21st Century Math For All

Students & Teachers of Linfield, 2017-18

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The Math Projects Journal
Temecula Valley USD

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@MathProjects
#21stCenturyMath

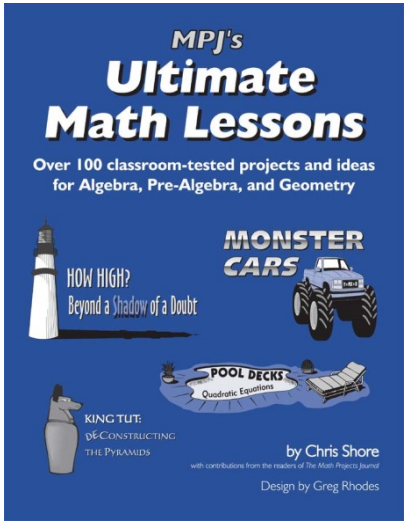
LICENSE PLATE INTRO

Name

LICENSE PLATE INTRO

Chris

My Experience with 21st Century Math Educations



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21st Century Math For All …

Objectives

Why?

What?

How?

21st Century Math For All …

Why

21st Century Math Purpose

Teach students to THINK and COMMUNICATE their thinking.

These are the 21st Century Skills.

21st Century Math Purpose

21st Century Math Purpose

Think & Communicate

are the 21st Century Skills.

Obtain & Retain

were the 20th Century Skills.

21st Century Math For All

$$6 + 4 + 4 + 8 = 21$$

The 6 Shifts

engage ny

We are redefining RIGOR.

Shift 1	Focus	Teachers significantly narrow and deepen the scope of how time and energy is spent in the math classroom. They do so in order to focus deeply on only the concepts that are prioritized in the standards.
Shift 2	Coherence	Principals and teachers carefully connect the learning within and across grades so that students can build new understanding onto foundations built in previous years.
Shift 3	Fluency	Students are expected to have speed and accuracy with simple calculations; teachers structure class time and/or homework time for students to memorize, through repetition, core functions.
Shift 4	Deep Understanding	Students deeply understand and can operate easily within a math concept before moving on. They learn more than the trick to get the answer right. They learn the math.
Shift 5	Application	Students are expected to use math and choose the appropriate concept for application even when they are not prompted to do so.
Shift 6	Dual Intensity	Students are practicing and understanding. There is more than a balance between these two things in the classroom – both are occurring with intensity.

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21st Century Math For All

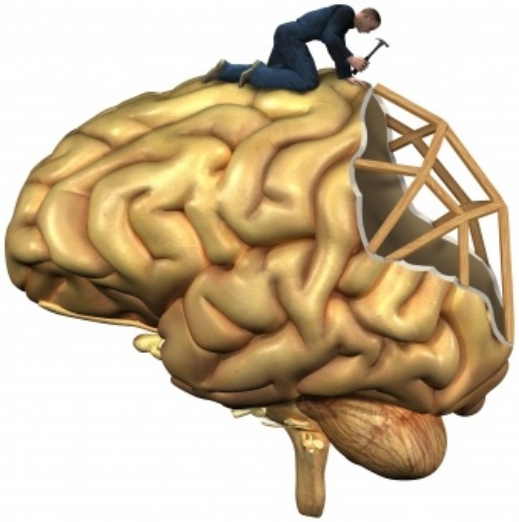
Think & Communicate

The 6 Shifts = The 21st Century Skills

The 4 C's

EdLeader21

We are redefining LEARNING and SCHOOL.



Critical Thinking

Communication

Collaboration

Creativity

60%

The 4 C's

EdLeader21

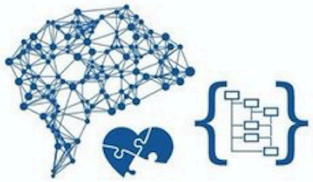
Our students' future is defining itself.

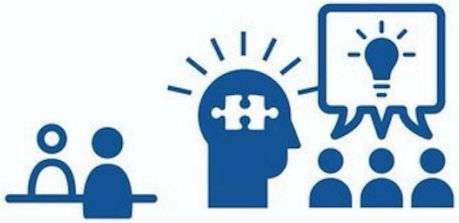
Top 10 skills

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

in 2020	in 2015
1. Complex Problem Solving	1. Complex Problem Solving
2. Critical Thinking	2. Coordinating with Others
3. Creativity	3. People Management
4. People Management	4. Critical Thinking
5. Coordinating with Others	5. Negotiation
6. Emotional Intelligence	6. Quality Control
7. Judgment and Decision Making	7. Service Orientation
8. Service Orientation	8. Judgment and Decision Making
9. Negotiation	9. Active Listening
10. Cognitive Flexibility	10. Creativity





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21st Century Math For All

Think & Communicate

The 4 C's = The 21st Century Skills

The 4 Claims

Smarter Balanced Assessment Consortium

We are redefining ASSESSMENT.

Concepts & Procedures

30%

Critical Thinking

Communicate Reasoning

Construct Models

MPJ

Old School vs New School

1 **What is 6050.287 rounded to the nearest ten?**

A 6050

B 6100

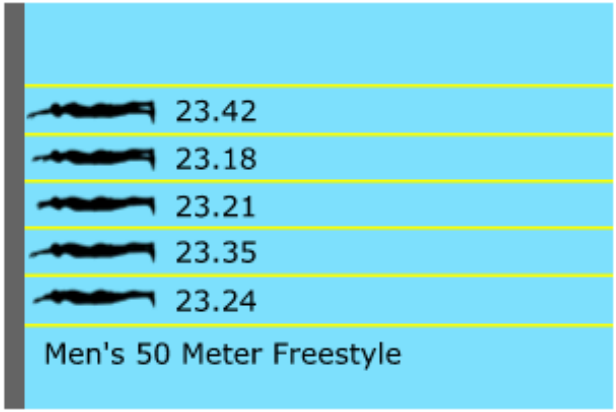
C 6050.29

D 6050.3

Old School vs New School

43025

Five swimmers compete in the 50-meter race. The finish time for each swimmer is shown in the video.



Explain how the results of the race would change if the race used a clock that rounded to the nearest tenth.

Old School vs New School

33

$$2\frac{1}{3}+4\frac{1}{2}=$$

A $6\frac{1}{6}$

B $6\frac{1}{5}$

C $6\frac{2}{5}$

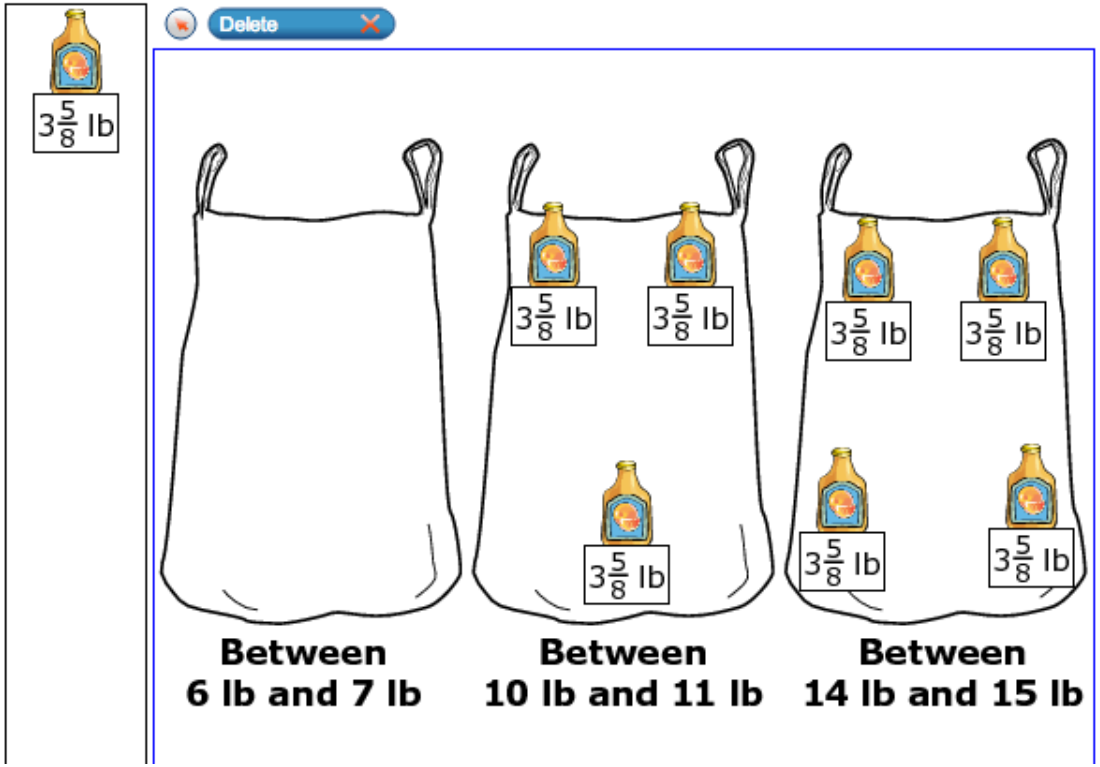
D $6\frac{5}{6}$

Old School vs New School

43328

Jared is testing how much weight a bag can hold. He plans to put juice bottles into three bags. He wants each bag to have a total weight within the given range.

- Drag juice bottles into each bag so that the weight is within the given range.
- Leave the bag empty if the given range is not possible using juice bottles.



SBAC Claim: Concepts & Procedures

42906

A. Drag into the box exactly three unique expressions whose sum is less than 10.

B. Drag into the box exactly three unique expressions whose sum is between 10 and 20.

C. Drag into the box exactly three unique expressions whose sum is greater than 20.

$5\sqrt{7}$

$\sqrt{13}$

$\frac{3^8}{3^6}$

$20 - \sqrt{20}$

$(4^{-2})^{-\frac{1}{2}}$

$8^{\frac{1}{3}}$

Delete

A. Three unique expressions whose sum is less than 10

B. Three unique expressions whose sum is between 10 and 20

C. Three unique expressions whose sum is greater than 20

SBAC Claim: Critical Thinking

42968

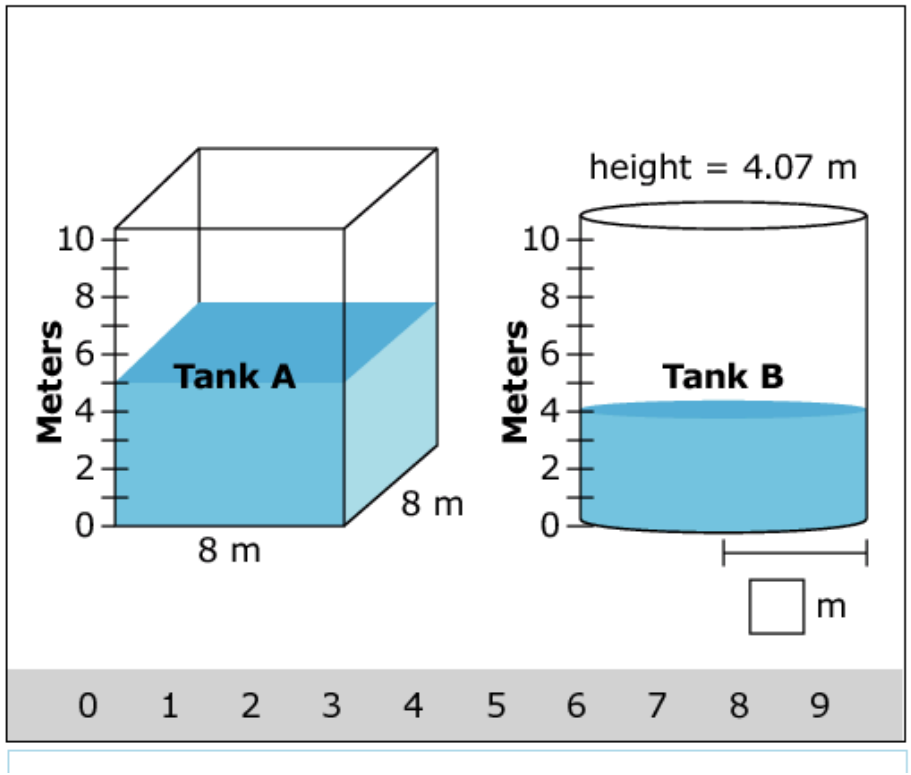
Two water tanks are shown. Tank A is a rectangular prism and Tank B is a cylinder. The tanks are not drawn to scale.

Tank A is filled with water to the 10-meter mark.

Click Tank A to change the water level. The volume of water that leaves Tank A is transferred to Tank B, and the height of the water in Tank B is shown.

Drag one number into the box to show the approximate radius of the base of Tank B.

Question



SBAC Claim: Communicate Reasoning

43052

Tony is buying a used car. He will choose between two cars. The table below shows information about each car.

Car	Cost	Miles Per Gallon (MPG)	Estimated Immediate Repairs
Car A	$3200	18	$700
Car B	$4700	24	$300

Tony wants to compare the total costs of buying and using these cars.

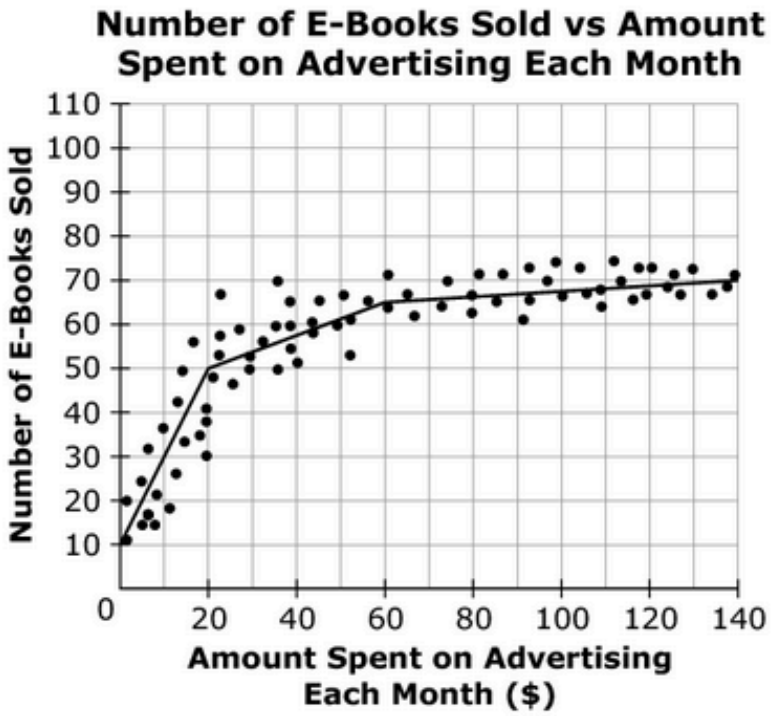
- Tony estimates he will drive at least 200 miles per month.
- The average cost of gasoline per gallon in his area is $3.70.
- Tony plans on owning the car for 4 years.

Calculate and explain which car will cost Tony the least to buy and use.

SBAC Claim: Models & Data

43028

Tyler earns $3.00 for every e-book he sells on his website. (E-books are books that are available electronically.) He investigated the relationship between the amount spent on advertising each month and the number of e-books sold. He used this information to determine the lines of best fit shown in this graph.



What is the greatest amount Tyler should spend on advertising each month? Show your work or explain how you found your answer.

College Ready … no ifs!

"In an AASA conference session, Advanced Placement in the Common Core Era… Trevor Packer, senior vice president of the College Board's Advanced Placement Program, told superintendents that his organization would integrate Common Core standards in AP course standards and AP exams.

The College Board is removing extraneous details from the AP course requirements and making AP classes less about simple memorization and more about critical thinking and synthesizing information."

AASA
THE SCHOOL SUPERINTENDENTS ASSOCIATION

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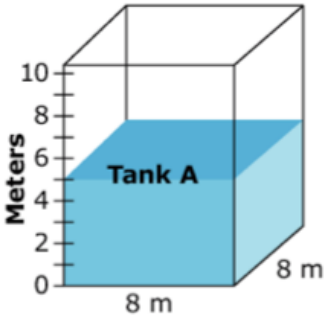
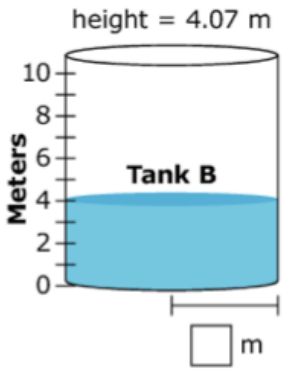
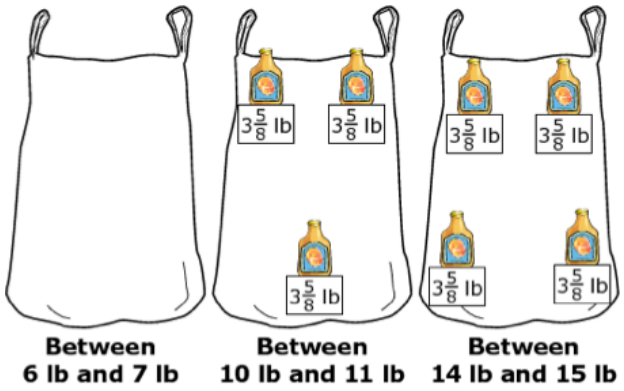
College Ready … no ifs!

David Coleman, who is often called the architect of the Common Core, arrived at the College Boards in 2012 and has since been on a campaign to make an SAT test that would incentivize students to take rigorous high-school classes and not just the best test-prep courses.

What Does This Say About Your New Job Description?







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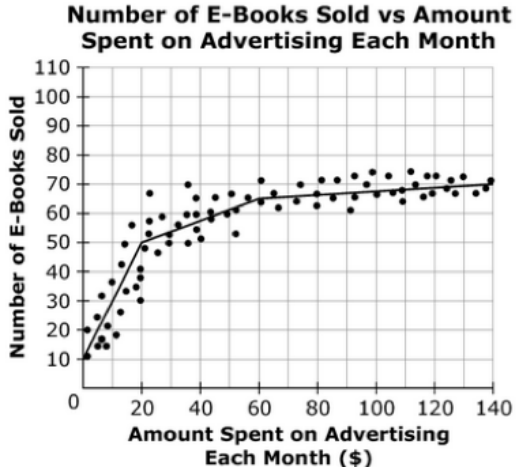


23.42

23.18

23.21

23.35

23.24

Men's 50 Meter Freestyle

21st Century Math For All

Think & Communicate

The 4 Claims = The 21st Century Skills

The 8 Practices

The Practices are for the students.

COMMON CORE STATE STANDARDS INITIATIVE

21st Century Math is all about the Practices.

Mathematical Practices

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

MPJ

21st Century Math For All

Think & Communicate

The 8 Practices =

The 21st Century Skills

21st Century Math For All

The 6 Shifts

+ The 4 C's

+ The 4 Claims

+ The 8 Practices

= The 21st Century Skills

21st Century Math For All

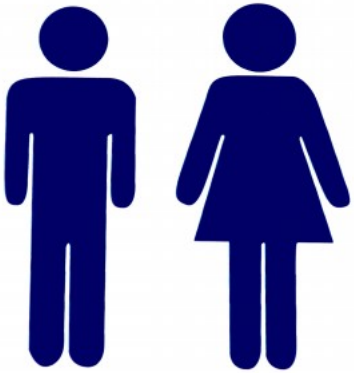
$$6 + 4 + 4 + 8 = 21$$

Linfield's
21st Century Math For All

Develop and inspire students …
to grow in knowledge and skill in order that
they may serve the Lord and the world.

Tell a partner WHY we need 21st Century Standards.

Break



10 minutes, until...

we see the WHAT

21st Century Math For All …

What

21st Century Math Defined

Mathematical Practices

1. Make sense of problems and persevere in solving them.
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Practices Posters

Make Sense of Problems and Persevere in Solving Them

I can understand a problem, devise a strategy, execute a plan and evaluate it s success.

Organize
Strategize
Change Strategies
Evaluate

SOLVE

- Understand
- Plan
- Execute
- Check
- Repeat until successful.

What exactly is this problem asking of me?
What information do I have?
What information do I need and how do I get it?
What is the best plan?
Is my answer reasonable?
If not how should I change my strategy?

Think and don't give up.

The Math Projects Journal, 2014

Practices Posters




What did these posters teach you about the 8 Standards of Practice?




21st Century Math Defined

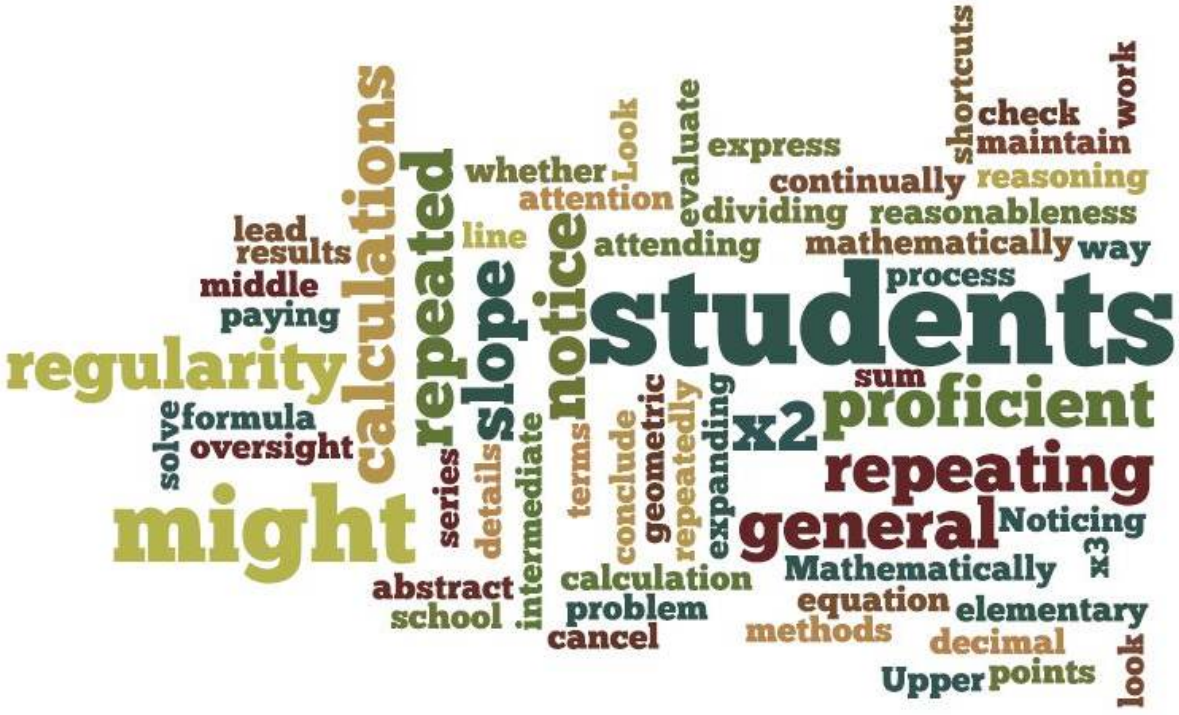
How many of the

8 SMP

do you remember?

Wordle Practices

Match the *Wordle* poster to its corresponding CC Standard of Mathematical Practice?



21st Century Math Defined

Mathematical Practices

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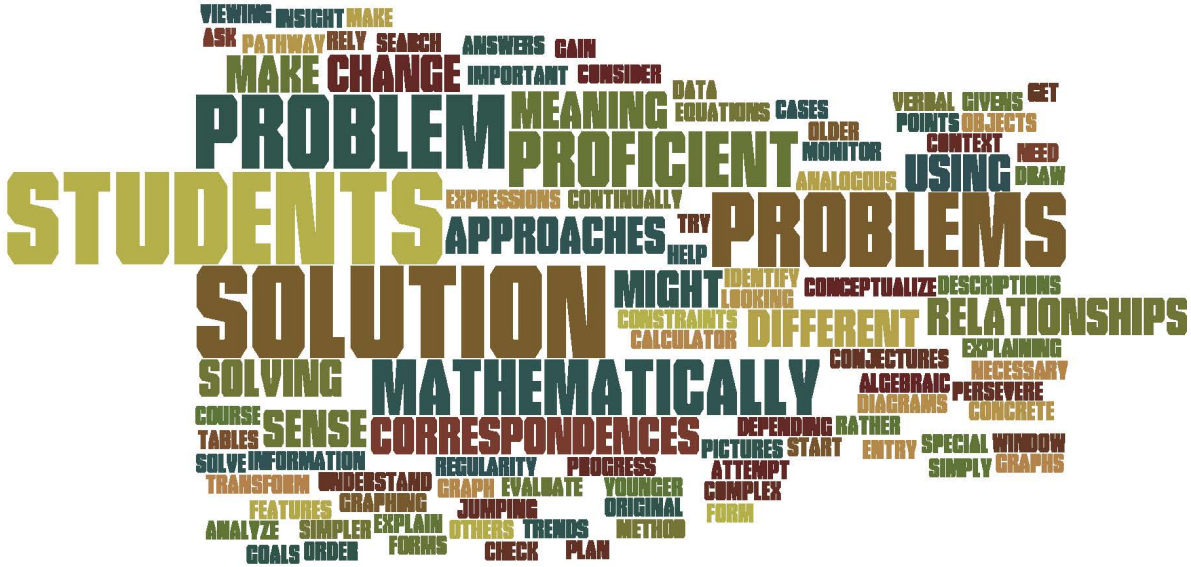
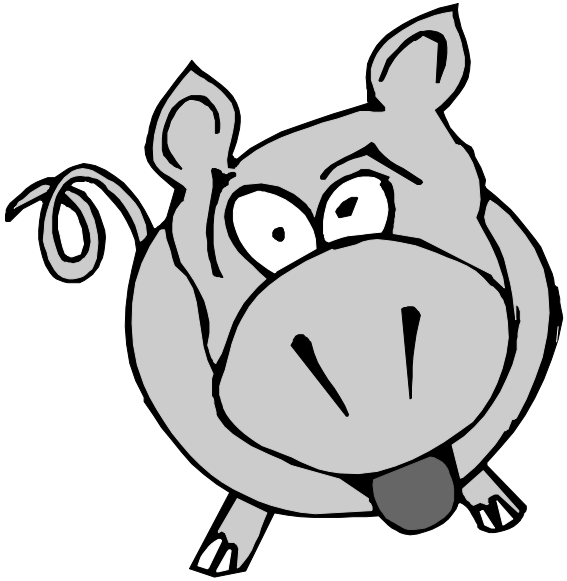
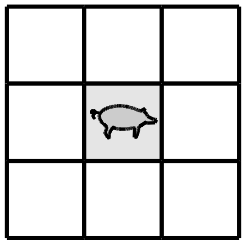
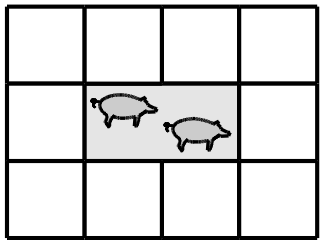
Wordle Practices

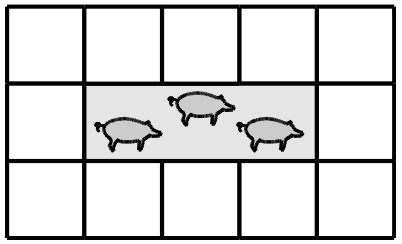


Pig Pen Algebra









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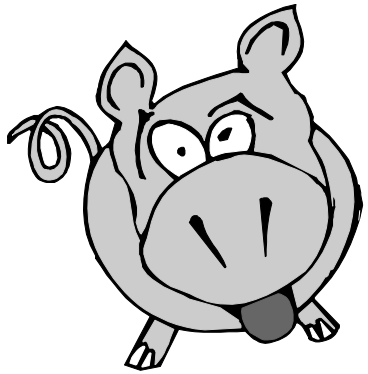


Which of the 8 SMPs did you see in this lesson and where?

Tell a partner WHAT elements of a 21st Century math lesson you saw.
(in contrast to a 20th Century math lesson that you grew up in.)

Lunch

Up next:

Experiencing the HOW

21st Century Math For All …

How

Explicit Teaching of Thinking

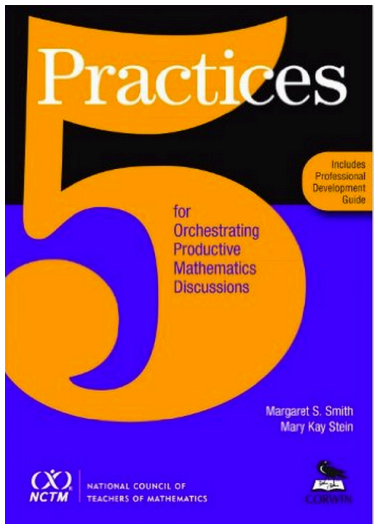
H.O.T.S.

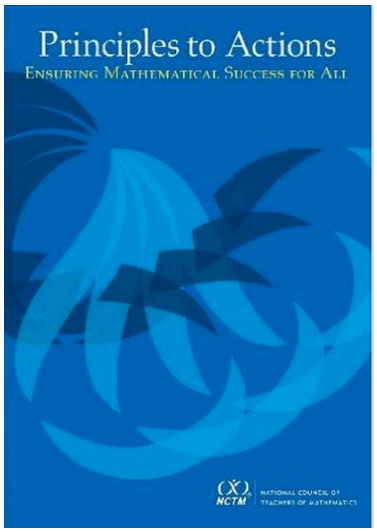
Dr. John Star

"Math does not teach Problem Solving."

"Only the explicit teaching of thinking teaches thinking."

Explicit Teaching of H.O.T.S.





Dr. Peg Smith

"It's all about the task.

It's all about the task.

It's all about the task."

Defining Problem Solving

Exercise

Problem

Don't Know How
Don't Have the Ability

Crisis

Being Task-Oriented

40%

60%

What is a Task?

"A *mathematical task* is a problem or set of problems that focuses students' attention on a particular mathematical idea and/or provides an opportunity to develop or use a particular mathematical habit of mind."

-- Adding it up (2001)

8 Practices

MPJ

Being Task-Oriented

What is a Task?

"a problem that provides an opportunity to develop mathematical ideas and [thinking]."

-- Adding it up (2001)

Tasks = Problems used to teach Content & Practices

Re-Orientation for H.O.T.S.

Notes-Oriented → **Task-Oriented**

40% ***Dual Targets*** **60%**

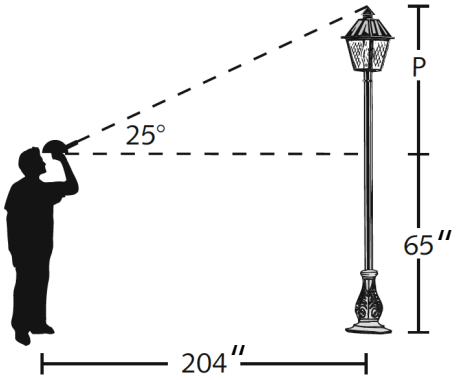
Content* and *Practice

 ***Daily!*** 

Explicit Instruction through Tasks in Geometry

"not quit"

Target: We will persevere in solving problems with trigonometry.



Use Ratios
Substitute
Plot Points
Use Formulas
Test Assumptions
Write an Equations
Guess-n-Check
Measure

Common Sense
Fight the Gravity Storm
Use Tools
Reverse the Steps
Draw
Use Properties
Teamwork
Wrestle the Bear

MPJ

Dual Targets for H.O.T.S.

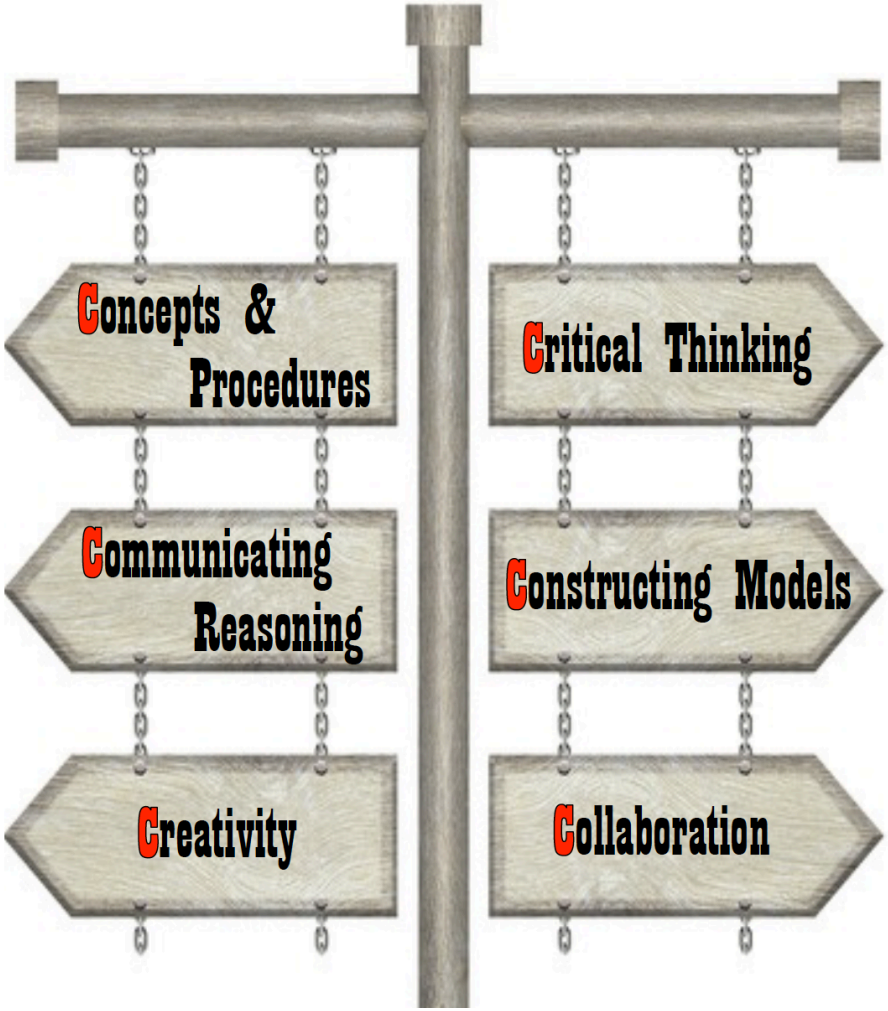
Content* and *Practice

 ***Daily!*** 

Write a Dual Target for the *Pig Pen Algebra* lesson.

The 6 C's of Claims-Based Grading

Chris Shore's one original thought.



#7 Structure
#8 Patterns

#2 Reasoning
#3 Conjectures

#1 Solving
#6 Precision

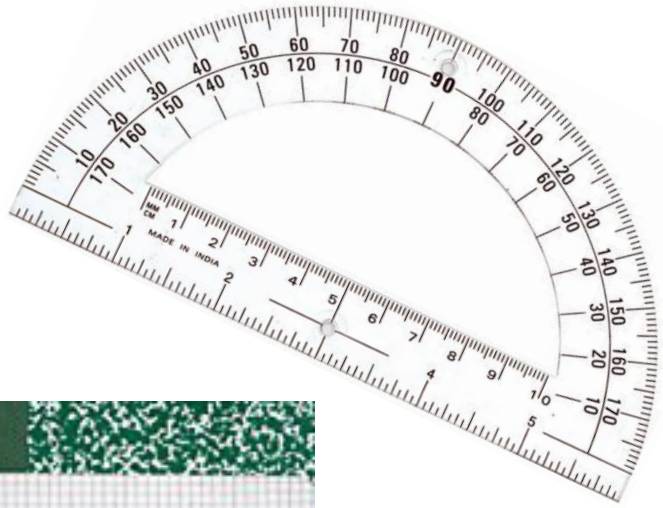
#4 Models
#5 Tools

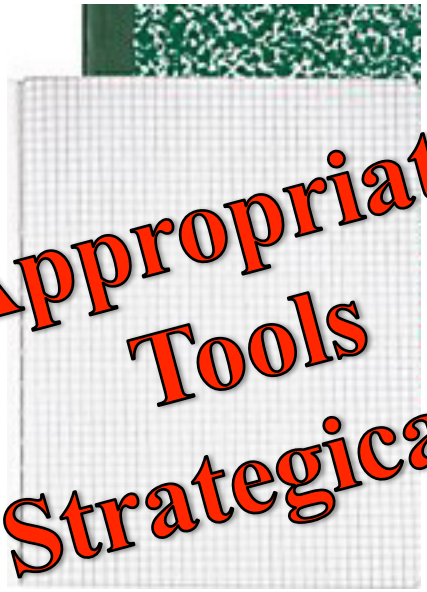
Self-Evaluated
w/ veto

MPJ

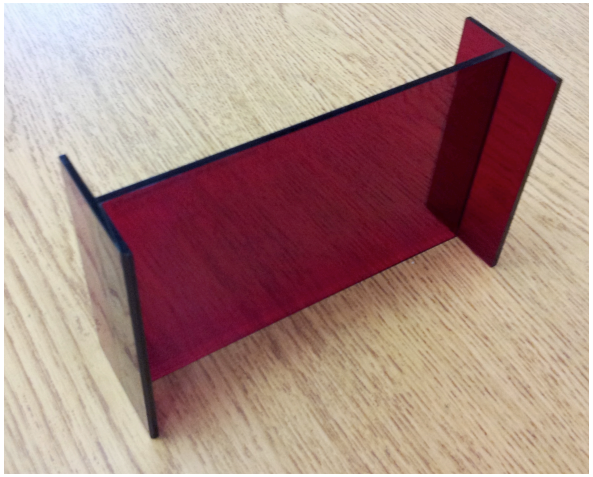
Creativity through Tasks

Creativity through Tasks

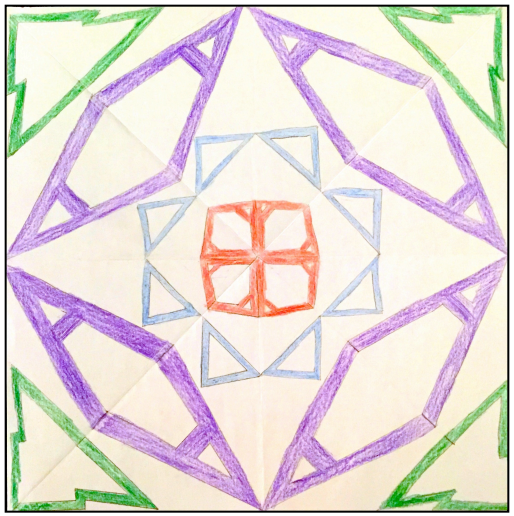


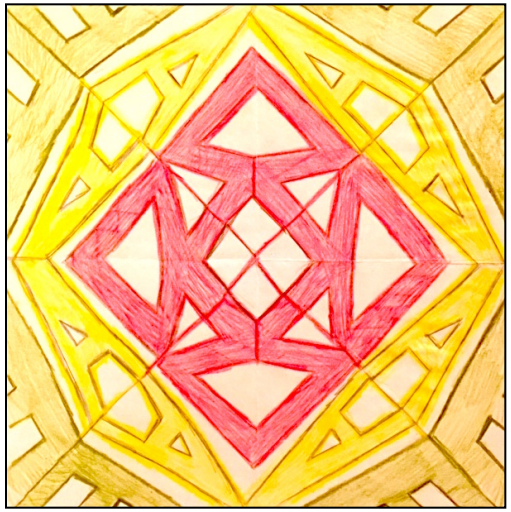


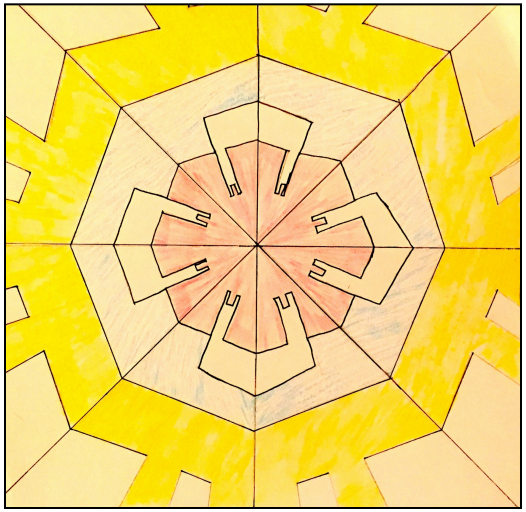
Appropriate Tools Strategically

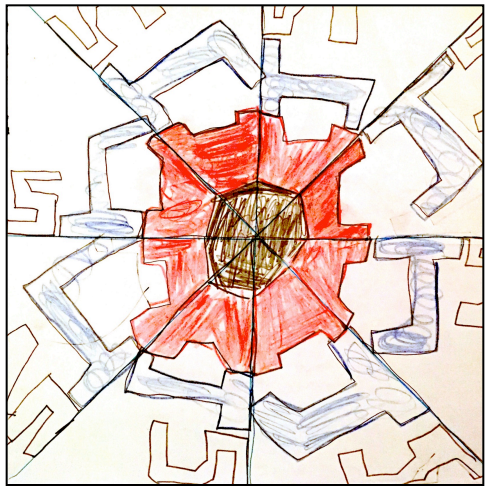


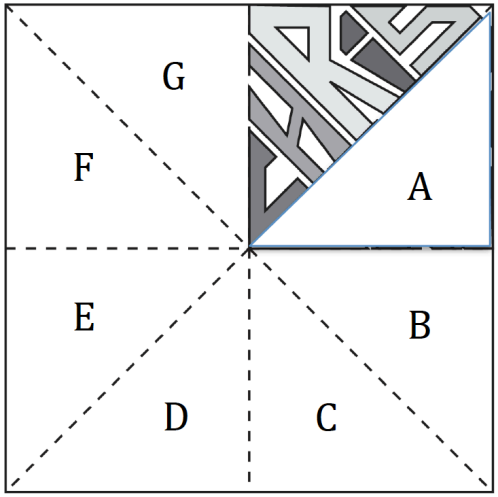
Creativity through Tasks











Transformations with Ms. Pac-Man

http://bit.ly/MsPacManMath

Use precise terms to describe various types of transformations.

By Robert Kaplinsky

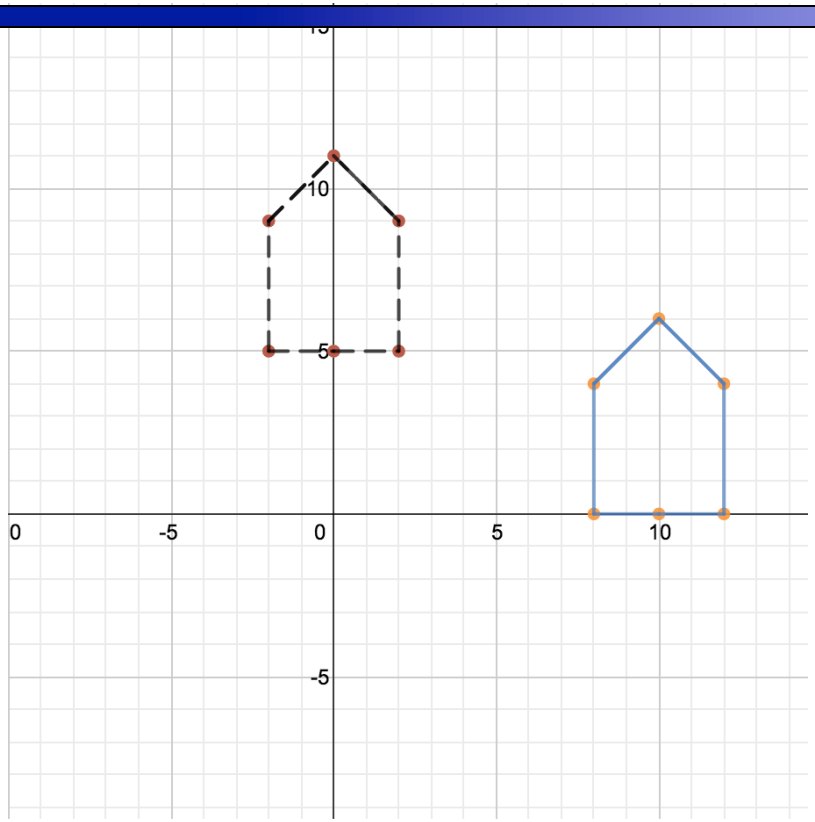
Bend with Rules

http://bit.ly/BendRules

Write rules of transformations to model their graphs.

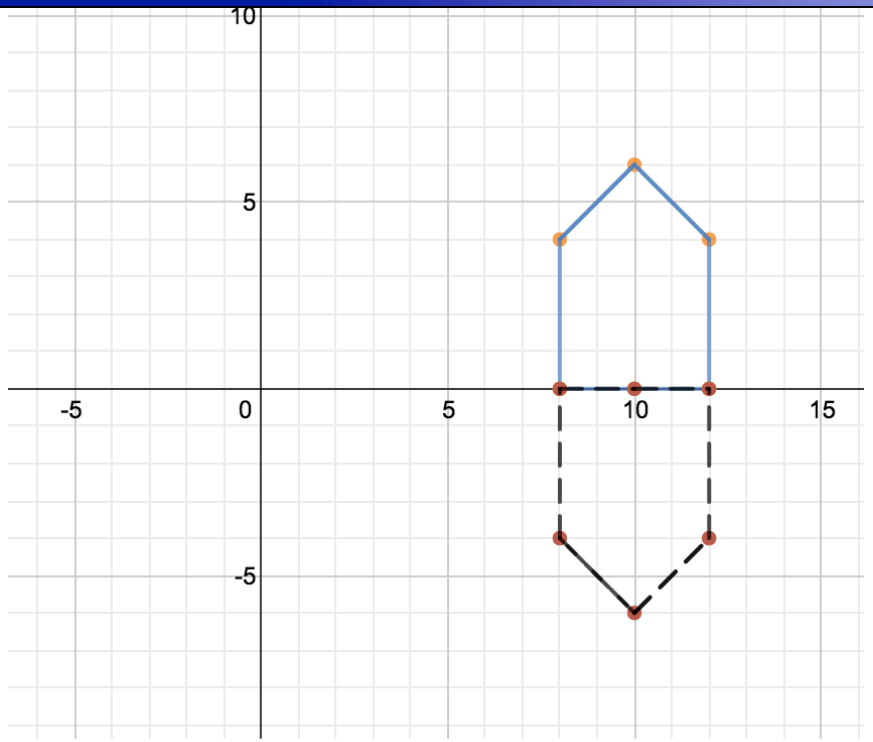
By Michael Pershan

Bend with Rules



$(x,y) \mapsto$

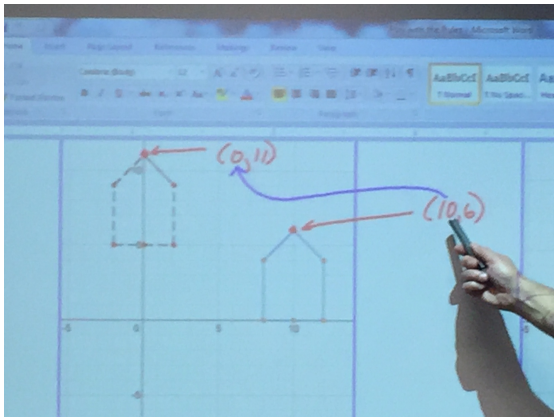
Bend with Rules



$(x,y) \mapsto$ _____

Back to Ms. Pac-Man

Use structure to write rules for our descriptions of transformations.



Your Take-Aways?

Why change to a 21st Century Math Education?

What is a 21st Century Math Education?

How do you teach for 21st Century Math Education?

My Take-Aways (hopefully)

Why?
A 21st Century Education is all about teaching students to *think & communicate,*

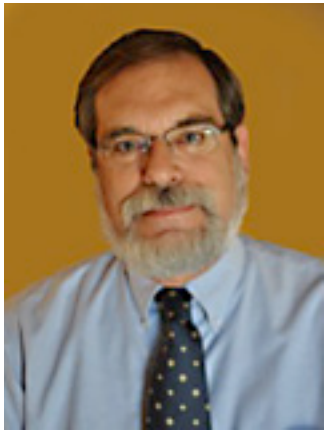
What?
defined by the *Math Practices,*

How?
through *explicit teaching* of the Standards of Content & the Standards of Practice by being *task-oriented.*

Call to Action

Fail Grandly

No Real Risk



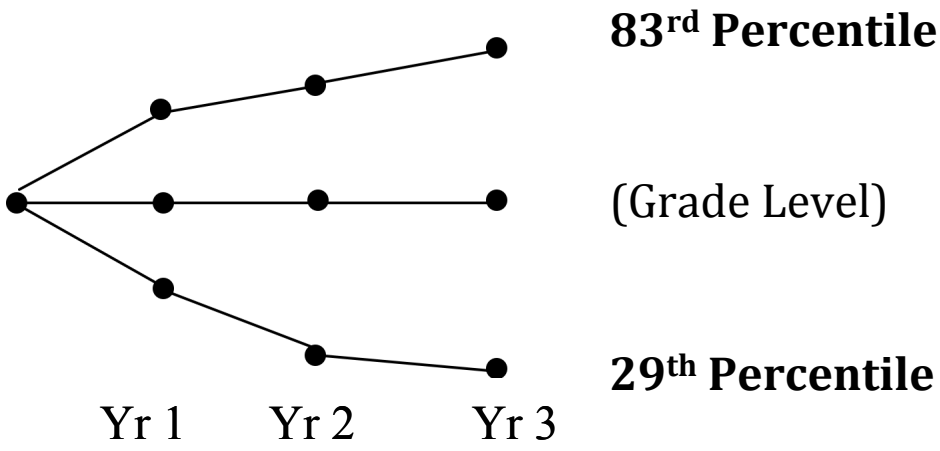
10%

2-Week Rule

Teacher Action is the Difference

"The greatest influence in the quality of the education that a student receives is the decisions that a teacher makes on a daily basis."

-- Dr. William Schmidt, University of Michigan



Teacher Action is the Difference

Teachers matter most.

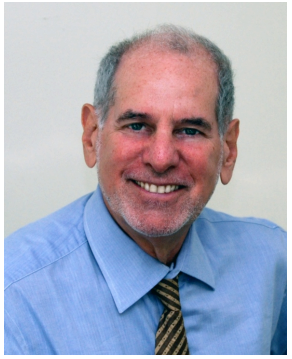
-- Dr. William Schmidt, University of Michigan

Teachers matter most.

-- Peg Smith, University of Pittsburgh

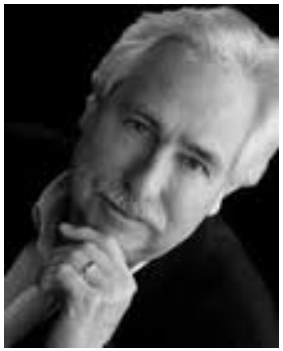
Teachers matter most.

-- Tim Kanold, Adlai E. Stevenson HS, Chicago



Poverty matters … a lot.

-- Dr. Uri Treismen, University of Texas, Austin

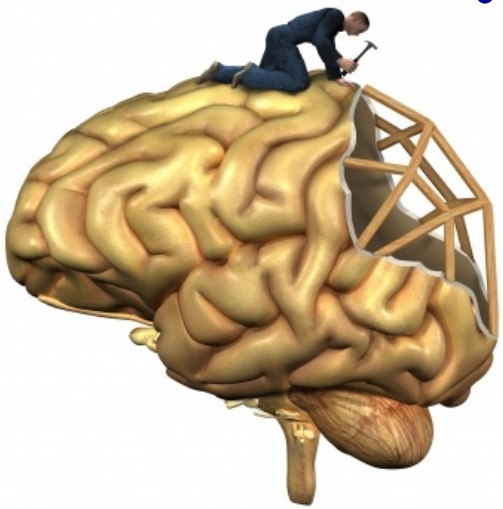


Teachers matter most.

-- David Foster, Silicon Valley Math Initiative, CA

MPJ

Teach students to *think & communicate* …



…with the faith that they can learn it,

and that we can teach it to them,

because what we do matters… the most.