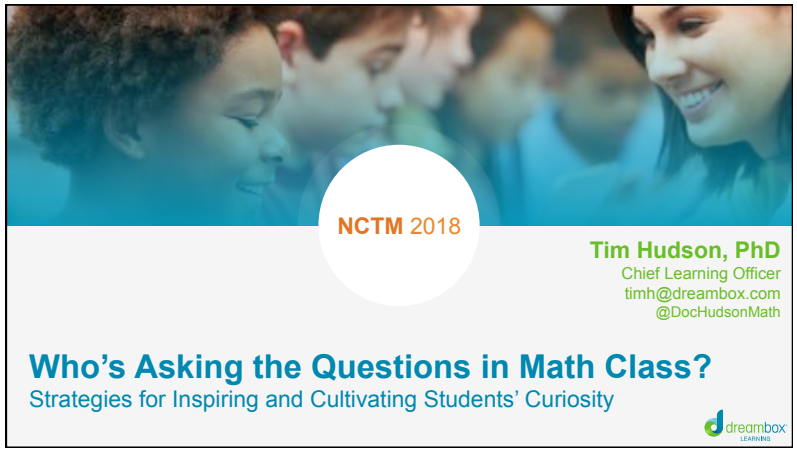
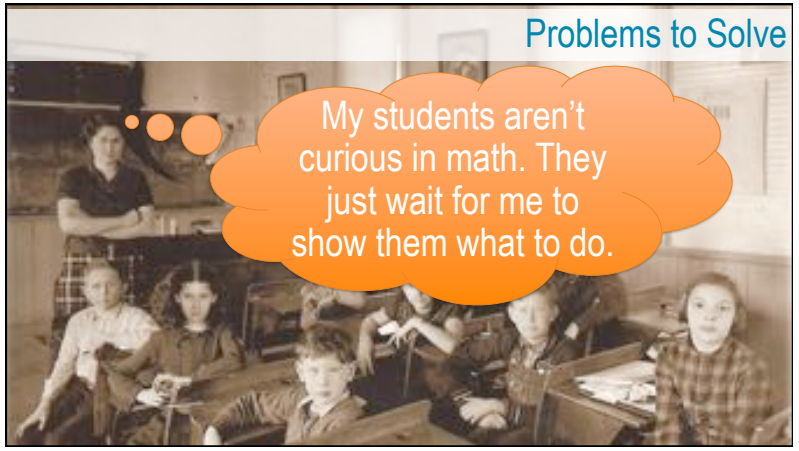


Mission

The Mission of the Parkway School District is to ensure all students are **capable, curious, and confident learners** who understand & respond to the challenges of an ever-changing world.

Questions from the Community

- Can curiosity be measured? If so, how?
- Can we really guarantee all students are curious learners?
- Can you make someone a curious learner? If so, how?
- Can you cause someone to be a non-curious learner? If so, how?
- Is there a difference between a curious *person* and a curious *learner*?
- Under what conditions is curiosity best cultivated?
- Others?



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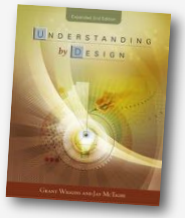
Plan "Backwards"

1. Identify desired results
2. Determine acceptable evidence
3. Plan learning experiences & instruction



Understanding by Design, Wiggins & McTighe, ©2005

Math Program Design

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Plan Backwards for Curiosity

1. What does a curious learner look like?
2. What is acceptable evidence of curiosity?
3. What classroom practices cultivate curious learners?

Understanding by Design, Wiggins & McTighe, ©2005

Math Program Design

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Defining Curiosity Outcomes

Curiosity	Lack of Curiosity

this study, a child is said to be curious when he (a) reacts positively to new, strange, incongruous, or mysterious elements in his environment, (b) exhibits a need to know more about himself and his environment, (c) scans his surroundings seeking new experiences, and (d) persists in examining and exploring stimuli in order to know more about them.

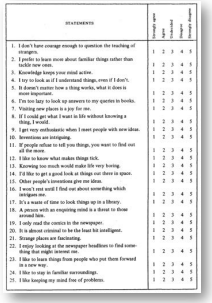
1. Developing a definition of curiosity.
2. Establishing criteria for validating tests of curiosity.
3. Developing and examining test items that logically seemed to measure curiosity.
4. Refining test items that the earlier substudy indicated had possible merit in the measurement of curiosity.
5. Casting into test batteries items which, in the earlier two substudies, had significantly separated groups of children with high curiosity from those with low curiosity.
6. Administering the final tests to a large group of children and analyzing the results.

An Attempt to Measure Curiosity in Elementary School Children
Author(s): Wallace H. Maw and Ethel W. Maw
Source: *American Educational Research Journal*, Vol. 3, No. 2 (Mar., 1966)
Published by: American Educational Research Association
Stable URL: http://www.jstor.org/stable/1161916

1966

THE MEASUREMENT OF A SCIENTIFIC ATTITUDE-CURIOSITY

R.B. Flegg and A.A. Hukins

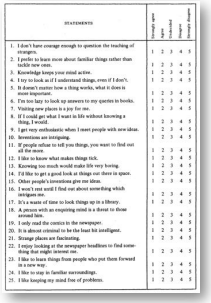


STATEMENTS	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1. I don't have courage enough to question the teaching of strangers.	1	2	3	4	5
2. I prefer to learn more about familiar things rather than tackle new ones.	1	2	3	4	5
3. Knowledge keeps your mind active.	1	2	3	4	5
4. I try to look as if I understand things, even if I don't.	1	2	3	4	5
5. It doesn't matter how a thing works, what it does is more important.	1	2	3	4	5
6. I'm too lazy to look up answers to my queries in books.	1	2	3	4	5
7. Visiting new places is a joy for me.	1	2	3	4	5
8. If I could get what I want in life without knowing a thing, I would.	1	2	3	4	5
9. I get very enthusiastic when I meet people with new ideas.	1	2	3	4	5
10. Inventions are intriguing.	1	2	3	4	5

1973

THE MEASUREMENT OF A SCIENTIFIC ATTITUDE-CURIOSITY

R.B. Flegg and A.A. Hukins



11. If people refuse to tell you things, you want to find out all the more.	1	2	3	4	5
12. I like to know what makes things tick.	1	2	3	4	5
13. Knowing too much would make life very boring.	1	2	3	4	5
14. I'd like to get a good look at things out there in space.	1	2	3	4	5
15. Other people's inventions give me ideas.	1	2	3	4	5
16. I won't rest until I find out about something which intrigues me.	1	2	3	4	5
17. It's a waste of time to look things up in a library.	1	2	3	4	5
18. A person with an enquiring mind is a threat to those around him.	1	2	3	4	5
19. I only read the comics in the newspaper.	1	2	3	4	5
20. It is almost criminal to be the least bit intelligent.	1	2	3	4	5
21. Strange places are fascinating.	1	2	3	4	5
22. I enjoy looking at the newspaper headlines to find something that might interest me.	1	2	3	4	5
23. I like to learn things from people who put them forward in a new way.	1	2	3	4	5
24. I like to stay in familiar surroundings.	1	2	3	4	5
25. I like keeping my mind free of problems.	1	2	3	4	5

1973

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Learning Outcomes: A-M-T

Acquire Knowledge and Skills	Make Meaning	Transfer
Information	Concepts	Independent Use
Facts	Ideas	Unfamiliar Situations
Procedures	Contexts	
	Situations	

Do you want students to be able to…

Acquisition	Meaning & Transfer
compute mean, median, and mode?	justify which measure is best for the situation?
know 8 + 7?	compute 3,998+4,247 mentally?
know their 12 x 12 "facts?"	compute 13 x 12 mentally?

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Do you want students to be able to…

Acquisition	Meaning & Transfer
compute mean, median, and mode?	know which measure is best for the situation?
know their "12 x 12 "facts?"	not grab a pencil or calculator to solve 13 x 12?

Do our students know we want all of these outcomes?

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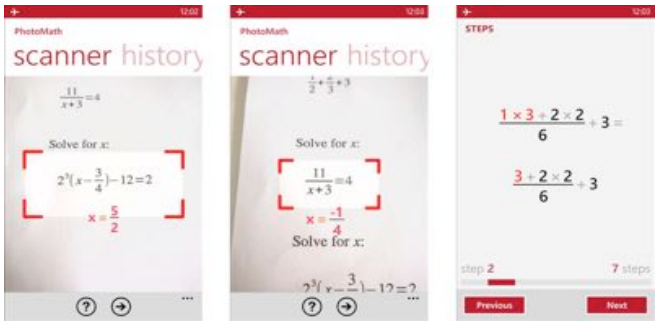
If they're excited by PhotoMath…



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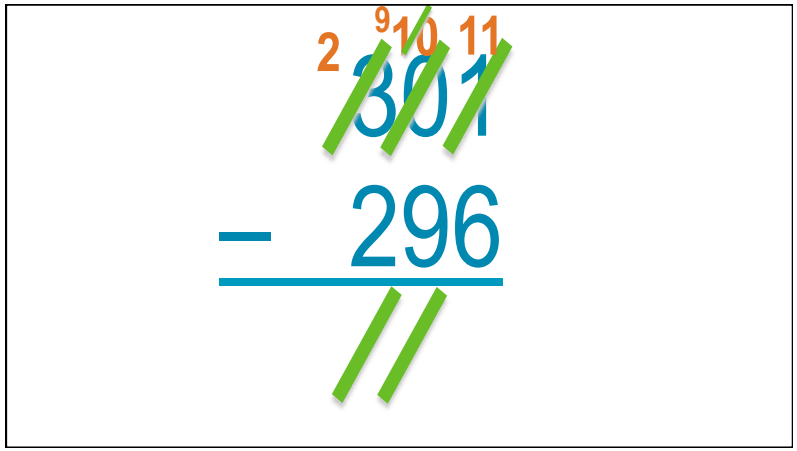

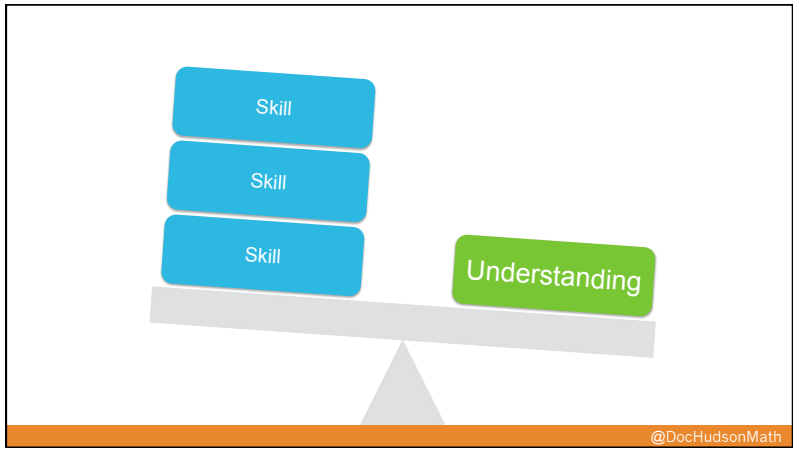

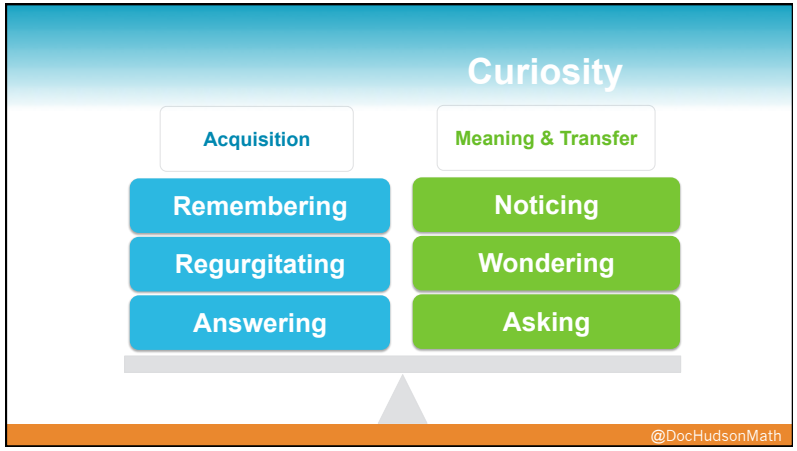

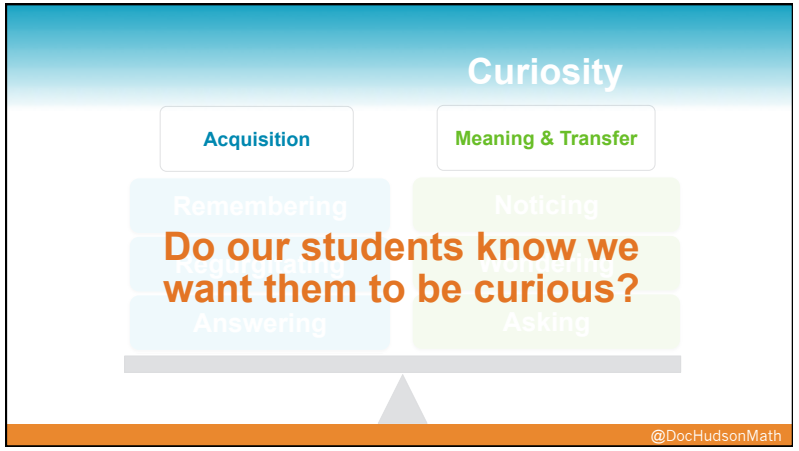

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If it's an outcome we want, we **MUST** assess it and report progress to students and parents

Otherwise, we can't know if students achieved it.
And why even bother to pretend we teach it?

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Math Program Design

Define Goals & Clarify Outcomes

Design Reports with Meaningful Feedback

Develop Assessments & Grading System

Ensure Print & Digital Resource Alignment

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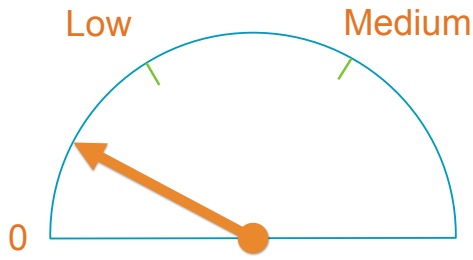

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1. If it matters at all, it is detectable or observable
2. If it is detectable, it can be detected as an amount (or a range of possible amounts)
3. If it can be detected as a range of possible amounts, it is measurable

How to Measure Anything, D.W. Hubbard

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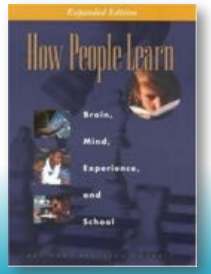
1. Learning: From Speculation to Science
2. **How Experts Differ from Novices**
3. Learning and Transfer
4. How Children Learn
5. Mind and Brain



For any outcome you want for your students, you can build a Novice-Expert rubric for it

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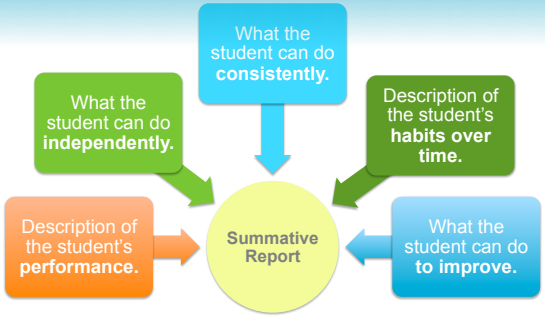
What Term-Long Rubrics Communicate



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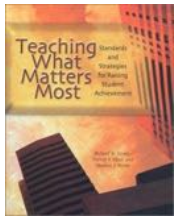
A Rubric for Thought

	Expert	Practitioner	Apprentice	Novice
Inquiry				
Knowledge Acquisition				
Problem Solving				
Communication				
Reflection				



Teaching What Matters Most by Strong, Silver, and Perini, © 2001, p. 58

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Inquiry Rubric

Expert	Practitioner	Developing	Novice
Can formulate questions and seek answers independently; generates, tests, and refines hypotheses according to well-formulated criteria; uses evidence powerfully and persuasively; foresees and responds to counterarguments.	Looks for and uses questions to guide investigation; uses criteria to generate hypotheses; uses evidence effectively, but may fail to fully address counterarguments	Can use pre-drafted questions to direct investigation but needs help formulating her own; may have trouble telling quality hypotheses apart from guesses; substantiates some claims; pays little attention to counterarguments	Fails to look for questions to guide investigation; generates hypotheses haphazardly; fails to use evidence to substantiate claims

Teaching What Matters Most by Strong, Silver, and Perini, © 2001, p. 58

Problem Solving Rubric

Expert	Practitioner	Developing	Novice
Is constantly looking for and posing relevant questions. Experiments with a variety of solutions and perspectives	Understands there is more than one way to attack a problem Surveys own understanding to determine progress toward solution	Accepts problems on their own terms (e.g., rarely restates them to make them more meaningful); Often generates only one or two obvious solutions	Avoids difficult problems & rarely questions ideas Looks for convenient solutions

Teaching What Matters Most by Strong, Silver, and Perini, © 2001, p. 58

Transfer: Measures of Central Tendency

Expert	Proficient	Developing	Novice
Apply new and unfamiliar statistical measures (or invent new ones) to make predictions and draw conclusions.	**Justify the most appropriate statistical measures** of center to make predictions and draw conclusions.	**Apply** mean, median, mode, and range to solve problems and make predictions. **(MO State Standard)**	**Compute** mean, median, mode, and range given a data set.

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Standard	Expert	Proficient	Developing	Novice
1. Represent Relationships (Creating Mathematical Models)	Translate quickly and fluently between contexts, tables, graphs, and equations. Select the best representation of a problem in context based on audience and purpose.	1.1 Meaningfully and mathematically represent a contextual situation in multiple ways. Represent a problem in context with a data table, graph, and equation (linear, quadratic, and exponential).	Translate an equation into a graph.	Translate data in a table into a graph. Translate an equation or a graph into a data table.
	Compare all real numbers and place them on a number line.	1.2 Represent, compare, and order rational and irrational numbers, including approximate locations on a number line. **N1A***	Place numbers on a number line and write inequalities if they are all in the same format (i.e., decimals, fractions), if they have the same denominator or the same number of decimal places.	Place numbers on a number line and write inequalities if the numbers are all in the same format (either whole numbers, decimals to two places, or simple fractions).
2. Identify Relationships (Classifying Mathematical Models)	Given tables, graphs, or equations of unfamiliar non-linear functions, determine and define properties of those functions.	2.1 Given a table, graph, or equation, classify a function as linear, quadratic, or exponential and justify your answer.	Given a table, graph, or equation, classify a function as linear or non-linear and justify your answer. **A1D**	Given a table or graph, classify a relationship as a function or non-function and justify your answer.
	Determine several models (including unfamiliar, non-linear functions) that might represent a given situation. Of those options, justify the model that best represents the situation.	2.2 Determine the type(s) of functions (linear, quadratic, or exponential) that might model a given situation. Of those options, justify the type of function that best models the situation. **A3A**	Explain the similarities and differences of tables, graphs, or equations of linear, quadratic, and exponential relationships. **A1C**	Explain the similarities and differences in the tables or graphs of linear and non-linear functions.
3. Analyze Relationships (Making Predictions with Mathematical Models)	Justify the relevant domain and range of any relationship from context.	3.1 Justify the relevant domain and range of a linear, quadratic, or exponential relationship from context.	Determine the domain and range of a relationship from an equation or graph.	Determine the domain and range of relationships given a table.
	Generate an equation that might model a given situation that appears to be linear and use it to make predictions about future data.	3.2 Consider multiple equations that might model a situation. Select and justify the best model for predicting the relationship.	Make and justify predictions about a relationship when given a table.	Make and justify predictions about a relationship when given a graph, including scatter plots. **D3A**
	Apply new and unfamiliar statistical measures to make predictions and draw conclusions.	3.3 Justify the most appropriate statistical measures of center to make predictions and draw conclusions.	Apply mean, median, mode, and range to solve problems and make predictions. **D2A**	Find the mean, median, mode, and range of a set of numbers.

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Transfer: Curious Learners (Questioning)

Expert	Proficient	Developing	Novice
I continually ask insightful questions both inside and outside of class that extend the conversation and learning into new areas.	I ask questions before, during, and after class that are relevant to the current conversation and lesson. I'm not complacent with just simple answers.	I ask unrelated questions or just ask for facts. I ask questions only when prompted, and only think about problems someone else tells me about.	I ask few, if any, questions either before or after being presented with information.

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Transfer: Curious Learners (Skepticism)

Expert	Proficient	Developing	Novice
When presented with questions, I question the underlying assumptions and perspective of the questioner to find deeper meaning.	When I am presented with a problem or new information, I ask questions to determine its meaning and begin reasoning to assess validity and credibility.	I often trust what I hear or read, but if something sounds really weird, I ask questions to learn more.	I immediately accept what is presented. I want an easy answer or method, so I can mindlessly use it forever.

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Transfer: Curious Learners (Mindset)

Expert	Proficient	Developing	Novice
I'd rather try something on my own first, because even through failure I'll learn something that I couldn't understand and learn any other way.	When I'm presented with a challenge, I usually keep at it until I solve it. I don't care if I'm wrong, fail, or make a mistake. These experiences only improve my understanding.	If I'm not successful after one or two tries, I stop trying. I might try again if someone else encourages me.	If I'm not familiar with something, I don't try. I avoid mistakes or doing things wrong.

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Curiosity Progress Report

	6-week	12-week	Semester
Algebra 1	Novice	Novice	Novice
Modern American History	Novice	Expert	Novice
Biology	Expert	Proficient	Novice
Orchestra	Proficient	Proficient	Proficient
Physical Education	Novice	Novice	Proficient
Honors English 1	Proficient	Proficient	Expert
Introduction to Business	Expert	Expert	Expert

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Change the assessment and reporting system and you change the conversation with students, teachers, and parents.

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Math Program Design

- Define Goals & Clarify Outcomes
- Design Reports with Meaningful Feedback
- Develop Assessments & Grading System
- Ensure Print & Digital Resource Alignment

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Assessing Questions

East High School has been recording the number of 12th graders who drop out of school before earning a diploma. The principal of East High School has asked you to help her reduce the number of students who drop out of school. She gives you this data table:

Dropping Out at East High School in 12th Grade from 2001-2011

School Year	2001-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11
Number of Seniors who Dropped Out	21	24	25	48	24	27	25	28	32	30

1. Write two questions you would ask the principal at East High School about these dropout data.

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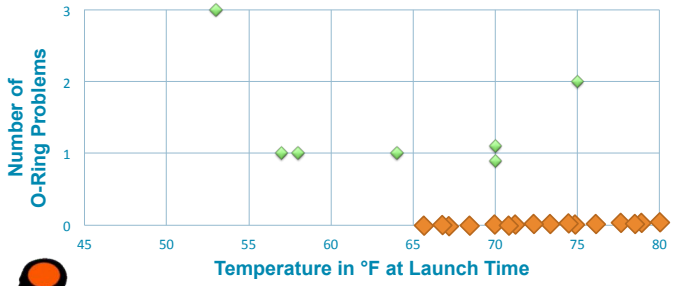
Questioning Data



Performance Tasks and Rubrics: High School Mathematics, Danielson & Vasquez, Eye on Education, ©1998

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Math Program Design

Define Goals & Clarify Outcomes → Design Reports with Meaningful Feedback → Develop Assessments & Grading System → Ensure Print & Digital Resource Alignment

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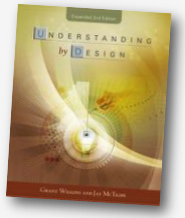
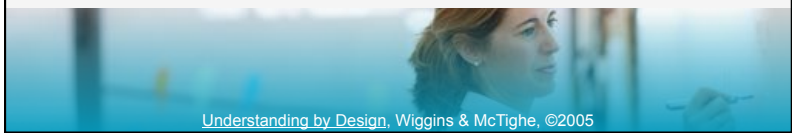
Plan "Backwards" for **Greatness**

1. Identify desired results
2. Determine acceptable evidence
3. Plan learning experiences & instruction





Understanding by Design, Wiggins & McTighe, ©2005

in·struc·tion [in-struhk-shuh n]

noun

1. the act or practice of instructing or teaching; education.
2. knowledge or information imparted.
3. an item of such knowledge or information.
4. Usually, **instructions**. orders or directions: *The instructions are on the back of the box.*
5. the act of furnishing with authoritative directions.
6. *Computers.* a command given to a computer to carry out a particular operation.

dictionary.com

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"It is little short of a miracle that modern methods of instruction have not completely strangled the holy curiosity of inquiry."

– Albert Einstein

Judy Willis M.D., M.Ed.
Radical Teaching

Want Children to "Pay Attention"? Make Their Brains Curious!

Force feeding won't work even on a hungry brain.

Posted May 09, 2010

"Getting into the brain is like getting into an exclusive nightclub where only the glamorous few are selected. Once inside, another gatekeeper, stress, determines what makes the cut to enter the upper VIP lounge in the prefrontal cortex - that valuable 13% of cerebral architecture where our highest cognition and emotional reflection takes place."

www.psychologytoday.com

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Want Children to "Pay Attention"? Make Their Brains Curious!

Force feeding won't work even on a hungry brain.

Posted May 09, 2010

"The system that determines what gets in – what the brain attends to – is the Reticular Activating System (RAS). When not under high stress alert, the RAS is particularly receptive to novelty and change that arouse curiosity. That is the key to the gate - the brain seeks input about the new, the unexpected, the colorful, musical, moving, aromatic sensations that are available when perceived or imagined threat is not blocking the way."

www.psychologytoday.com

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Force feeding won't work even on a hungry brain.

Posted May 09, 2010

"The brain actually learns based on a system of predictions and feedback as neuroplasticity strengthens neural networks used to make correct predictions and corrects memory networks used to make incorrect predictions. (This is why feedback is important so those faulty circuits can be replaced with accurate information.)"

www.psychologytoday.com

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Posted May 09, 2010

Have children make PREDICTIONS.

- written down
- shared with a partner
- held up on individual white boards at any point
- don't break the curiosity with a "yes" or "no"
- respond with a nod of acknowledgment or a "thank you" so other students continue to predict.

www.psychologytoday.com

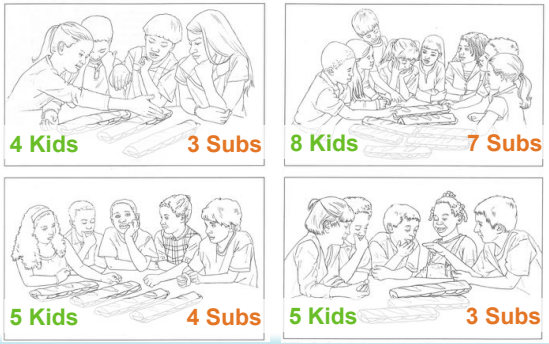
What is a "Learning Experience?"

Dewey, 1916

"**Thinking is the method** of an educative experience."

Genuine Situation → Genuine Problem Develops → Seek information, Make observations → Solutions OCCUR to her → Opportunity to Test Ideas

Classroom Learning Experience



Field Trips and Fund-Raisers: Introducing Fractions. C.T. Fosnot, Heinemann © 2007, used with permission

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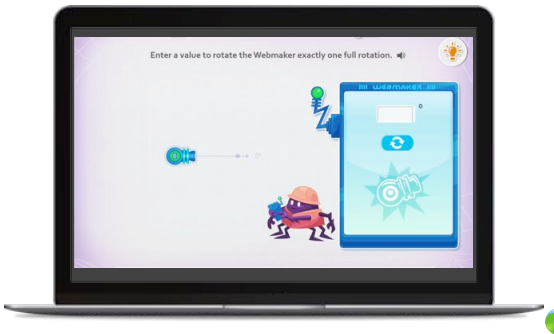
Digital Learning Experience



dreambox LEARNING

Learning is not accomplished by putting thoughts into a mind, but rather by empowering a mind to generate thoughts.

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Authenticity & Engagement Audit

MIND NUMBING
Contrived Problem
Dulls Thought

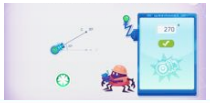
Mathematical Problem

HYPOTHETICAL SCENARIO
Students are given a theoretical situation that does not appear to be directly useful.

PRACTICAL SITUATION
Students are presented with a situation and a problem that have a potentially useful application.

GENUINE EXPERIENCE
Students encounter a situation authentically and are interested in a problem for its own sake.

THOUGHT PROVOKING
Genuine Problem
Stimulates Thought



4 Kids 3 Subs

"Last night I was wondering... is there a biggest prime number?"

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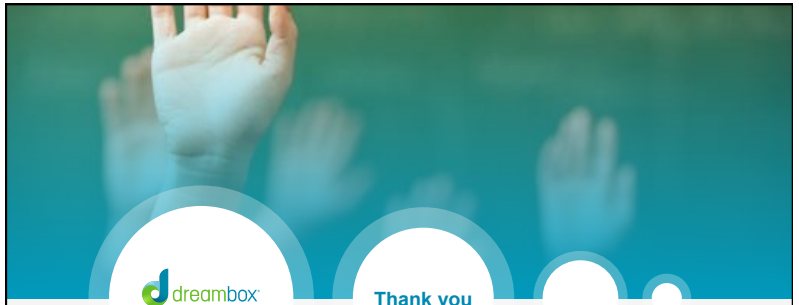

dreambox LEARNING

Thank you

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