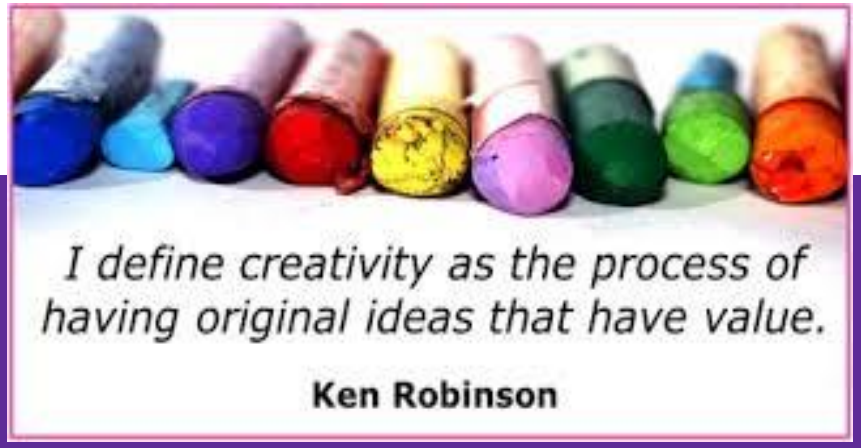
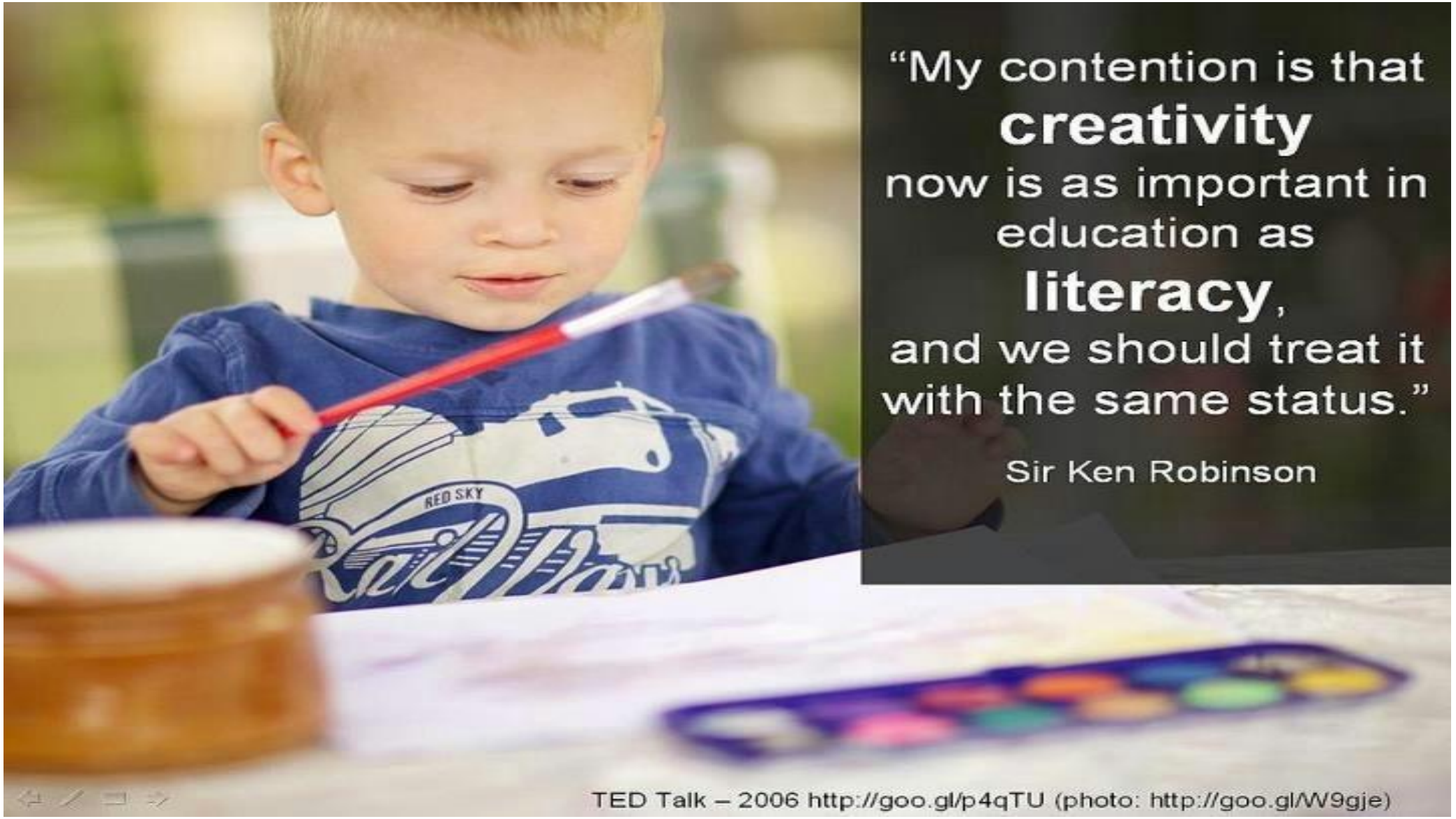
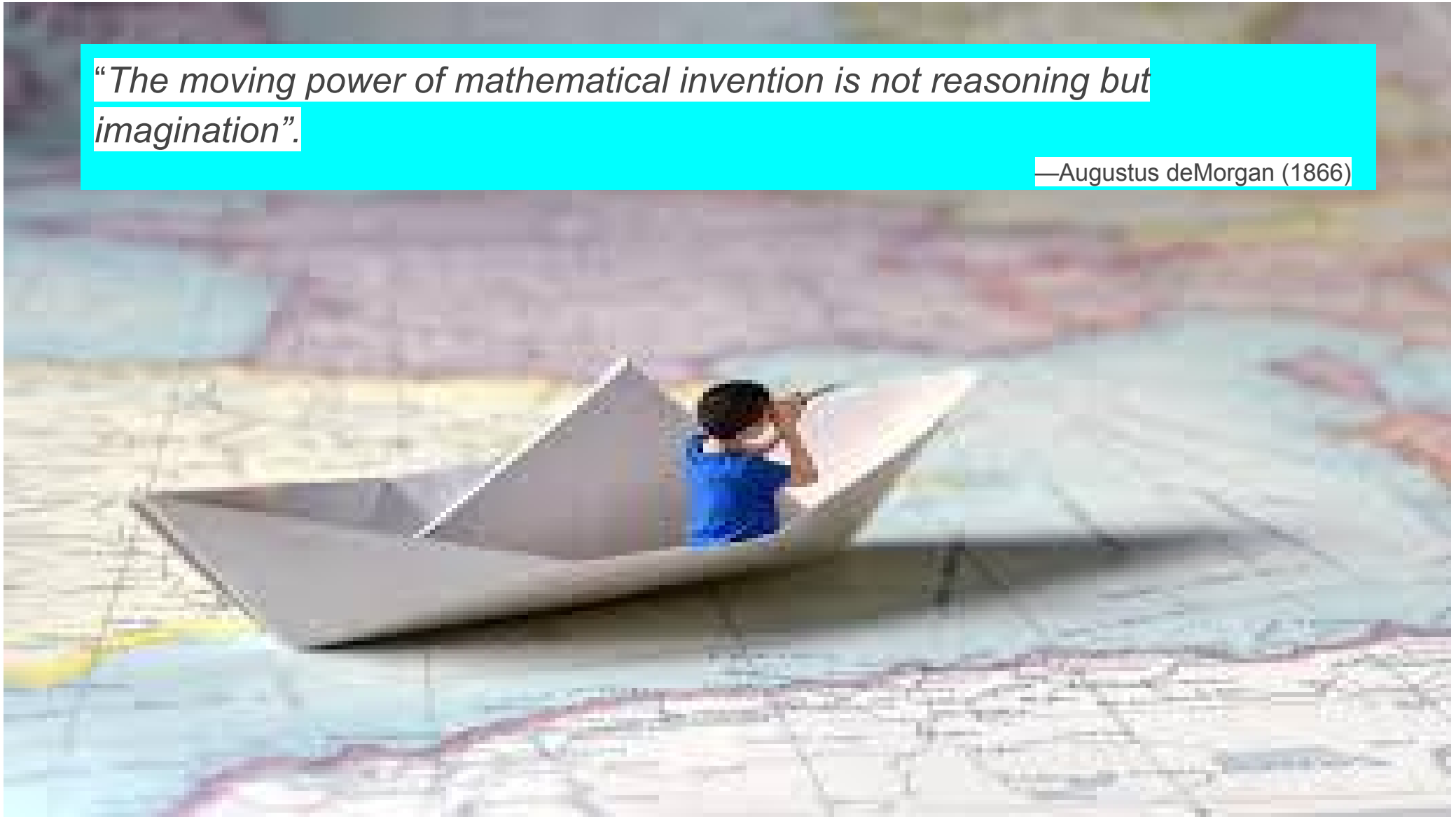
Illuminating Creativity in the Practice of Mathematics

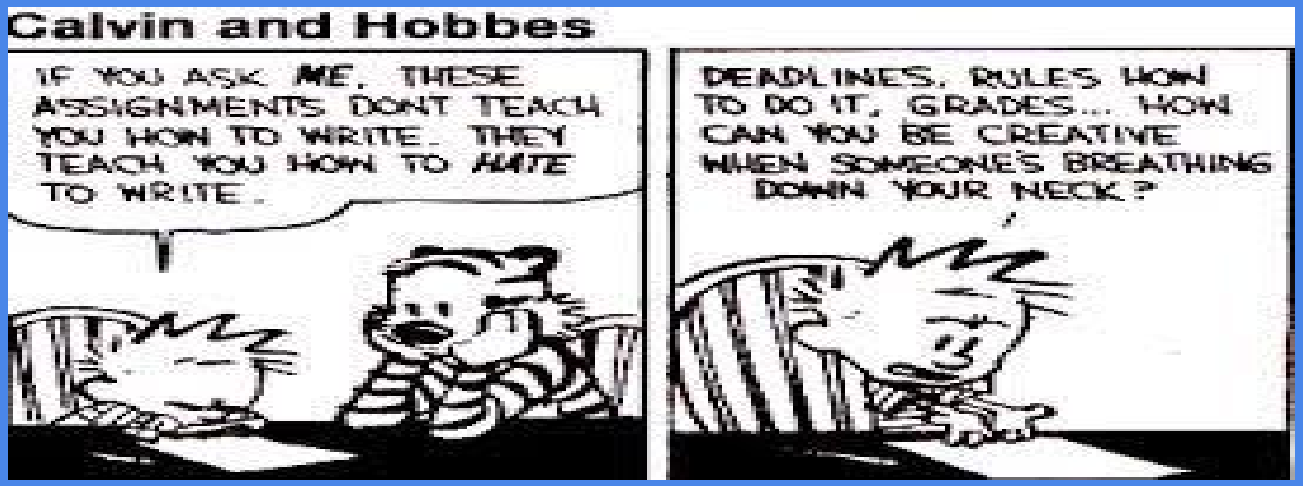


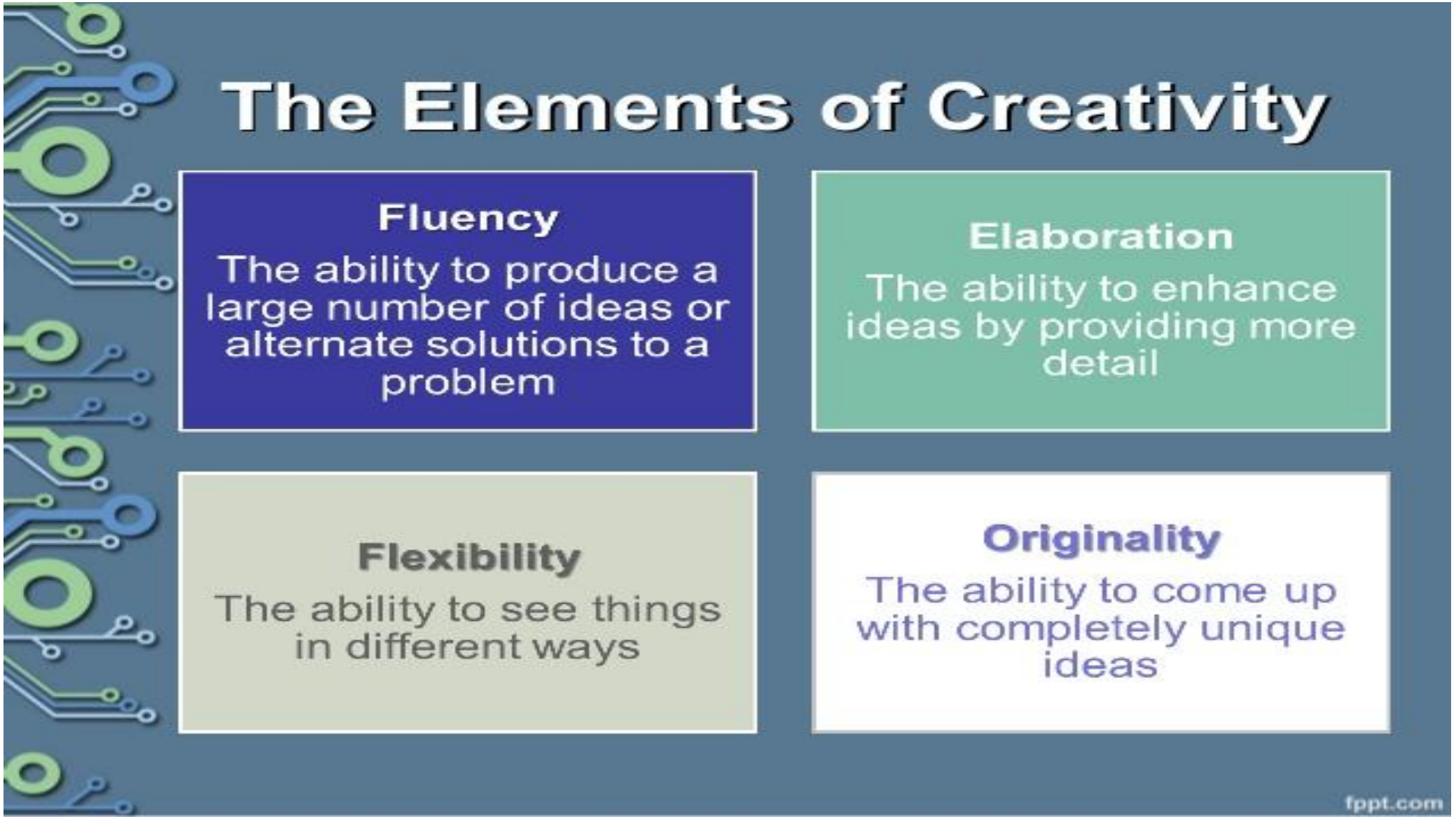
Cheryl Gehres cgehres@pvlearners.net
Karen Brown karbrown@pvlearners.net


"My contention is that
creativity
now is as important in
education as
literacy,
and we should treat it
with the same status."
Sir Ken Robinson
TED Talk – 2006 http://goo.gl/p4qTU (photo: http://goo.gl/W9gje)

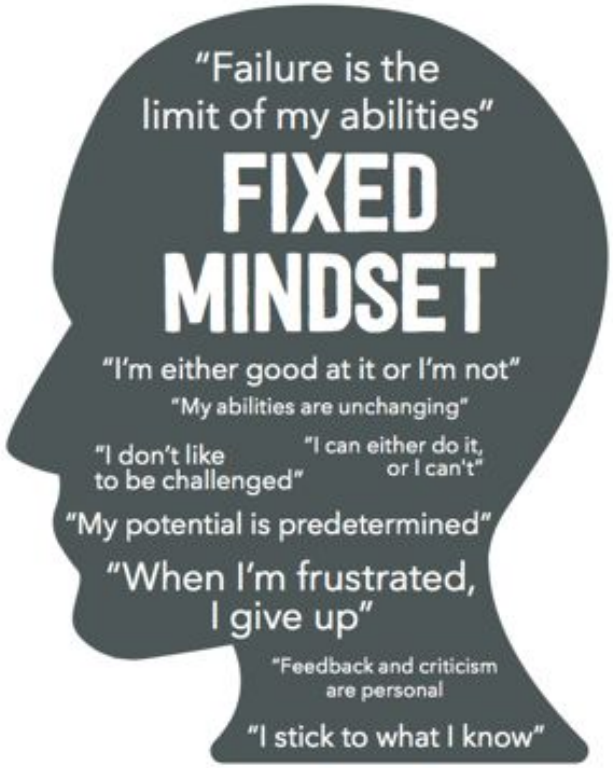

“The moving power of mathematical invention is not reasoning but imagination”.
—Augustus deMorgan (1866)

What is Creativity?



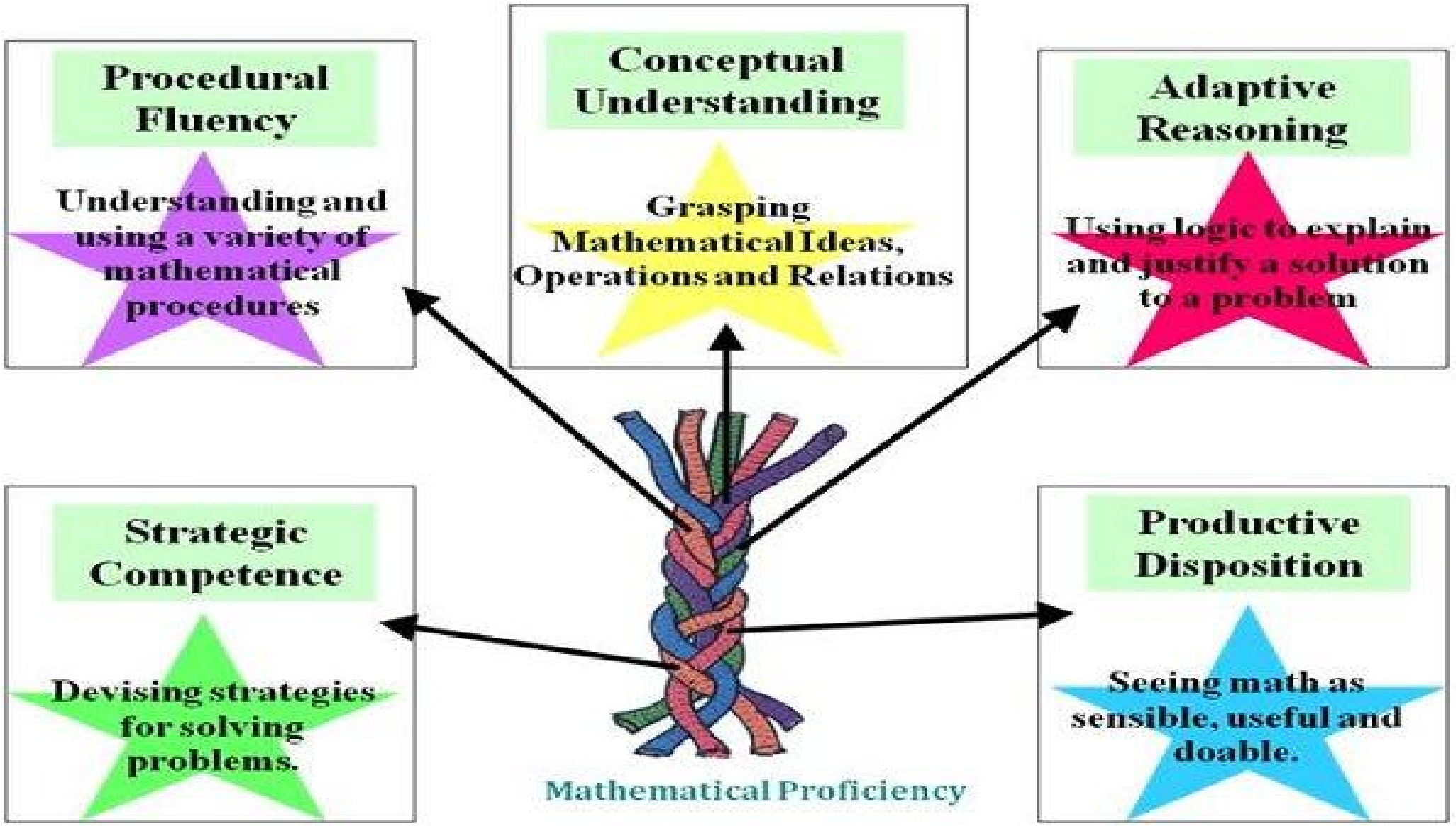

The Elements of Creativity
Fluency
The ability to produce a large number of ideas or alternate solutions to a problem
Elaboration
The ability to enhance ideas by providing more detail
Flexibility
The ability to see things in different ways
Originality
The ability to come up with completely unique ideas
fppt.com


"Failure is an opportunity to grow"
GROWTH MINDSET
"I can learn to do anything I want"
"Challenges help me to grow"
"My effort and attitude determine my abilities"
"Feedback is constructive"
"I am inspired by the success of others"
"I like to try new things"


"Failure is the limit of my abilities"
FIXED MINDSET
"I'm either good at it or I'm not"
"My abilities are unchanging"
"I don't like to be challenged"
"I can either do it, or I can't"
"My potential is predetermined"
"When I'm frustrated, I give up"
"Feedback and criticism are personal
"I stick to what I know"

8 Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.


Procedural Fluency
Understanding and using a variety of mathematical procedures
Conceptual Understanding
Grasping Mathematical Ideas, Operations and Relations
Adaptive Reasoning
Using logic to explain and justify a solution to a problem
Strategic Competence
Devising strategies for solving problems.
Productive Disposition
Seeing math as sensible, useful and doable.
Mathematical Proficiency

Webb's Depth-of-Knowledge Model
Context Ceilings

What is the knowledge?

DOK-1

RECALL AND REPRODUCTIION

How can the knowledge be used?

DOK-2

BASIC APPLICATION OF SKILLS AND CONCEPTS

Why can the knowledge be used?

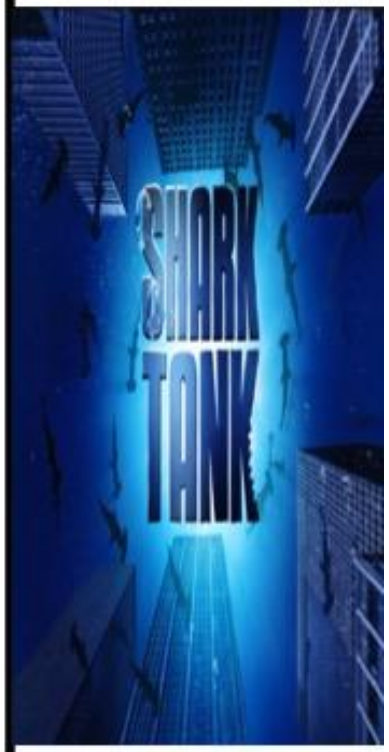
DOK-3

STRATEGIC THINKING

How else can the knowledge be used?

DOK-4

EXTENDED THINKING



What is a Mathematical Provocation?

Reggio Amelia inspired, a **provocation** is intended to ***provoke*** thought, questions, ideas,discussions, creativity and interests.

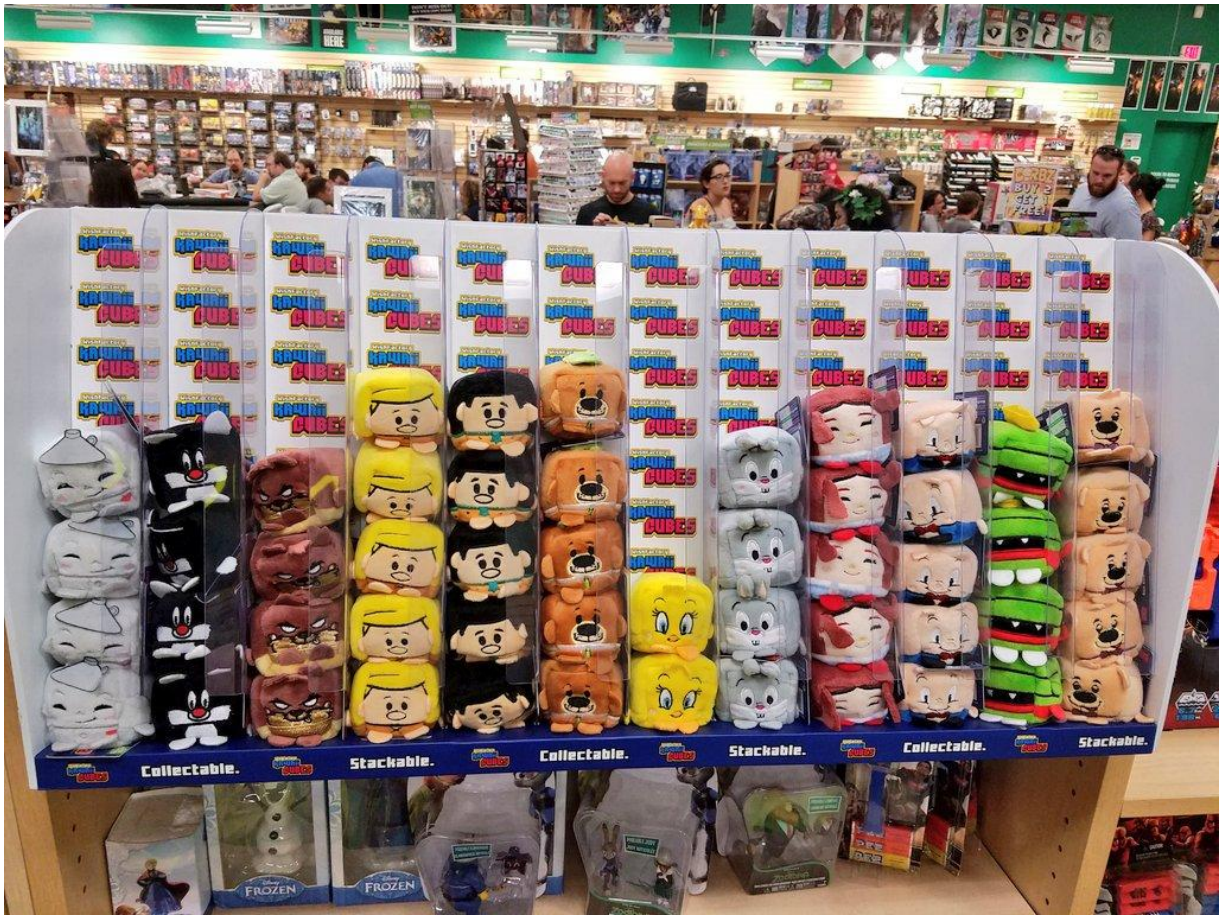
Mathematical Provocations ***provoke*** sense making, reasoning, problem-solving, and modeling. They provide context for purposeful inquiry and foster perseverance. They lead to self confidence, productive struggle, and a growth mindset.

Math is supposed to make sense!

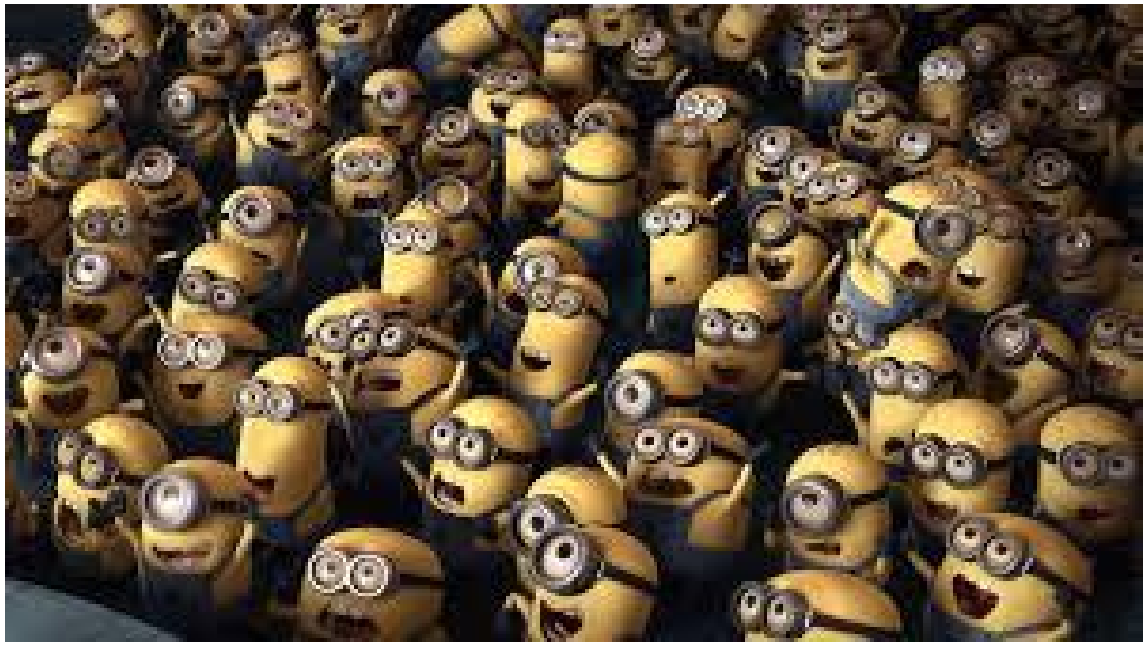
Charlotte's Web

How many Feet in the Barn?

Where's the Math?

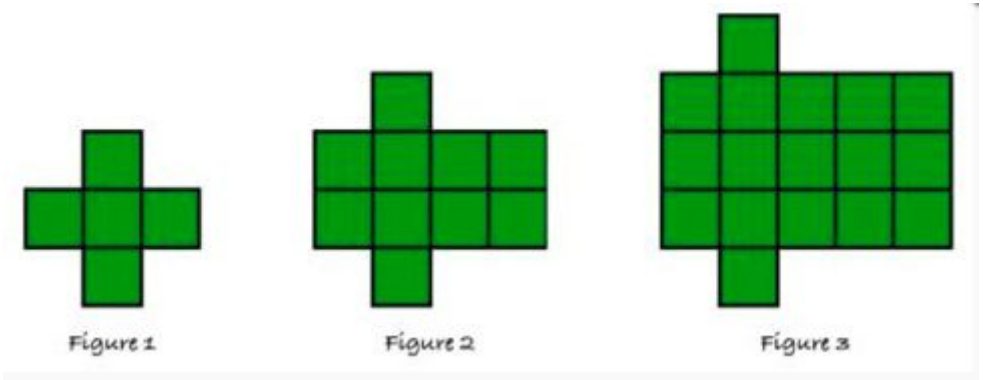


Where's the Math?



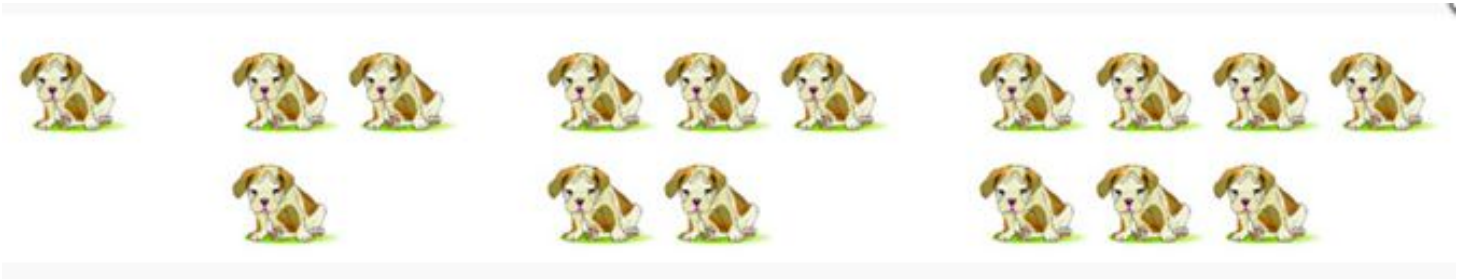
My favorite seasonal arrays!

Pose this: What questions might you ask and answer? What else do you need to solve?



Visual Patterns

Pattern #13, Footballs in step 43 = 946



The 10 card solution

Try This Now

The 1–10 Card Investigation

Arrange a set of ten cards, numbered 1 to 10, facedown so that the following occurs:

1. When you turn over the top card, it should be a 1. Place it faceup on the table.
2. Move the next card to the bottom of the deck, keeping it facedown.
3. When you turn over the third card, it should be a 2. Place it faceup on the table.
4. Move the next card to the bottom of the deck, keeping it facedown.
5. Continue this way, turning over a card, placing it faceup on the table, and moving the next card to the bottom of the deck.
6. When you're done, all of the cards on the table should be faceup in order from 1 to 10.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Life Size Jenga - a 3 Act Task

Life Size Jenga

Reflect:

- What did students gain?
- What conceptual understandings were developed?
- How did this problem support student growth in strategic competence?
- What misunderstandings might you identify?

Have a stack of quarters from the floor to the top of your head OR $225?

"Would You Rather" Activity

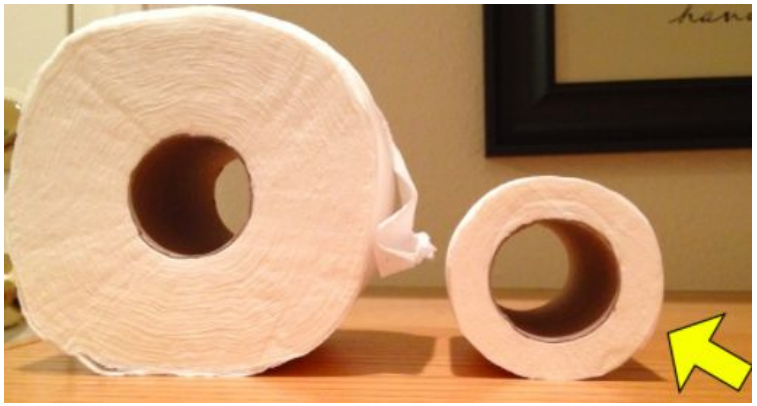
http://www.wouldyourathermath.com/

Take a question/prompt from the container.

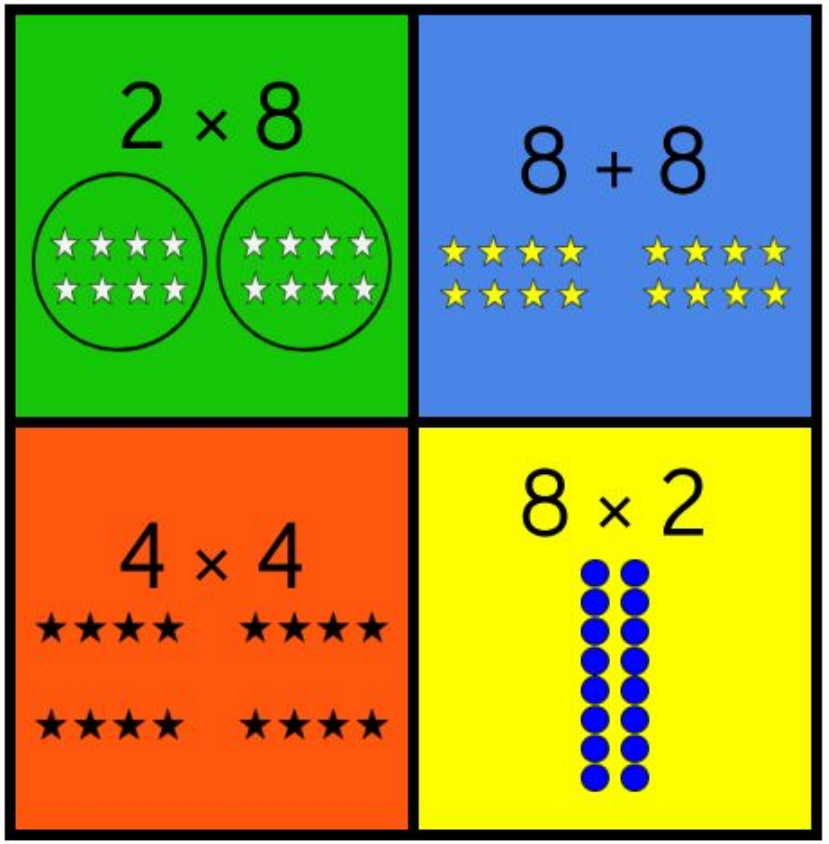
Discuss the *Would You Rather?* situation with your group or a partner nearby.

Think about it, "Where's the math?"

Estimation 180



Which one doesn't belong? WODB




CREATIVITY
IS
JUST
INTELLIGENCE
HAVING
FUN
ALBERT EINSTEIN
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Questions?

What was new information for you today?

What are you still wondering?

What will you try out in your classroom tomorrow?

What is your take away?

Thank you for your contributions this afternoon!

Provocations

- Would You Rather? www.wouldyourathermath.com
- Which One Doesn't Belong? http://wodb.ca/
- Ken Ken Puzzles http://illuminations.nctm.org/Lesson.aspx?id=6889
- 3 Act Math Problems https://whenmathhappens.com/3-act-math/ https://docs.google.com/spreadsheets/u/1/d/1jXSt_CoDzyDFeJimZxnhgwOVsWkTQEsfqouLWNNC6Z4/pub?output=html
- Visual Patterns http://www.visualpatterns.org/
- Numberless Word Problems https://bstockus.wordpress.com/numberless-word-problems/
- Notice and Wonder -Math Forum http://mathforum.org/pow/noticewonder/
- Same or Different? Supporting Mathematical Argument https://samedifferentimages.wordpress.com/
- Mathadazzles https://www.amazon.com/s/ref=nb_sb_noss_2?url=search-alias%3Daps&field-keywords=mathadazzles
- Estimation 180 http://www.estimation180.com/
- Open Middle: http://www.openmiddle.com/
- Math Trails https://www.edutopia.org/article/finding-beauty-math-outside-class

References

What is the Reggio Amelia Approach?
http://www.aneverydaystory.com/beginners-guide-to-reggio-emilia/main-principles/

Marilyn Burns Math Blog

http://marilynburnsmathblog.com/wordpress/the-1-10-card-investigation/

Thank you!