Elementary Real World Problem-Based Lessons

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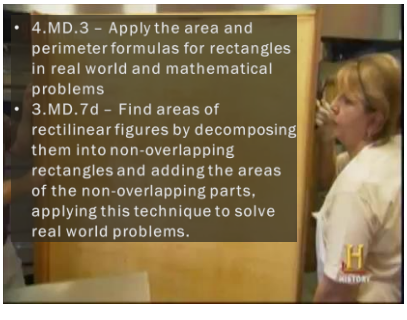
August 5, 2013

The Challenge

How many square inches is the Giant Sicilian pizza?

The Challenge

How many square inches is the Giant Sicilian pizza's delivery box?



- 4.MD.3 – Apply the area and perimeter formulas for rectangles in real world and mathematical problems
- 3.MD.7d – Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

- Focus
- Coherence
- Rigor

1	2	3	4	5	6	7	8	9	10	11	12	13	14
55	56	57	58	59	60	61	62	63	64	65	66	67	68
109	110	111	112	113	114	115	116	117	118	119	120	121	12
163	164	165	166	167	168	169	170	171	172	173	174	175	17
217	218	219	220	221	222	223	224	225	226	227	228	229	23
271	272	273	274	275	276	277	278	279	280	281	282	283	28
325	326	327	328	329	330	331	332	333	334	335	336	337	33
379	380	381	382	383	384	385	386	387	388	389	390	391	39
433	434	435	436	437	438	439	440	441	442	443	444	445	44
487	488	489	490	491	492	493	494	495	496	497	498	499	50
541	542	543	544	545	546	547	548	549	550	551	552	553	55

Standards for Mathematical Practice

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.

Connection to CCSS ELA

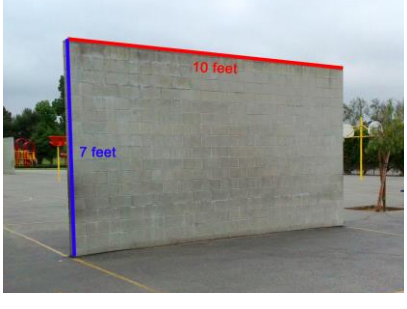
- Reading 7 - Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
- Writing 1 - Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
- Speaking & Listening 4 - Present information, findings, and supporting evidence such that listeners can follow the line of reasoning.

Solving Real-World Geometry Problems

High School	Middle School	Elementary School
• G-MG.1 – Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). • G-GMD.3 – Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	• 8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. • 7.G.6 – Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects. • 6.G.2 –Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	• 5.MD.5 – Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. • 4.MD.3 – Apply the area and perimeter formulas for rectangles in real world and mathematical problems • 3.MD.7d – Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems. • 2.MD.1 – Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. • 1.MD.2 – Express the length of an object as a whole number of length units. • K.MD.1 – Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

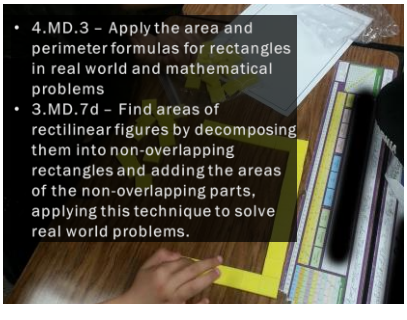
The Challenge

How can we figure out if we have enough paint to cover the handball wall?



SPECIFICATIONS

Color	Tintable	Color Family	Whites
Container Size	1 QT-Quart	Coverage Area (sq. ft.)	100 ft²
Exterior Paint & Stains Product Type	Siding & Trim	Low Temperature	No
Manufacturer Warranty	Limited Lifetime Guarantee	Minimum Temperature for Use (F)	50.0



STUDENT WORK SAMPLES

Do I have enough paint to cover the front of the handball wall? **Explain** how you know.

Yes because ma~70 =30 and 100 ~30 =70 We had 30 leftover We have 70 square feet on are handball courts and 30 square feet left over.

Do I have enough paint to cover the front of the handball wall? **Explain** how you know.

Yes! Because we counted 7 times ten and we got 70.

The Reality

- The question matters
  - Initially we asked students, "Do we have enough paint to cover the handball wall?"
- A few students immediately shouted out "Yes!"
  - I asked them to prove to me that they were correct using a drawing or tiles and many were initially unable to do so.
- Students had trouble articulating themselves in writing
  - Many students struggled with their explanations and will need extensive practice to improve.

- 4.MD.2 – Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

The Challenge

[illegible] and has [illegible] times [illegible] should your friend take her medicine?

WHAT ISN'T MATHEMATICAL MODELING?

- *It is not modeling in the sense of, "I do; now you do."*
- *It is not modeling in the sense of using manipulatives to represent mathematical concepts.*
- *It is not modeling in the sense of a "model" being just a graph, equation, or function.*
- *It is not just starting with a real world situation and solving a math problem.*
- *It is not beginning with the mathematics and then moving to the real world.*

Source: http://www.cde.ca.gov/be/cc/cd/documents/modelingaprilreview.pdf

The Challenge

What fraction is Mini-Me of Dr. Evil?

IMDb > Mike Myers > **Biography**

add/change photo

Biography for
Mike Myers (I)

Date of Birth
25 May 1963, Scarborough, Ontario, Canada

Birth Name
Michael John Myers

Height
5' 8" (1.73 m)

IMDb > Verne Troyer > **Biography**

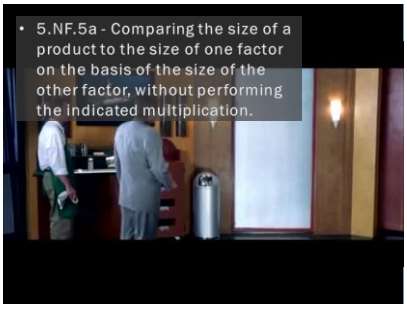
add/change photo

Biography for
Verne Troyer

Date of Birth
1 January 1969, Sturgis, Michigan, USA

Nickname
Mini Me
Mini-V

Height
2' 8" (0.81 m)



Connection to Learning Focused

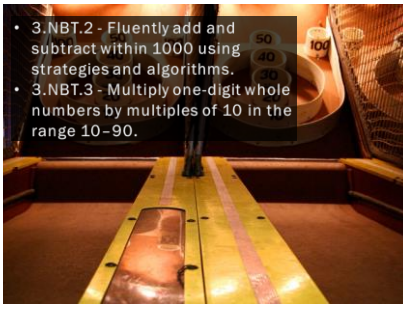
- Essential question
  - Every lesson comes with questions listed.
  - Most lessons have learning goals (objectives) and CCSS content standards listed.
- Activating strategies
  - Most lessons include highly engaging multimedia that build background knowledge and establish the context.
- Teaching strategies
  - Most lessons come with strategies and questions you can use to guide students without telling them.
- Summarizing
  - Built into the lesson through open ended questions.

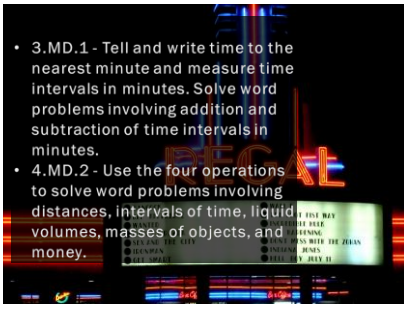
PROBLEM-BASED LEARNING FAQ

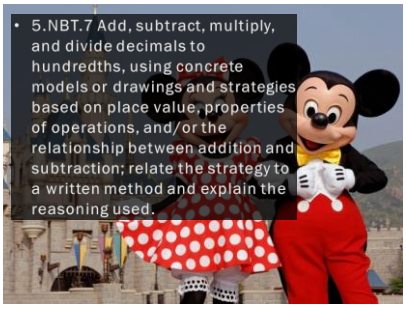
- *How often do teachers do problem-based learning?*
- *How long do problem based lessons take?*
- *Do teachers use problem-based lessons to introduce a topic or after you've already taught it?*
- *How is problem-based learning assessed?*
- *How much time does it take to create a problem-based lesson?*

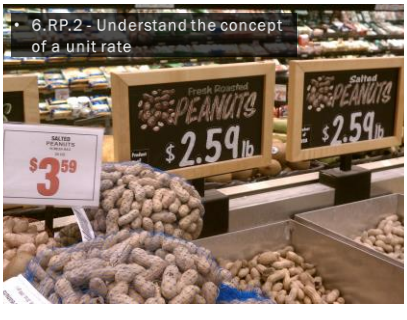
The Four C's

- Communication
- Curiosity









The Four C's

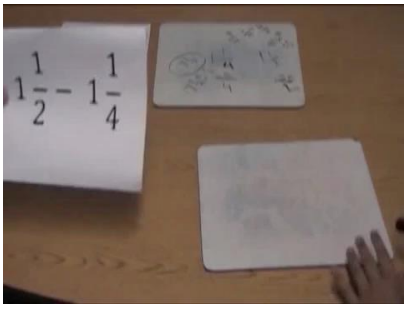
- Communication
- Curiosity
- Critical Thinking
- Content Knowledge

WHAT DOES IT LOOK LIKE...

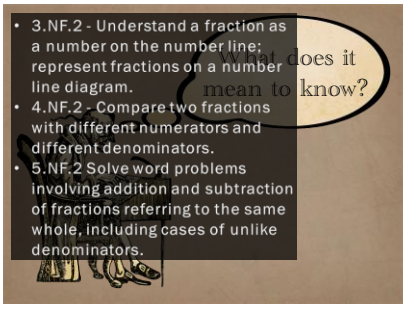
- when students **can** work with numbers but **cannot**:
  - critically think
  - applying knowledge and skills to real-world settings
  - analyze and solve complex problems
- when students have procedural skill but not conceptual understanding or the ability to apply mathematics?
- when students struggle to process mathematics at a higher depth of knowledge?

How far apart are the exits on this freeway: Jct 90 and Jefferson Blvd?

$$1\frac{1}{2} - 1\frac{1}{4}$$

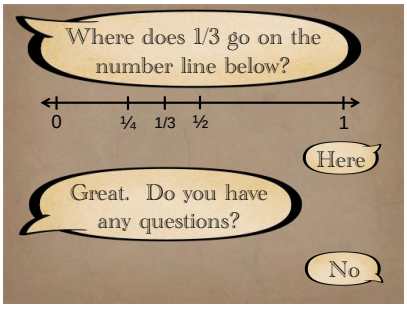


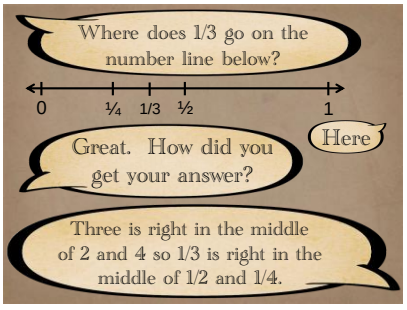
- 3.NF.2 - Understand a fraction as a number on the number line; represent fractions on a number line diagram.
- 4.NF.2 - Compare two fractions with different numerators and different denominators.
- 5.NF.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators.



Questioning Scenarios

- The activity begins with teachers in groups of three taking the roles of teacher, student, or observer.
- The individuals playing the role of teacher and student each receive a slip of paper describing their scenario.
- The individual playing the role of observer waits to record all of the teacher's questions to the student.
- Once the activity begins, the teacher will talk to the student in the context of the scenario they read about on the slips of paper.





Problem-Based Lesson Resources

- My lessons: http://www.robertkaplinsky.com/lessons
- Andrew Stadel: http://tinyurl.com/mrstadel
- Nathan Kraft: http://tinyurl.com/mrkraft
- Yummy Math: http://www.yummymath.com
- Dan Meyer's TED talk: http://tinyurl.com/meyer-TED

Planning Time

- Create a list of lessons for your grade level(s).
- Figure out which lessons you would like to incorporate first.
- Go through those lessons and figure out details such as:
  - When would I do this lesson?
  - What resources would I need?
  - What other teachers could I collaborate with?

NEXT STEPS

- *Start with realistic goals:*
  - *At least one per semester*
  - *Perhaps one per unit*
- *Collaboration is key*
- *Standards for Mathematical Practice*
  - *Talking and writing about mathematics*

Contact

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