**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

**QuEST: Quality English and Science Teaching**

Diane August
Center for Applied Linguistics

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- 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

**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

Sample Size Table

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<th>Teacher</th>
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Year One Results Table

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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)

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.]
**Application: Student Guide**

Part One: Viewing Plant Cells
1. Place a drop of water in the center of a slide.
2. With forceps, remove a leaf from an dicot leaf. Place the leaf in the drop of water on the slide. Make sure that the leaf is flat and not curled.
3. Put a cover slip on the leaf. If there is a bubble, tap the slide very gently to get rid of the bubble.

**Guided Reading**
- Cognates
- Base words
- Word roots

**Academic and technical vocabulary**
- Glossaries and assessments

**Cooperative group work and partner work**
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.)

0: 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: 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.)
The Chemicals of Life: 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.

<table>
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<td>[direct]</td>
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<tr>
<td>actividades</td>
<td>[activities]</td>
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Using the ELMO, show students the following Likert Scale. Explain to students that some of the cognates sound more alike than others and ask them to identify how alike or not the sets of cognates sound on a scale of 1 to 4. Sounds completely different 1

<table>
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<tr>
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<td>[activities]</td>
</tr>
</tbody>
</table>

Choose the highest frequency words indicated by the Academic Word List.
Academic Glossary

**Word:** Adequate
**Definition:** A word used to describe something that is not perfect but acceptable.

**Concentrate:**
- **Synonym:** Intensify
- **Antonym:** Dilute

**Consequence:** The result of an action. You are the result of something that happened in the past.

**Converse:**
- **Synonym:** Opposite
- **Antonym:** Similar

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**Technical Glossary**

**Word:** 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 otros suelos pueden pasar a través de ellos. Los arena y gravilla son permeables porque el agua puede pasar a través de ellos.

Selectively permeable means that some substances cannot pass through while others can. This membrane is selectively permeable when it can pass through it, but salt usually cannot pass through it.

Electroically permeable significa que algunos electros pueden pasar a través de la membrana celular.

**Process:** Diffusion is a process in which molecules move from an area of high concentration to an area of low concentration, not a list of molecules. When you put cream in coffee it diffuses through the coffee.

**Diffusion** es el movimiento de moléculas de un área de mayor concentración a un área de menor concentración (menos moléculas).

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**Moles:**
- **Definition:** Particles that are made of two or more atoms bonded together. Water molecules have 2 hydrogen atoms bonded with one oxygen atom.

- **Spanish:** Las moléculas son partículas que están formadas de dos o más átomos unidos. Las moléculas de agua tienen 2 átomos de hidrógeno unidos a un átomo de oxígeno.

**Process:** Osmosis is the process where water molecules move in and out of cells. Osmosis is usually not a type of diffusion. Water moves from a cell through a membrane, the cell becomes water.

**Osmosis** es el proceso en que las moléculas de agua entran y salen de las células. Osmosis no es un tipo de difusión. Las moléculas de agua pasan a través de la membrana celular, la célula se vuelve agua.

**Active transport** is the movement of materials through a cell membrane using energy.

**Passive transport** is the movement of materials through a cell membrane without using energy.

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Diane August
CREATE 2008
**QuEST: Year One Summary**

- Successful elements: focus on district and state standards; strong science expertise involved in development; hands-on activities aligned with textbook 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

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**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

Language and Science Objectives

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<thead>
<tr>
<th>Student Chart 11.18</th>
<th>Language and Science Objectives</th>
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<tbody>
<tr>
<td>Language Objectives</td>
<td>To learn the following academic words: inherit, generation, select, survive, occur</td>
</tr>
<tr>
<td></td>
<td>To learn the following science words: traits, heredity, gene, chromosome, DNA, selective breeding, sexual reproduction</td>
</tr>
<tr>
<td></td>
<td>To practice asking questions of the text</td>
</tr>
<tr>
<td>Science Objectives</td>
<td>To learn that:</td>
</tr>
<tr>
<td></td>
<td>Organisms resemble their parents because they inherit genetic material from their parents</td>
</tr>
<tr>
<td></td>
<td>Genetic material is contained in DNA, inside the nucleus of cells</td>
</tr>
<tr>
<td></td>
<td>In selective breeding, organisms that have certain traits are mated to produce the desired traits in their offspring</td>
</tr>
<tr>
<td></td>
<td>Traits are produced by a combination of genes that offspring inherit from both their parents</td>
</tr>
</tbody>
</table>

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 16:
Read each word, look at the picture, and write a sentence or a sentence of your own.

**microscope**
A microscope is an instrument that makes small objects look larger.
In science, a microscope is one example of a tool scientists use to observe the world at a small scale.
Your notes

**concept**
A concept is a general idea or understanding of something.
To explain "concept" please draw concept in the image above and write a sentence that explains what the concept is.
Your notes

**organ**
An organ is a group of tissues that perform a specific function.
In nature, "organ" usually refers to a structure or organ that is not visible to the naked eye but can be observed in more detailed studies.
Your notes

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CREATE 2008
Glossary

Teacher Concept Map

Student Concept Map

Word Learning Strategies

Rules: If you take off the ending of a verb or adjective and add “ion”, “all”, or “ment” it turns into a noun.

Example: “diffuse” minus “e” plus “ion” — diffused; “diffused” minus “ed” plus “ion” — diffused.
**Teacher Review Cards**

**ENGULF**

*To engulfl to cover or swallow up or surround someone or something.*

*En español engullir es cubrir, envolver o rodear algo o a alguien.

Flood water engulfs the house.

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

Student: A city where many houses were 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 each pair.)

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](http://www.cal.org)
- National Literacy Panel
- 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 SAIL
- 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:
- Texas Institute for Measurement, Evaluation, and Statistics, University of Houston
  - David J. Francis, Coleen D. Carlson
- California State University at Long Beach
  - Jana Echevarria, Catherine Richards
- Center for Applied Linguistics
  - Diane August, Deborah Short
- Harvard University
  - Catherine Snow
- University of California-Berkeley
  - Elfrieda Hiebert
- Vaughn Gross Center, University of Texas at Austin
  - Sharon Vaughn, Sylvia Linan-Thompson

Contact CREATE

- Find out more about CREATE’s projects and activities at www.cal.org/create.

- Subscribe to the email announcement list to receive regular updates from CREATE: www.cal.org/create/join.