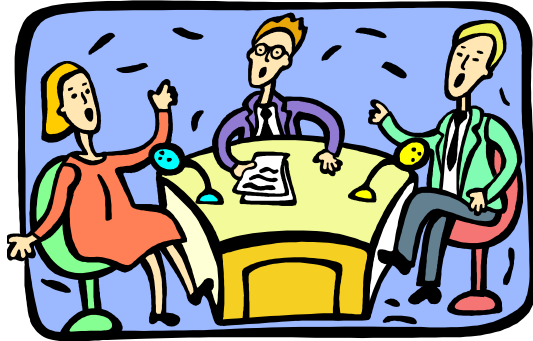


Math Gabs

When you first read each set of familiar words below they may not make much sense. However, if you continue to read them orally, your brain power will enable you to make sense of them.



1. Wreck Dane Gull Lores Awl Its
2. Lie Enough Cement Tree
3. I'll Ease Come In Mill Tea Pull
4. Oh Door If Hope Orate Shins
5. **ALGAE BREAK AXE PRESS ON**
6. Pipe Thag Organ The Rim
7. Crate Ask Omen Vak Tore
8. *Burpin' Tick Yeller Pie Sick Door*
9. Al Gore Is Thumb
10. Sea Imp Love Eye Urine Sir

Fostering Productive Struggle and Growth Mindset in Mathematics

LearnBop Director of Learning

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On Tap for Today...

How do you...

- encourage students to think differently?
- encourage students to use a variety of approaches and strategies for solving problems?
- encourage students to accept failure as part of the learning process?

Math Gabs

When you first read each set of familiar words below they may not make much sense. However, if you continue to read them orally, your brain power will enable you to make sense of them.

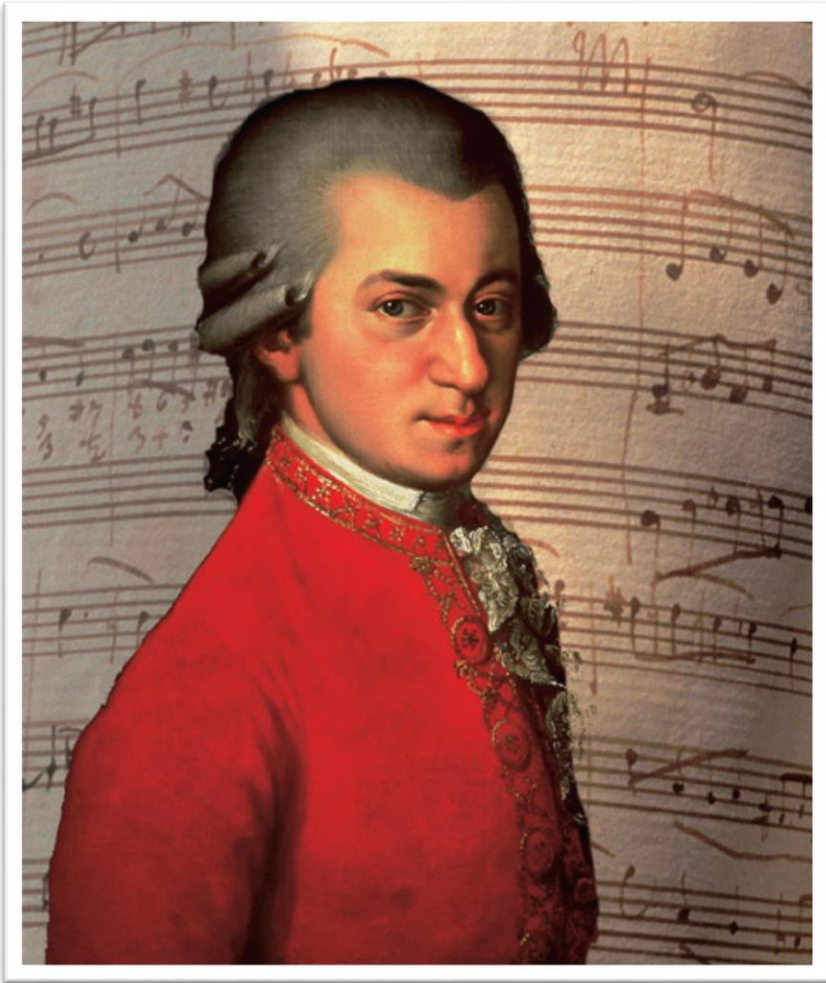
- | | | |
|-----|--|------------------------|
| 1. | Wreck Dane Gull Lores Awl Its | rectangular solid |
| 2. | Lie Enough Cement Tree | line of symmetry |
| 3. | I'll Ease Come In Mill Tea Pull | least common multiple |
| 4. | Oh Door If Hope Orate Shins | order of operations |
| 5. | ALGAE BREAK AXE PRESS ON | algebraic expression |
| 6. | Pipe Thag Organ The Rim | Pythagorean Theorem |
| 7. | Crate Ask Omen Vak Tore | greatest common factor |
| 8. | <i>Burpin' Tick Yeller Pie Sick Door</i> | perpendicular bisector |
| 9. | Al Gore Is Thumb | algorithm |
| 10. | Sea Imp Love Eye Urine Sir | simplify your answer |

Defining Genius...



Geniuses or those who make great creative contributions cannot be explained by talent alone, but rather deliberate **practice** they devote to their field (Ericsson, Charness, Feltovich, & Hoffman, 2006).

About Genius Practice...

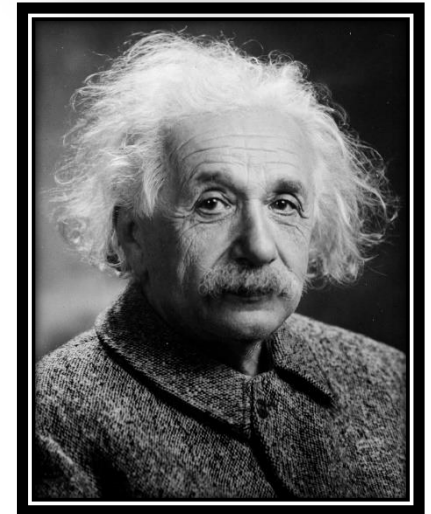


3500 hours of practice by age 6

Honed their writing skills
as young girls



Stone cutter before a sculptor



Mastered geometry and algebra
on his own in one summer



Barry Marshall and Robin Warren

Maria Montessori

Albert Einstein

thinking

Paul Baran

Thomas Edison

Charles Darwin



Thinking differently, from an unexpected angle beyond the logical approach...

Thinking outside the box...

A. Imagined them self as a plant.

Charles Darwin

B. Related a web of computers to neural pathways in the brain.

Paul Baran

C. Imagined he was traveling at the speed of light.

Albert Einstein

D. Created the phonograph after reimagining previous inventions.

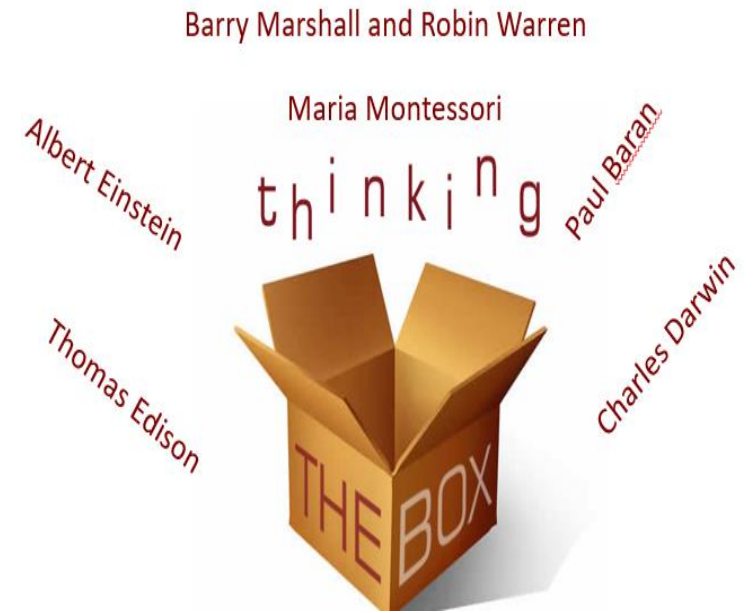
Thomas Edison

E. Observed biopsy abnormalities to think differently about what causes stomach ulcers.

Barry Marshall and Robin Warren

F. Through keen observation, discovered how children teach themselves.

Maria Montessori



PRODUCTIVE STRUGGLE:

The effort to make sense of something, to figure something out that is not immediately apparent.

Hiebert & Grouws, 2007

It all Adds Up!

Making Sense

Making Mistakes

+ *Making Progress*

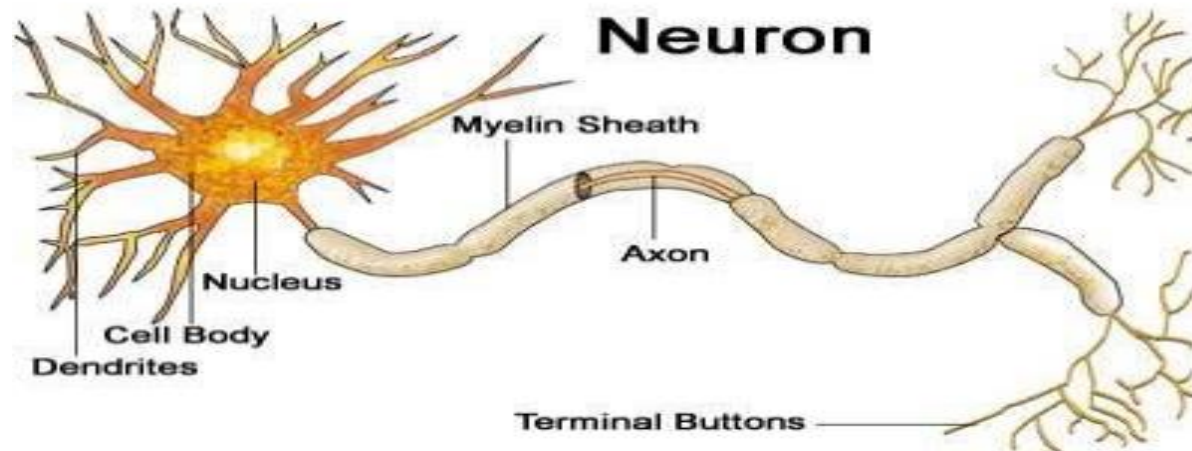
Productive Effort

Which color/number best represents your students' Productive Struggle level?

1	2	3	4
Attempts to make sense of problem/task	Makes sense of the problem/task, but makes little or no attempt at finding a solution	Makes sense of the problem/task and tries a variety of strategies that may/may not lead to a correct solution	Makes sense of the problem/task and tries/refines strategies until finding a correct solution

Fostering Productive Struggle & GROWTH Mindset

Productive Struggle + Growth Mindset = Growing Myelin + Building
(Faster/Stronger) Connections



Mindsets and Math/Science Achievement. Carol Dweck.

www.opportunityequation.org

Mathematical Tasks Choice matters

because...

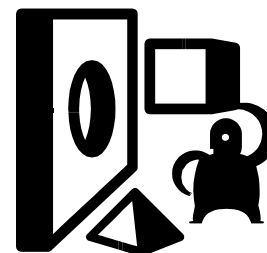
“Not all tasks are created equal, and different tasks will provoke **different levels and kinds of student thinking**.”

Stein, Smith, Henningsen, & Silver, 2000

and...

“The level and kind of thinking in which students engage **determines what they will learn**.”

Hiebert, Carpenter, Fennema, Fuson, Wearne, Murray, Oliver & Human, 1997



What score would you give a student for these answers?

$$12 - 3 = 9$$

$$1 + 3 = 4$$

$$5 - 5 = 12$$

$$6 + 1 = 7$$

$$11 + 3 = 2$$

$$9 + 2 = 11$$

$$8 - 6 = 2$$

What score would you give a student for these answers?

$$12 - 3 = 9$$

$$1 + 3 = 4$$

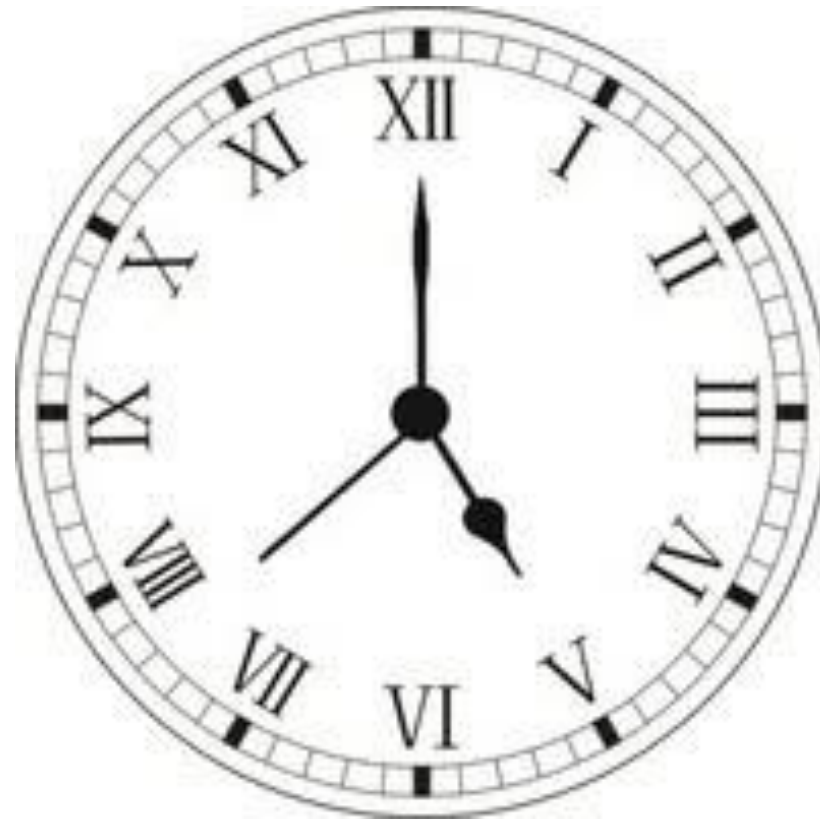
$$5 - 5 = 12$$

$$6 + 1 = 7$$

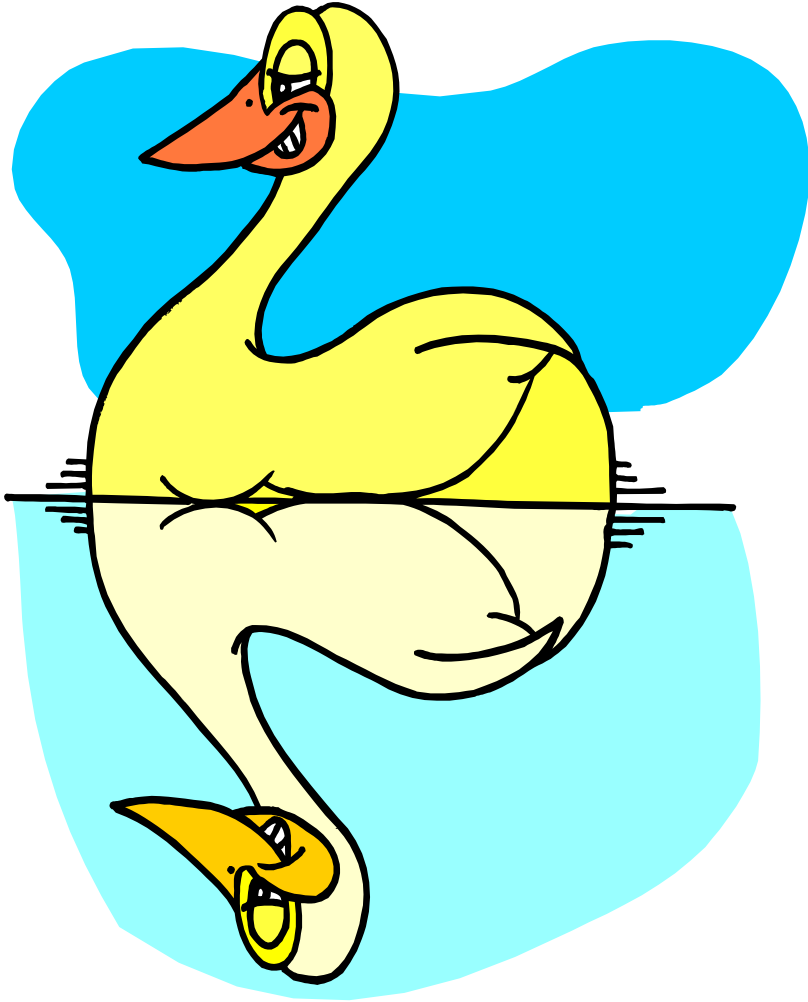
$$11 + 3 = 2$$

$$9 + 2 = 11$$

$$8 - 6 = 2$$



The **POWER** of Identifying Similarities and Differences



Researchers have found identifying similarities and differences to be basic to human thought and are considered the core of all learning.

(Gentner & Markman, 1994; Markman & Gentner, 1993a, 1993b; Medin, Goldstone, & Markman, 1995)

Different but Alike

All the cards below have a different set of numbers on them. But what do all the circled numbers on the cards have in common?

5, 10, 12, 2, 25

23

7, 5, 4, 4, 5, 6

3

9, 12, 25, 10, 6

19



Adapted from: http://www.archimedes-lab.org/2-Sunday_puzzle_42.html



Two strangers from different parts of America both build similar apartment buildings in their home towns. By chance, they both forget an important part of the project. They each, once again by chance, call the same national hardware store to order the missing items. The prices they are quoted are as follows:

- One will cost \$2 •Two will cost \$2 •Twelve will cost \$4
- One hundred twenty-four will cost \$6

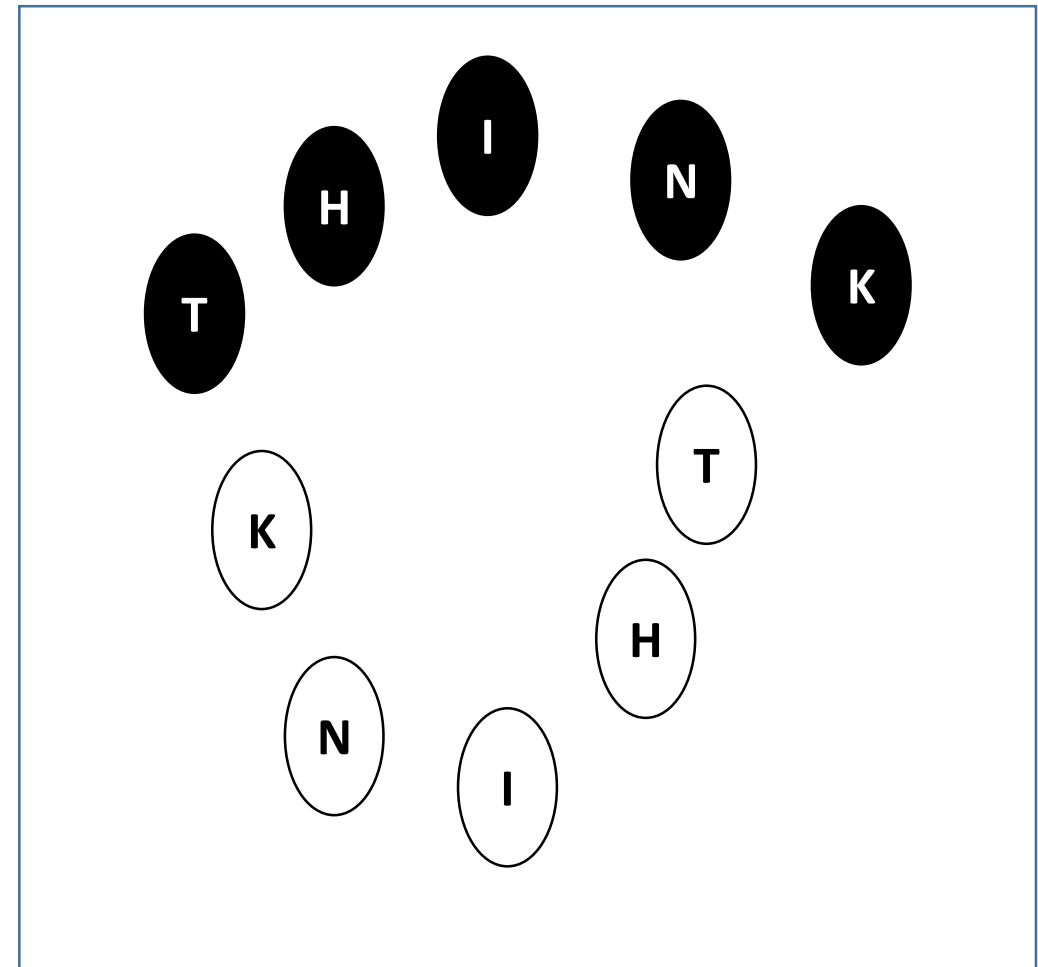
What item are they purchasing?

Two thousand one hundred twelve will cost \$8.



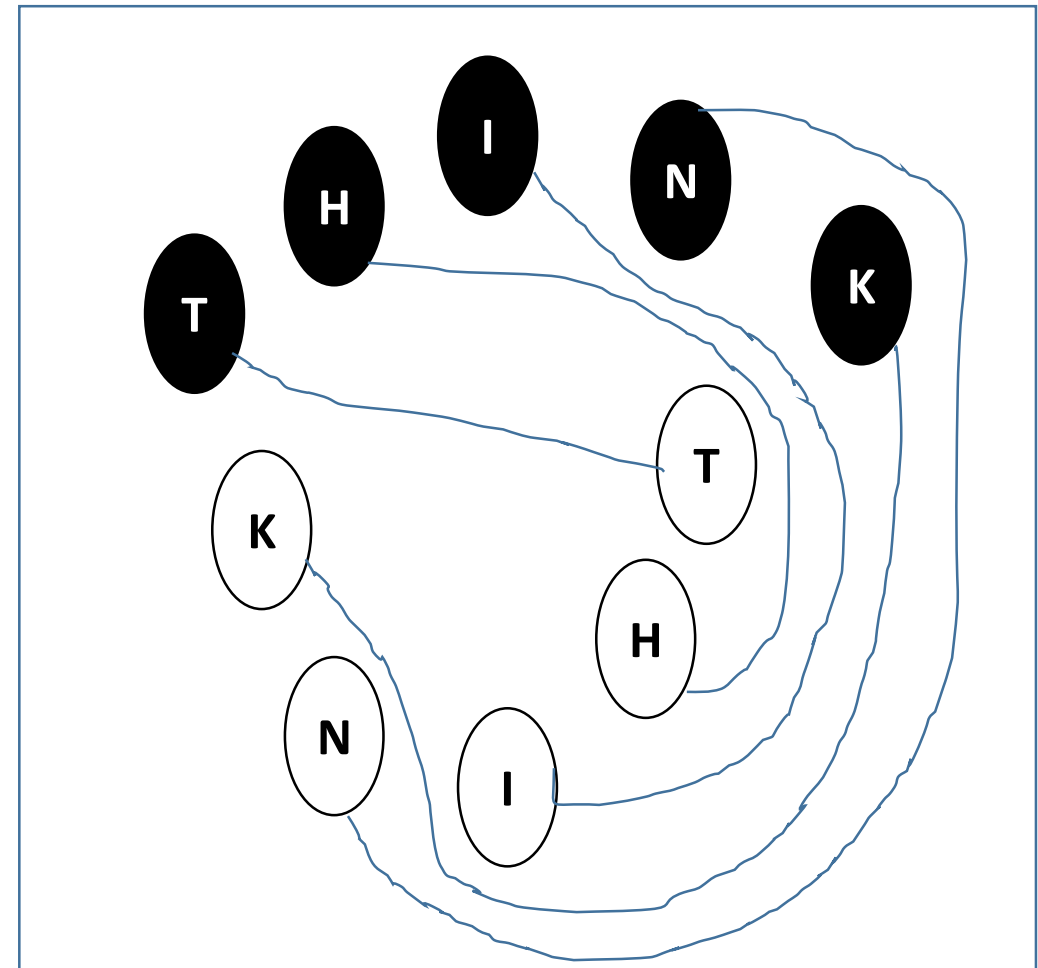
<http://www.archimedes-lab.org/pzm23b.html>

Draw lines to join each black letter to its corresponding white counterpart (t to t, h to h, etc.), without any line crossing another line.



<http://www.archimedes-lab.org/pzm23b.html>

Draw lines to join each black letter to its corresponding white counterpart (t to t, h to h, etc.), without any line crossing another line.



How Many R's?

Complete the sentences written on the card so that each statement is true. Do not use numerals such as 1, 2, 3, 4,...

In the sentence below there are
_____ R's.

In the upper sentence there are
_____ R's.

http://www.archimedes-lab.org/abracadabrain_Solu3_4A.html

How Many R's?

Complete the sentences written on the card so that each statement is true. Do not use numerals such as 1, 2, 3, 4,...

In the sentence below there are

precisely five R's. **four plus one**

In the upper sentence there are

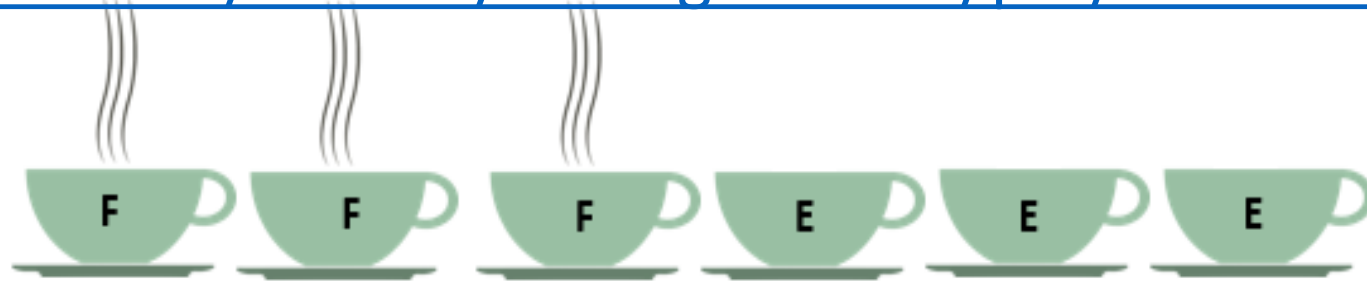
three R's.

[http://www.archimedes-lab.org/abracadabrain Solu3 4A.html](http://www.archimedes-lab.org/abracadabrain_Solu3_4A.html)

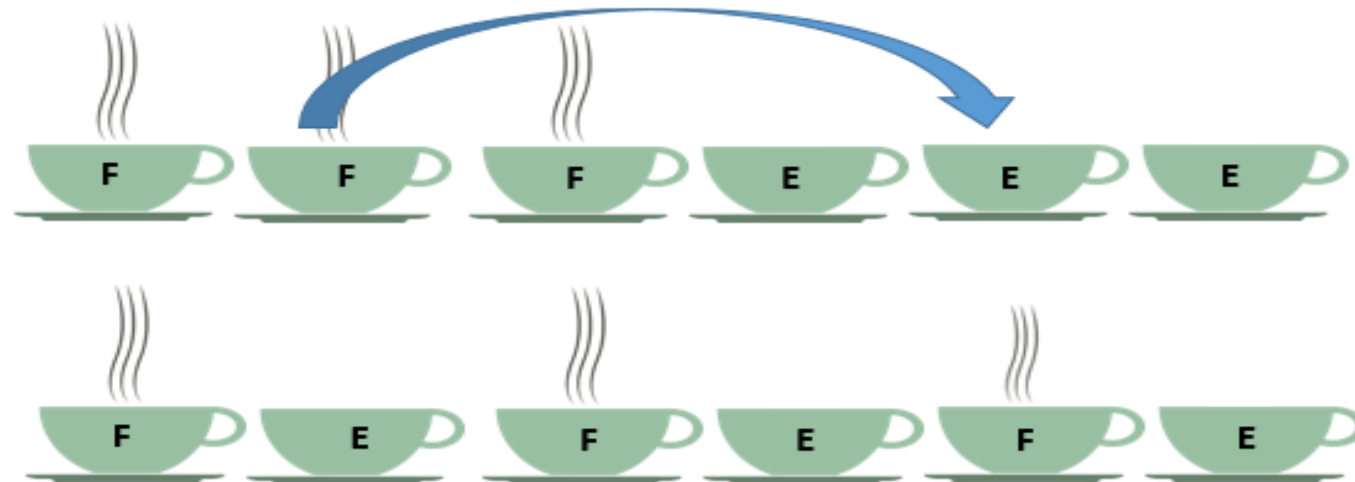
Cup Conundrum

Adapted from

<http://www.abc.net.au/science/surfingscientist/pdf/conundrum20.pdf>



6 cups are lined up, three are full and three are empty. What one move would you make to create a full empty, full empty, full empty pattern of the cups order?



How do you...

- encourage students to think differently?
- encourage students to use a variety of approaches and strategies for solving problems?
- encourage students to accept failure as part of the learning process?



- <http://www.edutopia.org/blog/growth-mindset-common-core-math-cindy-bryant>
- <http://www.edutopia.org/blog/mathematical-habits-of-mind-cindy-bryant>
- <http://thelearningcounsel.com/article/mind-over-mathematics>
- *Creative Problem Solving in School Mathematics* ISBN-13: 978-1882144105 ISBN-10: 1882144104 Edition: 2nd
- www.opportunityequation.org
- <http://www.greatmathsteachingideas.com/>
- www.nctm.org
- <http://nrich.maths.org>
- <http://www.openmiddle.com/>
- www.youcubed.org
- <http://www.abc.net.au/science/surfingscientist/pdf/conundrum20.pdf>
- <http://www.archimedes-lab.org>
- <http://www.inc.com/lolly-daskal/think-like-a-genius-and-be-the-smartest-person-in-the-room.html>
- <http://thetalentcode.com/>
- <https://www.illustrativemathematics.org/>
- www.learnbop.com

Door Prize, Questions & Staying Connected



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