

## **THE USE OF ACADEMIC LANGUAGE IN BILINGUAL SCIENCE CLASSROOMS IN SECONDARY SCHOOLS**

### **RATIONALE:**

The Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects set requirements not only for English language arts (ELA) but also for literacy in history/social studies, science, and technical subjects. Just as students must learn to read, write, speak, listen, and use language effectively in a variety of content areas, so too classroom instruction must address the literacy skills and understandings required for college and career readiness in multiple disciplines.

An area of need identified in by educators is the coherency and consistency in the development and use of academic language in bilingual content area classrooms in secondary schools. Presently, the use of academic English in bilingual content area classes is inconsistent and does not benefit English Language Learners. This document seeks to address this need by providing teachers with a variety of strategies to effectively incorporate academic English in their bilingual content area classes.

Effective bilingual instruction requires the consistent development and use of leveled higher order thinking to transition students from fluency in their native language to fluency in the English language. The goal in our secondary schools is to transfer the required challenging content area academic language to English. Active student engagement and the consistent use of purposeful/accountable talk are prerequisites to the successful implementation of the following language acquisition strategies.

Developing a coherent and consistent policy to develop academic English skills will serve to prepare students with the academic content language needed to maximize the opportunities for success on such challenging assessments as the English Language Arts Assessments, and Regents examinations, specifically in Science.

The purpose of this document is to provide guidance in the teaching of science classes so that our English Language Learners, regardless of their language proficiencies in their native language or in English, can attain the goal of the achievement of the Cognitive Academic Language

Essential to the effective development of academic English is the consistency around the frequency of incorporating academic English skills in content area classes. To further align bilingual instruction with research on teaching English Language Learners, it is imperative that code switching be avoided at all times.

## **STRATEGIES:**

The following five strategies focus on the four elements of language acquisition: listening, speaking, reading and writing. These include:

- 1- STRATEGIES FOR ACADEMIC VOCABULARY DEVELOPMENT IN ENGLISH;
- 2- STRATEGIES FOR STEP-BY-STEP ENGLISH LANGUAGE ACQUISITION;
- 3- GRAPHIC ORGANIZERS AS A TOOL FOR ENGLISH LANGUAGE ACQUISITION;
- 4- STRATEGIES FOR FOSTERING READING COMPREHENSION IN ENGLISH;
- 5- STRATEGIES FOR THE ACQUISITION OF WRITING FLUENCY IN ENGLISH FOR ALL LEVELS.

### **1. ACADEMIC VOCABULARY DEVELOPMENT IN ENGLISH THROUGH THE USE OF AN INTERACTIVE WORD WALL AND STUDENT GLOSSARIES**

#### **Interactive Word Walls**

- Teacher introduces the term either in context or through graphic organizers.
- Teacher develops a definition of the term with the class.
- Teacher, if applicable, creates a pictorial representation of the term with the class.
- Teacher places the class generated word definition in English and the pictorial representation on classroom area designated as “Word Wall” for future reference by students next to the native language word wall.

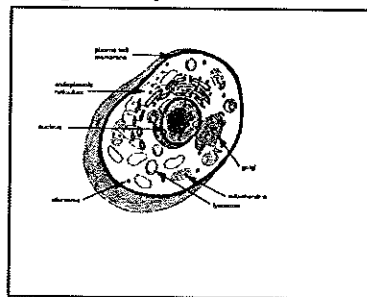
#### **Student Glossaries**

- Students write content area terms introduced and placed on the interactive word wall in the glossary section of their notebook.
- Students are encouraged by the teacher to write definitions in their own words.

#### **Science Sample of an interactive word wall or student glossary:**

**Cell: the most basic unit of living matter.**

**All organisms are made up of at least one cell.**



Cell diagram courtesy of Dr. G. Weaver, Colorado University at Denver

## **2. STRATEGIES FOR STEP-BY-STEP ENGLISH LANGUAGE ACQUISITION**

Vocabulary development in bilingual content area classes is a step by step process that must begin through the acquisition of the vocabulary in the students' native language. The ultimate goal of vocabulary development must be the transfer of these key content area terms from the native language into English. In order to make this transfer most effective, the presentation of the vocabulary must begin in the native language and should use the following order of learning and transfer:

- Teacher introduces the key content area terms in the native language.

**Sample key science terms in native language:**

Célula, núcleo nucleolo pared celular ribosoma  
membrana celular mitocondria citoplasma procariotes eucariotes.

- Teacher will engage students in activities to clarify the meaning of the terms in the native language.
- Students will practice the use of the key terms in the native language in content context (sentences, guided group work, paired activities).
- Teacher will introduce vocabulary words and definitions in English to students to allow for transfer of the terms from the native language into English.

cell nucleus nucleolus cell wall ribosome cell  
membrane mitochondrion cytoplasm prokaryotes eukaryote

- Teacher will assign homework that contains vocabulary work that will require the use of the words in English.

**Sample key science:**

**Complete each sentence with a term from the list:**

cell wall cytoplasm cell membrane mitochondrion cell  
nucleus prokaryote eukaryote

1. The most basic unit of life is a \_\_\_\_\_.
  2. The watery substance in a cell is \_\_\_\_\_.
  3. The smallest and simplest cells are \_\_\_\_\_.
  4. A \_\_\_\_\_ is an organism whose cells have a nucleus.
  5. The part of the cell that controls all other parts is the \_\_\_\_\_.
  6. A cell part that helps the cell store and use energy \_\_\_\_\_.
  7. The thin covering that holds the cell together is the \_\_\_\_\_.
  8. Plant cells have a thick covering called the \_\_\_\_\_.
- Teacher will use a hierarchy of questions in ascending order, beginning with the native language and culminating in English to ensure that students understand the concepts/terms. It is critical for the teacher to have detailed information/data about the proficiency of his/her students in order to be able to plan the primary focus on each of the level of questioning that follows:

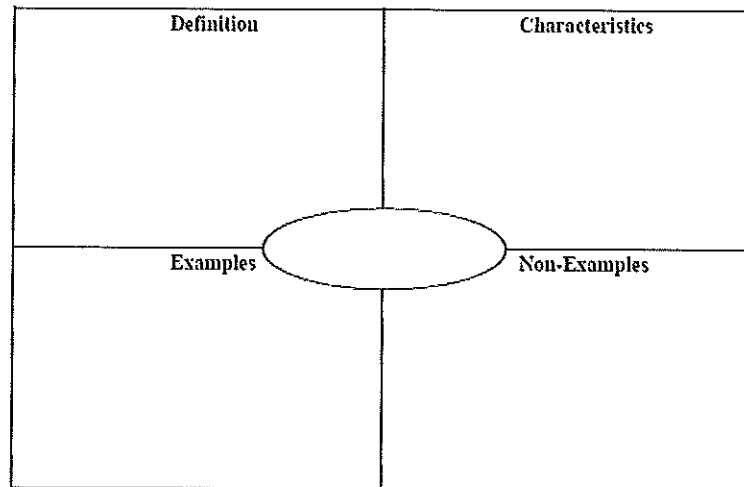
### **Examples of hierarchy of questioning:**

1. **BEGINNERS /SIFE** (Students with Interrupted Formal Education) - Teacher asks new arrivals to point to a picture or word to demonstrate basic knowledge - **"Point to the picture of the cell."**
  2. **BEGINNERS** - Using visual/pictorial cues, teacher asks simple yes/no questions **"Are cells the smallest and most basic unit of life?"**
  3. **BEGINNERS /INTERMEDIATE** - Teacher asks either/or questions in which the answer is embedded - **"What tool helps you view a cell, a telescope or a microscope?"**
  4. **INTERMEDIATE** - Teacher breaks complex questions into several steps - **"Read the definition in your glossary; what is a nucleus?"**
  5. **ADVANCED** - Teacher asks simple "how" questions that can be answered with a phrase or a short sentence – **"Why was the microscope an important discovery?"**  
Example of open-ended questions – **"In your own words, explain the differences between a plant cell and an animal cell."**
- Teacher will monitor for comprehension using the same hierarchy of structured questions as in the introduction/presentation.

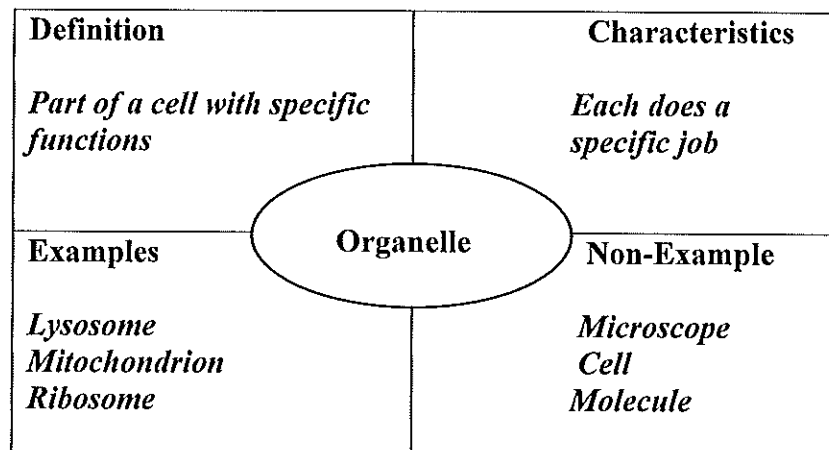
### **Examples for evaluating student comprehension in hierarchical order of ascendance:**

1. New arrivals can be asked to point to a picture or word to demonstrate basic knowledge.
2. Using visual cues, teacher can ask beginning students to point or simply respond "yes" or "no."
3. As language knowledge through the acquisition of vocabulary develops, students can respond to "either/or" questions in which the answer is embedded to demonstrate content area knowledge.
4. Finally, students can advance to simple who, what when, where and how questions. Breaking questions into several steps will allow students to retrieve complex information.

**Freyer Model:** This strategy develops students understanding of key concepts and helps students extend their content knowledge as they explore characteristic, definitions examples and non-examples of concepts. Teacher creates a model for the students to complete the organizer. Allow students to work in pairs to discuss their ideas as they complete their organizer.



**Science Sample of Freyer Model:**



**3. GRAPHIC ORGANIZERS AS A TOOL FOR ENGLISH LANGUAGE ACQUISITION**

**Brainstorming** – (This learning strategy precedes the use of graphic organizers)

- Teacher solicits from students words or phrases that students associate with content term written by the teacher.
- Teacher records student responses.
- Teacher combines and categorizes ideas.
- Teacher and students prioritize responses.

**Graphic Organizer:** A visual tool for organizing information.

- Teachers will utilize graphic organizers as well as focus on the language proficiency necessary to effectively utilize the strategy.

## Types of graphic organizers:

### 1. KWL and Anticipatory Chart

#### KWL

| K (what I know) | W (what I want to know) | L (what I have learned) |
|-----------------|-------------------------|-------------------------|
|-----------------|-------------------------|-------------------------|

- Teacher creates three columns on the board.
- First column – “K” (What I know) – Teacher brainstorms with class at the beginning of the lesson prior knowledge of the topic.
- Second column – “W” (What I want to know) – Teacher elicits from students what they want to learn.
- Third Column – “L” (What I have learned) - Teacher brainstorms with class at the end of the lesson.

#### Science Sample of KWL:

| K (what I know)                          | W (what I want to know)            | L (what I have learned)                                |
|--|------------------------------------|--|
| Cells are the most basic unit of matter. | How many kinds of cells are there? | Eukaryotic cells include plant cells and animal cells. |

#### Anticipatory Chart:

Anticipatory Chart helps students to brainstorm quickly what they know and what they want to know about a chart.

| This is what I know | I would like to find out |
|---------------------|--------------------------|
|---------------------|--------------------------|

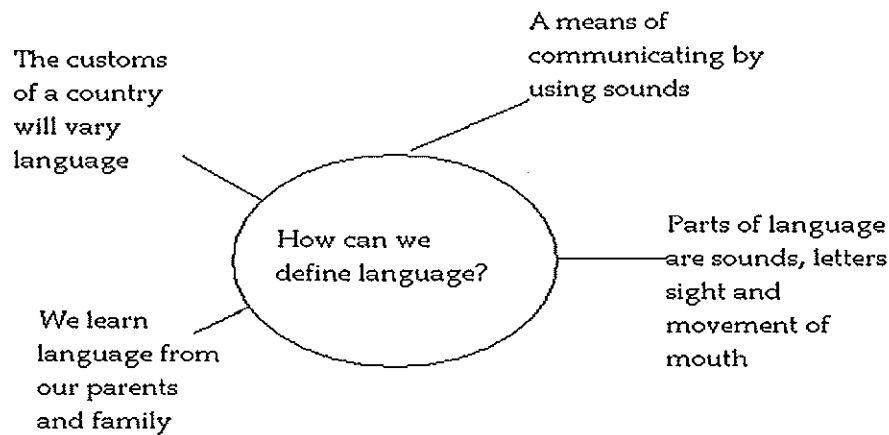
#### Sample Science Anticipatory Chart:

| This is What I know                                      | I would like to find out                           |
|--|--|
| 1. All living organisms are made up of cells.            | Are cells the biggest unit of life?                |
| 2. Eukaryotic cells include plant cells and animal cells | Are the organs of the human body made up of cells? |

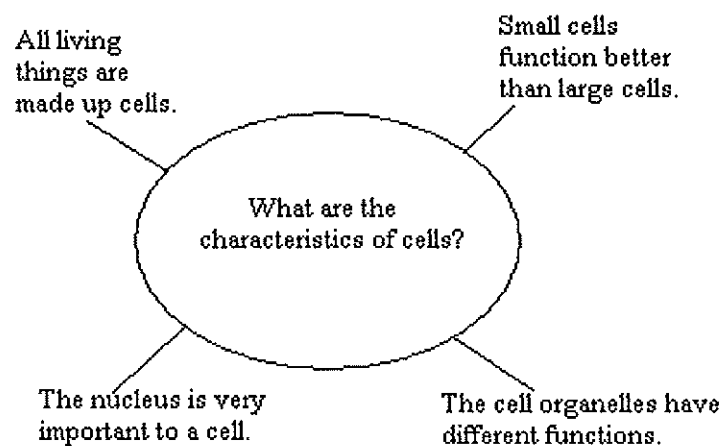
## 2 . Semantic Mapping

Semantic Maps provide students with useful ways of organizing ideas.

- Teacher creates a circle and writes a central theme or question in the circle.
- Teacher writes students' contributions in full/concise sentences.



### Sample Science Semantic Map:

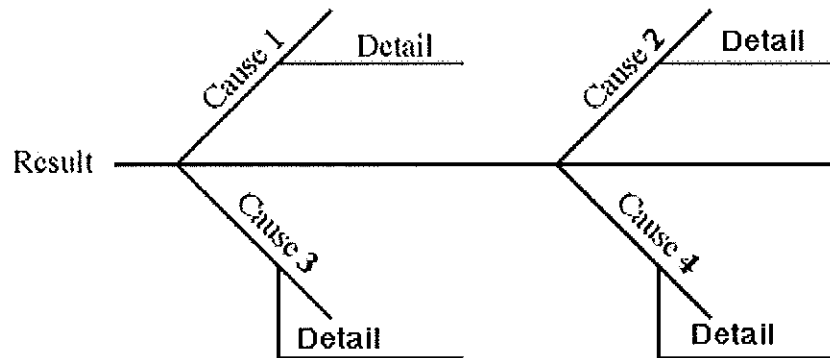


### 3. Fishbone Mapping

A fishbone is used to organize information or ideas. It can be used for problem solving and to identify as well as organize ideas relating to an issue. It has a positive and negative structure that facilitates the grouping of ideas.

A fishbone map is used to show the causal interaction of a complex event (an election, a nuclear explosion) or complex phenomenon (juvenile delinquency, learning disabilities).

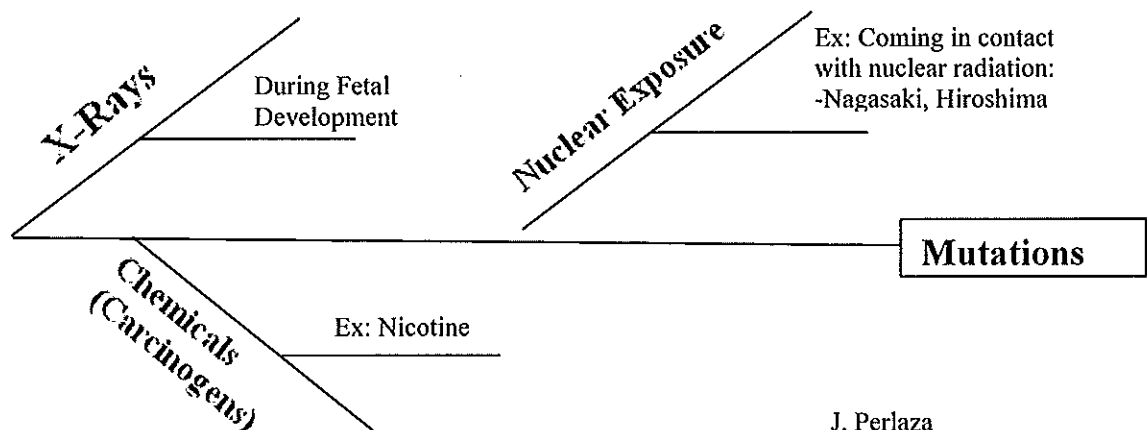
Key frame questions: What are the factors that cause X? How do they inter-relate? Are the factors that cause X the same as those that cause X to persist?



To create a fishbone diagram:

- Place on the left hand side of the backbone (Result) the topic of the fishbone.
- Identify the subject of the diagonal lines.
- Identify the details related to diagonal lines.
- Review with the class the classification, information or ideas presented in the fishbone
- Give students an assignment based on the fishbone.

**Science Sample of fishbone map:**



J. Perlaza

**Example of assignment:**

- Students are directed to write a paragraph related to the fishbone topic



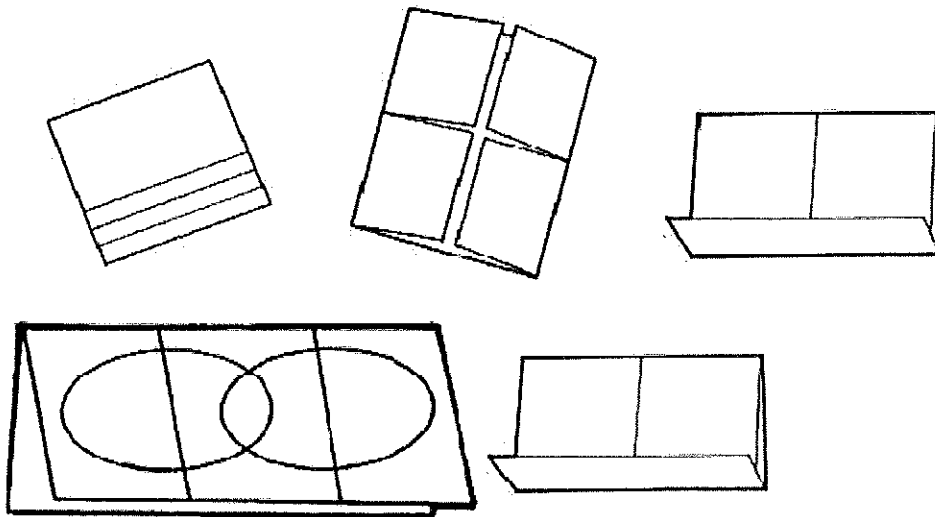
#### 4. Foldables

A foldable is a three-dimensional, student made manipulative and interactive graphic organizer. It organizes, displays and arranges data making it easier for students to grasp concepts, theories, processes, facts, and ideas.

Foldables may be utilized to:

- Incorporate such skills as comparing and contrasting, cause and effect, and similarities and differences into daily work and long-term projects. For example, these graphic organizers can be used to compare and contrast student explanations of inquiry based questions to explanations currently accepted by scientists.
- "Immerse" students in previously learned vocabulary, concepts, generalizations, ideas, and theories providing them with a strong foundation upon which they can build with newly learned knowledge, observations, and concepts.
- Communicate data through graphics, tables, charts, diagrams, models and Venn diagrams.
- Record qualitative and quantitative observations in student-made journals.
- Evaluate student progress as an alternative assessment tool.
- Connect language arts, social studies, mathematics, and science.

#### Samples

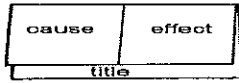


**Sample 1:**

### **CAUSE AND EFFECT**

Fold a sheet of paper in half horizontally (hamburger) so that one side is one inch longer than the other side.

**Teacher's Directions:** Write a paragraph or sentences summarizing a specific cause and effect.



**Sample 2:**

### **VENN DIAGRAM**

#### **Instructions:**

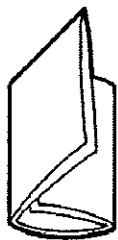
1. Fold a sheet of paper in half as indicated.



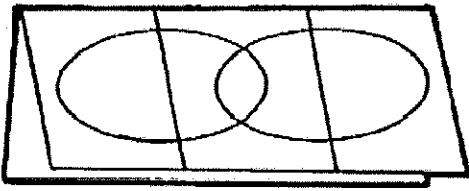
2. With the paper horizontal, fold the right edge toward the center, trying to cover one half of the paper.



3. Fold the left side over the right and crease to form three tabs.

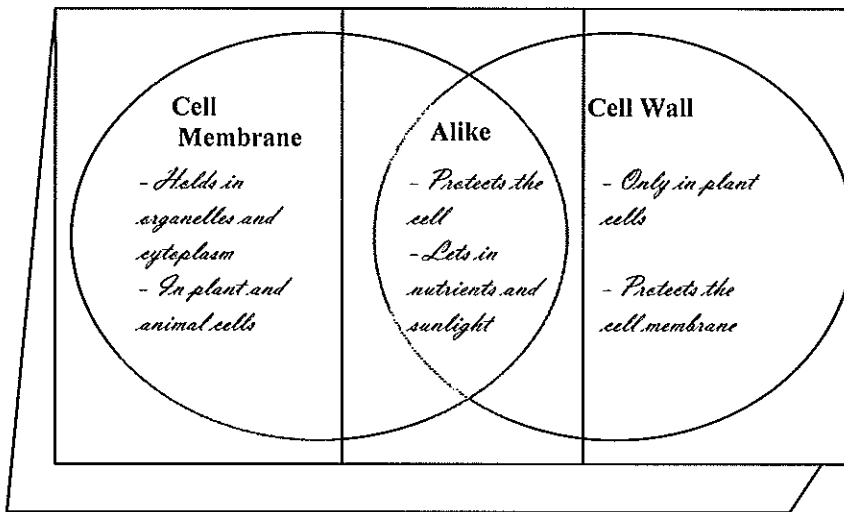


4. Draw two overlapping ovals on the front



Cut up the two valleys on one side only

**Science Sample of Venn Diagram foldable:**



(For additional information on foldables, please visit the following website:

<http://www.dinah.com/egroup/Dinah%20Zike%27s%20e-Group>)

**ADDITIONAL GRAPHIC ORGANIZERS:**

- Freyer Model
- Graphs
- T-Chart (cause and effect, compare and contrast)
- Venn Diagram (similarities/differences)
- Time Lines
- Flow Chart (utilize to sequence and to process acquired language)

#### **4. A STRATEGY FOR FOSTERING READING COMPREHENSION IN ENGLISH**

- Students are grouped heterogeneously.
- Teacher models skill or activity of the lesson.
- Differentiated level documents are distributed.

##### **1. Oral Development Jigsaw (QTEL, WestEd)**

This jigsaw may be used to allow students to orally describe various visuals, share their understanding, reach a consensus and then participate in a writing activity.

- Students are assigned groups and given a task.
- Students become knowledgeable in their particular task
- Students regroup and discuss the assigned task utilizing academic language
- Students return to their original groups and share and connect learning from the other groups.

##### **2. Round Robin (QTEL, WestEd)**

In groups of four, each student states what he/she believes the main idea of the paragraph is without interruption or discussion. No student should pass. If he/she has the same idea, he/she should state, "I agree with Jose" or "My idea is the same as Jose's." The technique is to ensure that all students all a voice.

##### **3. Reaching a Consensus (QTEL, WestEd)**

After the Round Robin, the floor is open for discussion. Collectively, the group will reach a consensus as to what they (as a group) think the main idea of the paragraph is. The purpose is to foster high quality interactions among ELLs.

##### **4. Double-Entry Journal (QTEL, WestEd)**

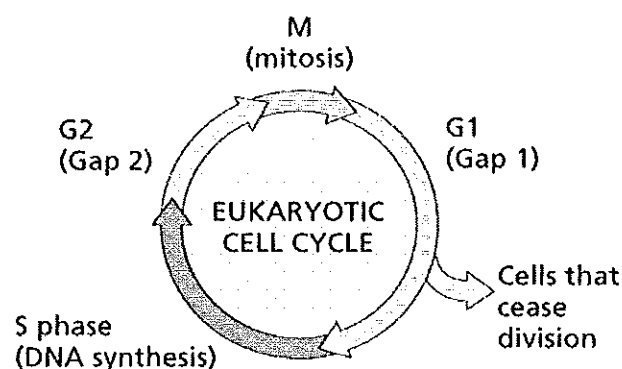
While reading, students are asked to complete individually a double-entry journal focusing on key ideas of the text such as the following:

| Key Ideas of the Paragraph | Evidence from the Text |
|----------------------------|------------------------|
|                            |                        |

## 5. Cause/Effect, similarities/differences, etc. (QTEL, WestEd)

- a) Visual documents.

**Sample science visual document:**



- b) Cloze type sentences to the intermediate level.

**Sample science cloze sentence:**

**Mitosis and meiosis are processes in which cells divide to make new cells. In mitosis, each set of chromosomes in a cell makes a complete copy of itself called replication.**

- c) A paragraph to determine main idea to the intermediate or advanced level.

**Sample science paragraph:**

Bacteria, like all organisms, have to make a living in an ever changing world. They face shifting climates, varying food supplies and--horror of horrors--antibiotics. How do they adapt? According to the results of a new study, simply by copying the successful innovation of their relatives.

Martin Lercher of the University of Bath in England and his colleagues studied a benign strain of *Escherichia coli* to see how the common intestine dweller picked up new parts for its metabolic network—the internal system of chemical reactions that produce the necessities of life, such as amino acids or cellular structures. By comparing *E. coli* to its ancestor *Salmonella* the geneticists found that the former had only one new gene that likely came about through mutation.

Source: Scientific American  
November 21, 2005

- d) Paragraph(s) to determine cause/effect, similarities/differences to the advanced level

- Students complete the activity of the lesson while teacher assesses progress of the group.
- Whole Class Share.

5. **A STRATEGY FOR THE ACQUISITION OF WRITING FLUENCY IN ENGLISH FOR ALL LEVELS.**

- **Writing to learn** is an activity that must take into account the language development stages of the students in a heterogeneously grouped bilingual content area classroom.

- Writing instruction should include:

**A) Process:**

1. Brainstorming
2. First Draft
3. Revision
4. Editing
5. Publishing

**B) Lesson Design:**

Step 1 - Teacher explains the strategy.

Step 2 - Teacher models the writing strategy.

Step 3 - Teacher guides writing practice focusing on key content area concepts.

Step 4 - Focused/directed independent writing by students

**Science Sample of writing activity:**

1. **“Name and explain two organelles found in both animal and plant cells.”**
2. **“Write and explain the predator-prey relationship and give examples.”\**

The following writing activities also promote fluency in English for ELL students.

- **Collaborative Writing**

To allow students with diverse linguistic abilities to engage in a writing assignment that helps them construct meaning and also deepen their understanding of the content or concept being addressed through text or visuals.

Implementation of the task:

- Students work in groups of four.
- Students write an individual quick write, as a response to the task.
- In the Round-Robin (QTEL, West Ed.) format, each student reads what he/she wrote while the others listen without interruption.
- After all have read their responses, they reach a consensus of the group response.
- Each student in the group writes down the group response.
- The groups share their final response with the rest of the class.

### Quick Writes

- Teacher present prompts to students. Students write their first impressions, memories or feelings.
- Teacher explains that writing is to go “from your heart, to your hand, to the paper”.

### I Search

The I Search involves the learners’ own voice and experience in the process. It is a writing/ research and inquiry process.

The I Search answers the following questions:

1. What do I want to know about this topic?
2. What are the answers found in the text?
3. How will I record or present the information that I learned?
4. How will I describe or communicate my learning process?
5. What did I discover about this topic and about learning?

Listed below are suggested strategies recommended by brain research to activate whole class participation to be used during classroom instruction.

- **Wait time** – The procedure by which teachers wait at least 30 seconds after posing a questions for a response.
- The use of “**each, all, or everyone**” by the teacher **when** asking a question to the class – This engages all students to participate in the classroom activity.
- **Turn and talk** – An activity that encourages exchanges of ideas and language development
- **Think – (Write) - Pair –Share** - An activity that stimulates thinking, exchange of ideas, and language development.

In addition, the following common elements are to be found in all bilingual classes:

- **Charts and Glossaries** must be in **both languages**.
- **Glossaries** - All students are to maintain glossaries in a section of their notebook or sourcebook in both languages. This will include the word, its definition in their own words and a representation that will allow the student to understand the word based on his/her learning style