TRICKS ARE NOT FOR KIDS!

SHIFTING FROM “ANSWER GETTING” TO THINKING AND UNDERSTANDING

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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

Math class needs a makeover

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.
THE LEARNING IS IN THE STRUGGLE!!!
“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?

Rules for Rounding:

- **Find your place.**
- **Look next door.**
- **5 or greater, add one more.**
- **Baby (0-4) stays the same.**
- **Bully (5-9) round up.**
- **A- Add zeros to the places behind the circled number.**

Rounding Rules:

- **Weak Numbers:** 1, 2, 3, 4
- **Strong Numbers:** 5, 6, 7, 8, 9

- **Round Down** Weak
- **Round Up** Strong
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.
   - Example: 9 x 5 = __

2. Subtract one from that number. Write down the difference. This is the first digit of your answer.
   - Example: 9 x 5 = 4 __

3. Think: “What can I add to this number to make 9?” This number is the second digit of your answer.
   - Example: 9 x 5 = 45

The digits in the product add up to 9!
THE BUTTERFLY METHOD??

Are These Fractions Equivalent?

\[
\frac{4}{6} \times \frac{2}{3} = \frac{12}{18}
\]

\[
\frac{8}{3} \times \frac{3}{4} = \frac{24}{12}
\]

\[\neq\]

Butterfly Method

\[
\frac{4}{6} \times \frac{3}{4} = \frac{1}{2}
\]
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.

Constricted 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)

\[ 17 + 25 = 42 \]
I got the answer by talking in my brain and I agreed of the answer that my brain got.
There are 295 students in the school. School buses hold 25 students. How many school buses are needed to fit all of the students?
A well-known classic........

How to Divide!

Does McDonald’s Serve Burgers?

÷ (divide)
X (multiply)
- (subtract)
↓ (bring down)
LOOK AT ALL OF THIS EFFORT!
WHAT HAPPENS WHEN STUDENTS FORGET THE ‘STEPS’??
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 PLACEVALUE 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

I will not let you leave this house looking so improper, young lady!
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??
Wayyyyy 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!

CONCRETE

PICTORIAL

ABSTRACT

\[
\begin{align*}
\frac{1}{3} &> \frac{1}{3} & \frac{1}{8} &> \frac{1}{8} \\
\frac{1}{8} &> \frac{1}{8} & \frac{1}{8} &> \frac{1}{8} \\
\frac{1}{8} &> \frac{1}{8} & \frac{1}{8} &> \frac{1}{8} \\
\frac{1}{8} &> \frac{1}{8} & \frac{1}{8} &> \frac{1}{8}
\end{align*}
\]
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?

$8 \div 2$

Even better with context!

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

Think... how many $\frac{3}{4}$ ths are in $\frac{1}{2}$?
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
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.
WHAT’S WRONG WITH THIS PICTURE?
FIX: USE PLACE VALUE REPRESENTATIONS AND PRECISE LANGUAGE TO EXPLAIN OPERATIONS

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

737
- 479

Carrying? Borrowing? Um...NO
LANGUAGE/ACADEMIC VOCABULARY
(ATTEND TO PRECISION!!!)

DIGIT vs NUMBER

1 5 3

153

- -

digit  digit  digit

numeral

number

d o g  d o g

letter  letter  letter

word

idea

FAIR TRADE

DECOMPOSE

REGROUP

BORROW

CARRY

Tens  Ones

1 3

- 2 9
FIX: PROMOTE UNDERSTANDING BY BUILDING UNDERSTANDING OF PLACE VALUE USING VISUALS

Conceptual Long Division
HOW ABOUT ADDING ZEROES???

$80,000 + 0 = $800,000

“That’s right, I’ve decided to give myself zero pay raise this year.”
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....

SOOO...JUST MOVE THE DECIMAL OVER ONE

...THEN MULTIPLY BY 2?

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:

3 groups of 6

Think of all of the opportunities you have to make connections to area and dimensions!
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
SOOOOOOOOOOO....WHAT WILL YOU TRY?

STOP TELLING ME TO BE QUIET

I NEED TO TURN AND TALK
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.

AND REMEMBER.......
FIX THE TRICKS AND UPGRADE THE RESULTS OF YOUR INSTRUCTION FROM TEFOLON....TO.... VELCRO
QUESTIONS?

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