CREATE
Center for Research on the Educational Achievement and Teaching of English Language Learners

A partnership of:
Texas Institute for Measurement, Evaluation, and Statistics at the University of Houston;
California State University, Long Beach;
Center for Applied Linguistics;
Harvard University;
University of California, Berkeley; and
Vaughn Gross Center at the University of Texas at Austin.

QuEST: Quality English and Science Teaching

Diane August
Center for Applied Linguistics

Overview

- Project located in middle schools in south Texas
- Most students are language minority and Spanish is their first language
- District in which there are high levels of poverty
- Two year study
- Major strand of the National Research and Development Center on English-language Learners—CREATE

Overview

- QuEST integrates
  - Science
    - NSF model of science instruction that includes engagement, exploration, explanation, elaboration, and evaluation
  - Activities to build language and literacy development, including writing
    - Methods based on findings from the National Literacy Panel on Language Minority Children and Youth
  - Motivation
    - Methods based on work by John Guthrie
  - Ongoing assessment
  - Professional development and mentoring

Year One

- 10 sixth grade science teachers in five middle schools
- Approximately 1,000 students involved in the study
- Within teacher, 2 science sections were randomly assigned to QuEST and 2 were randomly assigned to the regular curriculum (Prentice Hall)
- Curriculum for all sections: two six-week units focused on Living Systems and Environment; material aligned with state and district standards

Year One

- Curriculum-based measures of science knowledge and vocabulary constructed for each science unit
  - Each test consisted of 30 items
  - Scores were summed across the assessments for the two different units to create a composite measure of science knowledge and a composite measure of vocabulary, each administered pre- and post-instruction
- Treatment effects were tested separately for science knowledge and vocabulary using analysis of covariance, with the analogous pre-test serving as the covariate
  - Analyses included fixed effects of treatment assignment and the covariate, and random effects for section and teacher
  - Treatment effects were tested at the level of the section

Year One

- Results indicated students in the treatment sections outperformed students in control sections on growth in vocabulary and in science knowledge
- Examination of variance components showed significant variability across teachers and sections in the performance of students in both treatment and control sections

Sample Size Table

Teacher	Control		Treatment	
	Section 1	Section 2	Section 1	Section 2
ELT00001	32	29	22	25
ELT00002	34	26	25	22
ELT00003	30	27	28	29
ELT00004	16	22	27	19
ELT00005	20	16	17	22
ELT00006	18	25	15	19
ELT00007	18	18	12	15
ELT00008	13	23	21	18
ELT00009	27	23	22	25
ELT00010	25	28	23	23

Year One Results Table

Measure	Group	Pre Test		Post Test		Adjusted Post	
		Mean	s.d	Mean	s.d.	Mean	S.E.
Vocabulary	Treatment	10.9	11.5	18.8	16.2	19.6	0.83
	Control	12.2	11.9	15.5	14.6	15.4	0.65
Science	Treatment	8.5	3.9	12.7	6.7	13.04	0.76
	Control	8.9	4.3	12.1	6.4	12.08	0.83

Science $p<.054$; Vocabulary $p<.0001$

QuEST Curriculum Cycle: Year One

- Days 1-4
  - Engagement (warm-up)
  - Exploration, Explanation, Elaboration
    - Hands-on science activity days 1, 2, and 3
    - Guided reading days 1 and 3
    - Language arts day 4
  - Wrap up
- Day 5
  - Evaluation (Week 1, vocabulary; Week 2, science)

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Introduction: Teacher Guide

Topic: Inside Cells
TEKS 6.10b
Science Explorer pages 142-143

Preparation
- Copy student activity charts and make one teacher copy of each chart to use with the Elmo.
- Read and follow the preparation listed on page 148 of the teacher's guide for A Magnified View of Life.
- Make sure you have fresh Elodea plants and prepared slides of animal cells

Materials
- Student activity charts and teacher copy for Elmo
- Plastic dropper
- Water
- Microscope slide
- Microscope
- Forceps
- Cover slips
- Elodea
- Colored pencils
- Prepared slides of animal cells

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Introduction: Teacher Guide

Introduction
1. **Student Activity A:** Show What You Know Quiz
2. **Student Activity B:** Warm-Up - have students respond to the question "Plant cells have a cell wall which supports and protects the plant cell. Why do you think animal cells don't have a cell wall?" Discuss responses.

[Expected Response: students should say that most animals have something else that provides them with structure, like a skeleton (an internal or exoskeleton), or they may say that some animals or other non-plant cells are unicellular and do not need that type of support.]

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Application and Wrap-Up: Teacher Guide

Application
1. **Student Activity C:**
Review the instructions for A Magnified View of Life with students. See student activity charts for lab procedure. The lab was adapted from *Unit 2 Resources*, page 28. Make sure students know what diagrams and questions to complete. Review the rules of microscope use and the techniques for using a microscope.

2. Have students complete the lab.

Wrap-Up
1. **Student Activity D:** Students respond to the question "What are the main differences between plant and animal cells?" Discuss as time permits. You may want to post the differences in a prominent place to refer to during the rest of the cell unit.

[Expected Response: plant cells have chloroplasts and cell walls. Animal cells do not. Plant cells are usually rectangular in shape, while animal cells are often round.]

2. **Student Activity E:** Introduce Academic Words Glossary Part One homework.

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Application: Student Guide

Student Activity C

A MAGNIFIED VIEW OF LIFE

Follow the steps below to observe and record characteristics of plant and animal cells.

Part One: Observing Plant Cells

1. Place a drop of water in the center of a slide
2. With forceps, remove a leaf from an Elodea plant. Place the leaf in the drop of water on the slide. Make sure that the leaf is straight and flat.
3. Put a coverslip on the leaf. If there is a bubble, tap the slide very gently to get rid of it.
4. Use a microscope to examine the Elodea leaf under low power. Then, carefully switch to high power.
5. In the space below, draw and label what you see under low power and high power, including the colors of the cell parts. Give your drawing a title and record the magnification. Make sure you include the power in your title as well.

Total Magnification: _____ Total Magnification: _____

6. Remove the leaf and discard it according to your teacher's directions.
7. Clean and dry your slide and coverslip.

Application: Student Guide

Part Two: Observing Animal Cells

1. Put a prepared animal slide under the microscope.
2. Observe the animal cell under low power and high power.
3. In the space below, draw and label what you see under low power and high power. Make sure you remember to label the organelles that you see. Give your drawing a title and record the magnification. Make sure you include the power in your title as well.

Total Magnification: _____ Total Magnification: _____

Application and Wrap-up: Student Guide

Part Three: Thinking About Observations.

Answer the questions below.

1. What natural color appeared in the plant cells? What structures give the plant cells this color?

2. Why is it important to record your observations while you are examining a speicimen?

Student Activity D

WRAP UP

What are the main differences between plant and animal cells?

Student Activity E

GLOSSARY HOMEWORK

Complete Week 5 Academic Words Glossary, Part One. For each word, read the definition, and then write a sentence using that word.

Activities to Build Academic Language in the Context of Science Instruction

- Guided Reading
- Writing
- Word-learning strategies
  - Cognates
  - Base words
  - Word roots
- Academic and technical vocabulary
  - Glossaries and assessments
- Cooperative group work and partner work

Guided Reading: Teacher Guide

A cell membrane is usually permeable to substances such as oxygen, water, 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 membra
(**Oxygen** water, and carbon dioxide can **permeate** the cell membrane.)

O: Name some things that cannot easily permeate the cell mem
(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 structure does not allow all substances to pass through it.)

Writing: Student Guide

QUEST: Week Five, Day Five
Student Activities B - D, 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 baterial 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			

Writing: Student Guide

Student Activity C
WRITING FOR SCIENCE!

In this assignment you will be comparing two kinds of cells. You have already brainstormed for your writing in **Student Activity A** from Day 3. You will be using that brainstorm for the next part. Follow the steps below to write a compare/contrast paragraph.

Step 1: Choose your topic
Use **Student Activity A** from Day 3 to choose your topic. Out of the three types of cells (**plant, animal** and **bacterial**), which two are you going to compare? For example, you could compare plant and animal cells.

_____ and _____

Step 2: Plan your writing
Use **Student Activity A** from Day 3 to help you plan your writing.

- Choose two different characteristics to compare. For example, you could compare the cell wall and the nucleus of both plant and animal cells.
  - Characteristic #1: _____
  - Characteristic #2: _____
- Examine the similarities and differences of the characteristics.
  - How is Characteristic #1 the same in both cells?
    _____
  - How is Characteristic #1 different in both cells?
    _____
  - How is Characteristic #2 the same in both cells?
    _____
  - How is Characteristic #2 different in both cells?
    _____

Writing: Student Guide

- Write a **topic sentence.** Explain what you are going to write about in your paragraph. Introduce the topic to the reader.

Topic Sentence: _____
_____

- Write a **concluding sentence.** End your paragraph by explaining what you wrote in your paragraph. End the paragraph well.

Concluding Sentence: _____
_____

Step 3: Write!
Use the space below to write you paragraph.

Word Learning Strategy: Student Guide

Student Chart 6.4A
Warm-Up

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

StudenChar6.4B
Work with a partner to find all the cognates in the paragraph. The nine more.

The Chemicals of Life cells of all living things are composed chemical substanc
The most abundan chemical substanc in cells is water Other chemical substanc called carbohydrates (kar boh HY draytz) are a cell's main energy source. The othe substance proteins (PRO teenz) and lipids (LIP idz), are the building materials of ce much like wood and bricks are the building terials of houses. Finally, nucleic (noo KL ik) acids are the genetic mate the chemical instructions that direct the cell's activit

Word Learning Strategy: Student Guide

StudenChart 7.4B

Spanish	English Cognat	Letter(s) in Sp 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]	

Word-learning Strategy: Student Guide

Student hart 7.4C dentification of Sound Differences
Using the ELMO, s ow students the following Likert Scale. Expla to students that some of the cognates sound more alike than Direct students to identify how alike or not alike the f cognate sound on a scale of 1 to 4.

Sounds complet different	Sounds slight different	Sounds simil	Sounds exact alike
1	2	3	4
substances substancias			
1	2	3	4
chemical químicas			
1	2	3	4
cell / célula			
1	2	3	4
compos compuestas			
1	2	3	4
abundan abundante			
1	2	3	4
energy / energía			
1	2	3	4
protien proteínas			
1	2	3	4
carbohydrates carbohidratos			
1	2	3	4
lipids / lípidos			
1	2	3	4
materiales materials			
1	2	3	4

Selection of Vocabulary

- Choose the highest frequency words indicated by the Academic Word List

Academic Glossary

Week Six Academic Words
Student Glossary, Part One

Directions: Read each word's definition, then write a sentence of your own.

adequate *adecuado*	Adequate means good enough. This man is shivering because he is not wearing adequate clothing for the cold weather. *Adecuado significa apropriado para las condiciones o circunstancias. Algo que es suficiente.* Your sentence: _____ _____	
concentrated *concentrado*	Concentrated means brought together in one place. Most of the tall buildings are concentrated in the downtown area of the city. *Concentrado significa reunido en un mismo lugar.* Your sentence: _____ _____	
consequence *consecuencia*	Consequence is the result of an action. The consequence of staying up too late is that you are tired the next day. *Consecuencia es el resultado de una acción. Algo que pasa como resultado de algo.* Your sentence: _____ _____	

Academic Glossary

job *trabajo/ mandado*	A job is something that has to be done, or a piece of work. It is this boy's job to mow the lawn. *Un trabajo/ mandado es algo que se tiene que hacer.* Your sentence: _____ _____	
likewise *igualmente*	Likewise means similarly, or in the same way. The girl watches how her teacher plays the piano so that she can do likewise. *Igualmente significa de la misma forma, de igual manera, así mismo o también.* Your sentence: _____ _____	
located *localizado*	Located means where something is. This famous tower is located in Paris, France. *Localizado significa el lugar determinado o el lugar específico donde algo se encuentra o donde algo está.* Your sentence: _____ _____	

Technical Glossary

Directions: Read each definition, then write the technical word in the blank next to its definition. Draw a picture of the word if there is a box underneath it.

Word	Definition
_____	**A permeable** substance is a substance which allows other substances such as water to pass through it. Sand and gravel are **permeable** because water can pass through them. ***Permeable** significa que el agua y otras sustancias pueden pasar a través. La arena y grava/ gravilla son **permeables** porque el agua puede pasar a través de ellos.*
_____ Picture:	**Selectively permeable** means that some substances can pass through while others cannot. The cell membrane is **selectively permeable:** water can usually pass through it, but salt usually cannot pass through it. ***Electivamente permeable** significa que algunas sustancias pueden pasar a través de la membrana celular.*
_____	**Diffusion** is a process in which molecules move from an area of high concentration (a lot of molecules) to an area of low concentration (not a lot of molecules). When you put cream in coffee it diffuses through the coffee. ***Difusión** es el método principal por el cual pequeñas moléculas se mueven dentro y fuera de las células. Durante la **difusión**, las moléculas se mueven de un área de mayor concentración (muchas moléculas) a un área de menor concentración (menos moléculas).*

Technical Glossary

_____ Picture:	**Molecules** are particles that are made of two or more atoms bonded together. Water **molecules** have 2 hydrogen atoms combined with one oxygen atom. *Las **moléculas** son partículas que están hechas/ formadas de dos o mas átomos unidos. Las **moléculas** de agua tienen 2 átomos de hidrógeno combinados con un átomo de oxígeno.*
_____ Picture:	Osmosis is the process where water molecules move in and out of cells. Osmosis is a specific type of diffusion, involving water and a selectively permeable membrane. When water enters a cell through osmosis, the cell becomes swollen. ***Osmosis** es el proceso cuando agua se mueve adentro y fuera de las células. **Osmosis** es difusión, pero con agua.*
_____	**Active transport** is the movement of materials through a cell membrane using energy. ***Transporte activo** es el movimiento de materiales a través de la membrana celular utilizando/ usando energía.*
_____	**Passive transport** is the movement of materials through a cell membrane without the use of energy. **Diffusion** and **osmosis** are examples of passive transport. ***Transporte pasivo** es el movimiento de materiales a través de la membrana celular sin utilizar/ usar energía. **Difusión** y **osmosis** son ejemplos de transporte pasivo.*

Vocabulary Assessment

Student Activity A
SHOW WHAT YOU KNOW Vocabulary Quiz.

network	organelles	distribute
cell membrane	constant	mature
attached	nucleus	cell wall
encounter	specific	regulate

1. _____ means happening all the time and never stopping.
2. A _____ is a system of things that cross or connect.
3. _____ means adult or fully grown.
4. _____ means connected.
5. _____ means to spread something out over a large area.
6. _____ means exact or particular.
7. _____ means to control or to manage. It also means to adjust or to keep at some standard.
8. To _____ something means to meet or interact with it.
9. _____ are smaller structures within the cell that carry out specific functions.
10. _____ is a structure of the cell that is either located just inside the cell wall or is an outside boundary that separates the cell from its environment.

Vocabulary Assessment

1. _____ is the cell's control center, directing all of the cell's activities.
2. The _____ is a rigid layer of nonliving material that surrounds the cells of plants and some other organisms.

Student Activity B
WARM UP

Plant cells have a cell wall which supports and protects the plant cell. Why do you think animal cells don't have a cell wall?

QuEST: Year One Summary

- Successful elements: focus on district and state standards; strong science expertise involved in development; hands-on activities aligned with text-book content; exposure of all students to grade-level text with scaffolding; partner work; extensive professional development
- Lessons learned: need for more professional development with on-going mentoring; importance of partner training; need for more integration of science text and hands-on activities; importance of writing associated with reading; context matters (classmates, district capacity)
- Teacher overall rating of curriculum at 9.2 on a 10 point scale, with guided reading rated as the weakest element

QuEST: Year Two

- January – May (including testing)
- Sample
  - 15 6th grade science classrooms
  - 7 middle schools
- Same design

QuEST: Year Two

- Modifications to the curriculum
  - More professional development
  - More explicit use of a 5-E model consistent with district curricular model
    - Engagement
    - Exploration, Explanation, Elaboration
    - Evaluation
  - Integration of guided reading with hands-on activities
  - Partner work instead of cooperative groups

QuEST: Year Two

- Changes in the curriculum
  - Posting of language and science objectives
  - Additional methods to develop vocabulary and comprehension
    - Illustrations added for 'technical' words
    - Direct instruction of language used in science assessments
    - Concept maps
    - Vocabulary review
    - Comprehension strategies added to guided reading
      - Question generation
      - Summarization

Language and Science Objectives

Student Chart 11.1B
Language and Science Objectives

Language Objectives
- To learn the following academic words: inherit, generation, select, survive, occur
- To learn the following science words: traits, heredity, gene, chromosome, DNA, selective breeding, sexual reproduction, asexual reproduction
- To practice asking questions of the text

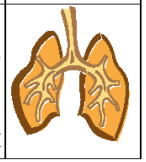
Science Objectives
To learn that:
- Organisms resemble their parents because they inherit genetic material from their parents
- Genetic material is contained in DNA, inside the nucleus of cells
- In selective breeding, organisms that have certain traits are mated to produce the desired traits in their offspring.
- Traits are produced by a combination of genes that offspring inherit from both their parents

Circle the number that rates your previous knowledge of the objectives below. 1=very little to 5=a great deal

1 2 3 4 5

Glossary

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

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

Glossary

QUEST: /Week 13
Vocabulary Glossary

role	A role means a part played by a person or thing. *En español "role" quiere decir una función, rol o propósito que tiene una persona o una cosa.* The **role** of this policeman is to direct traffic. **Your sentence:**	
producers	Producers are organisms that can make their own food. *En español "producers" quiere decir productores u organismos que pueden producir su propio alimento, como los cactus y las algas.* Plants like flowers, seaweed and cacti are **producers.** **Your notes:**	
consumers	Consumers are organisms that get energy by eating on other organisms. *En español "consumers" quiere decir consumidores u organismos que consiguen energía a base de comer otros organismos, como por ejemplo, la serpiente.* Snakes are **consumers** that eat plants and animals for food. **Your notes:**	

Word Learning Strategies

Student Chart 11.4B

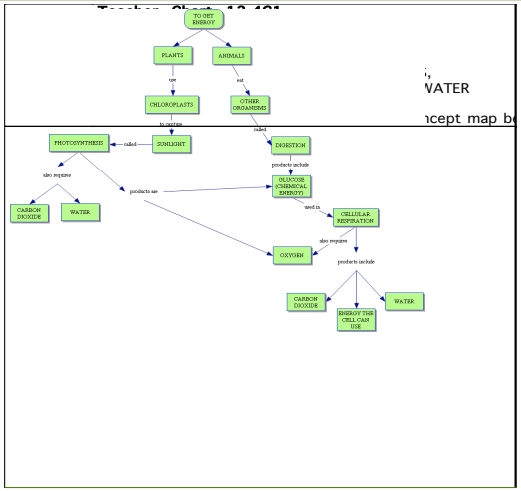
Practice turning verbs and adjectives into nouns.

Noun	Verb	Adjective
diffusion	diffuse	diffused
	concentrate	
		required
removal		
engulfment		
	locate	

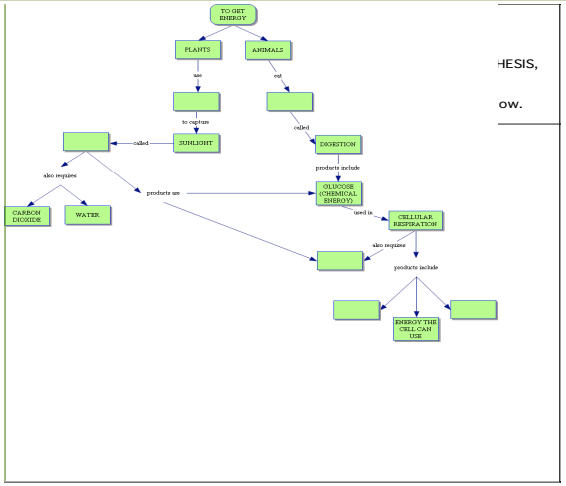
Rules: If you take off the ending of a verb or adjective and add 'ion', 'al' or 'ment' it turns into a noun

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

Teacher Concept Map

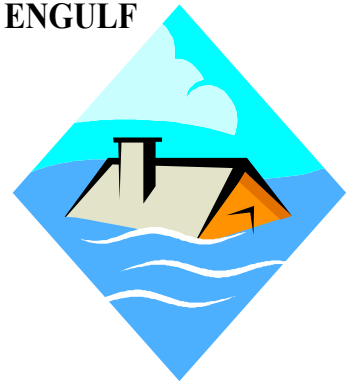


Student Concept Map



Teacher Review Cards

ENGULF



To **engulf** is to cover or swallow up or surround someone or something.

En español ***engulf*** *quiere decir cubrir, envolver o rodear algo o a alguien.*

Flood waters **engulf** the house.

Teacher: Can you think of a city where many houses **engulfed** by a flood?

Student: A city where many houses **engulfed** by a flood is: _____.

Comprehension Strategies

You have probably noticed that offspring tend to resemble their parents. Maybe you see that your cousin's hair is the same color as his mother's. If you save seeds from sunflowers in the fall and then plant them the next spring, the flowers that grow look like sunflowers. They don't look like tulips or lilies. The new sunflowers resemble the flowers of the plants that produced the seeds.

Partner Talk: Summarize the information in this paragraph (Call on several pairs.)

Offspring resemble parents because organisms inherit characteristics from their parents. The physical characteristics that an organism can pass on to its offspring are called traits. Human traits include such characteristics as eye color and whether hair is straight or curly. Some traits of sunflowers are the color and shape of the petals, the shape of the leaves, and the way leaves are arranged on the stem.

Ask: What are traits? (Traits are the physical characteristics that an organism can pass on to its offspring)
Partner Talk: Make up as many questions as you can about this paragraph. (For each question posed, have other students answer it.

Overarching Theme: Differentiation and Scaffolding

- Differentiation
  - Use of same activity in different ways (concept map example)
  - Partnering with high and low proficient students working together, while teacher pulls group of struggling learners
  - Use of on-level supplementary materials for students who are more advanced
- Scaffolding
  - Guided reading where teacher reads the text
  - Lots of teacher modeling (e.g., discussion then writing)
  - Clear written instructions; written examples of what students have to produce
  - Hands-on activities and visuals prior to reading the text

Additional Resources

- www.cal.org
- National Literacy Panel
  - August, D. & Shanahan, T. (2007). *Developing literacy in second-language learners*. Mahway, NJ: Lawrence Erlbaum Associates.
  - August, D. & Shanahan, T. (2008). *Developing reading and writing in second-language learners*. Routledge, IRA, and CAL
- Acquiring Literacy in English
- Center for Research on the Educational Achievement and Teaching of English Language Learners (CREATE)
- Optimizing Outcomes for English Language Learners: Project SAILL
- Testing and Assessment: Diagnostic Assessment of Reading Comprehension (DARC)

About CREATE

CREATE is a National Research and Development Center funded through the National Center for Education Research (NCER), Institute of Education Sciences (IES), U.S. Department of Education. It addresses specific challenges in the education of English language learners in the middle grades (Grades 4-8)

CREATE is a partnership of researchers from several institutions:

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