



## Developing Science Knowledge and Vocabulary in English- Language Learners: Project QuEST

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## Acknowledgements

My collaborators on the QuEST studies include:

- Center for Applied Linguistics: Lauren Artzi, Cheryl Dressler, Jennifer Gray, Julie Mazrum, Sarah Moore, Christine Rafal, Michelle Lombard, and Jennifer Powell
- University of Houston: David Francis, Lee Marten, Coleen Carlson, Chris Barr, Elsa Hagan, Gaby Cedillo, and Ruth Sanchez.

The work reported here was supported by Grant Number R305A050056 from the Institute of Education Sciences, U.S. Department of Education

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## Overview: Project QuEST

- Intervention with 3<sup>rd</sup> and 4<sup>th</sup> grade English-language learners
  - Students did significantly better on vocabulary that they had been explicitly taught using intervention methods than vocabulary they were exposed to, but not explicitly taught.
- Intervention with 6<sup>th</sup> grade English-language learners
  - Posttest results of students who had received the intervention were significantly higher than comparable students in the control group in both science knowledge and academic vocabulary.

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## Attributes of Interventions

- Aligned with state standards and district curriculum
  - FOSS (Full Option Science System)
  - Five E Model of instruction (engage, explore, explain, extend, and evaluate), district textbook, and labs
- Alterations for English-language learners
  - Scaffolding content and reinforcement
  - Explicit focus on developing language proficiency

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## Scaffolding Content

- Use of Visuals
  - Illustrations of academic and discipline specific vocabulary
  - Graphic organizers
- Previews of the activities to ensure an understanding of goals and procedures
  - Discussion of science and language objectives
  - Teacher modeling of science experiments
- Shared interactive dialogues during science activities and textbook reading

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## Reinforcement

- Glossaries
- Concept maps
- Games

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## Visuals (Side 1) EROSION

Week 125 – Key/Science Vocabulary  
Word 4 – Erosion  
Image 2



1. Another word in the text is erosion. Erosion occurs when rock or soil is worn down or moved by rivers, the sea or the wind.
2. En español "erosion" quiere decir erosión. La erosión ocurre cuando se produce un desgaste o un movimiento de las rocas o la tierra por efecto de los ríos, el mar o el viento.
3. Erosion in English and erosion in Spanish are cognates.
4. Now, let's look at a picture that demonstrates the word erosion. These rocks have been eroded or worn down by the wind, which is why their shapes are unusual [point to the picture].

## Visuals (Side 2)

## EROSION

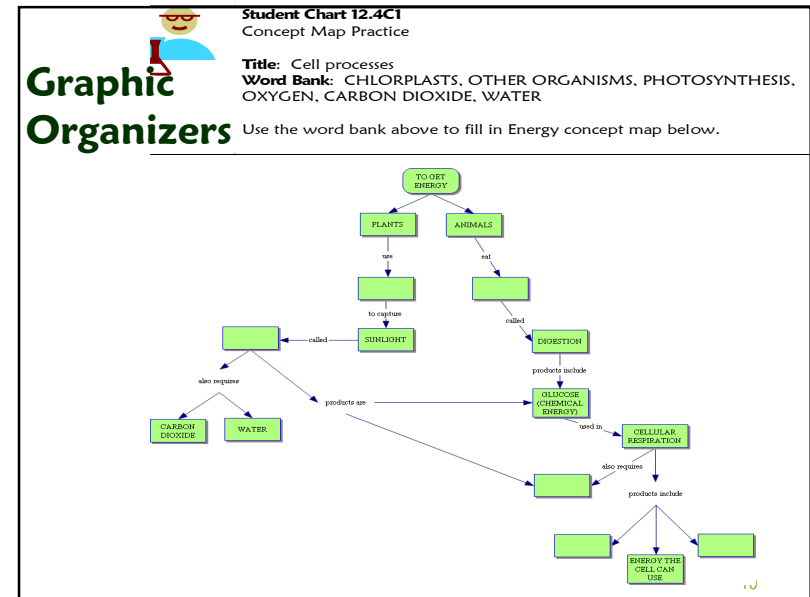
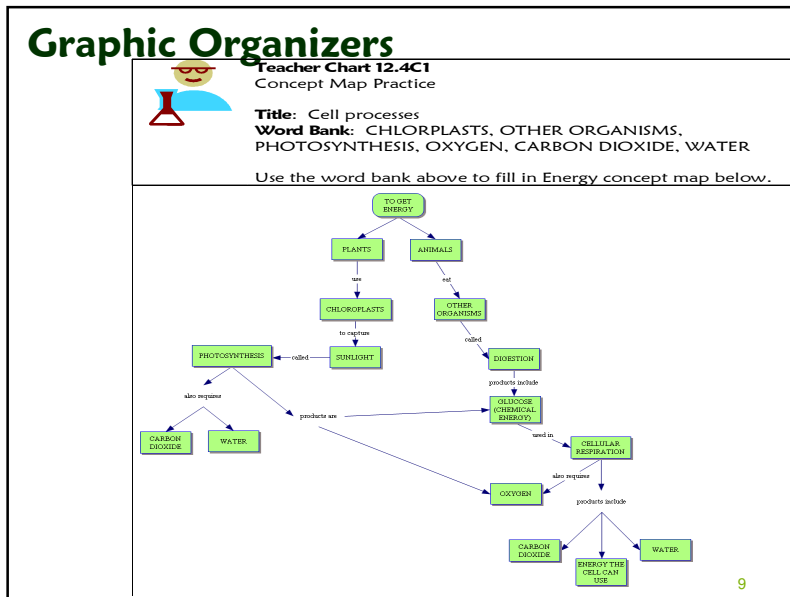
Week 125 – Key/Science Vocabulary  
Word 4 – Erosion  
Image 1



5. Here is another picture of erosion.  
Partner talk: turn to your partner and talk about why this picture demonstrates the word erosion.  
[Anticipated possible response: the rock was eroded or worn down by the water and wind]



6. Say erosion with me three times – erosion, erosion, erosion.



## Shared Interactive Dialogues

A cell membrane is usually permeable to substances such as oxygen, water, and carbon dioxide. On the other hand, the cell membrane is usually not permeable to some large molecules and salts. Substances that can move into and out of a cell do so by one of three methods: diffusion, osmosis, or active transport.

**A 3: Name some things that can easily permeate the cell membrane.**  
(Oxygen, water, and carbon dioxide can permeate the cell membrane.)

**O: Name some things that cannot easily permeate the cell membrane.**  
(Large molecules and salts cannot permeate the cell membrane.)

**Have students answer Key Question #1 in their student charts.**

**Key Question 1:** How does the structure of the cell membrane relate to its function?  
(The cell membrane is structured so that substances can only move into and out of a cell by either diffusion, osmosis, or active transport. The cell membrane's structure does not allow all substances to pass through it.)

ICREATE 11

## Reinforcement

**Week Seven Vocabulary Glossary**  
Read each word's definition and write notes or a sentence of your own.

microscope	A <u>microscope</u> is an instrument that makes small objects look larger. <i>Un microscopio es un instrumento que amplifica la imagen de objetos pequeños.</i> Your notes:	
concept	A <u>concept</u> is a general idea or understanding of something. <i>En español "concept" quiere decir concepto o idea general o entendimiento de algo.</i> The boy had only a vague <u>concept</u> of what the answer might be. Your notes:	
organ	An <u>organ</u> is a group of tissues that perform a specific function. <i>En español "organ" quiere decir órgano o estructura en el cuerpo que está compuesta de diferentes tipos de tejidos.</i> The <u>organ</u> in the picture are lungs. Your notes:	

## Explicit Focus on Developing Language

- **Teaching Individual Words**
  - Methods
    - Pre-teaching
    - Reinforcement in Context
  - Types of Words
    - General academic vocabulary: average; assemble, acquire, core
    - Discipline specific vocabulary: monument, pyramid, rubble, obelisk, granite, outcropping, dome, magma, solid, hollow
- **Word Learning Strategies**

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## Reinforcement In Context

TEACHER READER  
Week 12

### DAY ONE: TREASURE UNDERFOOT

People have extracted or taken minerals from the ground for thousands of years. At first, people used shovels to move the layer of soil covering the minerals. They dug mines or underground holes where mineral are found using picks. It was a dirty and dangerous job. At times, children were forced to do the work.

Today mining is done in many ways. Excavating machines or machines that dig in the earth and backhoes are used to move earth. Mechanical shovels with spinning teeth cut through rock. Explosive charges break rock into pieces.

The minerals are turned into tools, pottery, and jewelry. But did you know the first iron used to make tools was not mined but came from meteorites.



backhoe



shovel



explosive charges

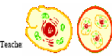


pick

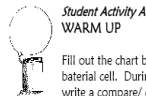
1. In earlier times, what did people use to extract minerals from the ground?
2. What do people use now to take minerals from the ground?
3. What are some things that people make with minerals?
4. Where did the first iron for tools come from?

## Reinforcement In Context

QUEST: Web Five, Day Five  
Student Activities 8–10, Student Chart and Teacher



INSIDE CELLS, Part Two  
Day 3



Student Activity A  
WARM UP

Fill out the chart below to describe the characteristics of a plant, animal, and bacterial cell. During groupwork, you will use this information to help you write a compare/contrast paragraph.

Characteristic	Plant Cell	Animal Cell	Bacterial Cell
Cell Membrane			
Cell Wall			
Chloroplast			
Cytoplasm			
Nucleus			
Shape			

15

## Word-learning Strategies



Student Chart 6.4A  
Warm-Up

English Word	English Meaning	Spanish Word	Spanish Meaning
Necessary		Necesario	
Flexible		Flexible	
Pie		Pie	



Student Chart 6.4B

Work with a partner to find all the cognates in the paragraph. There are nine more.

**The Chemicals of Life** The cells of all living things are composed of chemical substances. The most abundant chemical substance in cells is water. Other chemical substances called carbohydrates (kar boh HY draytz) are a cell's main energy source. Two other chemical substances, proteins (PRO teenz) and lipids (LIP idz), are the building materials of cells, much like wood and bricks are the building materials of houses. Finally, nucleic (noo KLEE ik) acids are the genetic material—the chemical instructions that direct the cell's activities.

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16

## Word-learning Strategies

**Student Chart 7.4B**



Spanish	English Cognate	Letter(s) in Spanish, not in English
sustancias	substances	
químicas	[chemicals]	
célula	[cells]	
compuestas	[composed]	
abundante	[abundant]	
energía	[energy]	
carbohidratos	[carbohydrates]	
proteínas	[proteins]	
lípidos	[lipids]	
materiales	[materials]	
finalmente	[finally]	
ácidos	acids	
nucleicos	[nucleic]	
genético	[genetic]	
instrucciones	[instructions]	
dirigen	[direct]	
actividades	[activities]	

17

## Word-learning Strategies

**Student Chart 7.4C Identification of Sound Differences**

Using the ELMO, show students the following Likert Scale. Explain to students that some of the cognates sound more alike than others. Direct students to identify how alike or not alike the sets of cognates sound on a scale of 1 to 4.




Sounds completely different	Sounds slightly different	Sounds similar	Sounds exactly alike
1	2	3	4
substances / substancias			
1	2	3	4
chemical / químicas			
1	2	3	4
cell / célula			
1	2	3	4
compose / compuestas			
1	2	3	4
abundant / abundante			
1	2	3	4
energy / energía			
1	2	3	4
proteins / proteínas			
1	2	3	4
carbohydrates / carbohidratos			
1	2	3	4
lipids / lípidos			
1	2	3	4
materials / materiales			
1	2	3	4

18

## Word-learning Strategies

**Student Chart 11.4B**



Practice turning verbs and adjectives into nouns.

Noun	Verb	Adjective
diffusion	diffuse	diffused
	concentrate	
		required
removal		
engulfment		
	locate	

Rules: If you take off the ending of a verb or adjective and add 'ion', 'al' or 'ment' it turns into a noun

Example: 'diffuse' minus 'e' plus 'ion'=diffusion; 'diffused minus 'ed' plus 'ion' = diffusion.

19

## Summary

- Align with district and state standards
- Build on district scope and sequence and curricular resources
- Scaffold content
- Provide reinforcement
- Develop students' language proficiency in the context of content area instruction
- Be creative and have fun!

20