Transferring Mathematical Understanding to a True Application

Amy Vickers and Connie Rivera

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LINCS is funded by the U.S. Department of Education - Office of Career, Technical, and Adult Education. It is comprised of the Resource Collection, managed by Kratos Learning, the Regional Professional Development Centers, and the Technical Contractor, Quotient, Inc.

LINCS
Literacy Information and Communication System

WHAT IS A LINCS COMMUNITY ACTIVITY?

“I know what my students understand when I see them in a place they have never been.”

~Al Cuoco, 2011

Why does True Application matter?

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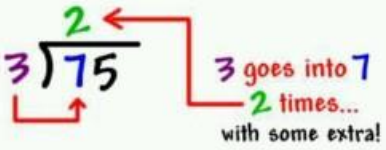
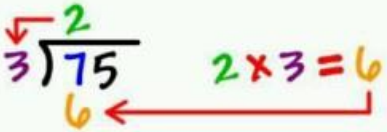
Divide:	
Multiply:	
Subtract:	
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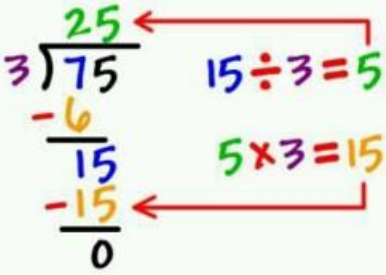
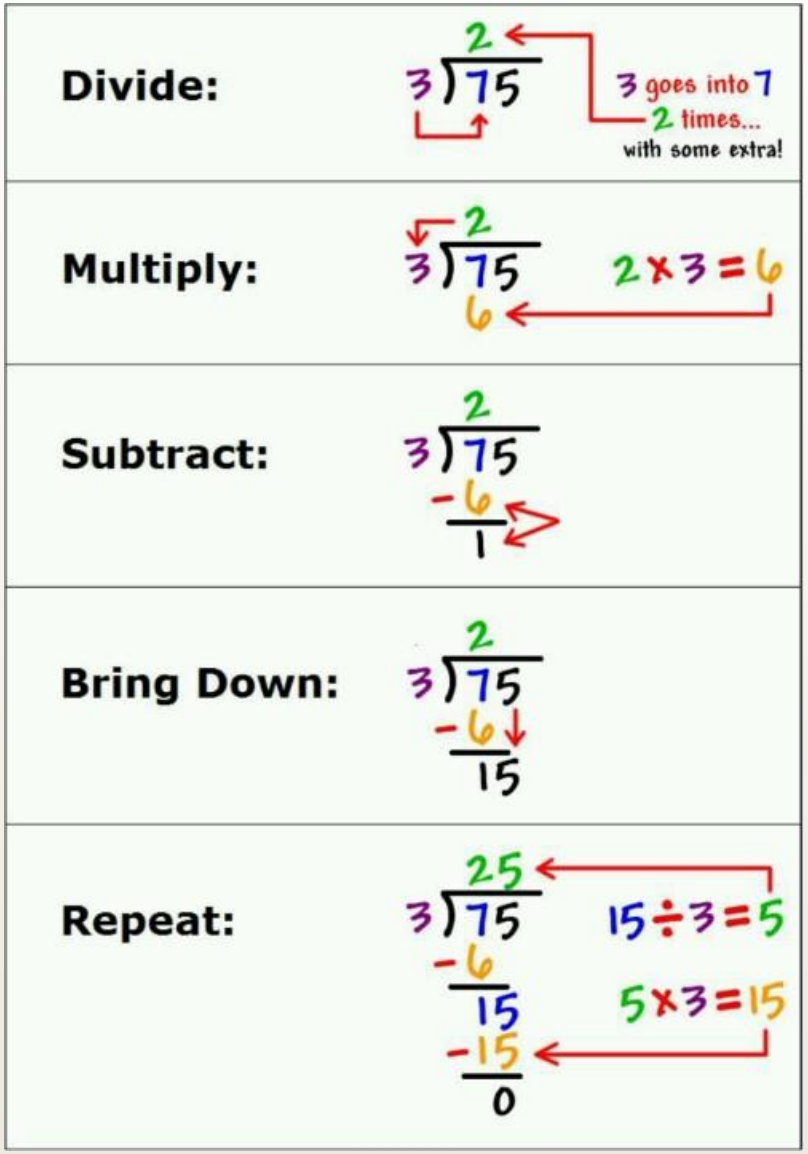
Repeat:	

Why does True Application matter?

Math in life can be **unrecognizable** as math because of how we teach school math.



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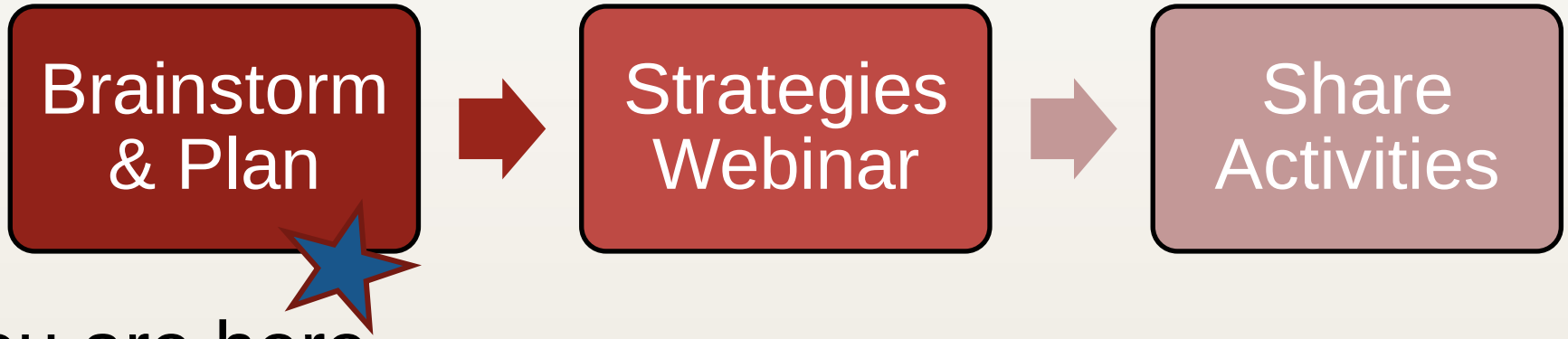
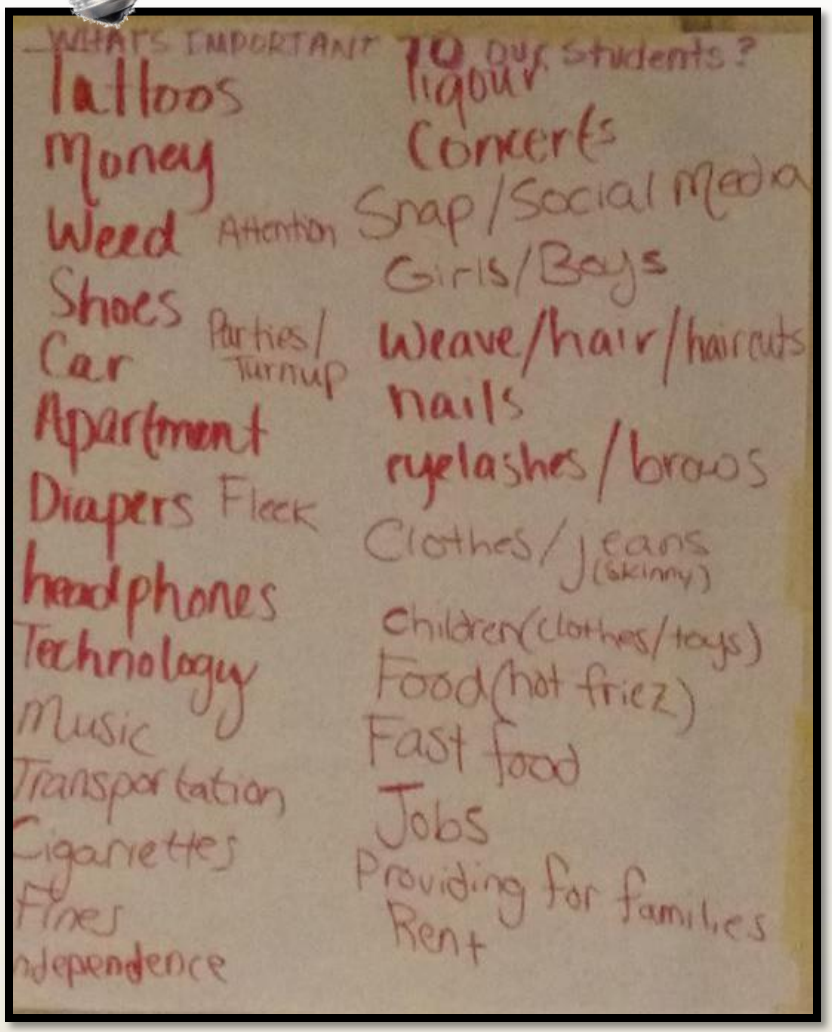


Brainstorm: What is important *to* our students?



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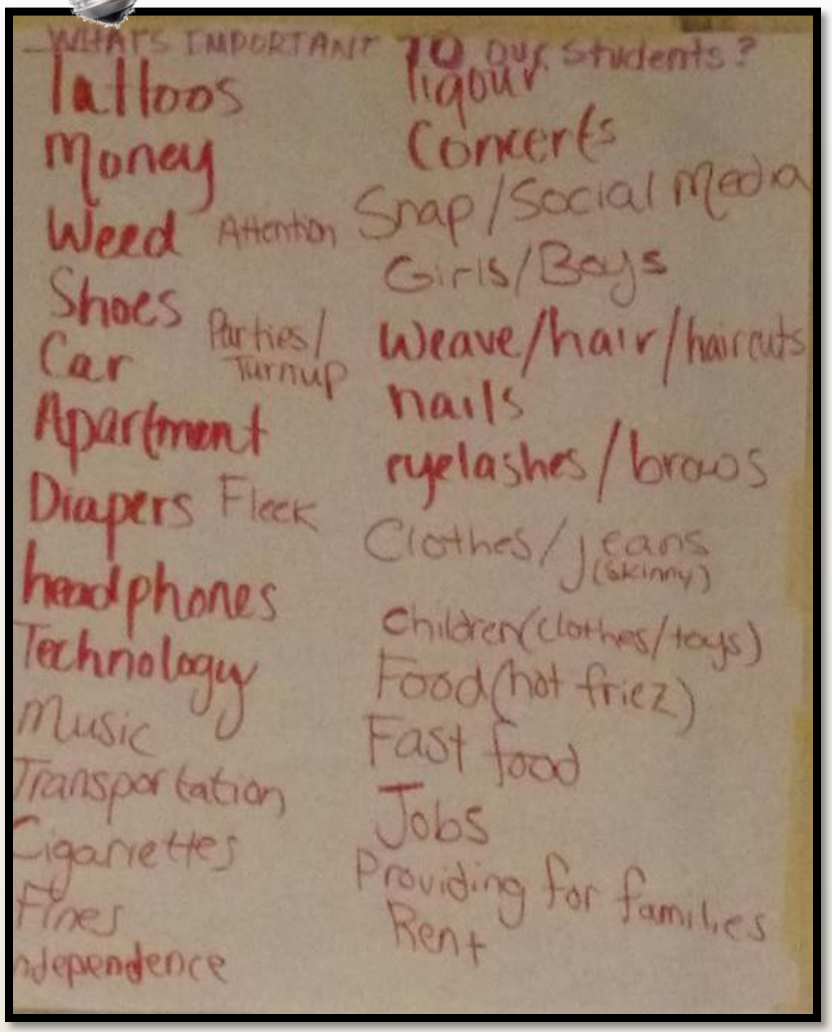

- 2 choosing a childcare center
- 1 housing concerns
- 2 getting child or self proper healthcare
- 3 reliable transportation
- 1 understanding a paycheck
- 1 raising American kids with an understanding of the parents' native country
- 1 being able to support their kids education
- 2 going to college
- 1 getting a job

Brainstorm: What is important *for* our students?

Foundational Math Concepts:

- Interconnection between concept, procedure, symbols, and vocabulary.
- Same quantity can be expressed in multiple ways
- Thinking of relationships between numbers
- Making sense of data and statistics
- Reasoning proportionally

Transferring Mathematical Understanding to a True Application

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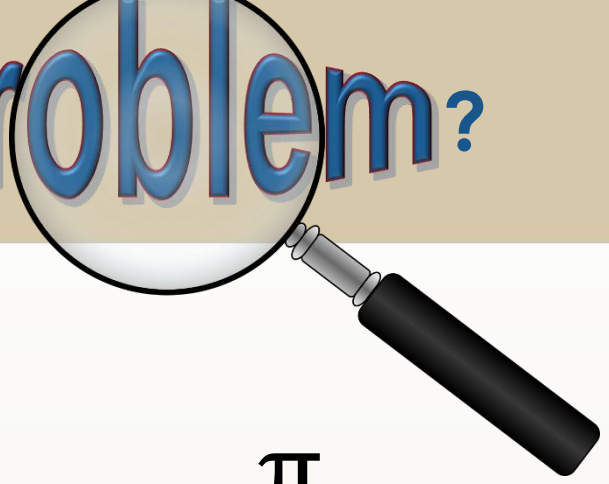
Is this a problem?

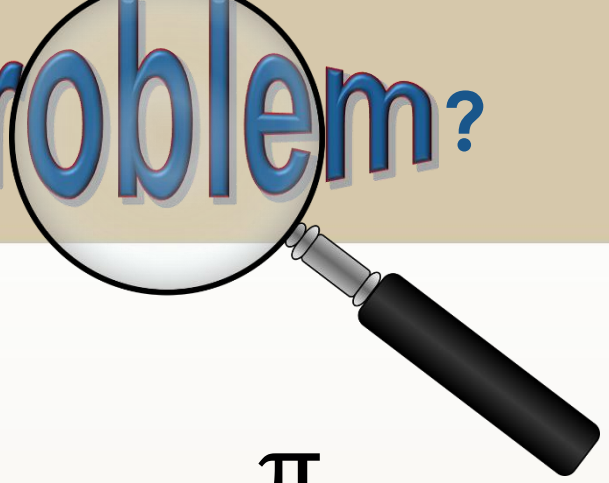


- Evaluate: $sin\,\frac{\pi}{3}$

- Use the digits 1 to 5, at most one time each, to fill in the boxes to create a true number sentence with the greatest possible sum.

$$\square + \square = \square$$

Is this a problem?



- Evaluate: $sin\frac{\pi}{3}$ http://robertkaplinsky.com/depth-knowledge-matrix-secondary-math/

- Use the digits 1 to 5, at most one time each, to fill in the boxes to create a true number sentence with the greatest possible sum.

$$\square + \square = \square$$

http://robertkaplinsky.com/depth-knowledge-matrix-elementary-math

Is this a problem?

- Evaluate: $sin\frac{\pi}{3}$

DOK 1

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DOK 1

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$\square + \square = \square$

DOK 3

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True Application appears at…

- **Webb's Depth of Knowledge**

LEVEL 3 or 4 DOK

WEBB'S DOK LEVEL 3	WEBB'S DOK LEVEL 4
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Is this a problem?

- Amy drove 55 miles in one hour. At that rate, how far can she drive in 36 hours?

Is this a problem?

- Amy drove 55 miles in one hour. At that rate, how far can she drive in 36 hours?

- Amber saw the perfect present being sold for $128, but a sign announced that it was on sale for "35% off." How much would the perfect present cost after the discount? Explain your reasoning.

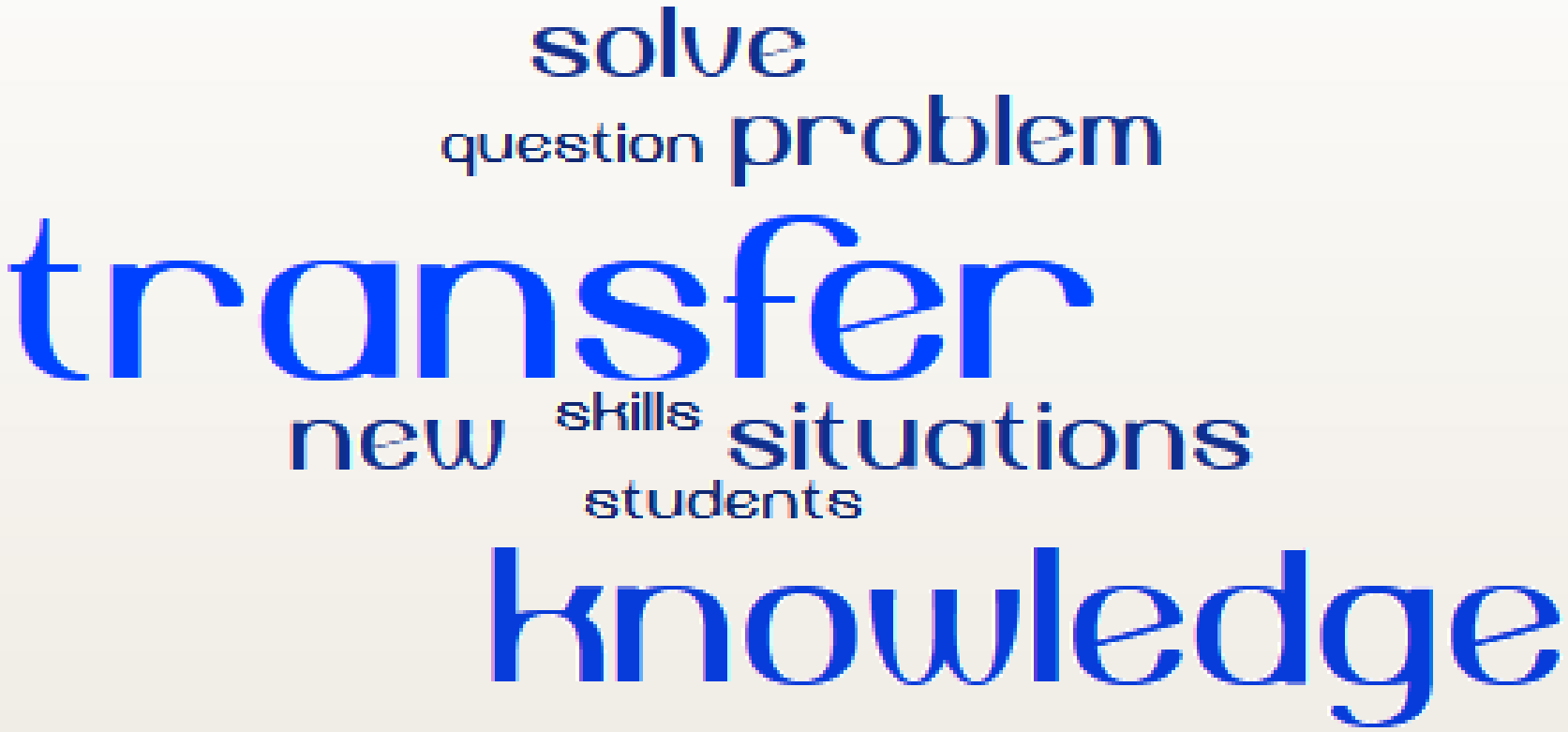
Is it a *problem*, or just a 'word problem'?

Is it a *problem*, or just a 'word problem'?

"A problem is defined…as any task for which the students have no prescribed or memorized rules or methods, nor is there a perception by students that there is a specific correct solution method."

Hiebert (1997)

True Application allows…



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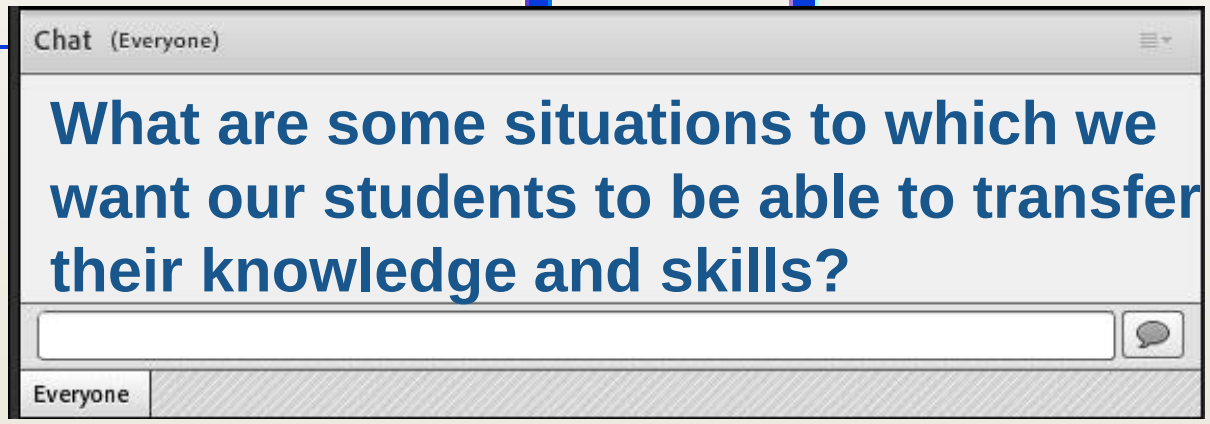
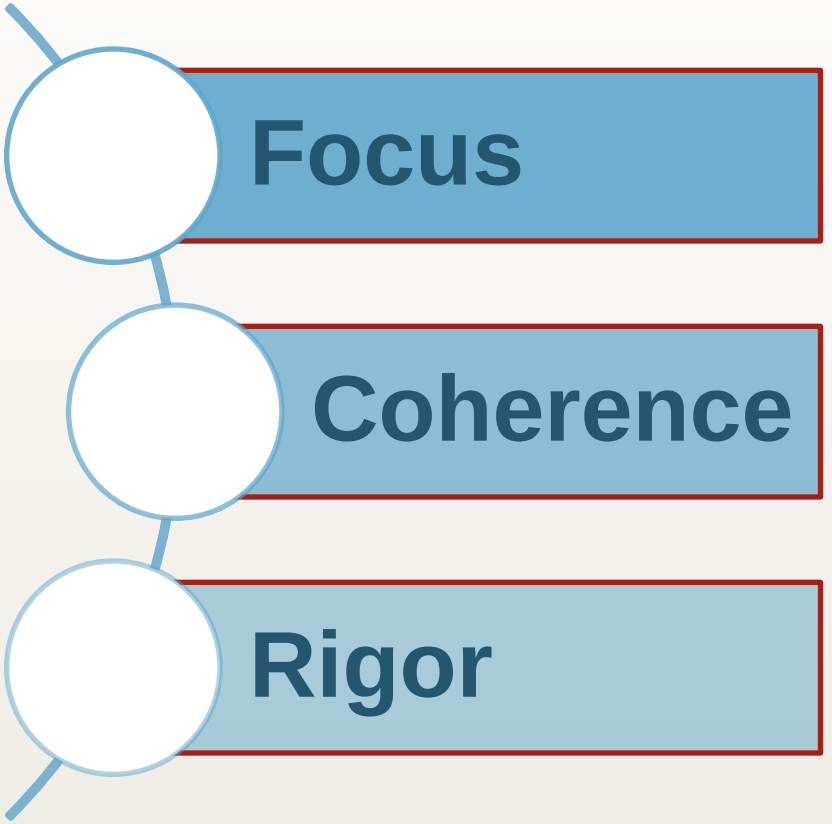


College and Career Readiness Standards for Adult Education (CCRS)

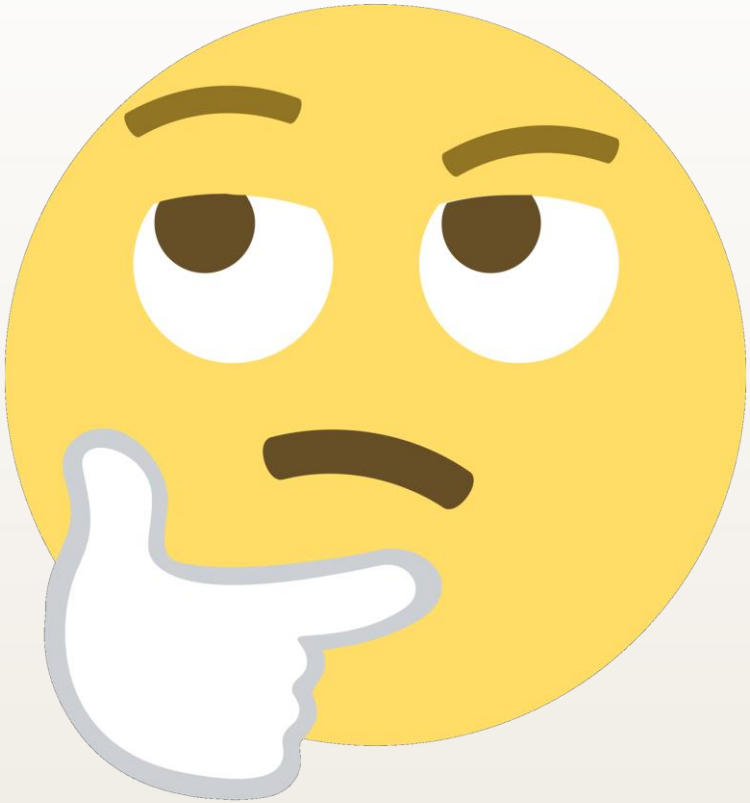
Mathematics: Key Shifts in the Standards



*U.S. Department of Education, Office of Vocational and Adult Education. *College and Career Readiness Standards for Adult Education.* Washington, D.C., 2013.

True Application features…

True Application asks…



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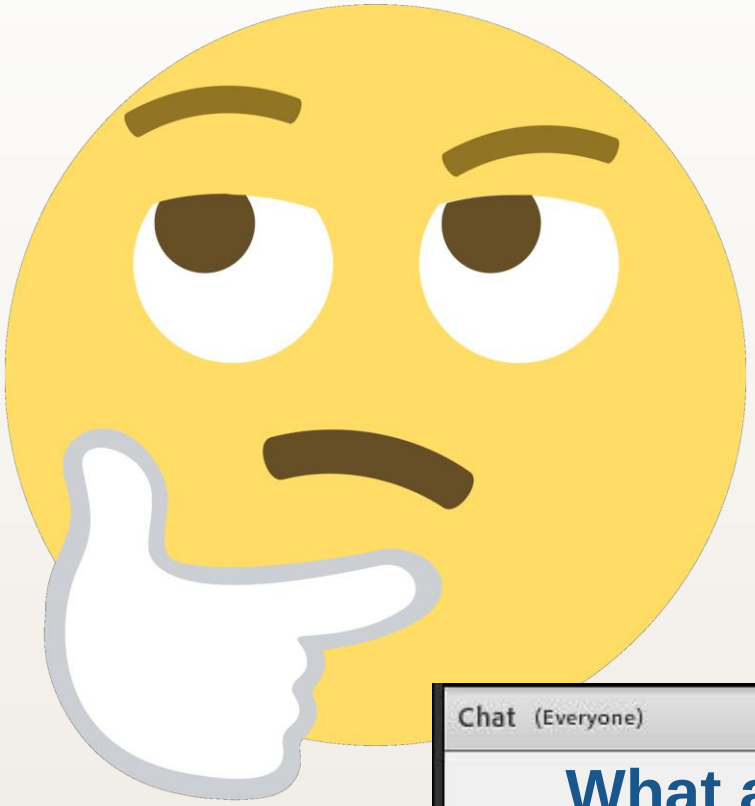


Chat (Everyone)

What are some mathematically informed decisions our students need to make?

Everyone

True Application incorporates…

True Application incorporates…

Chat (Everyone)

What tools or supports can you give students to help them focus while doing online research?

Everyone

True Application includes…

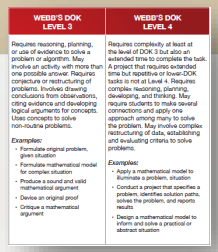
True Application includes…

Chat (Everyone)

What are some other assignments that include communicating to others who care about the outcome?

Everyone

Elements of True Application:



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- **DOK 3 or 4**

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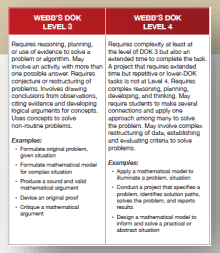

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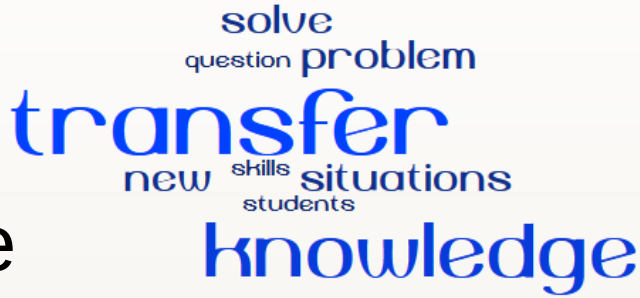

- Transferrable knowledge

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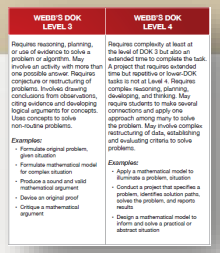

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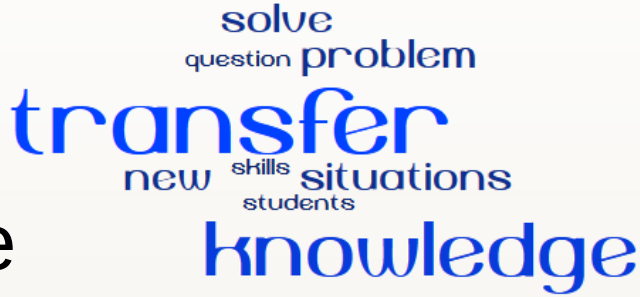
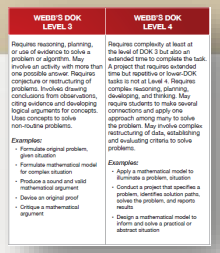


- Transferrable knowledge
- Multiple entry points

Elements of True Application:



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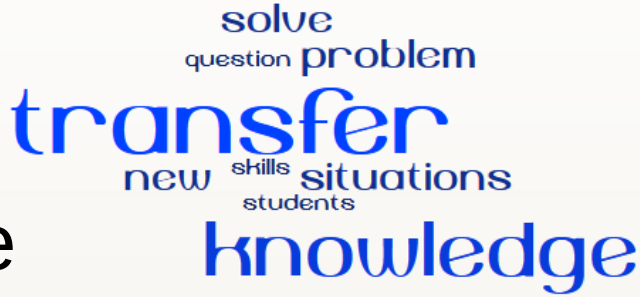

- Transferrable knowledge
- Multiple entry points

- Make a decision

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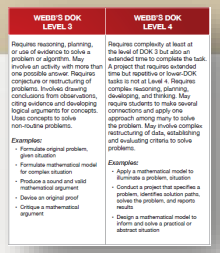

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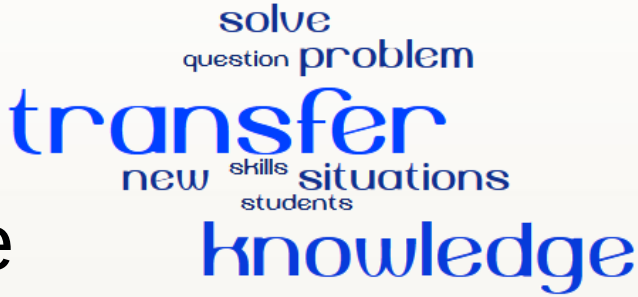

- Transferrable knowledge
- Multiple entry points

- Make a decision

- Research and reasoning

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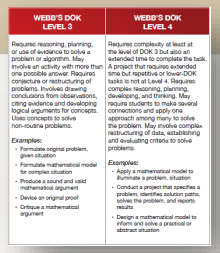

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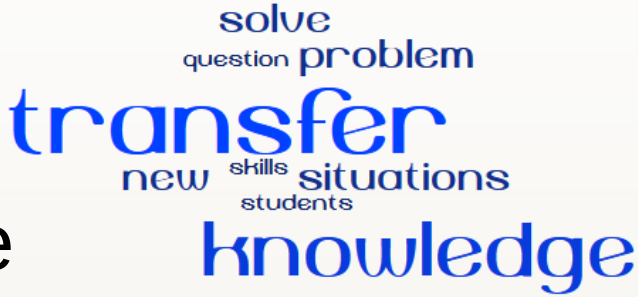

- Transferrable knowledge
- Multiple entry points

- Make a decision

- Research and reasoning
- Communication

Goal Statements – College

- Students will learn to make sense of data and statistics by identifying, collecting and analyzing relevant data from two colleges.

Goal Statements – Health Care

- Students will demonstrate understanding of ratio and bar graphs by determining which of two health care plans is the best option.
- Students will demonstrate understanding of percent, proportion and circle graphs by determining which of two to three health care plans is the best option.
- Students will demonstrate understanding of linear functions and line graphs by determining which health care plan is the best option.

Goal Statements - Transportation

- Students will be able to use estimation, relational thinking and properties of operations in order to make decisions about their transportation for the upcoming semester.

Goal Statement Sentence Frames

- *Students will learn* _____ *by* _____.
  [concept] [doing something real]

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- *Students will learn* _____ *by* _____.
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Goal Statement Sentence Frames

- *Students will learn* _____ *by* _____.
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- *Students will demonstrate understanding of* _____ *by* _____.
  [concept] [doing something real]

- *Students will be able to* _____
  [apply the skills learned]
  in order to _____.
  [do something real]

Do something real, such as…

- Sort through options and use tables, charts, and/or graphs to make an informed choice about:
  - Health care
  - Child care
  - A phone plan
  - Transportation
  - Renting a moving van
  - An apartment

Do something real, such as…

- Design a questionnaire to gather and report information

Do something real, such as…

- Design a questionnaire to gather and report information
- Prepare a case and present it to a town meeting

Do something real, such as…

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- Create visuals (graphs) to persuade others of your point of view

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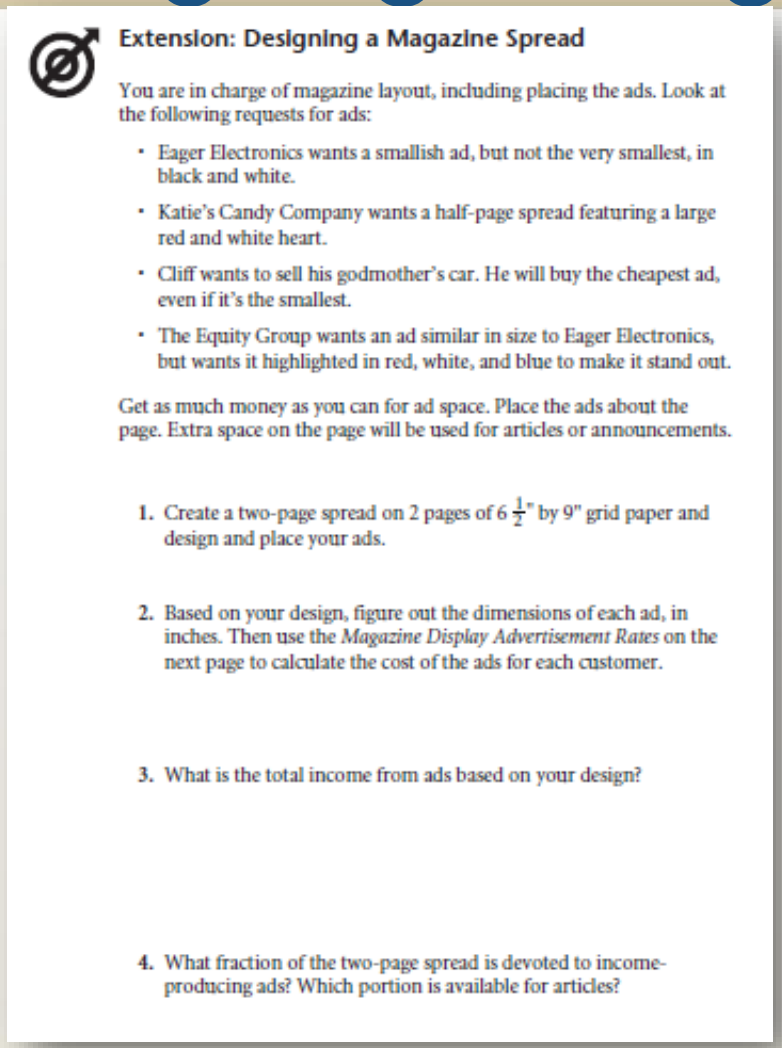
- Use tables and charts to explain a financial decision

Do something real, such as…

- Design a questionnaire to gather and report information
- Prepare a case and present it to a town meeting
- Create visuals (graphs) to persuade others of your point of view
- Use tables and charts to explain a financial decision
- Write a letter proposing a purchase or disputing a charge

Example: Designing a Magazine Spread



Extension: Designing a Magazine Spread

You are in charge of magazine layout, including placing the ads. Look at the following requests for ads:

- Eager Electronics wants a smallish ad, but not the very smallest, in black and white.
- Katie's Candy Company wants a half-page spread featuring a large red and white heart.
- Cliff wants to sell his godmother's car. He will buy the cheapest ad, even if it's the smallest.
- The Equity Group wants an ad similar in size to Eager Electronics, but wants it highlighted in red, white, and blue to make it stand out.

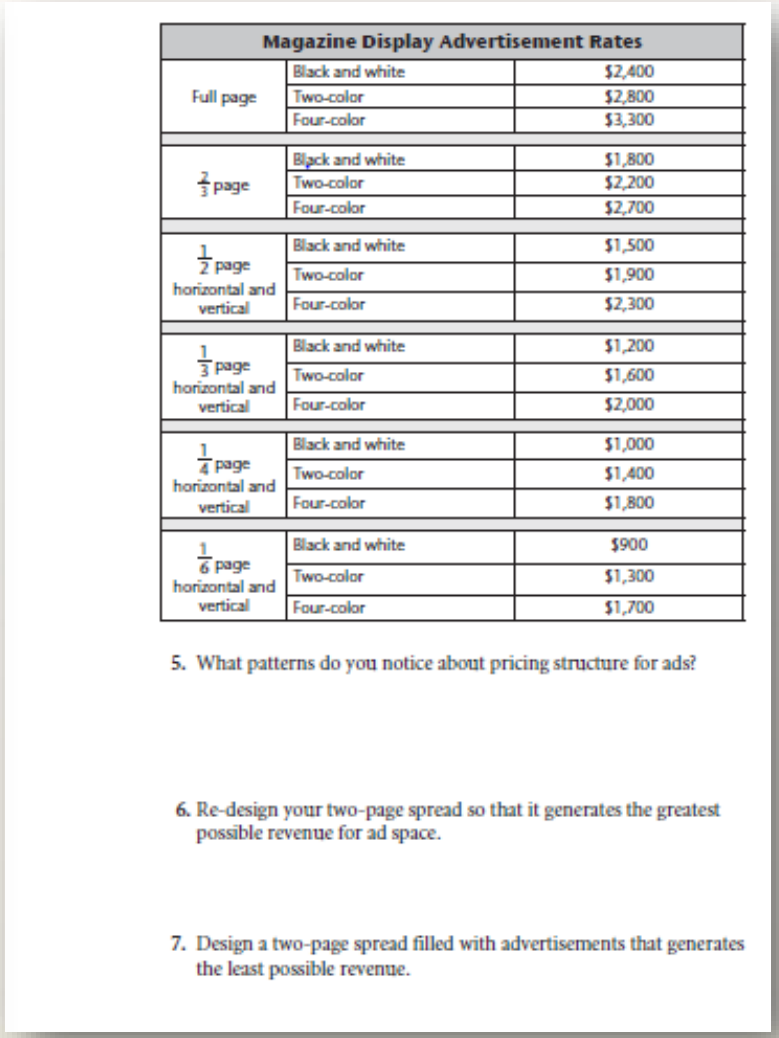
Get as much money as you can for ad space. Place the ads about the page. Extra space on the page will be used for articles or announcements.

1. Create a two-page spread on 2 pages of $6\frac{1}{2}$" by 9" grid paper and design and place your ads.

2. Based on your design, figure out the dimensions of each ad, in inches. Then use the *Magazine Display Advertisement Rates* on the next page to calculate the cost of the ads for each customer.

3. What is the total income from ads based on your design?

4. What fraction of the two-page spread is devoted to income-producing ads? Which portion is available for articles?



Magazine Display Advertisement Rates

Full page	Black and white	$2,400
	Two-color	$2,800
	Four-color	$3,300
$\frac{2}{3}$ page	Black and white	$1,800
	Two-color	$2,200
	Four-color	$2,700
$\frac{1}{2}$ page horizontal and vertical	Black and white	$1,500
	Two-color	$1,900
	Four-color	$2,300
$\frac{1}{3}$ page horizontal and vertical	Black and white	$1,200
	Two-color	$1,600
	Four-color	$2,000
$\frac{1}{4}$ page horizontal and vertical	Black and white	$1,000
	Two-color	$1,400
	Four-color	$1,800
$\frac{1}{6}$ page horizontal and vertical	Black and white	$900
	Two-color	$1,300
	Four-color	$1,700

5. What patterns do you notice about pricing structure for ads?

6. Re-design your two-page spread so that it generates the greatest possible revenue for ad space.

7. Design a two-page spread filled with advertisements that generates the least possible revenue.

From the EMPower Plus title ***Using Benchmarks: Fractions and Operations***. Copyright © 2016, TERC. Images used with permission.

Example: Got Rhythm?

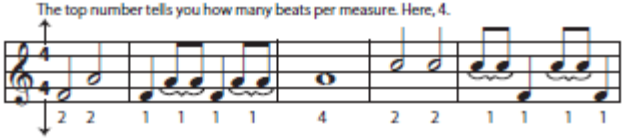
Extension: Got Rhythm?

Written music is built on fractions. One whole note is divided into two half notes; half notes are broken in half to create quarter notes; and so forth.

𝅝	This is a whole note.
𝅗𝅥	This is a half note. It gets half as many beats as a whole note.
♩ ♩	These are quarter notes.
♪	This is an eighth note.
♫	These are two eighth notes together. They are equal to one quarter note.
𝅘𝅥𝅯	This is a sixteenth note.

Each measure (space between two vertical bars) has the same total beats, like this:

The top number tells you how many beats per measure. Here, 4.



The bottom number tells you what kind of note counts as one beat. Here a quarter note counts as one beat, so there are 4 quarter notes, or the equivalent, in a measure.

1. Create your own rhythm. As in the example above, each measure must equal 4 beats using any combination of notes. Use at least one sixteenth note. Write out at least two measures.

2. Clap out the rhythm—hold the long beats, go faster for short beats. What do you like about your rhythm?

3. For four measures, what would be the highest total of sixteenth notes possible?

4. Annie asks you to write down notes that sound like fast rain. What fraction beats will you use? Why?

5. Mu asks you to write a rhythm that sounds like slow footsteps and fast footsteps. Use the lines below to show the notes. Show how the notes total 4 beats per measure by writing the fraction underneath each beat.

From the EMPower Plus title ***Using Benchmarks: Fractions and Operations***. Copyright © 2016, TERC. Images used with permission.

Example:
Cost of Light Bulbs

Cost of light bulbs – updated!

April 20, 2014

Finally updated! There's a lot of misinformation out there about the cost to consumers of CFL and LED bulbs and the savings in energy and money that could be realized.

Let your students "do the math" and realize some of the profit that could be made by changing our ways.

https://www.yummymath.com/2014/cost-of-light-bulbs-new-and-improved/

Example:
Choose an Apartment

Select an apartment realistic for your budget. Look at the square footage and the number of bedrooms and bathrooms listed. Sketch and label several possible floor plans.

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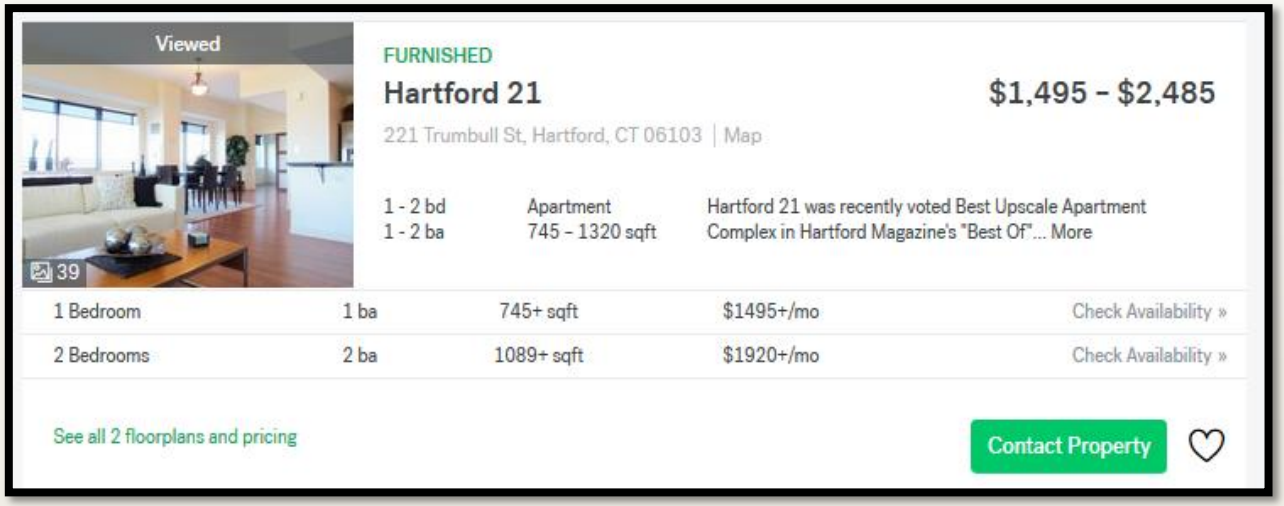

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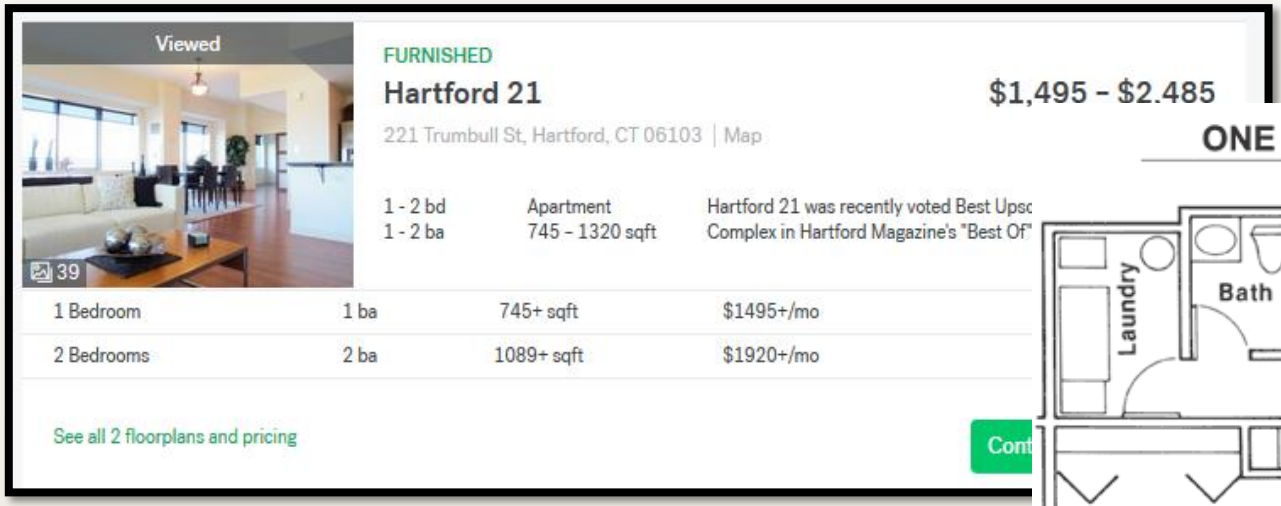

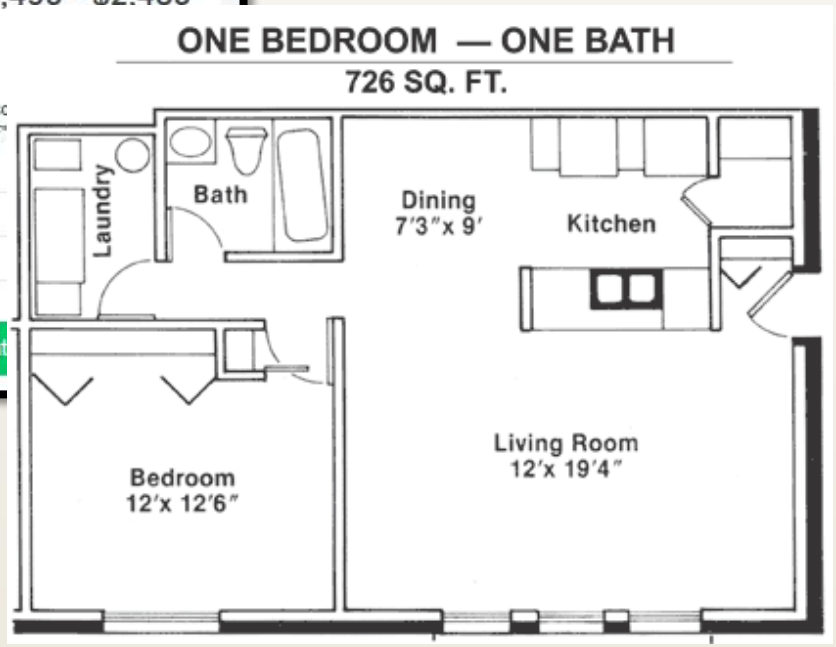

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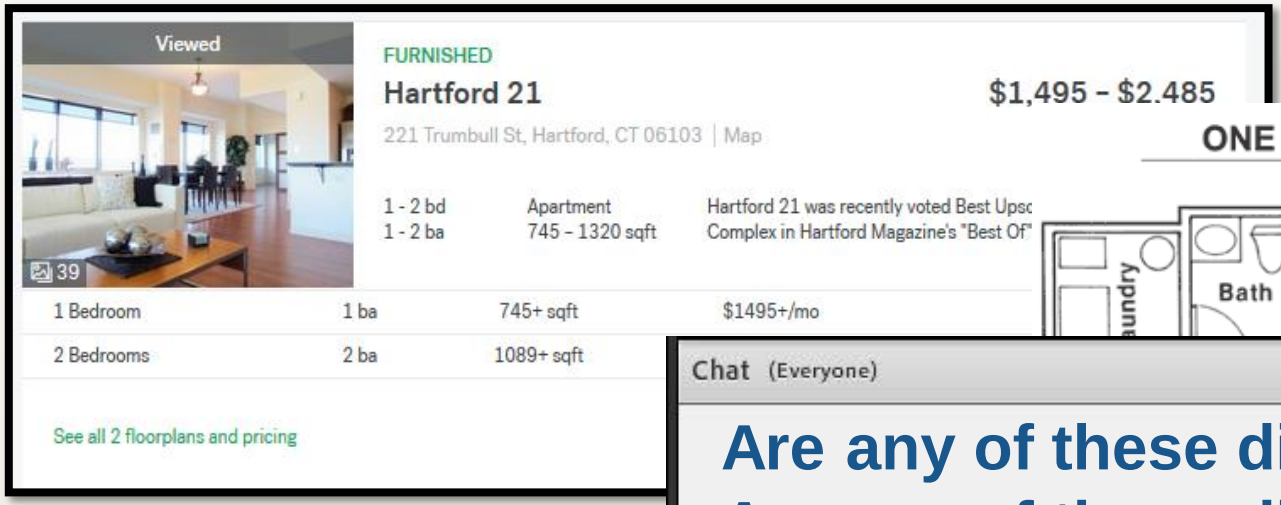

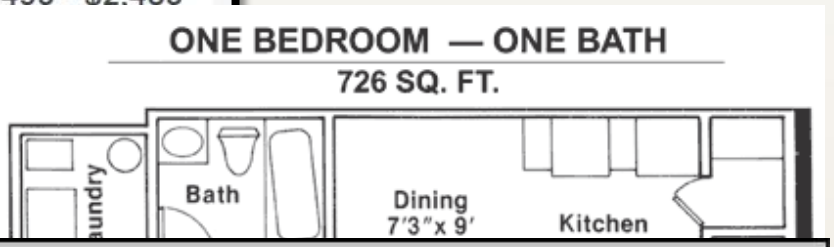

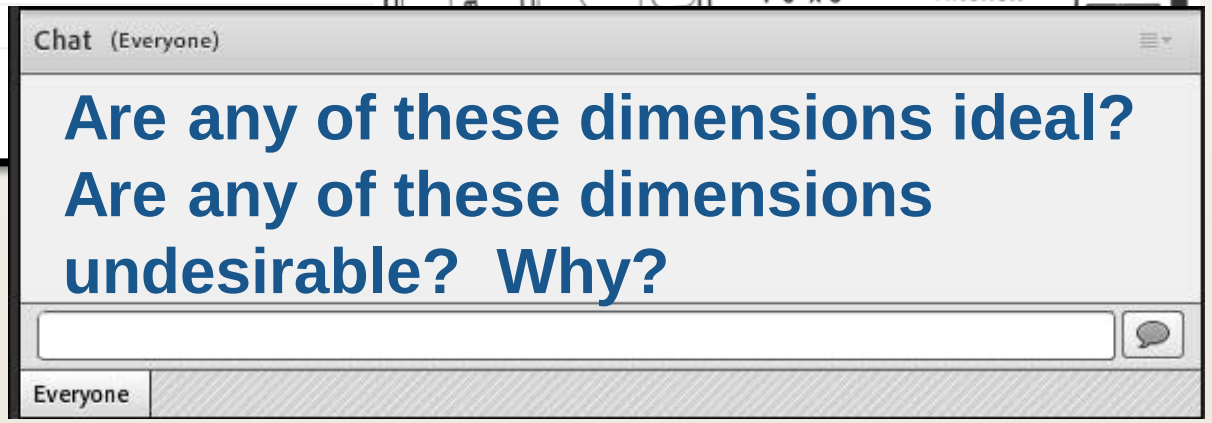

True Application Example & Non-Example

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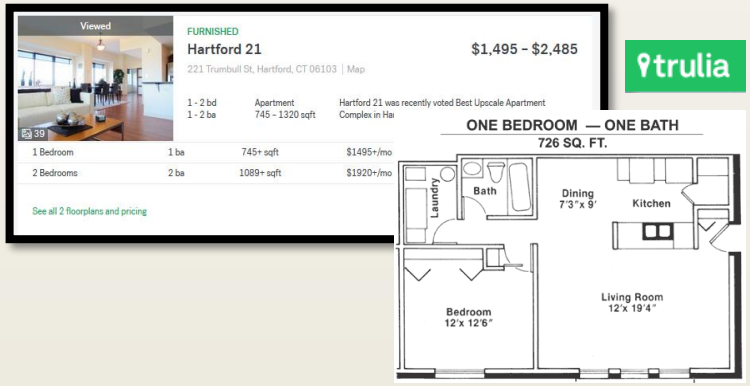

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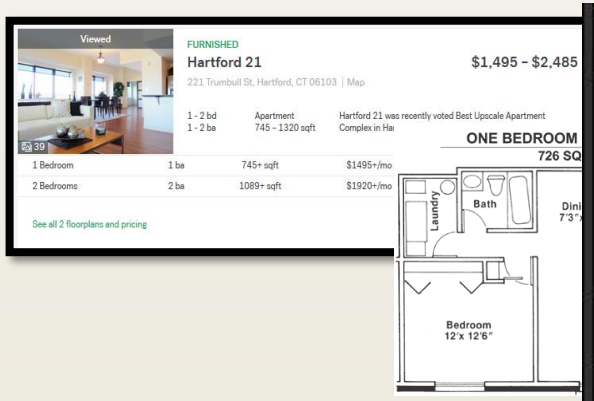

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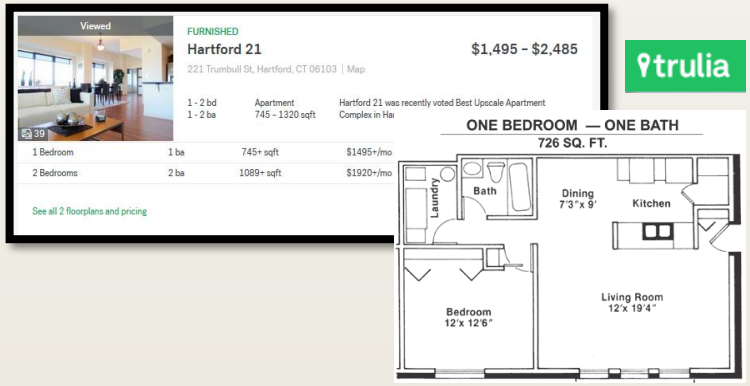

Word "Problem"

Your apartment has a bedroom that is 12' by 12'6", a living room that is 12' by 19'4", and a dining room that is 7'3" by 9'.

What is the approximate **square footage** of your apartment?

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Example: Write a Quote

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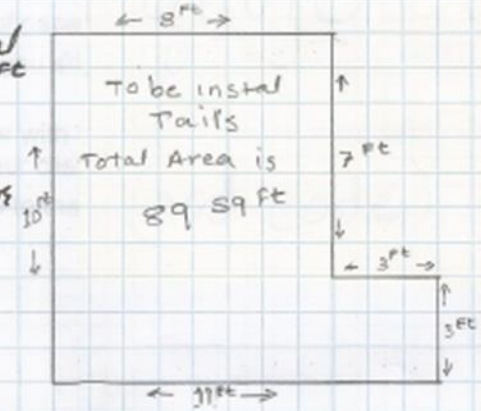
Project Quote For Mr. Michael

- To be install Tiles total Aria is 89 sq Ft
- and cove base is 10+11+3+3+7+8 Ft = 42 Ft perimeter



* Materials Cost
  Tiles Cost per sq Ft $ 2
  Cove base Cost per Ft $ .50
  Glue 1 Gal $ 30

* Labor Cost
  To install Tiles Cost per sq Ft = $ 10
  and Cove base Cost per Ft = $ 2

* To be Finished this project Cost will be bellow -

Materials Cost

Tiles	89 sq Ft X $ 2	→	= $ 178
Cove base	42 Ft X $ .50	→	= $ 21
Glue	1 Gal X $ 30	→	= $ + 30
			$ 229

Labor Cost

To install Tiles Cost per sq Ft $ 10 X 89 sq Ft = $ 890

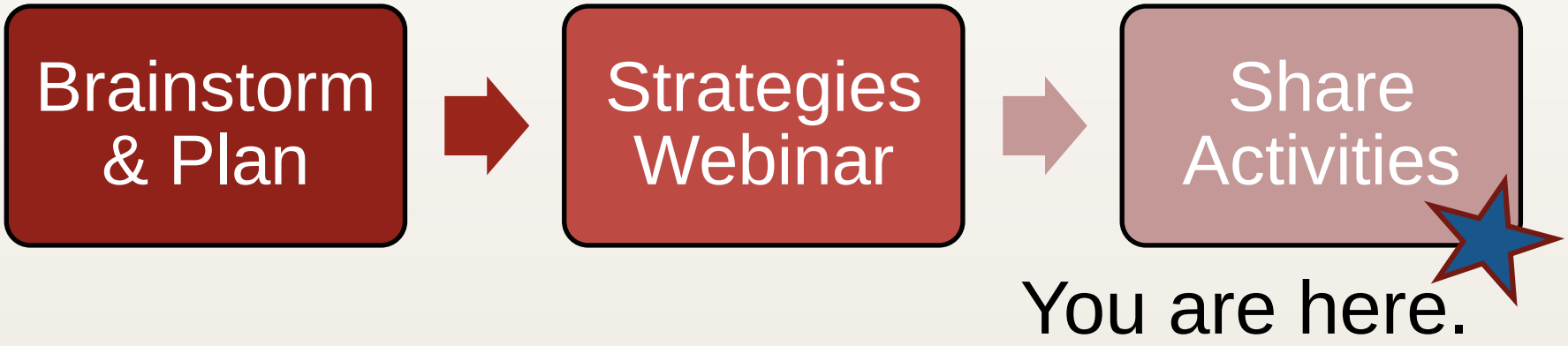
and Cove base per Ft $ 2 X 42 sq Ft $ + 84

$ 974

Materials Cost $ 229
Labor Cost $ + 974
Total Cost Will be $ 1203

Transferring Mathematical Understanding to a True Application

Transferring Mathematical Understanding to a True Application



Planning a True Application Activity

1. **Determine the need.** *Include student ideas when possible.*

A. What is important to this student or this group of students?
B. What math content and practices do I know to be important for this student or group of students at this time?
Highlight or circle elements from A and B that could fit together.

2. **Write a goal statement.** *By the end of this unit, student will be able to [apply the skills learned] in order to [do something that is meaningful to them]. See other sentence frames below.*

Goal Statement Sentence Frames • Students will learn _____ by _____ [concept] [doing something] • Students will demonstrate understanding of _____ by _____ [concept] [doing something] • Students will be able to _____ [apply the skills learned] in order to _____ [do something]	Goal statement:

3. Briefly **describe the true application activity** through which student(s) can reach this goal. *Include multiple entry points, possible supports, a specific product or outcome, and how solutions will be communicated.*

4. **Assessment**: How will you and student(s) measure success? *What does 'excellent' look like? Describe successful completion of the goal.*

LINCS Discussion

- Choose one of the goal statements written from our brainstorming.
  - Comparing Colleges
  - Health Care (3)
  - Transportation Options
- Fill out the planning sheet and then post a short summary of an application activity and assessment that you could use in your classroom.

“I know what my students understand when I see them in a place they have never been.”

~Al Cuoco, 2011

THANK YOU!