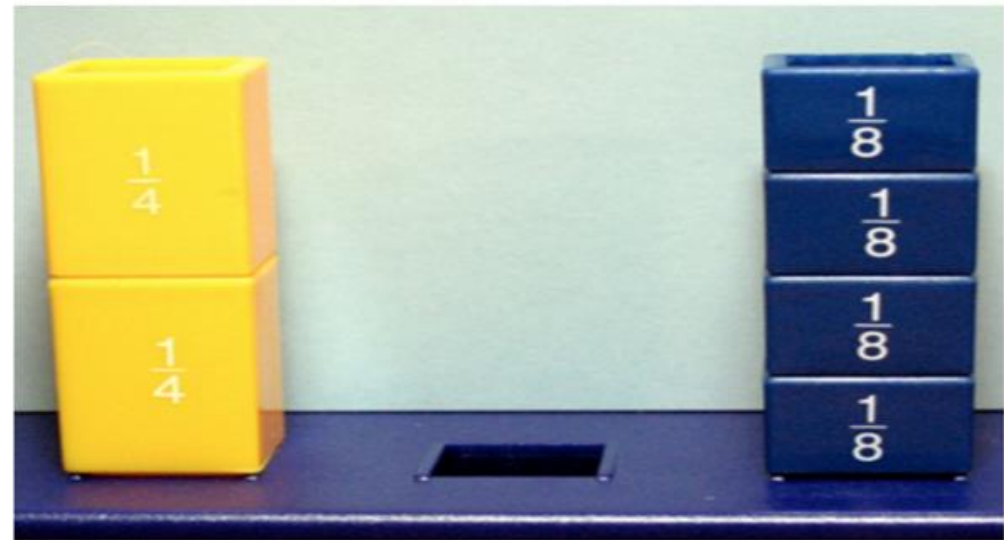
How can these replace tricks and build
understanding for students??



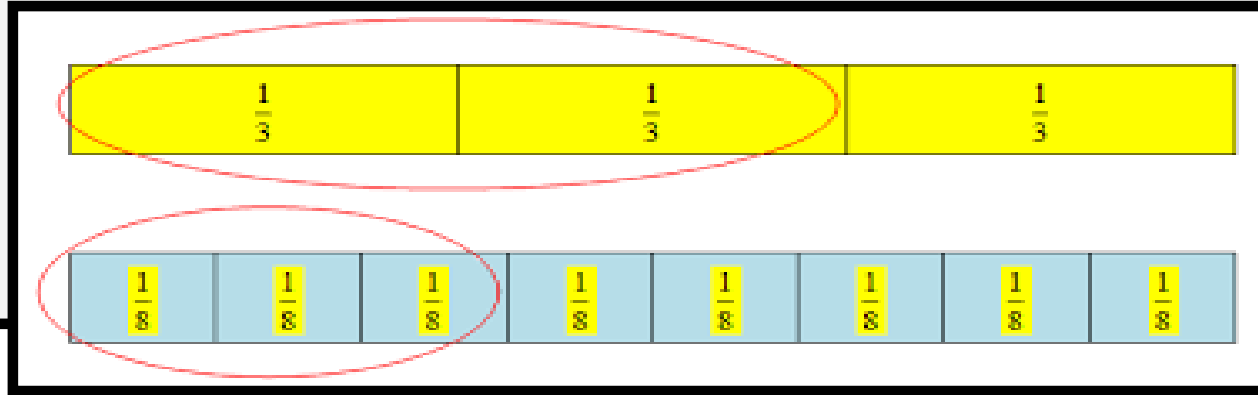
WAYYYY BETTER THAN MEMORIZING STEPS

Equivalent Fractions

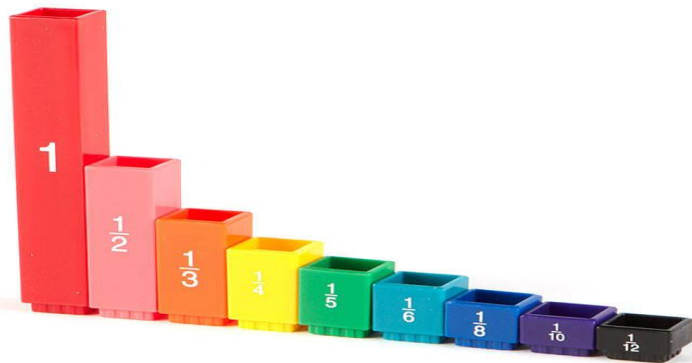
Can you find one
Fraction Tower piece
that is the same
height as the towers
for $\frac{2}{4}$ and $\frac{4}{8}$?



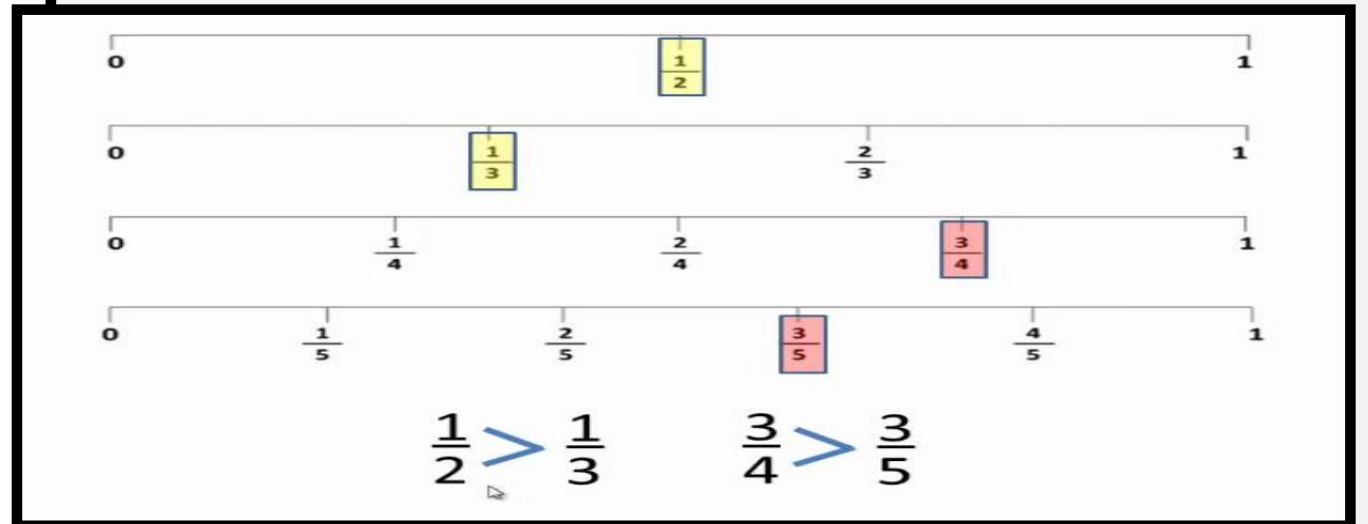
COMPARING WITH MEANING... NO BUTTERFLIES ANYWHERE!



PICTORIAL



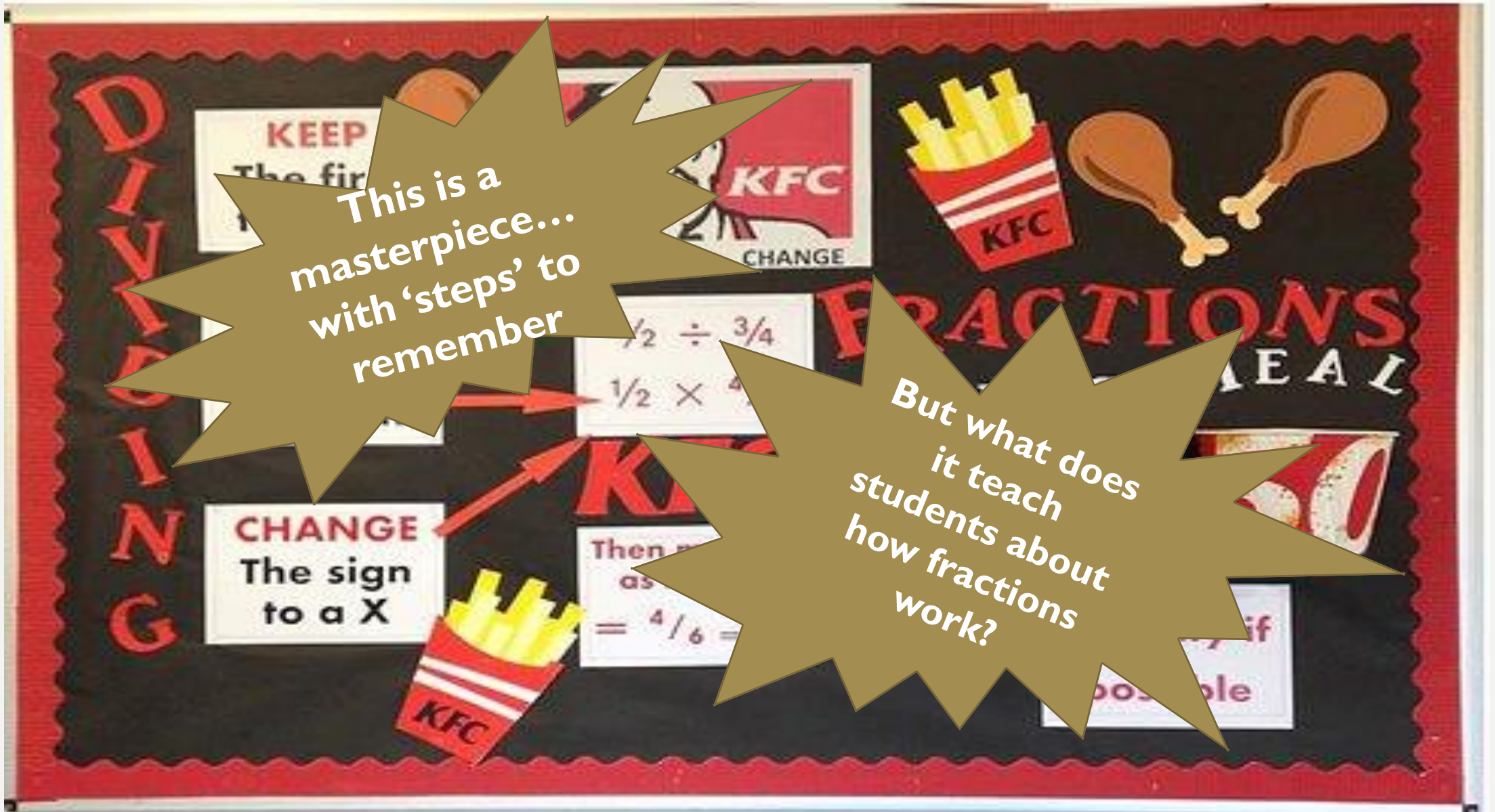
CONCRETE



ABSTRACT

This is a masterpiece...
with 'steps' to remember

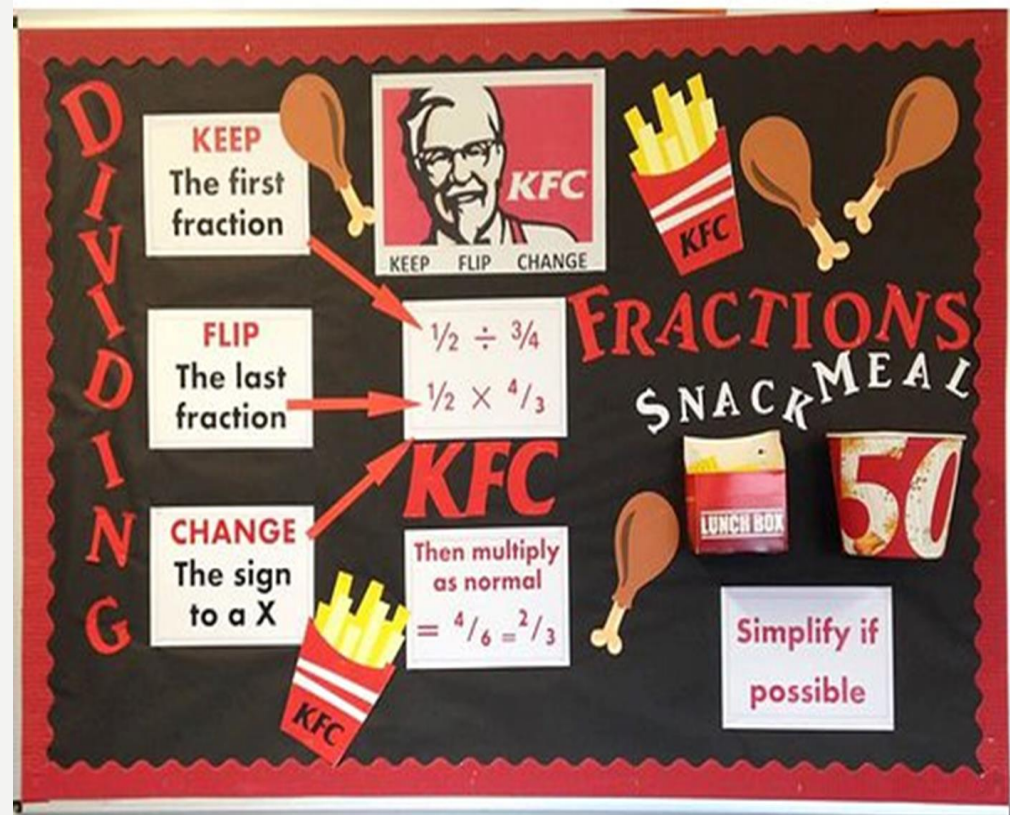
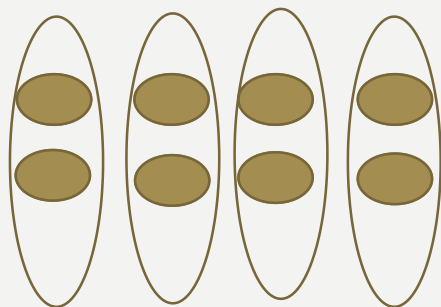
But what does
it teach
students about
how fractions
work?



LET'S REVISIT THIS WITH A VISUAL MODEL

Connect to
prior
knowledge...
how many 2's
are there in 8?

$$8 \div 2$$



$$\frac{1}{2} \div \frac{3}{4}$$

THINK...
how many
 $\frac{3}{4}$ ths are
in $\frac{1}{2}$?

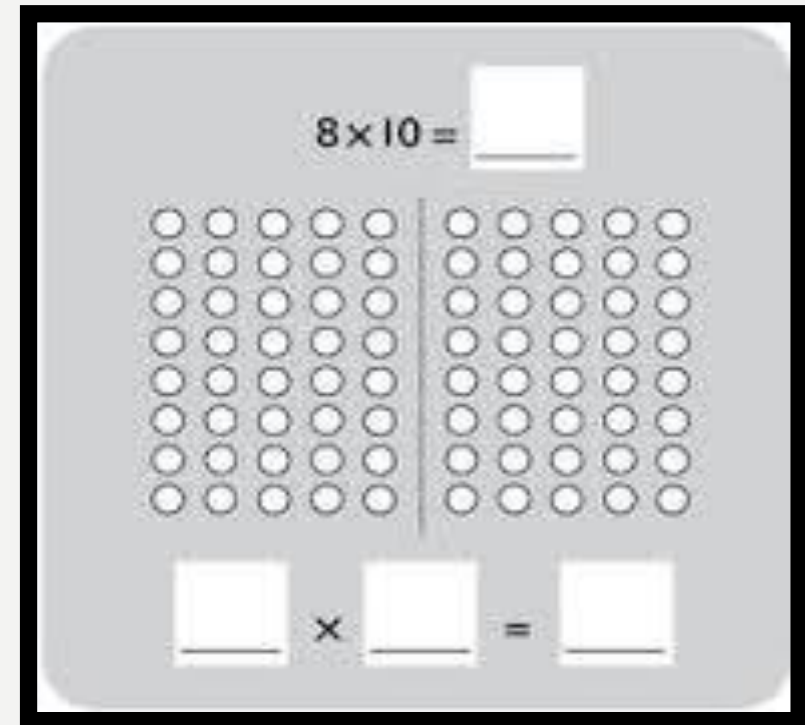
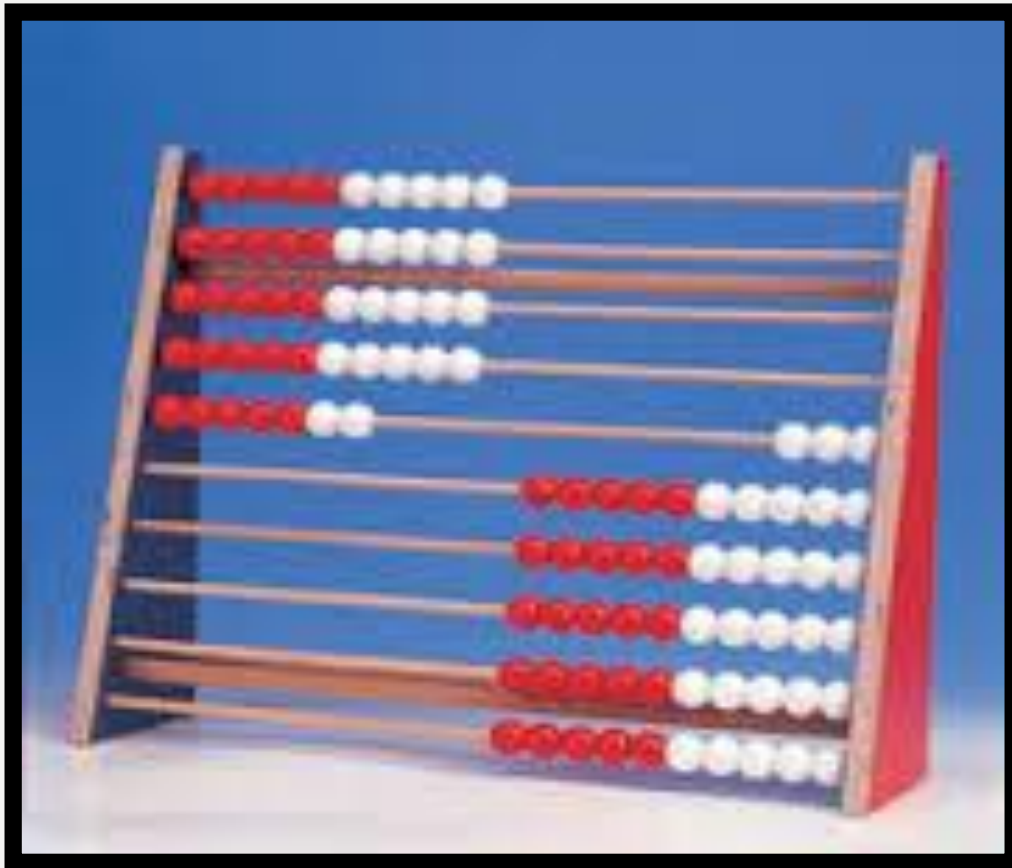


EVEN BETTER WITH CONTEXT!

WHAT ELSE SHOULD WE PUT IN OUR TOOLBOXES?



DITCH THAT 9 TRICK FOR THE REKENREK AND STRATEGIES!



Use 10's

DON'T HAVE REKENREKS?? MAKE THEM!



THE BEADED NUMBER LINE...A VERSATILE TOOL FOR MULTIPLE OPERATIONS



[Dr. Nicki](#)

4:45



NOW YOU TRY IT!!

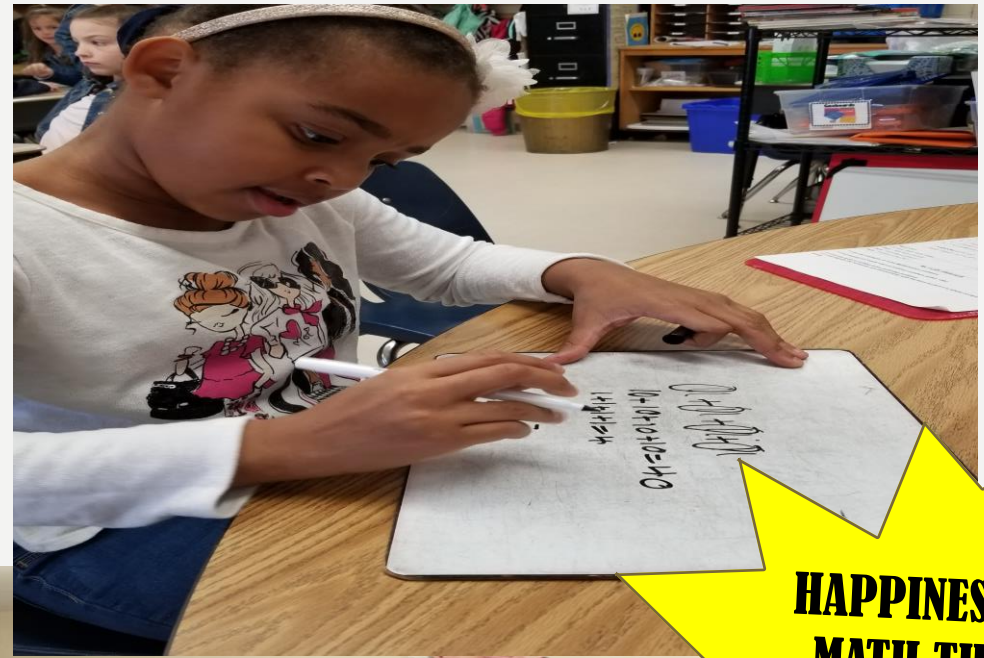


WHY DOES IT MATTER???

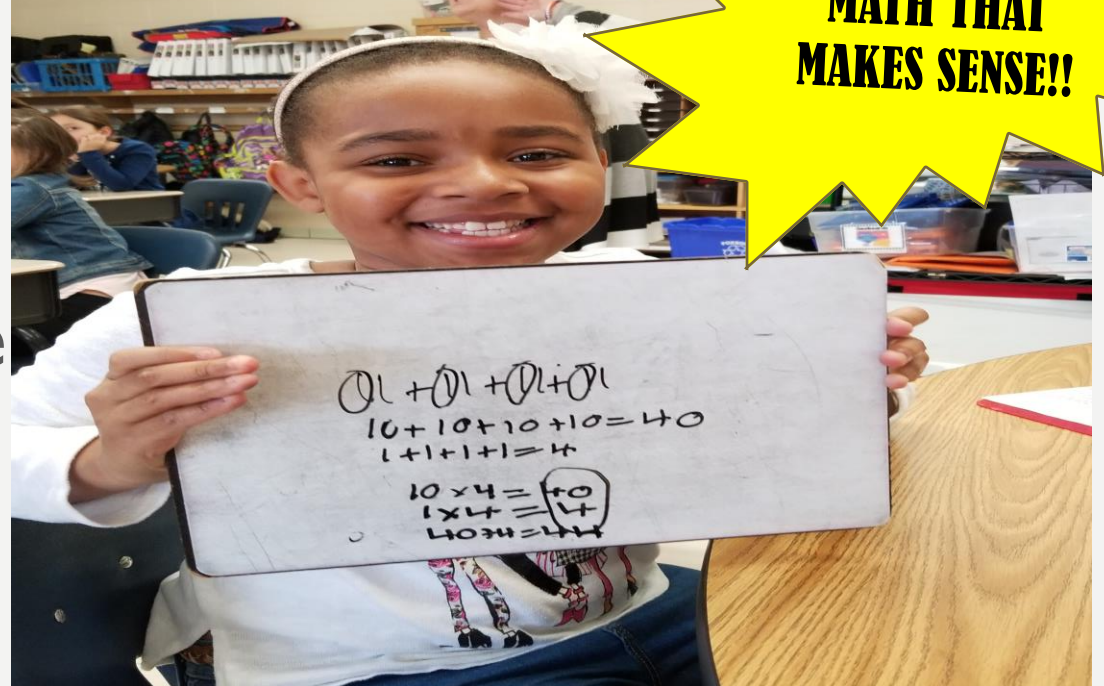


Answer or Understanding? What is important.

Students must attain
CONCEPTUAL
UNDERSTANDING and a sound
comprehension of **PLACE VALUE**
before being introduced to the
Standard Algorithm (grade 5)
This is done through concrete
modeling (base-ten blocks),
partial products/other alternative
algorithms, and
explicit place value language



**HAPPINESS IS
MATH THAT
MAKES SENSE!!**



WHAT'S WRONG WITH THIS PICTURE?

Double Digit Subtraction

END HERE → 36 - 12 = 24 ← START HERE

3
- 1
—
2

6
- 2
—
4

Double Digit Addition

END HERE → 36 + 12 = 48 ← START HERE

3
+ 1
—
4

6
+ 2
—
8

**FIX:
USE PLACE VALUE
REPRESENTATIONS AND
PRECISE LANGUAGE TO
EXPLAIN OPERATIONS**

737

- 479

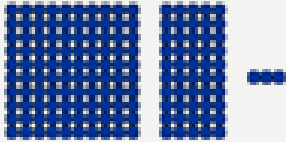
Carrying?
Borrowing?
Um...NO

There are 3 different
7's in the problem.
Do they all
represent the same
amounts?

LANGUAGE/ACADEMIC VOCABULARY

(ATTEND TO PRECISION!!!)

DIGIT vs NUMBER

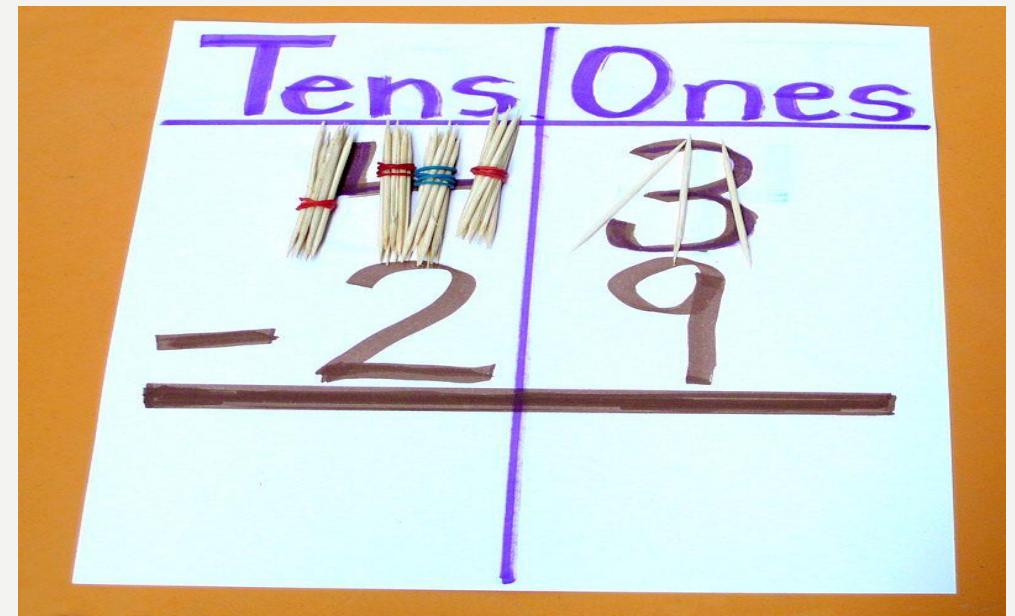
1	5	3	153	
digit	digit	digit	numeral	number
d	o	g	dog	
letter	letter	letter	word	idea



FAIR TRADE
DECOMPOSE
REGROUP



BORROW
CARRY



FIX: PROMOTE UNDERSTANDING BY BUILDING UNDERSTANDING OF PLACE VALUE USING VISUALS

Conceptual Long Division



HOW ABOUT ADDING ZEROES???



LIES MY TEACHER TOLD ME

To multiply by
10, just add zero
to the number

Wait...What??

$$.8 \times 10 = 8$$

$$6.25 \times 10 = 62.5$$

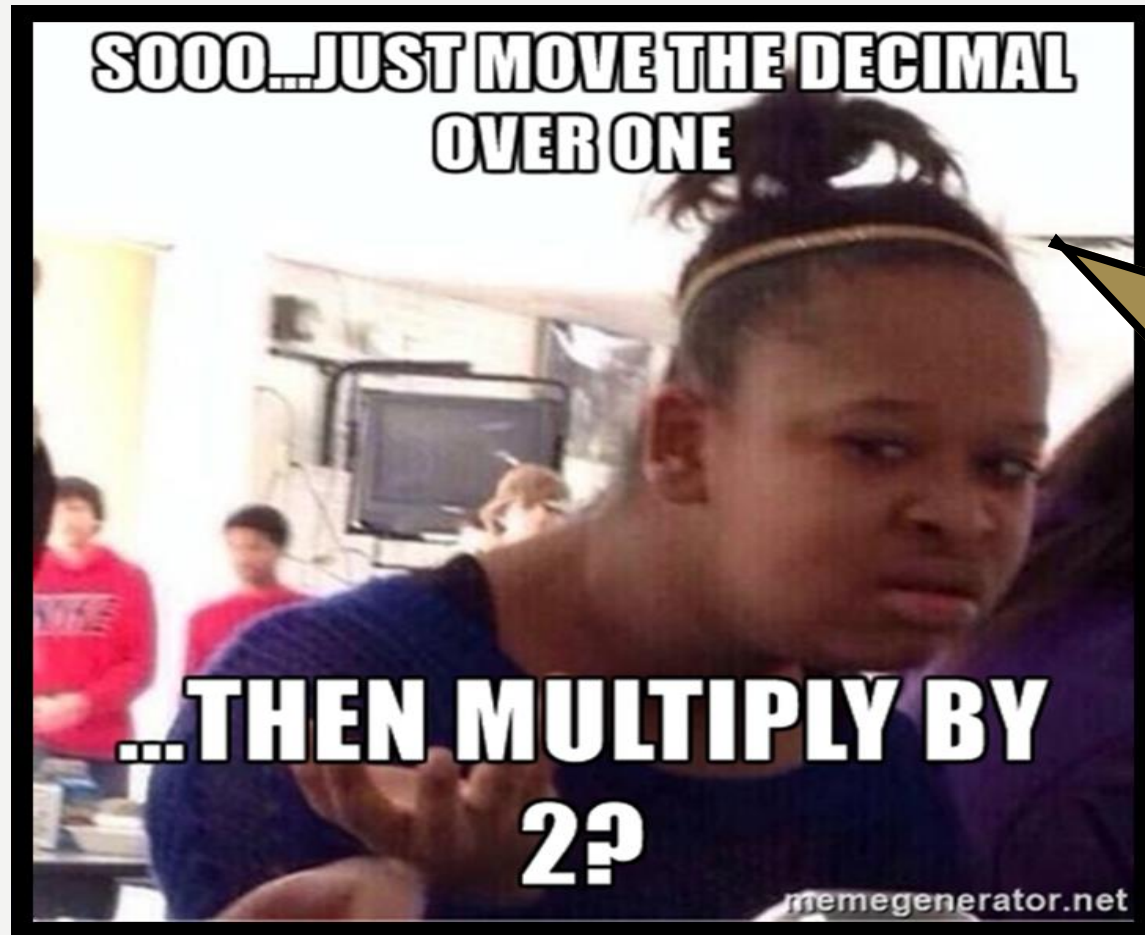
Multiplication
makes values
larger

Wait...What??

$$20 \times .5 = 10$$

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

AND MY PERSONAL FAVORITE....

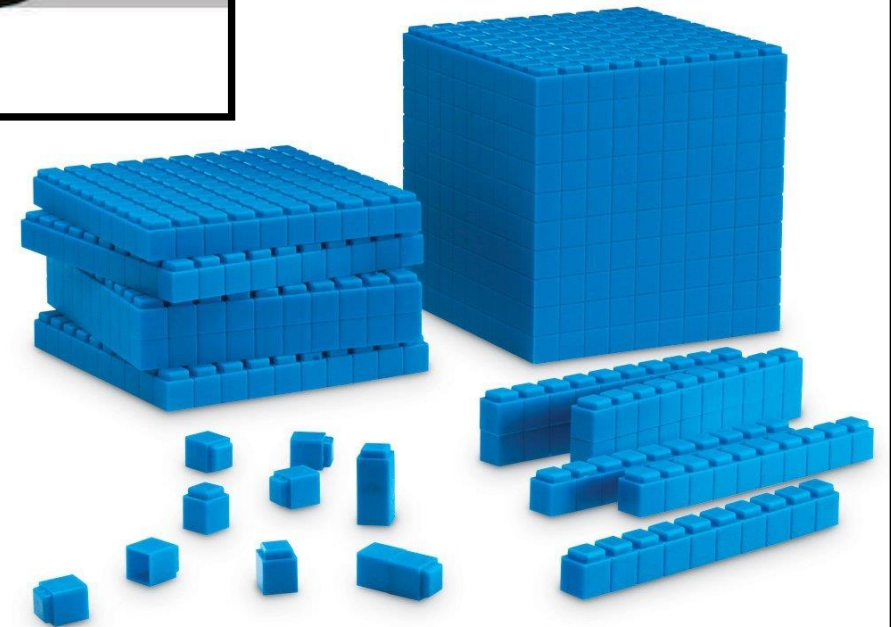
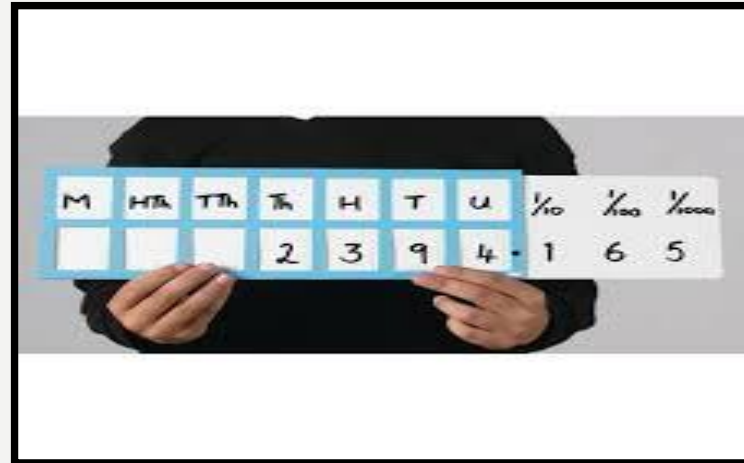
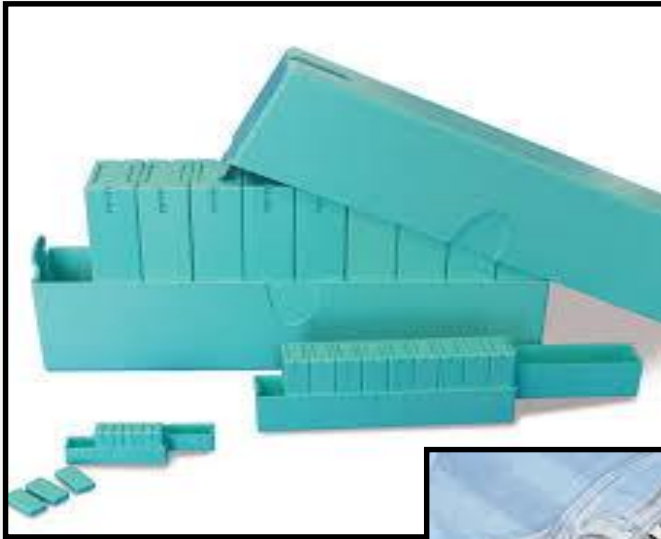


Raise your hand if you can
describe a real life
example where you moved
a decimal point.

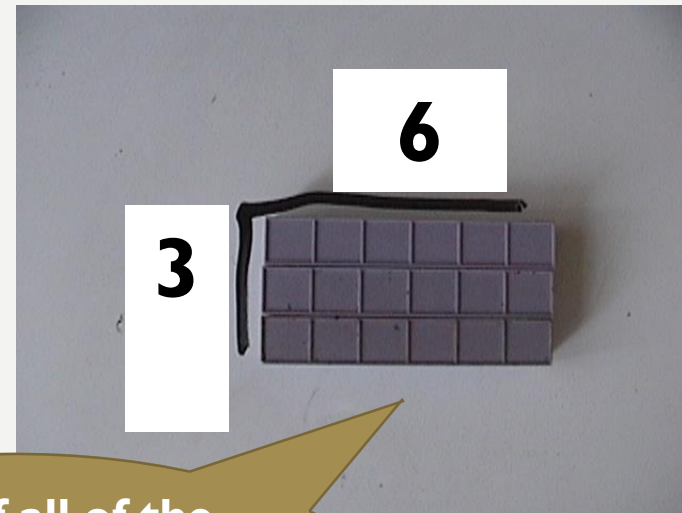
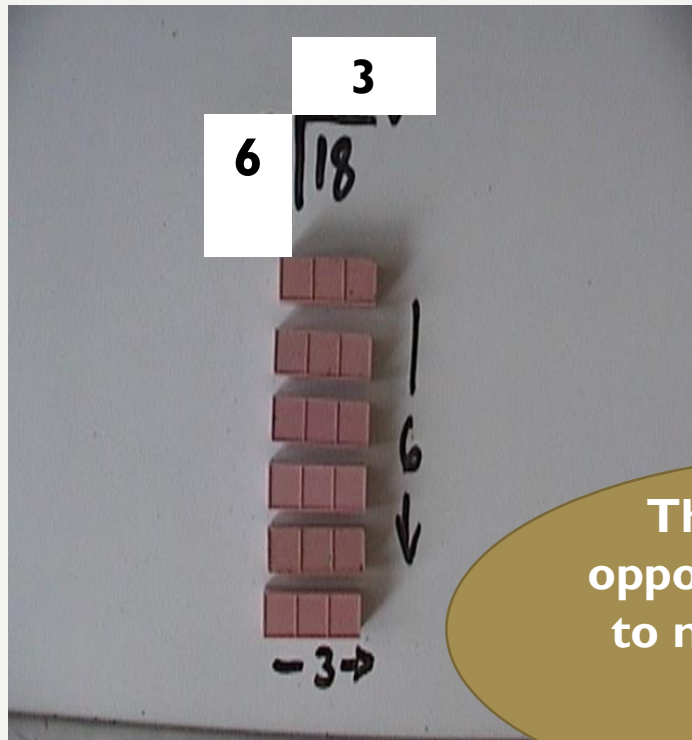
Do decimal points move?

PLACE VALUE...THE TOOLS TO FIX THE TRICKS!

PV Slider



IN EARLIER GRADES, DEVELOP THE CONCEPT OF DIVISION AS EQUAL GROUPS...KEEPING IT CONCRETE:



Think of all of the
opportunities you have
to make connections
to **AREA** and
dimensions!

$33 \div 3$

$3 \overline{) 33}$

33

Make 3 of the same groups.

IT MIGHT BE A TRICK IF IT...

- Is not grounded in mathematical meaning
- Has no real reason WHY it works
- Has steps that must be followed
- Cannot be explained by you or the students
- Lacks any connection to other math ideas
- Is wrapped in a cute riddle or mnemonic



SOOOOOOOOOO.....WHAT WILL YOU TRY?

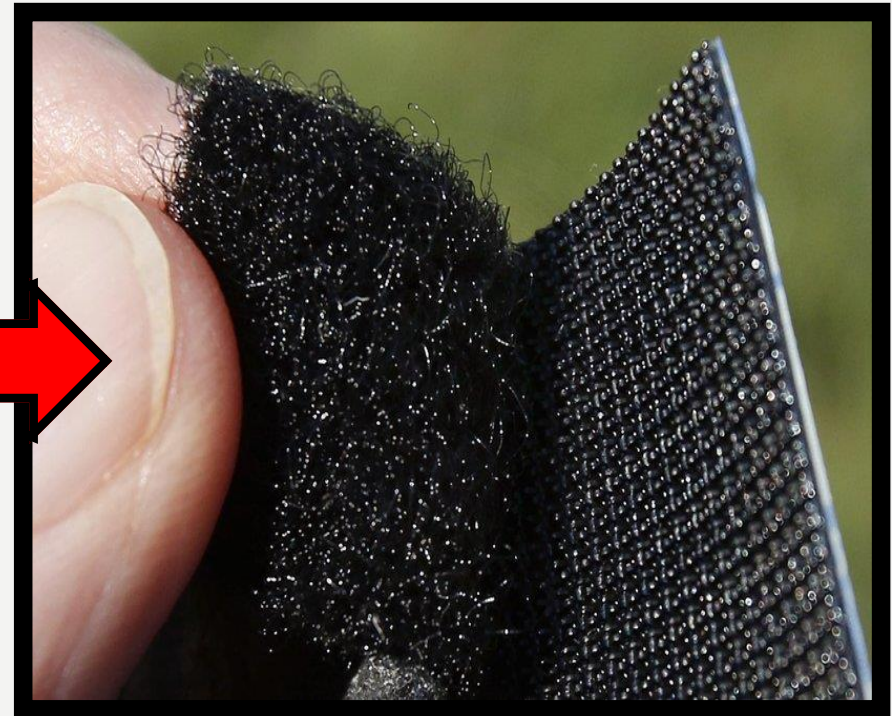
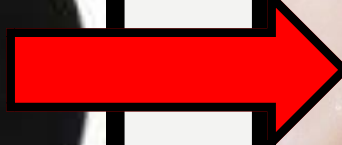
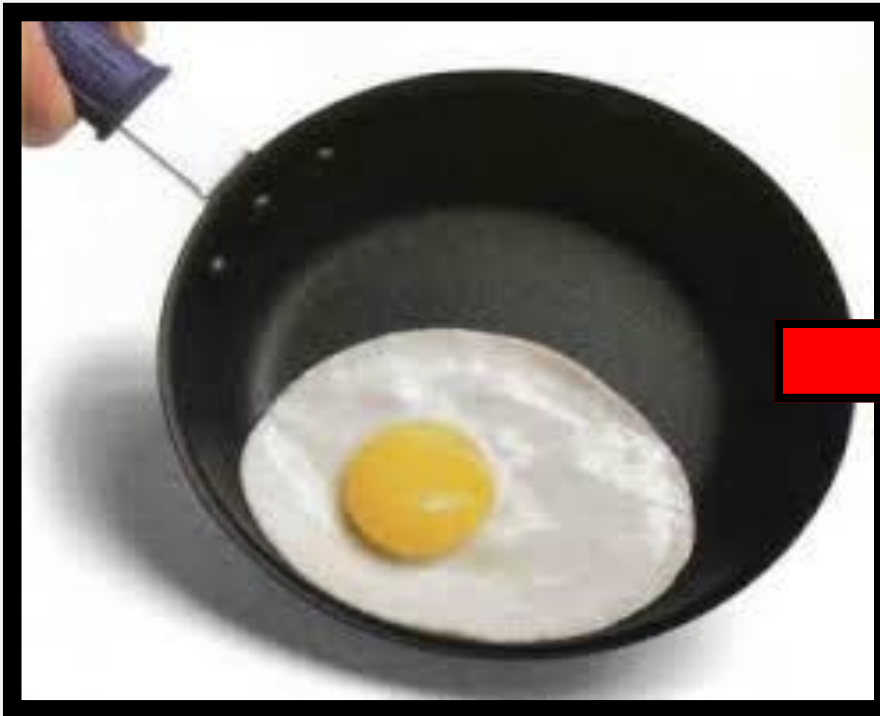


AND REMEMBER.....

Teaching TRICKS gives students
the idea that all we are
interested in is the **ANSWER.**

Our goal is to produce
**THINKERS, not answer
getters.**

FIX THE TRICKS AND UPGRADE THE RESULTS OF YOUR INSTRUCTION FROM TEFLON....TO.... VELCRO



QUESTIONS?



Contact Me

alisonmellomathpd@gmail.com

Follow me on Twitter



[alisonmellomath](https://twitter.com/alisonmellomath)



[DrMelloAsstSup](https://twitter.com/DrMelloAsstSup)