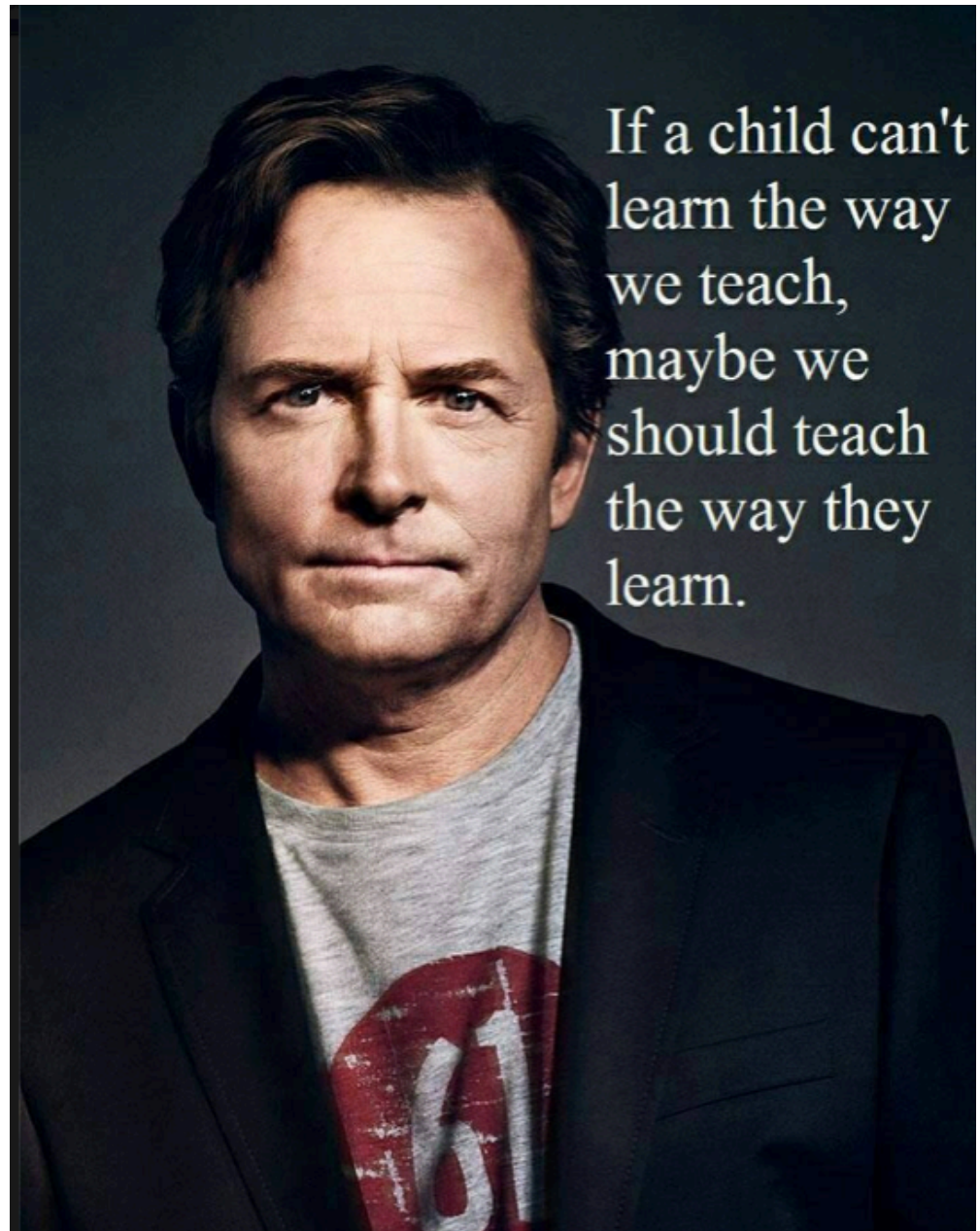


Welcome!

Contextualizing
Mathematics The
Importance of
Relevance In Learning

Improving Test Scores
Using Math in CTE

Brian Gordon, Executive Director, TREES



About Me

THE WALL STREET JOURNAL



Brian Gordon - 20 years in Education

14 years in Business and Industry



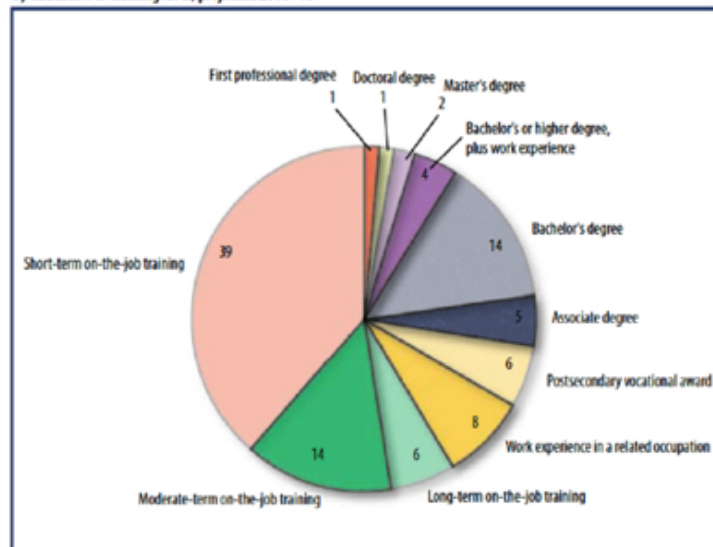
Getting to know you

How many teachers? What subjects?

Any guidance counselors?

Others?

Percent distribution of job openings due to growth and replacement needs by education or training level, projected 2006–18



Boom Goes The

Manufacturers may be among the biggest beneficiaries of the natural gas boom



Sources: ASSEMBLY, Associated Press, Bloomberg, Business Wire, *Daily Journal of Commerce*, Greater Phoenix Economic Council, KPAX, McClatchy-Tribune Regional News, *The News & Observer*, *The New York Times*, NPR, PR Newswire, Rolls-Royce, Volkswagen, *The Wall Street Journal* and *Wyoming Business Report*; and PricewaterhouseCoopers, *Shale Gas: A Renaissance in U.S. Manufacturing?*, December 2011.

STEM Jobs!

Energy

Utilities

Manufacturing
According to a

PricewaterhouseCoopers
study,

high rates of shale gas
recovery could result in a
million

new U.S. manufacturing jobs
by 2025.

But.....

From the National Association for Manufacturing web site

-

- **Close the Skills Gap! Take Action Now!**
- 82% of manufacturers report a moderate or serious shortage in skilled production workers.
- 75% of manufacturers say the skill shortage has negatively impacted their ability to expand.
- 600,000 jobs in manufacturing are unfilled today because employers can't find workers with the right skills.

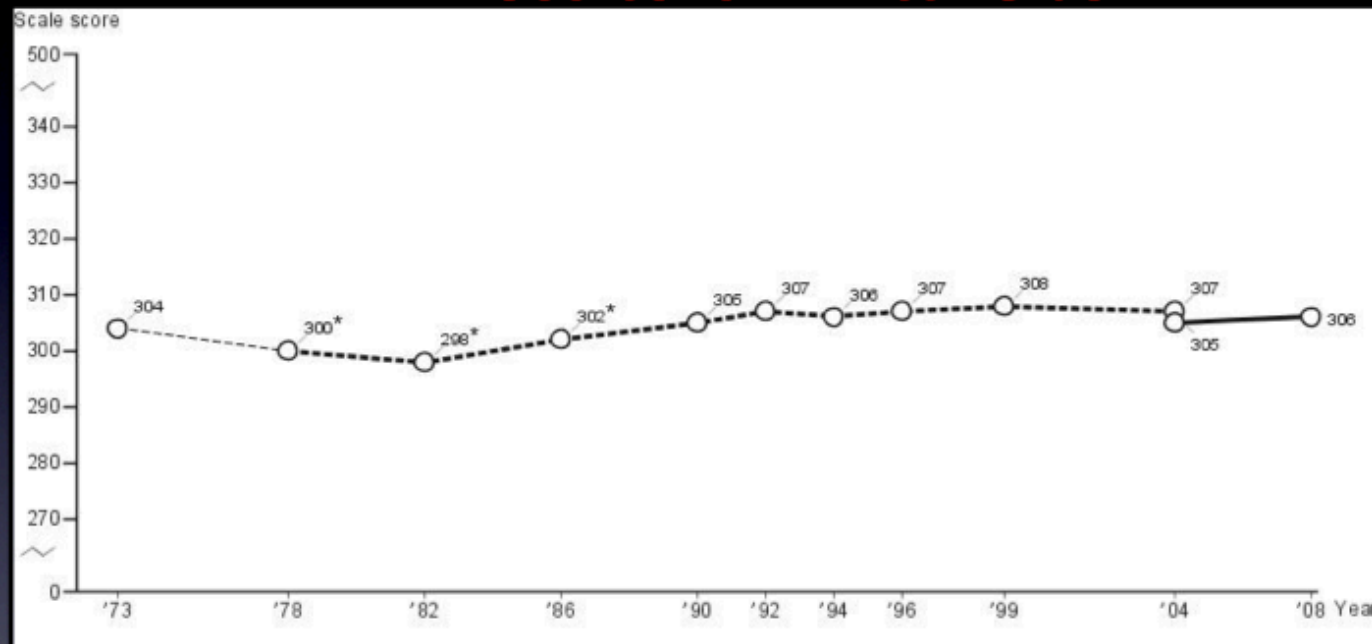
In an effort to address the “skills gap”
which has existed for some time,
most states have naturally mandated **more math**
courses be taken in high school.
Well intentioned, yes..... Has it worked out? Let's take a
look.



National Assessment of Educational Progress

Math needs relevance!

NAEP Scores for 17 Year Olds



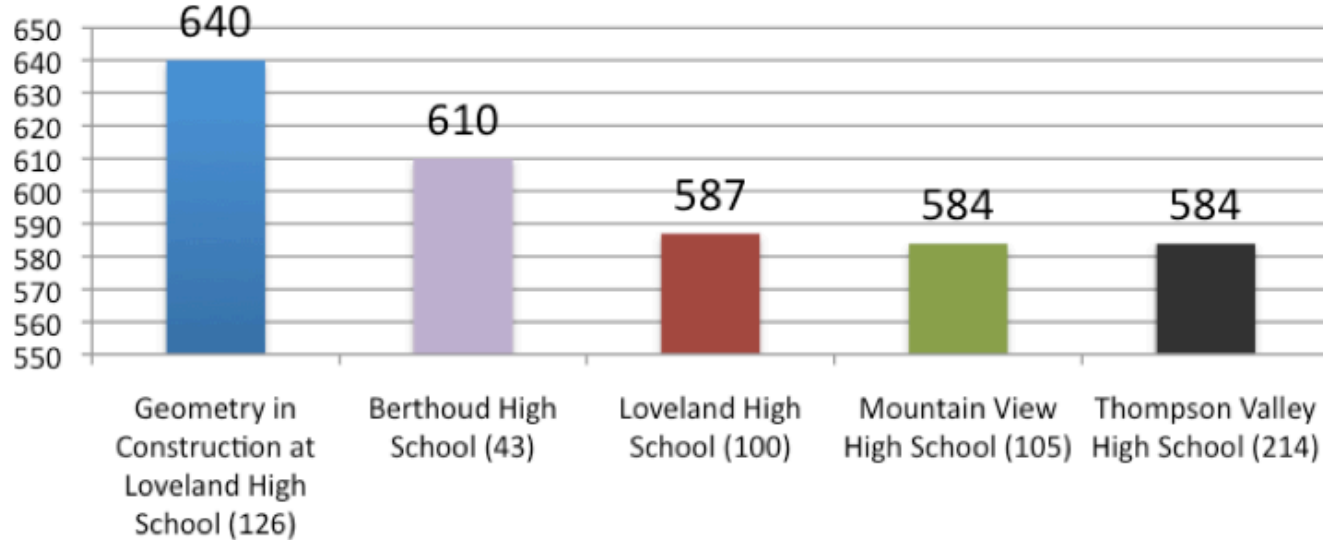
“Math should not be delivered as a stand alone subject. It’s like taking an automotive class and only learning about the tools.”

-Jack Gilbert, Engineer and CEO of GDJ Inc.

Loveland, CO results

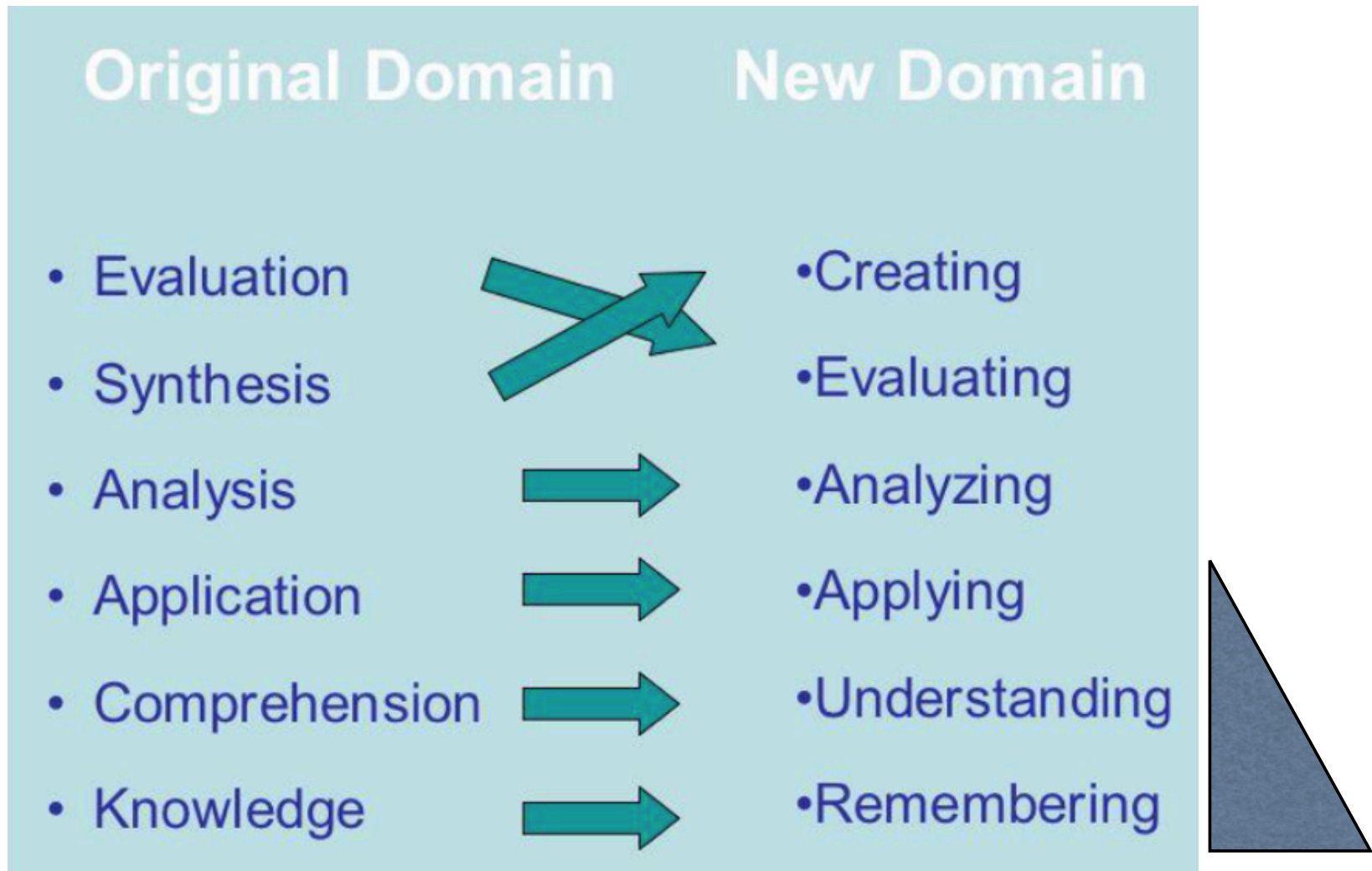
State Standardized Test Scores

**Average of Geometry CSAP Scores from
Spring 2010 (Excludes Honors and IB)
N = 588 Students**



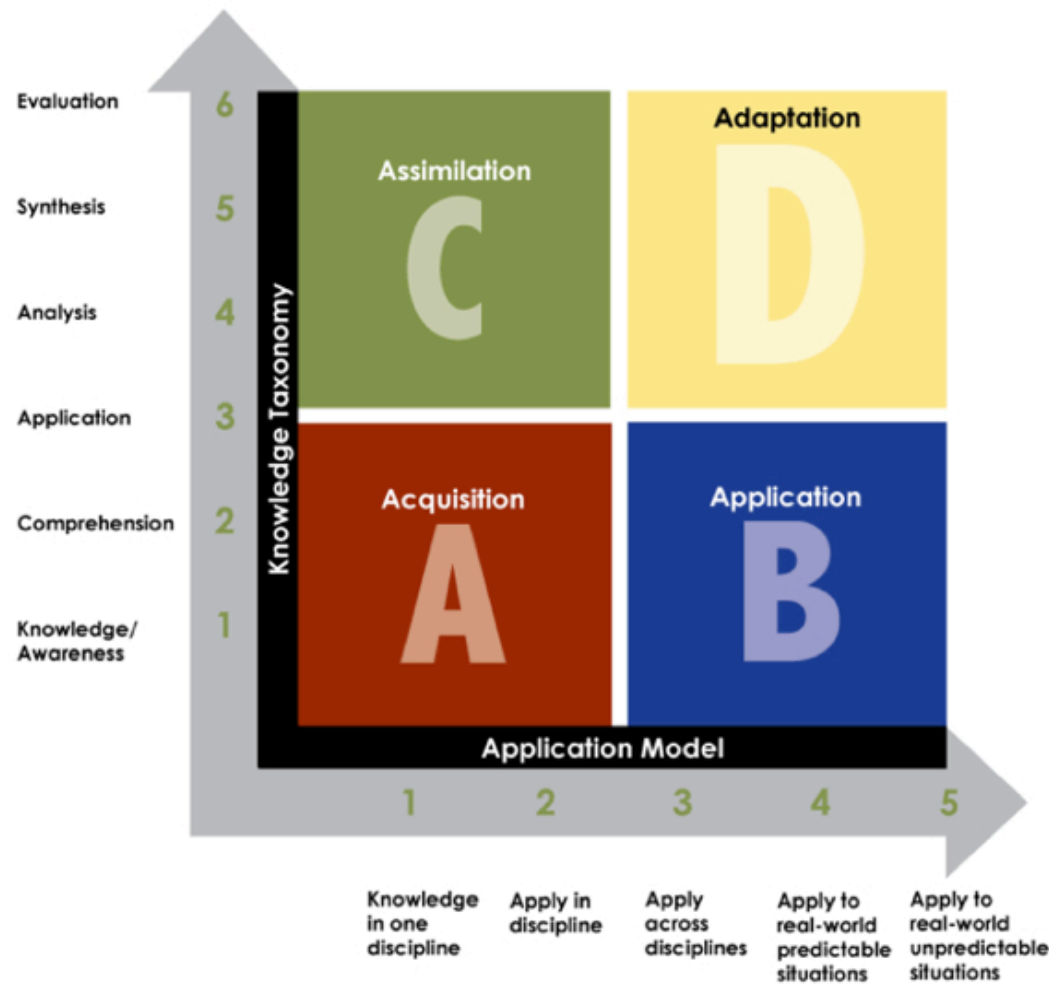
Quality, Brain Friendly, Instructional Delivery

Some Terms We Will Use and Concepts to keep in Mind



Where does our most important test fall on here?

Daggett's Quadrant D is “Creating” Rigor/Relevance Framework®



This begs the question:

**How do our Math
teachers do at creating high
level assessments?**

Apparently, they need some help.

Teacher-Developed Tests

Cognitive Level of Questions

	<i>R</i>	<i>U</i>	<i><u>Ap</u></i>	<i>An</i>	<i><u>Ev</u></i>	<i>Cr</i>
<i>Elem</i>	83%	0%	7%	10%	0%	0%
<i>JHS</i>	97%	0%	3%	3%	0%	0%
<i>HS</i>	88%	9%	0%	3%	0%	0%

SOURCE: Fleming and Chambers; 8,800 test items analyzed

New Domain

Cr •Creating

Ev •Evaluating

An •Analyzing

Ap •Applying

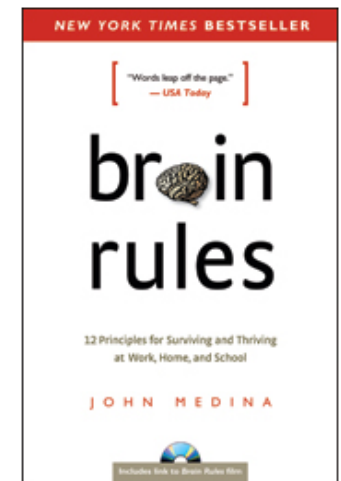
U •Understanding

R •Remembering

Finish this sentence

If you wanted to create an education environment that was directly opposed to what the brain was good at doing, you probably would design something like a

- John Medina



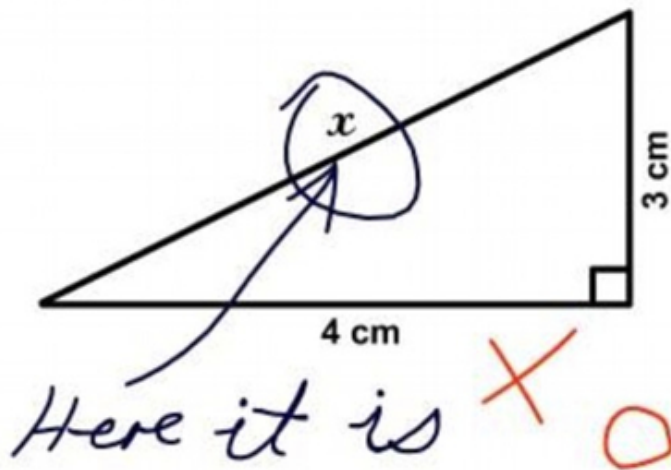
Common Sense and Brain
Research tell us

We learn through experiences!

CTE provides authentic

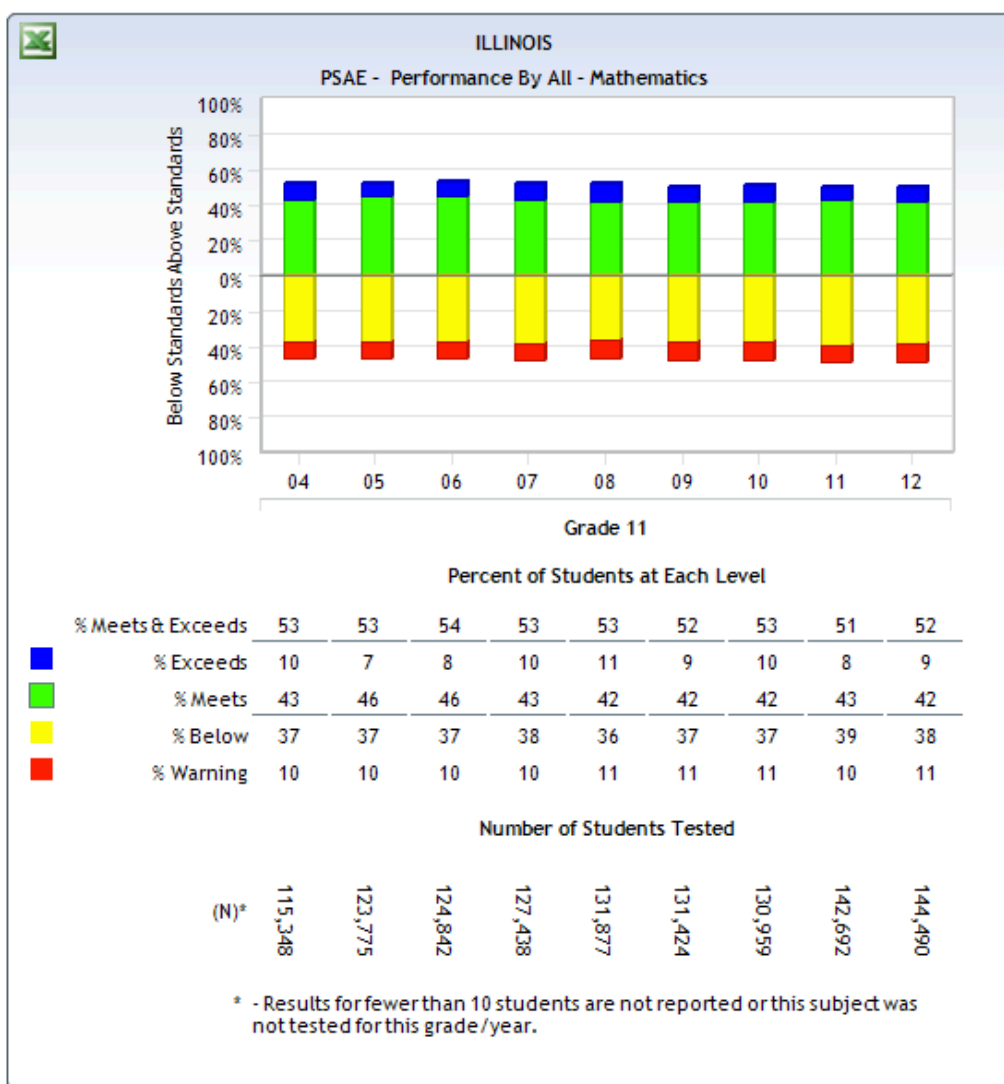
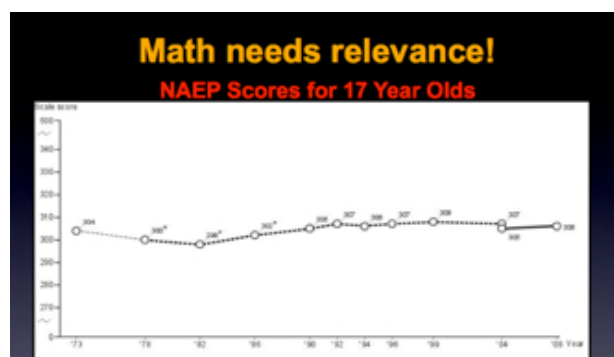
Which is more meaningful?

3. Find x .



Bringing it Back to

Illinois math scores
are as stagnant as
the NAEP



Business must Adapt or Die --

Is lecture based education in our schools in trouble?



WolframAlpha computational knowledge engine

apple vs microsoft

apple vs microsoft market cap

apple vs microsoft vs ibm

Input interpretation:

Apple (AAPL) | Microsoft (MSFT)

Latest trades:

AAPL	\$495.27 (AAPL NASDAQ 9 mins ago)
MSFT	\$31.24 (MSFT NASDAQ 8 mins ago)



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Aaron
Independent Learner
United Kingdom

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* If they are self motivated, **our best and brightest students no longer need us for content knowledge.**

The information is out there for them. The art of teaching is reaching those students that have difficulty in learning and applying knowledge.

- **Relationship and motivation** are by far the most important things we have to offer them.



Peoria, Illinois Example

Construction Work Based Learning - Tests administered 9/09 & 12/14

Students Reading Scores - 9.39 - 10.20 + .81

Computational Math - 9.01 - 9.14 + .13

Applied Math - 11.15 - 11.23 + .08

However, When you look at those students that came in
below 9th grade level in these math categories

Computational Math - +1.15 Applied Math - + 1.33

After 3 months in a Contextualized Environment

“All In” examples

- Back-to-back co-taught courses
- Geometry In Construction
- Geometry In CAD
- Algebra in Automotive

Loveland Revisited

- * Tom Moore (The MATH teacher) realized a need to change.
- * How much attention was paid to aligning curriculum to standards when they designed this course?

0 - That is Zero

- * They set out to provide quality instructional delivery.
 - * A Geometry In Construction concept “adopter”

Wawasee H.S. - Syracuse, IN



Exiting the Box

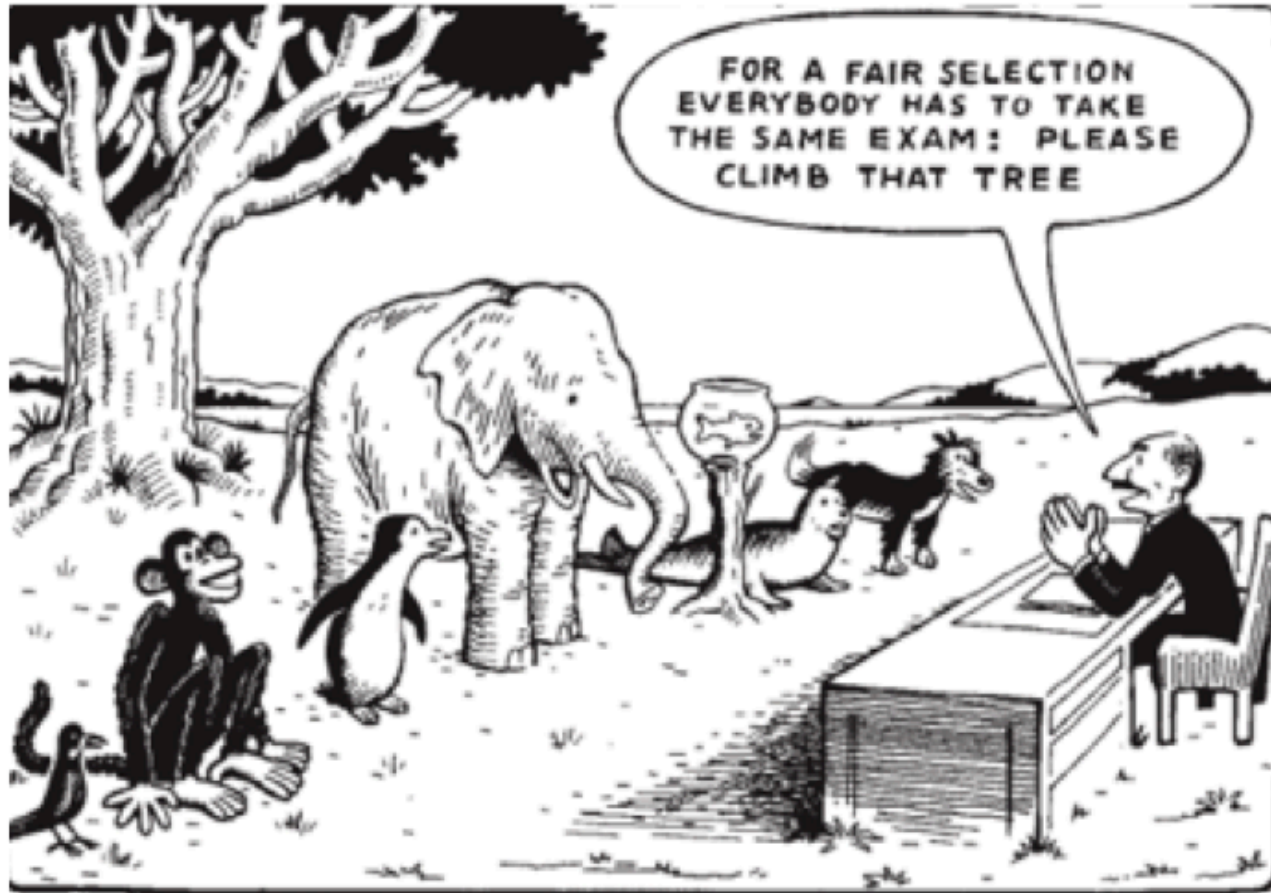
- During my visit to Syracuse, the teachers lamented they only offered one section of Geometry In Construction.
- Later in the morning, they shared with me that all of their Geometry courses gave common assessments. They shared that in spite of their students coming in with lower overall GPAs, the GIC students scored an

Why is it important for us to pay attention to these success stories?

Why do we insist on “doing it the way we always have” or mandate more of the same we know does not work?

We would suggest this has something to do with it.....

Measuring Success in American Schools



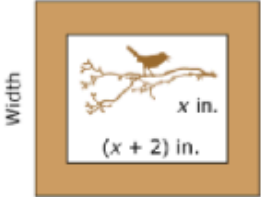
<https://assistivetechologytidbits.wikispaces.com/About+UDL>

Change is coming... PARCC - Partnership for Assessment of Readiness for
College and Careers

Designed to test in Quadrant D -
Although, Not Everyone Will Think It is Good News

A new PARCC sample

Sam uses one-inch frames for pictures for which the length is 2 inches (in.) longer than the width, as shown.



The area of the frame for a picture that is x inches wide is given by the expression:

$$(x + 4)(x + 2) - (x + 2)x$$

There are four descriptions shown. Drag the correct expression to the appropriate box below the corresponding description.

x	$(x + 2)$	$(x + 4)$	
$(x + 2)x$	$(x + 4)(x + 2)$		

the length of the picture alone, in inches	the length of the frame, in inches	the area of the picture alone, in square inches	the area of the picture and frame together, in square inches
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Click on a choice and drag it to a box.

PARCC Samples

- Your thoughts?

It's your turn to see how this works

Marketing and Profitability Activity: 9-12 A CED 3, K-12 MP.1, 3, 4 (among others)

The MIRN (Math I Really Need) Snack Mix Company assigns you to a team whose goal is to oversee the “launch” of the company’s newest snack product.

MIRN’s new snack product’s **proposed** batch ratios are:

- 1 part Pretzels
- 1 part Cheerios
- $\frac{1}{2}$ part Candy Corn
- 1 part Corn Chex cereal
- 1 part Rice Chex cereal
- $\frac{1}{2}$ part M&Ms



If we were to change the proposed batch ratio, any snack mixture we take to market must contain all of these ingredients. Each ingredient would have a minimum of .5 ounces in the 8 ounce bag while no ingredient could be more than 4 ounces.

1. Taste the product.
2. Brainstorm a name for the new product. _____

Packaging and Product Cost Data:

The product would be sold in 8-ounce packages.

Ingredient costs:

Pretzels	\$3.99/20 oz.
Cheerios	\$6.49/120 oz.
Candy Corn	\$2.99/20 oz.
Corn Chex Cereal	\$1.99/13 oz.
Rice Chex Cereal	\$1.99/13 oz.
M&Ms	\$8.49/42 oz.

3. Based on the proposed batch ratio, calculate each ingredient’s weight in an 8 ounce batch.

Pretzels	_____ oz.
Cheerios	_____ oz.
Candy Corn	_____ oz.
Corn Chex Cereal	_____ oz.
Rice Chex Cereal	_____ oz.
M&Ms	_____ oz.

Cost Considerations: Cost, Profit Margin, & Selling Price

4. What is the product cost of an 8-ounce package? _____
5. What would MIRN charge for an 8-ounce package if they wanted a 20% profit margin (based on product cost)? _____
6. What other costs (expenses) are factored into the selling price of this snack product for us to accurately determine our profit margin & or set our price?
7. What is the least expensive mixture we could produce if we were to alter the proposed batch ratio?
8. Food for thought - Would the formula we find in question 7 be the most profitable for us to bring to market? Why or why not?

This IS higher level math and could go to even more complex levels if we were to incorporate nutrition labels, profit margins, sales data, etc...

More importantly: It is Relevant and Engaging for students. This is “Quadrant D” learning. It is CAREER READY MATH.

Contextualized Examples

Teaching Math across the content area - Turning on the Light Bulb



- Integrated Lessons in CTE - 5 lessons per semester impacts standardized test scores - NRCCTE, University of Louisville

UNIVERSITY OF
LOUISVILLE



Linear, Quadratic, and Exponential Models

- Let's get excited!

Who in here is comfortable with this topic?

Time Value of Money

- This is a little easier for most of us to get excited about!
- Why? Most of us are interested in money. It is



This IS Linear, Quadratic, and Exponential modeling!

“Contextualized Math”



This Works In Ag, or a variety of business courses

➤ **Pathway:** Agribusiness

➤ **Lesson:** ABR B4-1: The Time Value of Money

➤ **Common Core State Standards for Mathematics:** 9-12.F-LE.1, 3

Domain: Linear, Quadratic, and Exponential Models F-LE

Cluster: Construct and compare linear, quadratic, and exponential models and solve problems.

Standard: 1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

Standard: 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly.

This language, however, is foreign to CTE
(and quite frankly the work force)

➤ **Student Objective:** Students will distinguish between linear and exponential relationships and use this information to make financial decisions.

BACKGROUND KNOWLEDGE for Teachers and Students

► Math Concepts:

Linear Function: A function whose graph is a straight line. As the x-values increase, the y-values change by a constant amount each time.

Ex: $y = 500 + 25x$

x	y
0	500
1	525
2	550
3	575
4	600

The y-values are increasing at a constant increment of 25.

Exponential Function: A function whose y-values change by the same factor as the x-values increase. The equation has the variable x as the exponent of a specified value.

Ex: $y = 100(1.5)^x$

x	y
0	100
1	150
2	225
3	337.50
4	506.25

The y-values are increasing by a constant factor of 1.5 (a 50% increase each time).

Graphs of Exponential Functions

Growth

Decay

➤ Agriculture Concepts:

When making financial decisions for a family farm or agribusiness, it is important to understand that the value of a dollar increases over time. The economy experiences inflation, money that is invested can earn simple or compound interest, salaries increase, and land values increase.

Guided Practice Exercises:

You have \$6,000 and want to invest it for a period of 10 years. You have two options for how to invest it.

☀ **Option A** is to invest in a bond that offers 4.75% simple interest. With a bond, the interest is paid to you at the end of each year, and the principal continues to earn interest for the remaining years.

☀ **Option B** is to invest in a certificate of deposit (CD) that offers 4.75% interest compounded annually. With a CD, the money remains in the account for the full 10-year term and can be withdrawn, including any interest earned, at the end of the term.

1. Complete each table to represent the total value of each investment over the 10-year period. Round values to the nearest cent if necessary.

A)

Year	Total Value
now	\$6,000
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

B)

Year	Total Value
now	\$6,000
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

2. Look at the values in the Total Value column of each chart (there should be a pattern to the values). What is the pattern for the total value of each option?

It can go to a much higher level...

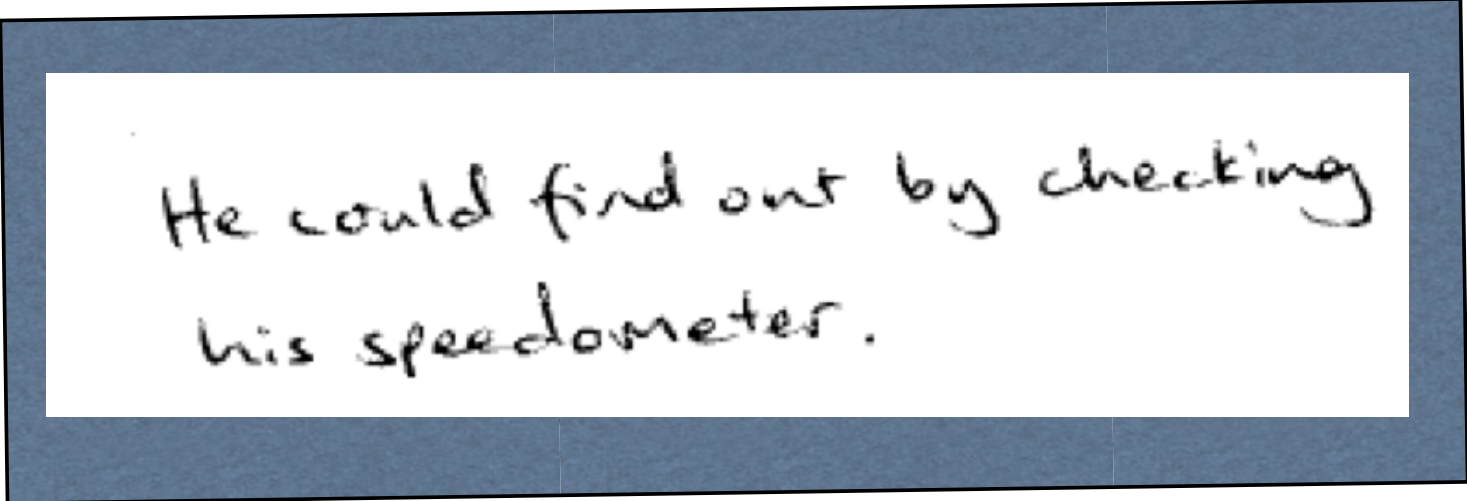
But does it really need to?

Our employers are seeing a skills “gap.”

Knowing this, why are we not identifying those skills and addressing the need?

What would industry do with this guy?

Steve is driving his car. He is travelling at 60 feet/second and the speed limit is 40 mph. Is Steve speeding?

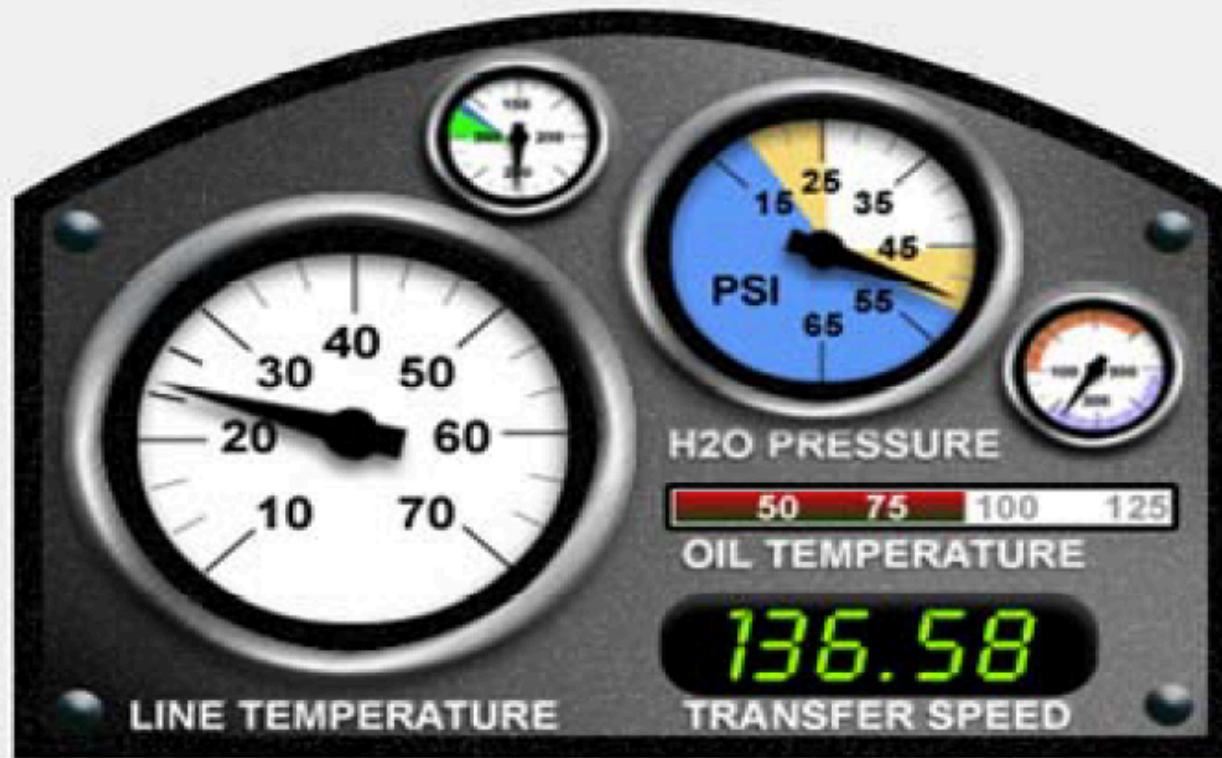


He could find out by checking his speedometer.

From the Book: F In Exams by Richard Benson

He might just be the guy they are looking for!

Operations Practice Test Question
from a Fortune 200 Company



Tolerance Check

Out of Range

- ☐ Line Temperature
- ☐ H₂O Pressure
- ☐ Oil Temperature
- ☐ Transfer Speed

[Next Group of Gauges >>](#)

Frames Completed: 0

Select the out of range
gauges.

Tolerance Limits:

Line Temperature: 25° to 35° H₂O Pressure: 20 PSI to 28 PSI
Oil Temperature: 75° to 100° Transfer Speed: 134.22 to 136.34

ELA CC.11-12.R.ST.7 (Reading in Science and Tech)

Compare the readings for each labeled gauge display. (Line Temperature, H₂O, Oil Temperature, Transfer Speed) to the tolerance limits provided.

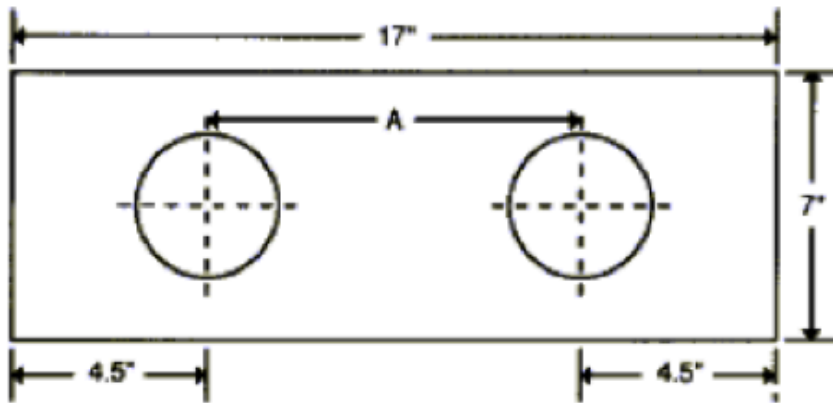
Where, if anywhere, do we find this in our schools?

Graphic Math - Operator Exam Prep

Source: Fortune 200 Company on-line exam prep

Use the drawing below to answer the two example questions. (Please note that the dimensions shown on the drawing are not necessarily drawn exactly to scale.) Mark your answers to the questions in the "Examples" box on your answer sheet.

CC 2.MD.5



b. What was the surface area of the side shown in the drawing before the holes were drilled?

- a) 24.0 square inches
- b) 79.0 square inches
- c) 84.0 square inches
- d) 109.0 square inches
- e) N

COMMON CORE MATHEMATICS

Integration Activity

- **Pathway:** Mechanical Systems and Technology
- **Lesson:** AMT A4–3: Measuring and Calculating Electricity
- **Common Core State Standards for Mathematics:** 9-12.A-CED.1, 9-12.A-CED.4
 - Domain:** Creating Equations A-CED
 - Cluster:** Create equations that describe numbers or relationships.
 - Standard:** 1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
 - Standard:** 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R .
- **Student Objective:** Students will be able to manipulate the Ohm's law formula and the power equation to solve for the desired quantity.

➤ Math Concepts:

Expression: A statement of value using numbers, variables, and operators. Ex: $(2x + 5)/y$.

Equation: A statement showing two expressions as equal using an equal sign.

Ex: To solve for x , you must isolate the variable x on one side by using basic operations.

In an equation, you must perform the same operation to both sides.

Ex: Solving for the variable x :

$$\begin{array}{rcl} 4y + 6 & = & 2x - 4 \\ + 4 & & + 4 \end{array}$$

➤ Agriculture Concepts:

Electricity is a staple of the agricultural industry, supplying the majority of fixed building power for animal and crop production. Electricity is the flow of electrons in a conductor. The electrons must have a path to and from their source, a circuit. Ohm's law describes the relationship between voltage, amperage, and resistance within a circuit. It states that Amps (I) = Volts (E) / Ohms (R). I designates the rate of electrical flow per second across a certain point. E designates electromotive force, voltage, which is the measure of electrical pressure. R , resistance, measured in ohms, quantifies a material's opposition to the flow of electricity. The power equation describes the relationship between watts, amperage, and voltage. It states that Watts (P) = Amps (I) \times Volts (E). P denotes wattage, or electrical power.

Spreadsheets in your Business Classrooms Can be Meaningful, Relevant, & FUN!



TITLE: 2013 Chicago Blackhawks win the Stanley Cup!

BACKGROUND: The Chicago Blackhawks, a professional ice hockey team based in Chicago, are the defending Stanley Cup Champions having won five Stanley Cup championships since their founding in 1926; winning two in just the last four years.

Below are some 2013 Chicago Blackhawks team statistics.

National Hockey League: Chicago Blackhawks															
2012-2013 Stanley Cup Winners															
Season Playoffs - 4 Rounds/23 games															
#	Pos	Player	GP	Goals	A	P	+/-	PIM	PP	SH	GW	S	S%		
88	R	Patrick Kane	23	9	10	19	7	8	0	0	2	88	10		
29	L	Bryan Bickell	23	9	8	17	11	14	1	0	2	49	18		
81	R	Marian Hossa	22	7	9	16	8	2	3	0	2	70	10		
10	L	Patrick Sharp	23	10	6	16	1	8	2	0	2	91	11		
19	C	Jonathan Toews	23	3	11	14	9	18	1	0	0	70	4.3		
2	D	Duncan Keith	22	2	11	13	10	18	0	0	0	51	3.9		
26	C	Michal Handzus	23	3	8	11	7	6	0	1	0	17	18		
67	R	Michael Frolik	23	3	7	10	1	6	0	1	1	46	6.5		
65	R	Andrew Shaw	23	5	4	9	2	35	1	0	2	36	14		
27	D	Johnny Oduya	23	3	5	8	12	16	0	0	1	30	10		
36	C	Dave Bolland	18	3	3	6	-2	24	0	0	1	29	10		
20	L	Brandon Saad	23	1	5	6	-1	4	0	0	0	50	2		
4	D	Niklas Hjalmarsson	23	0	5	5	10	4	0	0	0	12	0		
16	C	Marcus Kruger	23	3	2	5	-2	2	0	0	1	27	11		
32	D	Michal Rozsival	23	0	4	4	9	16	0	0	0	14	0		
7	D	Brent Seabrook	23	3	1	4	-1	4	0	0	2	39	7.7		
25	R	Viktor Stalberg	19	0	3	3	-1	6	0	0	0	27	0		



PROBLEM:

- 1) Circle the BEST type of chart you would use to depict the number of goals (bolded on the first page of the table) each member made, as compared to the total goals the team made overall, during the playoff season.

a. Bar	b. Bubble	c. Doughnut	d. Gantt
e. Histogram	f. Line	g. Map	h. Pie
- 2) Why is that type of chart the BEST choice to use to “tell your story?” (Use full sentences)

SOLUTION:

- 1) Pie Chart
- 2) While a bar chart could be used to show how many goals each player scored, the pie chart is the most appropriate as the individual players' goals could be added together to show one total value (100%). Also, since this table offers values in only one data series, a pie chart would be the most appropriate.

BLOOM'S COGNITIVE PROCESS: 5.2 (Judging/Critiquing under Evaluating)



Common Core Math, Reading, and CTE is embedded!

CC ALIGNMENT:



CC.9-12.S.ID.1	Summarize, represent, and interpret data on a single count or measurement variable. Represent data with plots on the real number line (dot plots, histograms, and box plots).
CC.9-12.N.Q.1	Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
CC.K-12.MP.4	Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

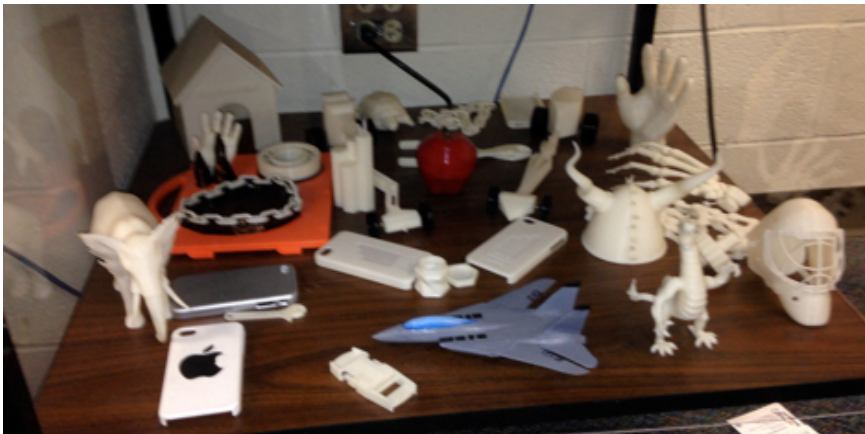
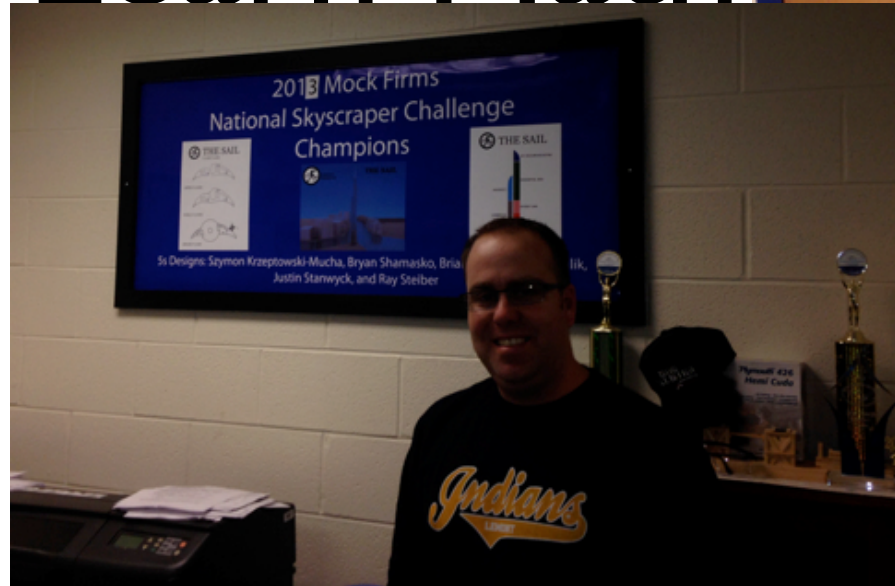


This could easily be adapted towards something other than NHL statistics. Students could choose from a menu of topics to track while learning Excel and reinforcing these standards.

CC.9-10.W.HST.2.a	Text Types and Purposes: Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
CC.9-10.R.ST.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NETS-S	Students use digital media and environments to 2B) Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
ESS01.02.06	Comprehend key elements of oral and written information such as cause/effect, comparisons/contrasts, conclusions, context, purpose, charts/tables/graphs, evaluation/critiques, mood, persuasive text, sequence, summaries, and technical subject matter.
ESS02.09.01	Create tables, charts, and figures to support written and oral communications.



You can Have Fun and Learn Math





See how to make this recipe! ▶

Not to
mention the
science behind
the cooking
process.

Sequential Thinking Ratios and Proportions Following Instructions

Ingredients [Edit and Save](#)

Original recipe makes 1 1/2 dozen [Change Servings](#)

- | | |
|--|---|
| <input type="checkbox"/> 2 cups all-purpose flour | <input type="checkbox"/> 1/2 cup white sugar |
| <input type="checkbox"/> 1/2 teaspoon baking soda | <input type="checkbox"/> 1 tablespoon vanilla extract |
| <input type="checkbox"/> 1/2 teaspoon salt | <input type="checkbox"/> 1 egg |
| <input type="checkbox"/> 3/4 cup unsalted butter, melted | <input type="checkbox"/> 1 egg yolk |
| <input type="checkbox"/> 1 cup packed brown sugar | <input type="checkbox"/> 2 cups semisweet chocolate chips |

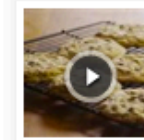
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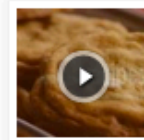
Directions

1. Preheat the oven to 325 degrees F (165 degrees C). Grease cookie sheets or line with parchment paper.
2. Sift together the flour, baking soda and salt; set aside.
3. In a medium bowl, cream together the melted butter, brown sugar and white sugar until well blended. Beat in the vanilla, egg, and egg yolk until light and creamy. Mix in the sifted ingredients until just blended. Stir in the chocolate chips by hand using a wooden spoon. Drop cookie dough 1/4 cup at a time onto the prepared cookie sheets. Cookies should be about 3 inches apart.
4. Bake for 15 to 17 minutes in the preheated oven, or until the edges are lightly toasted. Cool on baking sheets for a few minutes before transferring to wire racks to cool completely.

Watch video tips and tricks



Best Big, Fat, Chewy Chocolate Chip



Absolutely the Best Chocolate Chip Cookies

PREP
10 mins

COOK
15 mins

READY IN
40 mins

Any Math in Julian Beever's Work?



Q&A

Do your math students possess the mathematical skills
necessary to enter the work force?

Questions?

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