



# **Integrating Strategies for English language learners and Standards-based Mathematics**

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# *Warm - Up*

With a partner, share:

- Your Name
- A double-meaning word

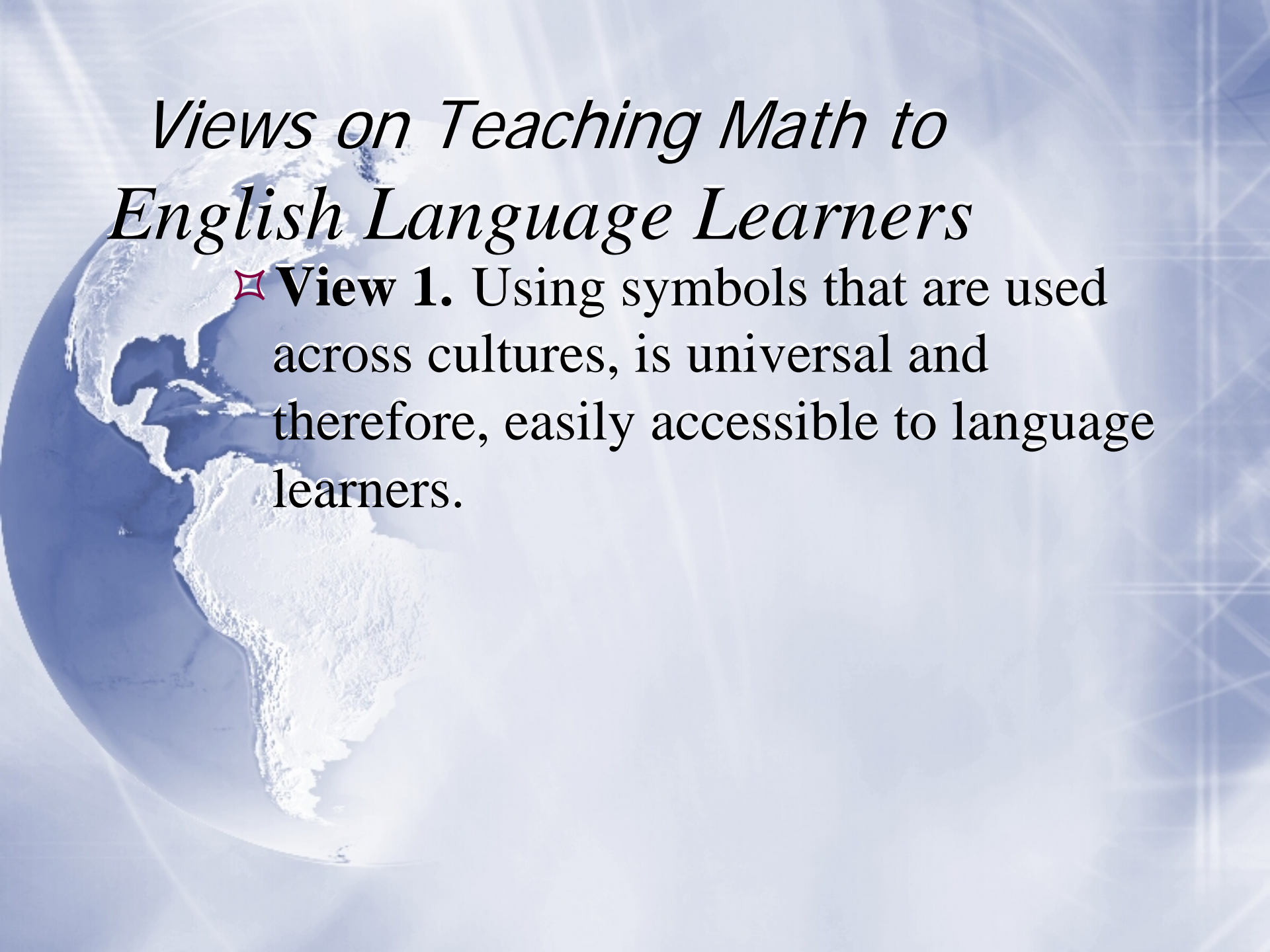
[means something different in math than in other settings, for example, similar]





## *Our Goals*

- ✧ To understand what a “standards-based” classroom looks like
- ✧ To deepen knowledge related to the specific needs of ELLs in math instruction.
- ✧ To explore research-based strategies for supporting ELLs in a standards-based setting.



# *Views on Teaching Math to English Language Learners*

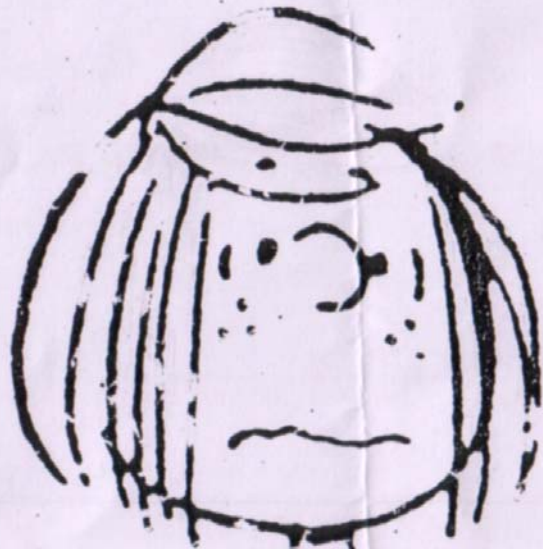
✧ **View 1.** Using symbols that are used across cultures, is universal and therefore, easily accessible to language learners.



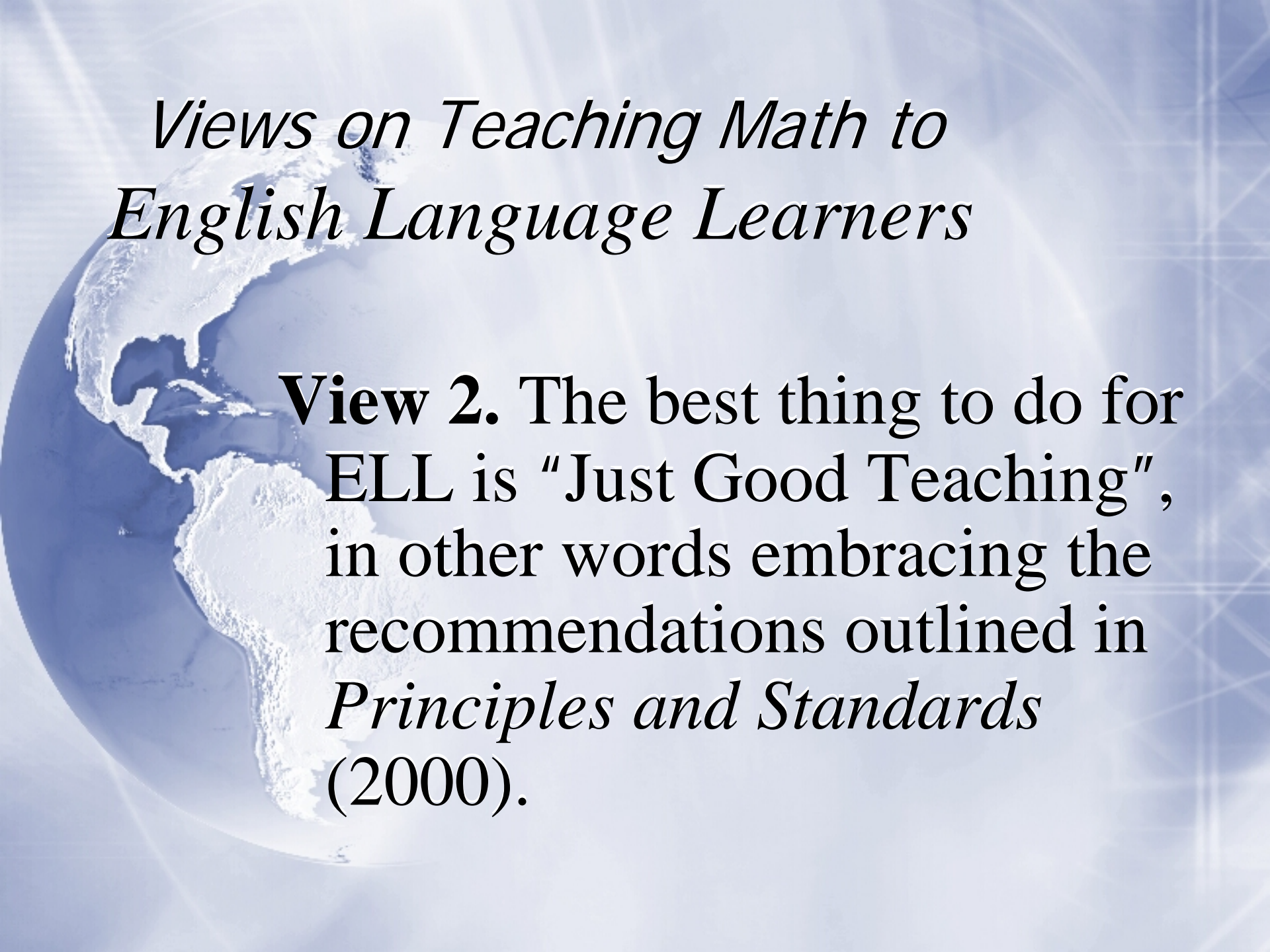
# *Problems with View #1*

- ✧ Symbols are one of many representations
- ✧ We may rush to the symbolic stage, shortening developmental learning time.
- ✧ Symbols still include concepts that are not known to students (fraction bar, =,  $\leq$ )
- ✧ Language is inseparable from symbols.
- ✧ Really knowing mathematics includes FIVE dispositions - symbolic representations/computational fluency is only one (See Adding it Up)

NOTHING SPOILS NUMBERS FASTER  
THAN A LOT OF ARITHMETIC!



SCHEIDT



*Views on Teaching Math to  
English Language Learners*

**View 2.** The best thing to do for ELL is “Just Good Teaching”, in other words embracing the recommendations outlined in *Principles and Standards* (2000).

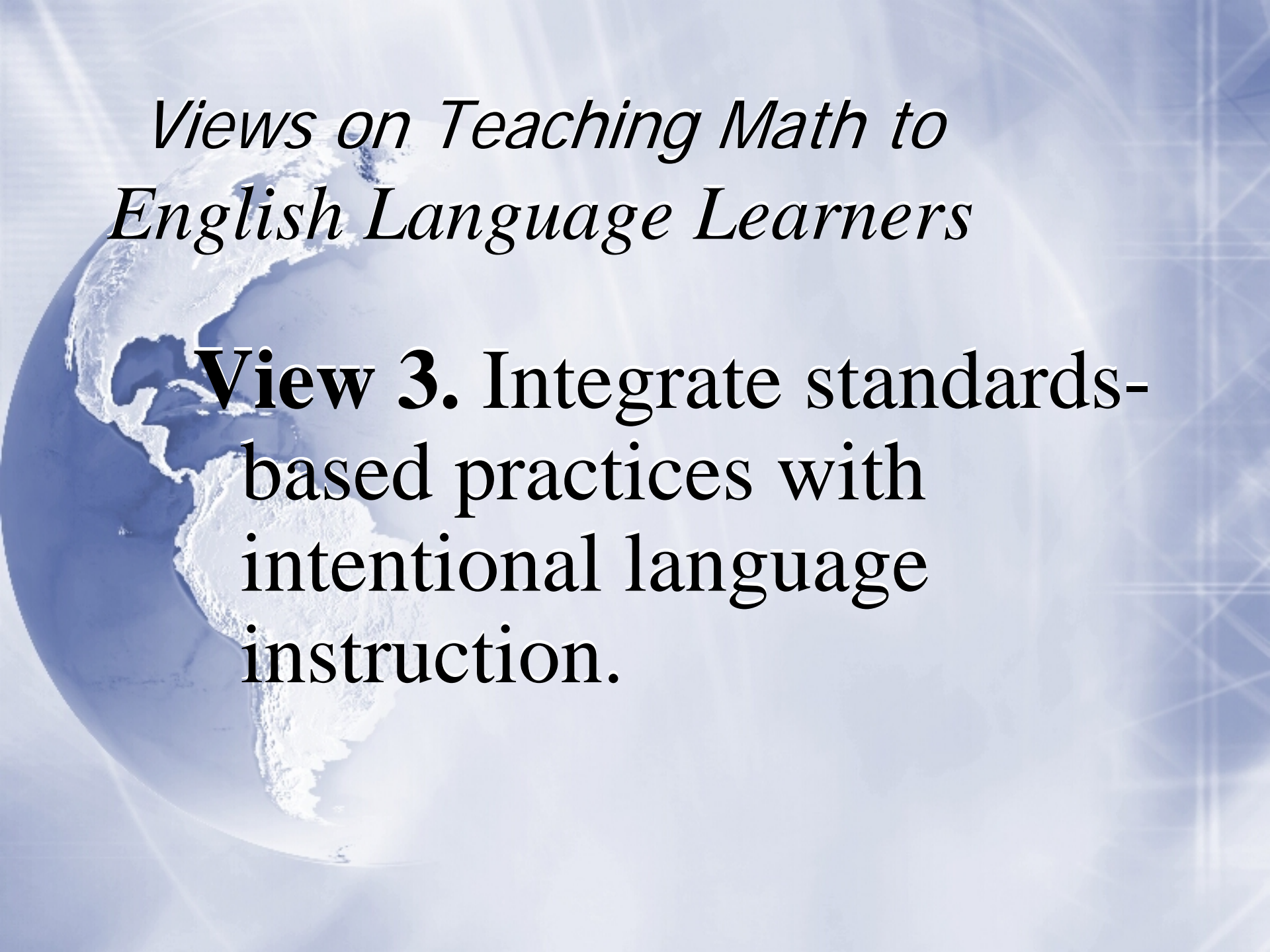


## *Problems with View #2*

Many of the strategies outlined in PSSM align with strategies suggested for ELLs, however:

- ❖ An achievement gap still exists in classrooms that report to be standards-based.
- ❖ Nothing in PSSM addressing explicit teaching of language during math instruction.
- ❖ Saying that it's "just good teaching" implies no additional strategies are needed for ELLs.





*Views on Teaching Math to  
English Language Learners*

**View 3.** Integrate standards-based practices with intentional language instruction.



*View 3. Integrate standards-based practices with intentional language instruction.*

- ❖ High expectations and strong support: The Equity Principle.
- ❖ Teach vocabulary and reading comprehension.
- ❖ Incorporate more language use (and scaffold, as needed).
- ❖ Encourage native language use.
- ❖ Consider culture in decision making and lessons.
- ❖ High expectations and strong support - Worth repeating!



*High Expectations and  
Strong Support*

*Equity Principle, NCTM, 2000*



# *What is Standards-based?*

You are a reporter for the news. The camera is about to roll and the question to you is "What is standards-based math?"

Remember the audience is the public.

*Share Report with a partner (I will say SWITCH at 30 seconds).*



# *High Expectations: Curriculum*

Materials that:

1. Are Comprehensive
2. Are Coherent
3. Develop Ideas in Depth
4. Promote Sense Making
5. Engage Students
6. Motivate Learning

(Trafton, Reys, Wasman, 2001):



*High Expectations :*  
*What is Standards-based Math?*

*National Council of Teachers of Mathematics*

**5 Content Standards**

**5 Process Standards:**

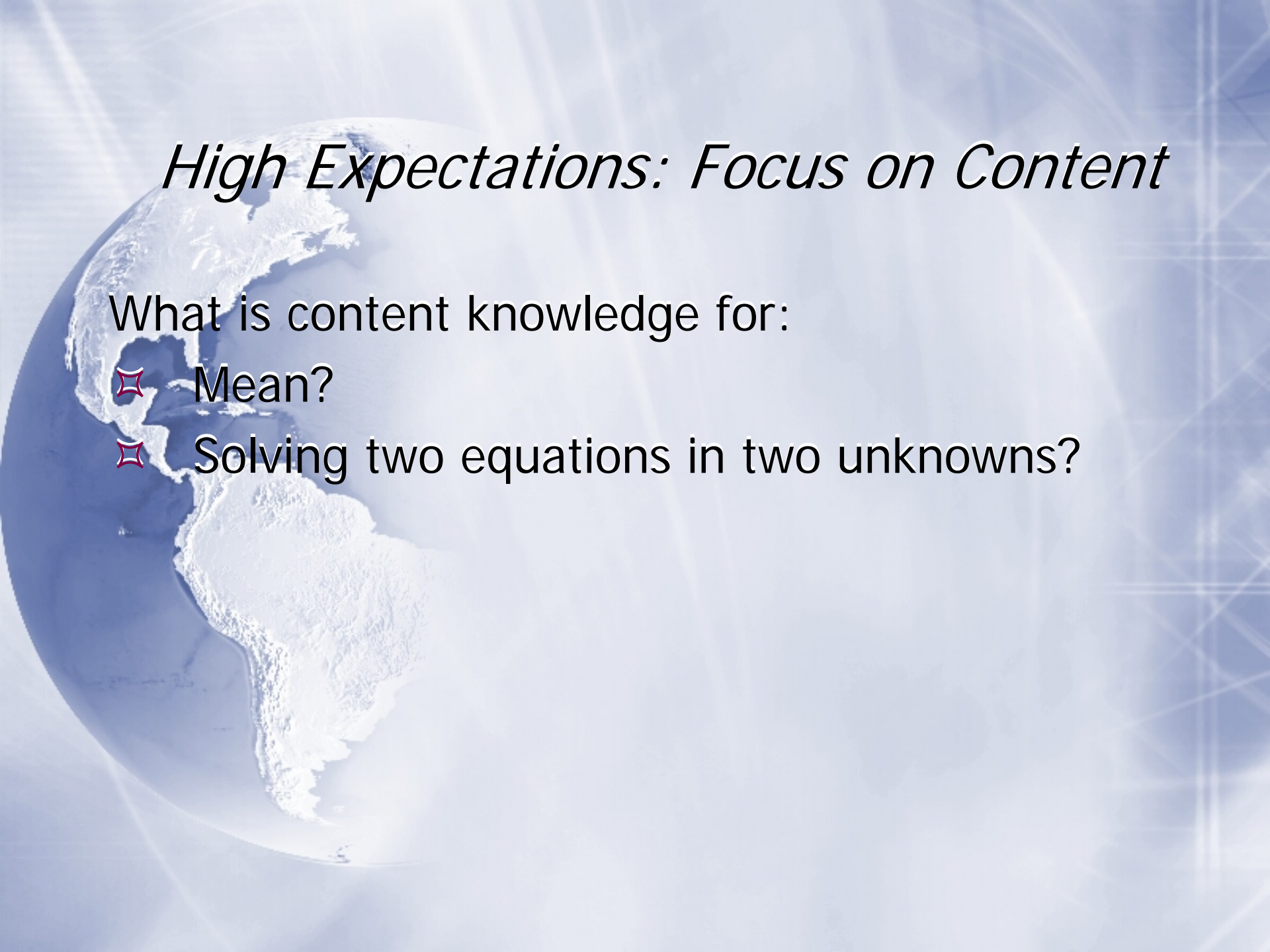
*Reasoning*

*Problem Solving*

*Communication*

*Representation*

*Connections*



## *High Expectations: Focus on Content*

What is content knowledge for:

✧ Mean?

✧ Solving two equations in two unknowns?

# *Standards-based: Focus on Content*

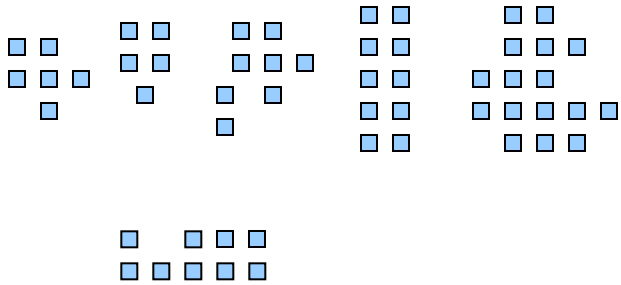
✧ **LINK SHEET** Topic: \_\_\_\_\_

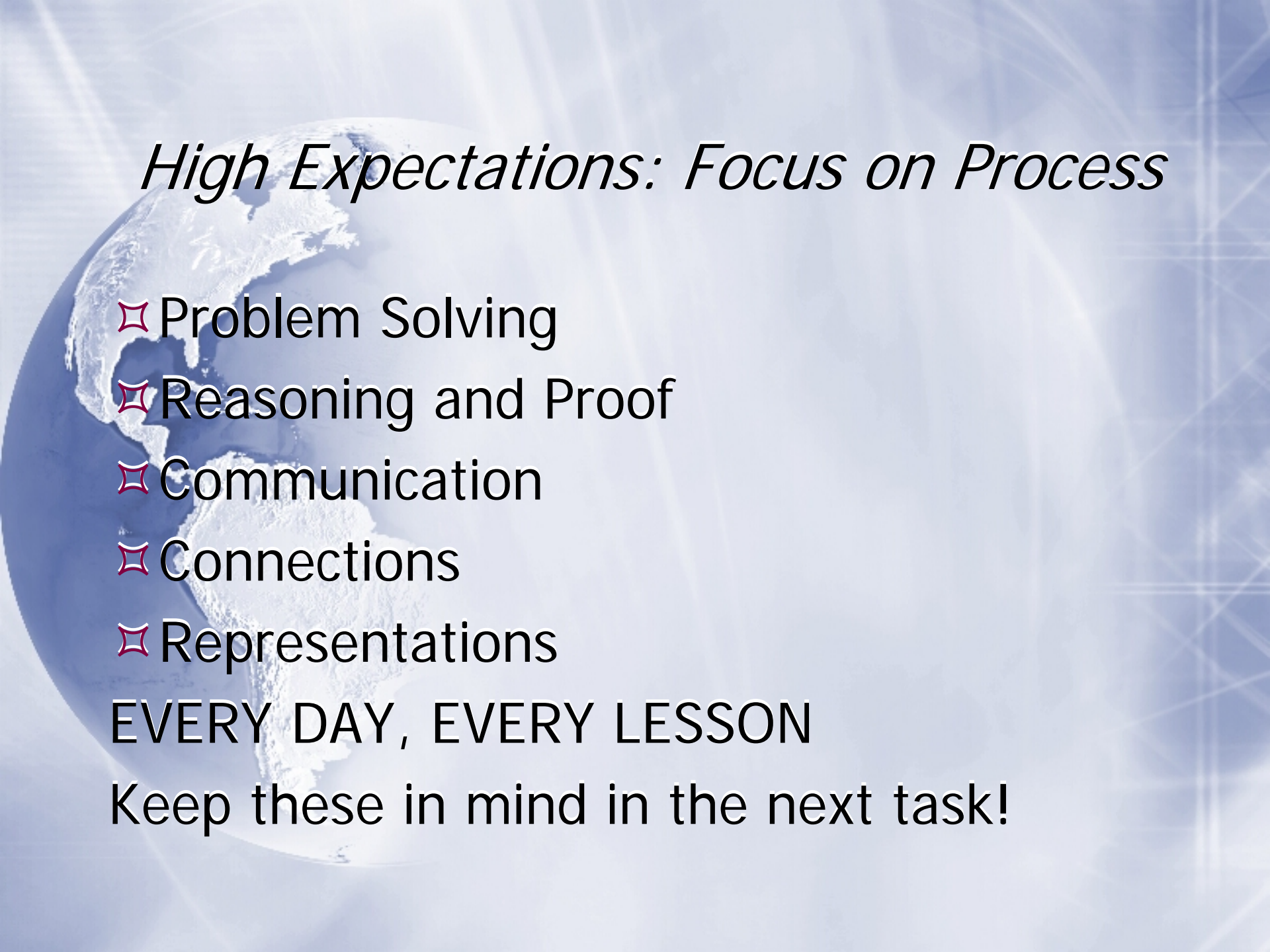
<b>Mathematics Example (procedure)</b>	<b>Everyday Example (Context)</b>
<b>Diagram/picture/graph (representation)</b>	<b>My explanation (general description)</b>



# Standards-based: Focus on Content

✧ LINK SHEET Topic: MEAN

<b>Mathematics Example (procedure)</b>	<b>Everyday Example (Context)</b>
$  \begin{array}{r}  3, 5, 8, 10, 19 \\  \hline  3 + 5 + 8 + 10 + 19 \\  5  \end{array}  $	<p>Money earned selling candy bars.</p>
<b>Diagram/picture/graph (representation)</b>	<b>My explanation (general description)</b>
	<p>It is the evening out - Finding out if all days were the same, what it would be.</p>




## *High Expectations: Focus on Process*

- ✧ Problem Solving
- ✧ Reasoning and Proof
- ✧ Communication
- ✧ Connections
- ✧ Representations

EVERY DAY, EVERY LESSON

Keep these in mind in the next task!



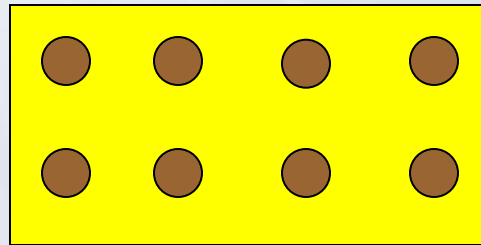
*Standards-based: Focus on Process*

Box of Chocolates

**Chocolates**

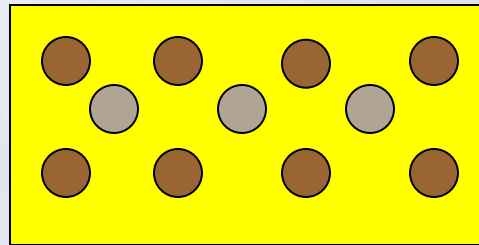
*Standards-based: Focus on Process*

Box of Chocolates



# *Standards-based: Focus on Process*

## Box of Chocolates



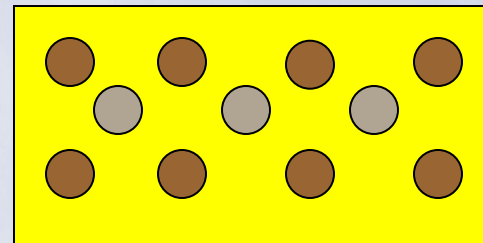
For any sized box, can you tell:


- (1) How many dark chocolates inside?
- (2) How many light chocolates inside?

# *Standards-based: Focus on Process*

## Box of Chocolates

- ❖ Where are the processes in the lesson?
- ❖ What additional use of the processes could be included?



A blue-tinted image of Earth from space, showing the continents of North and South America. The text "Equity ≠ Equality" is overlaid in the center in a large, black, sans-serif font. The background features a grid of white lines and a bright light source on the left, creating a lens flare effect.

**Equity ≠ Equality**



# *Strong Support*

## Building Background

1. Developing meaning of words and concepts



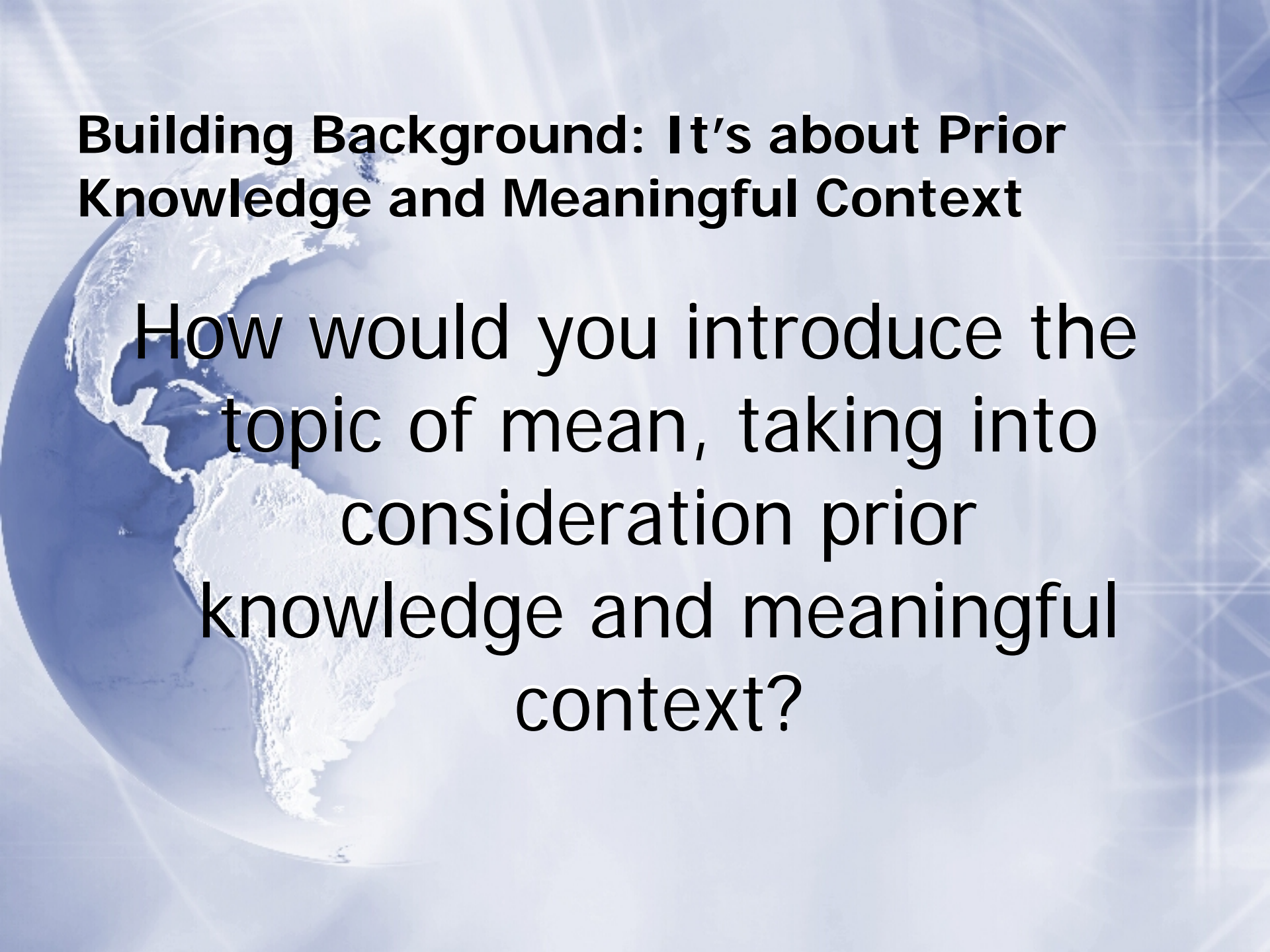


## **Building Background**

*It's about:*

*(1) Prior Knowledge and*

*(2) Meaningful Context*



## **Building Background: It's about Prior Knowledge and Meaningful Context**

How would you introduce the topic of mean, taking into consideration prior knowledge and meaningful context?



# *Strong Support*

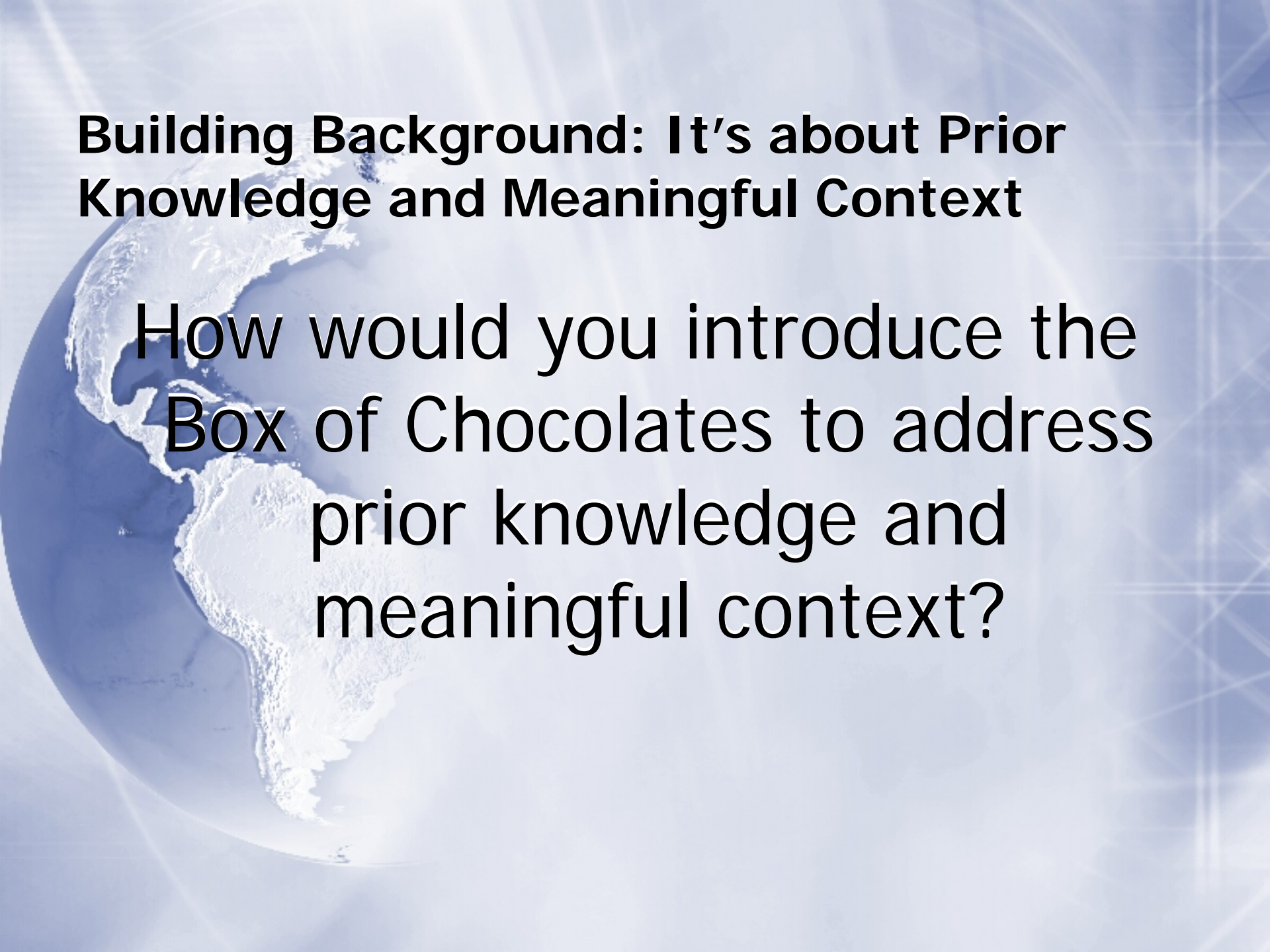
**The mean of a set of four numbers is 5. Three of the numbers are 4.3, 8.15, and 1.65. What is the fourth number of the data set? How did you find it?**



# *Strong Support*

**The mean of a set of four numbers is 5. Three of the numbers are 4.3, 8.15, and 1.65. What is the fourth number of the data set? How did you find it?**

- ✧ **Tell**
- ✧ **Show**
- ✧ **Write**



## **Building Background: It's about Prior Knowledge and Meaningful Context**

How would you introduce the Box of Chocolates to address prior knowledge and meaningful context?



# *Strong Support*

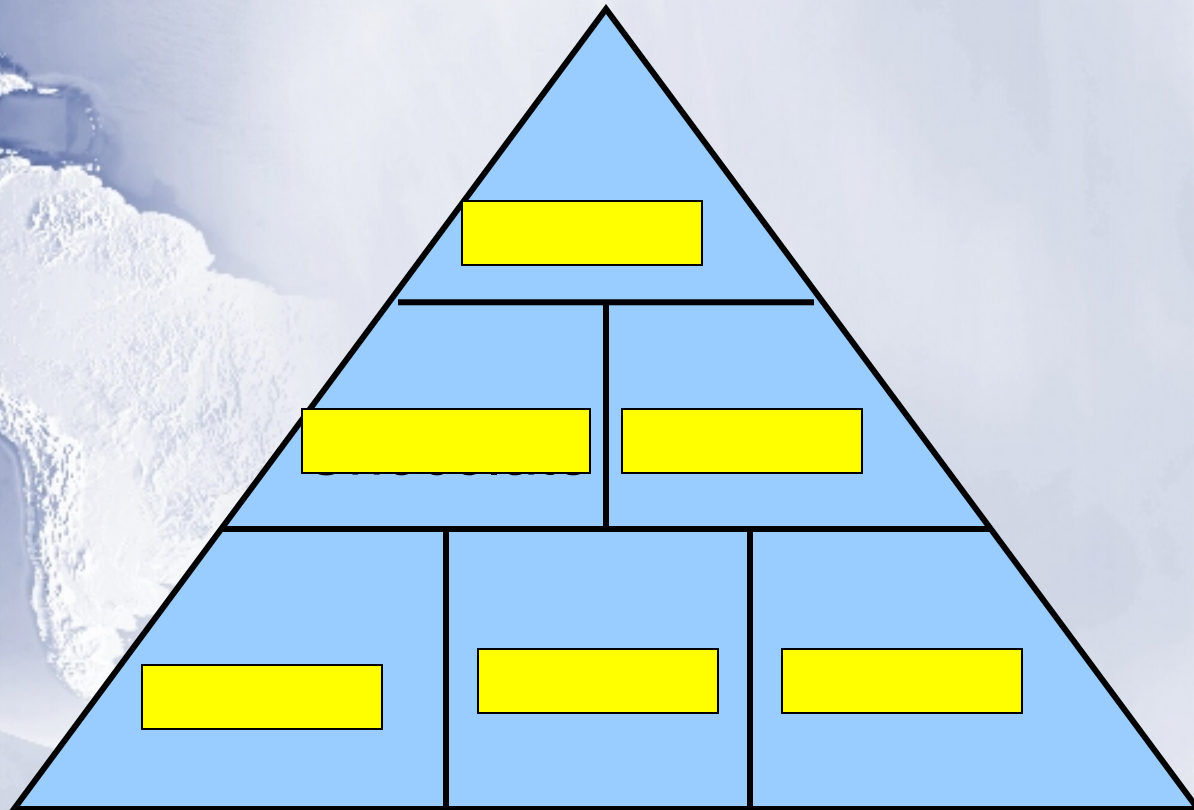
How might we accommodate this task to support language learners?

- ✧ Vocabulary support before, during, after
- ✧ Visuals
- ✧ Grouping of Students
- ✧ Support for writing (modeling, graphic organizer, sentence starters)
- ✧ Use of native language
- ✧ Others?

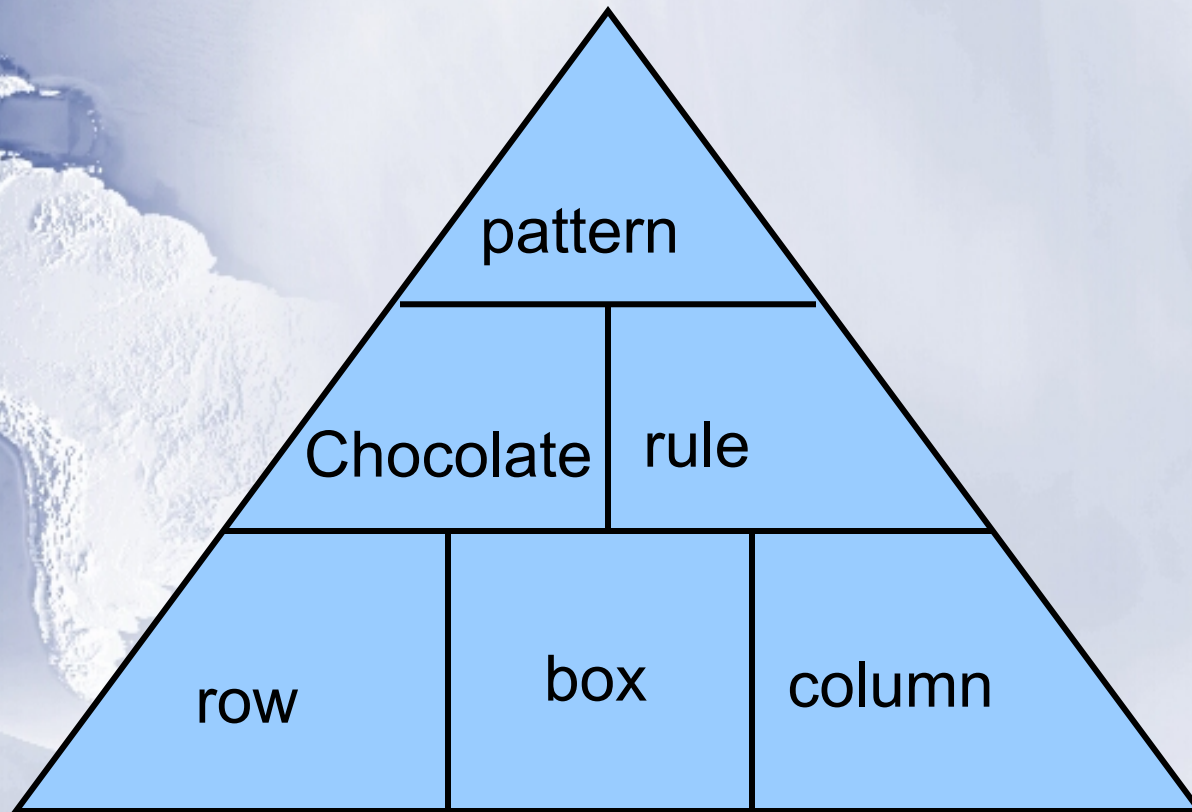
# ***Strong Support: Vocabulary Review***

## **Task Analysis:**

Example to review vocabulary BEFORE the lesson.



# \$10,000 Pyramid Example







# *Vocabulary Instruction*

## Task Analysis:

Identify review vocabulary and key new vocabulary

Ideas for **reviewing** Key Vocabulary:

Games (e.g., 10,000 Pyramid)

Think-Pair-Share

Rotation Brain Storm

Quick Talk



# *Vocabulary Instruction*

## Task Analysis:

Identify review vocabulary and key new vocabulary

Ideas for **NEW** Key Vocabulary:

Word Walls - INTERACTIVE

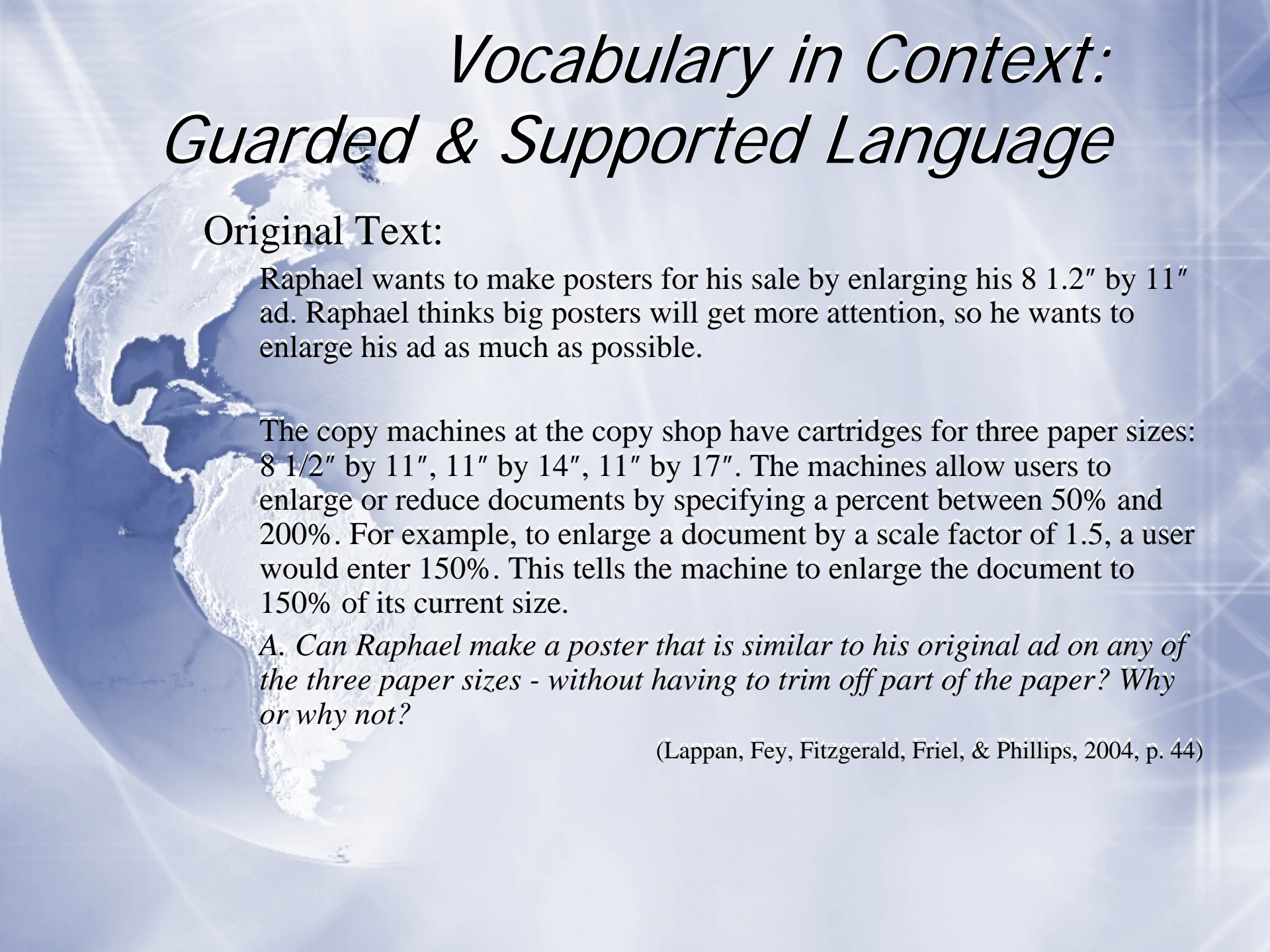
Journals

Link Sheet

Graphic organizers

Concept Maps

Student USE of it



# *Vocabulary in Context: Guarded & Supported Language*

## Original Text:

Raphael wants to make posters for his sale by enlarging his 8 1.2" by 11" ad. Raphael thinks big posters will get more attention, so he wants to enlarge his ad as much as possible.

The copy machines at the copy shop have cartridges for three paper sizes: 8 1/2" by 11", 11" by 14", 11" by 17". The machines allow users to enlarge or reduce documents by specifying a percent between 50% and 200%. For example, to enlarge a document by a scale factor of 1.5, a user would enter 150%. This tells the machine to enlarge the document to 150% of its current size.

*A. Can Raphael make a poster that is similar to his original ad on any of the three paper sizes - without having to trim off part of the paper? Why or why not?*

(Lappan, Fey, Fitzgerald, Friel, & Phillips, 2004, p. 44)

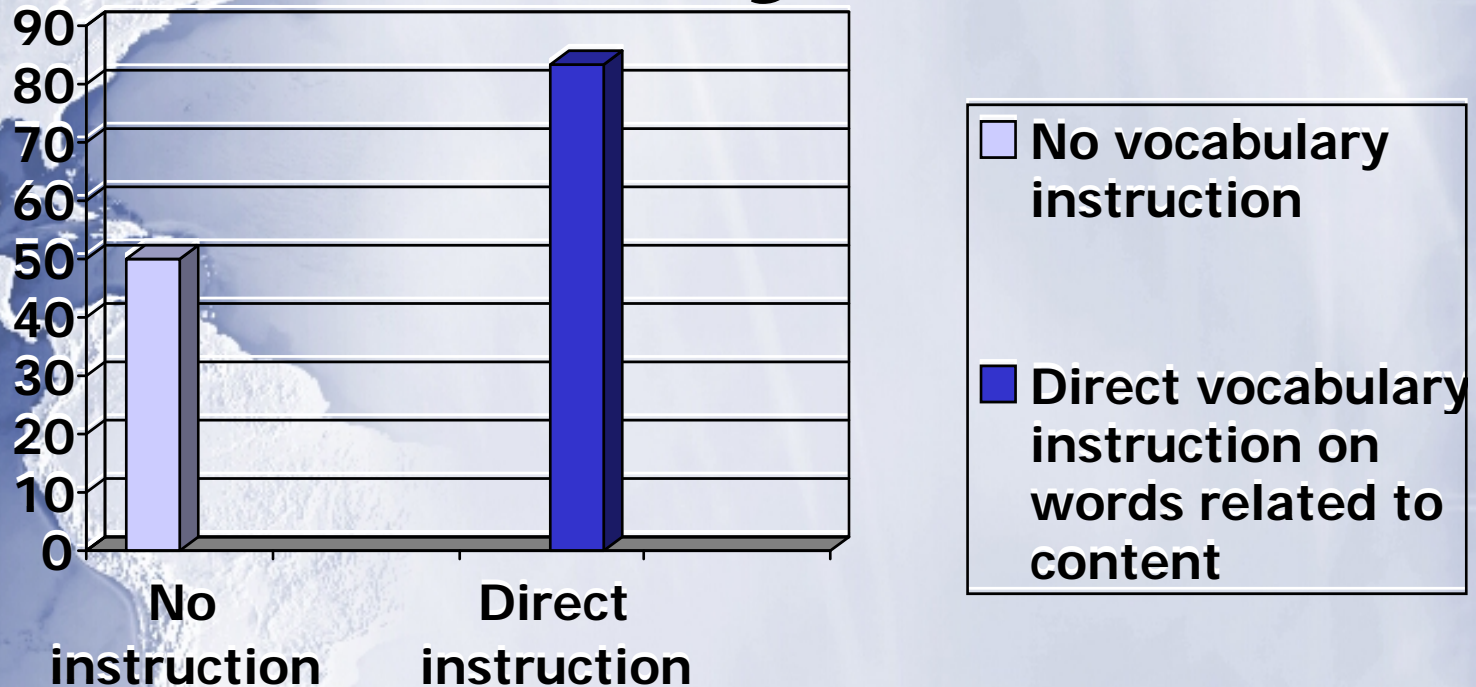
# *Vocabulary in Context: Guarded & Supported Language*

Modified Text:

Raphael is having a sale. He made an ad on paper that is  $8\frac{1}{2}$ " by 11", but he wants to make it as big as possible.

There are three sizes of paper:  $8\frac{1}{2}$ " by 11", 11" by 14", or 11" by 17". He can make the copy machine change the size of the paper by choosing a percent between 50% and 200%. For example, to make the ad bigger by a scale factor of 1.5, Raphael would choose 150%. This will make the ad 150% bigger than it is now.

# *Impact of Direct Vocabulary Instruction*



Stahl & Fairbanks, 1986, as cited in Marzano, 2004

## **NEW Key Vocabulary**

“Teaching specific terms in a specific way is probably the strongest action a teacher can take to ensure that students have the academic background knowledge they need to understand and be able to ‘do’ mathematics.”

**Marzano & Pickering, 2005, p. 1**



*Developing Meaning of Words*

Definition  
versus  
Description



# *Hallacas*

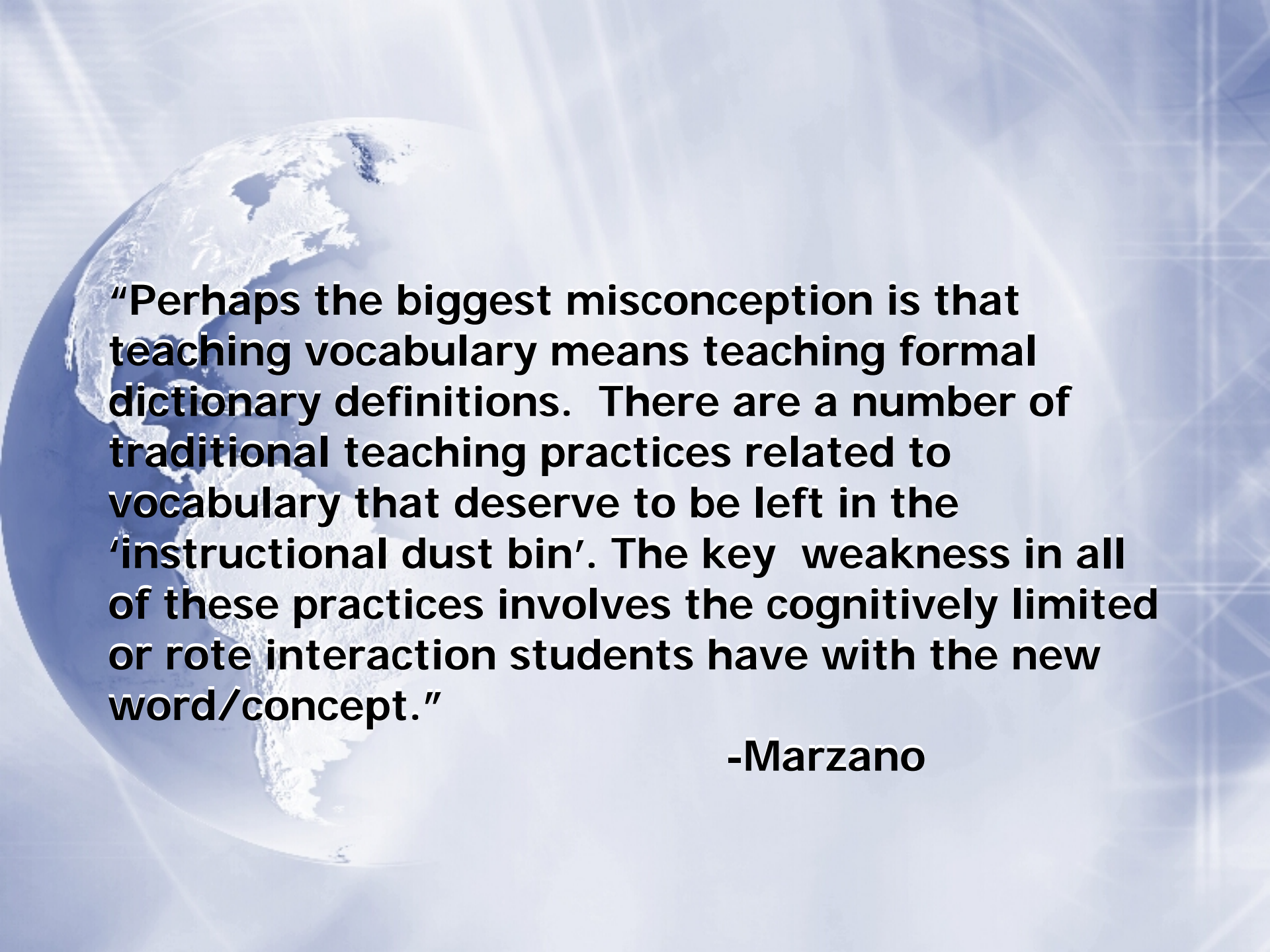
- ✧ Everyone likes hallacas.
- ✧ One can buy them or make them at home.
- ✧ Many families make them together.
- ✧ They are a typical Christmas dish.
- ✧ It is necessary to gather a lot of ingredients to prepare them.
- ✧ A special dough made of corn flour is used.





# *Hallacas*

- ✧ This dough is made very thin and formed in a circle and then is filled with a mixture of chicken, pork, tomatoes, red peppers, onions, garlic and other spices that give the dish flavor.
- ✧ The dough is doubled over with this filling inside and wrapped in banana or plantain leaves. It is tied with a string and then put in hot water to cook for approximately an hour.
- ✧ Venezuelans eat hallacas during the entire month of December but on Christmas and New Year's Eve it is a dish that is never missing from the table.



**"Perhaps the biggest misconception is that teaching vocabulary means teaching formal dictionary definitions. There are a number of traditional teaching practices related to vocabulary that deserve to be left in the 'instructional dust bin'. The key weakness in all of these practices involves the cognitively limited or rote interaction students have with the new word/concept."**

**-Marzano**



# *Traits of Math Definitions*

**In mathematics, definitions are more precise than in other domains. They are unique in that:**

- (1) They are based on the least amount of information needed.**
- (2) There is “nesting” within definitions.  
(relationships are implied, but not stated)**

**Example: Least Defining List**



*From description to definition:*  
*Square*

List as many properties as you can think  
of related to:

- (1) Sides**
- (2) Angles**
- (3) Diagonals**
- (4) Symmetry**



*From description to definition:*  
*Square*

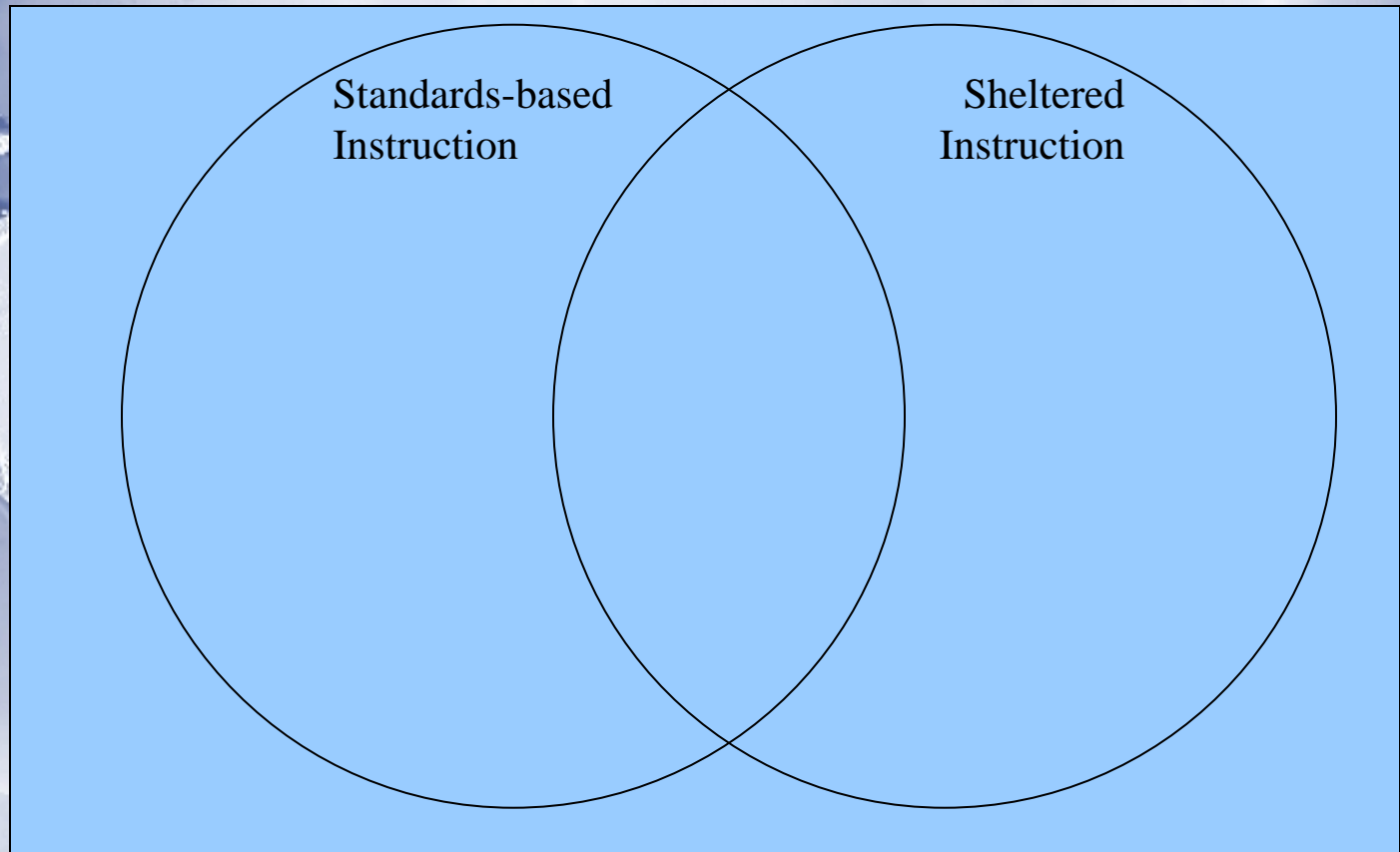
Review the lists and determine the minimum characteristics you need to define a square.

Minimal List must be:

- (1) Sufficient to ensure shape will be a square AND
- (2) Necessary (cannot be removed and #1 would still be true).

# Moving Towards View 3

What is unique and what is the same?





## *The Vision*

“Equity does not mean that every student should receive identical instruction. Rather, it demands that reasonable and appropriate accommodations be made and appropriately challenging context be included to promote access and attainment for ALL students”

(NCTM, 2000)



## *WHAT IT TAKES*

Successfully teaching students from culturally and linguistically diverse backgrounds- especially students from historically marginalized groups-involves more than just applying specialized teaching techniques. It demands a new way of looking at teaching that is grounded in an understanding of the role of culture and language in learning.

-Ana Maria Villegas & Tamara Lucas





*Questions?*

THANK YOU!

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