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# Building English Language Learners' Conceptual Understanding

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# Principles of Learning

(National Research Council (NRC), 2000)

- We learn new things using things we know (derived from previous learning)
- We learn as we interact with the world (social context)

Therefore, learning is on-going and dependent on the culture in which we reside

We must utilize what students bring (asset inventories)

Curriculum and instruction should be responsive, should reflect students

# Cognitive Theory

- Learning is an active, dynamic process in which learners are fully engaged
- Information is selected from the environment and retained when it is important to the learner
- Information is organized, related to what is already known, and used in appropriate contexts

# Orchestrating Teaching

(Daniel Cassany, 1999 and Schlechty, 2002)

The content presented is organized in ways that are most likely to appeal to the personal interests of the largest possible number of students.

# Product Focus
(Schlechty, 2002)

The tasks students are assigned and the activities students are encouraged to undertake are clearly linked in the minds of the teacher and the students to problems, issues, products, performances, and exhibitions about which the students care and upon which students place value.

# Content and Substance
(Schlechty, 2002 and Wiggins, 1998)

- Among themselves, teachers and administrators have a clear and consistent understanding of what students are expected to know and to be able to do, and there is community consensus regarding these matters.

# Why align?
(Wiggins, 1998)

- For efficient use of resources
- A “no surprises” approach motivates learners
- To support those who most need support
- To meet the achievement expectations of our community
- For coordination across the grade level
- For supportive articulation throughout the different grade levels

# Types of Knowledge

- ✓ Declarative knowledge consists of “what” we know or can declare. It is stored in memory frameworks called *schemata*
- ✓ Procedural knowledge concerns what we know how to do. It consists of a series of steps in which there is a “condition” and an “action”

# The Dimensions of Knowledge

(A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives, 2001)

- Factual
  - Basic elements students must know
- Conceptual
  - Relationship between elements of a discipline within a larger structure
- Procedural
  - How to, methods, skills, criteria, algorithms, techniques
- Metacognitive
  - Awareness of own thinking and skills to guide one's own thinking

# The Taxonomy Table

**Two-Dimensional Taxonomy Table**

| The Knowledge Dimension | The Cognitive Process Dimension | | | | | |
|---|---|---|---|---|---|---|
| | 1. Remember / Recall | 2. Understand / Comprehend | 3. Apply | 4. Analyze | 5. Evaluate | 6. Create / Synthesize |
| A. Factual Knowledge | | | | | | |
| B. Conceptual Knowledge | | | | | | |
| C. Procedural Knowledge | | | | | | |
| D. Metacognitive Knowledge | | | | | | |

***A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives***
**(Anderson and Krathwohl, 2001, p. 28)**

# Kinds of Memory

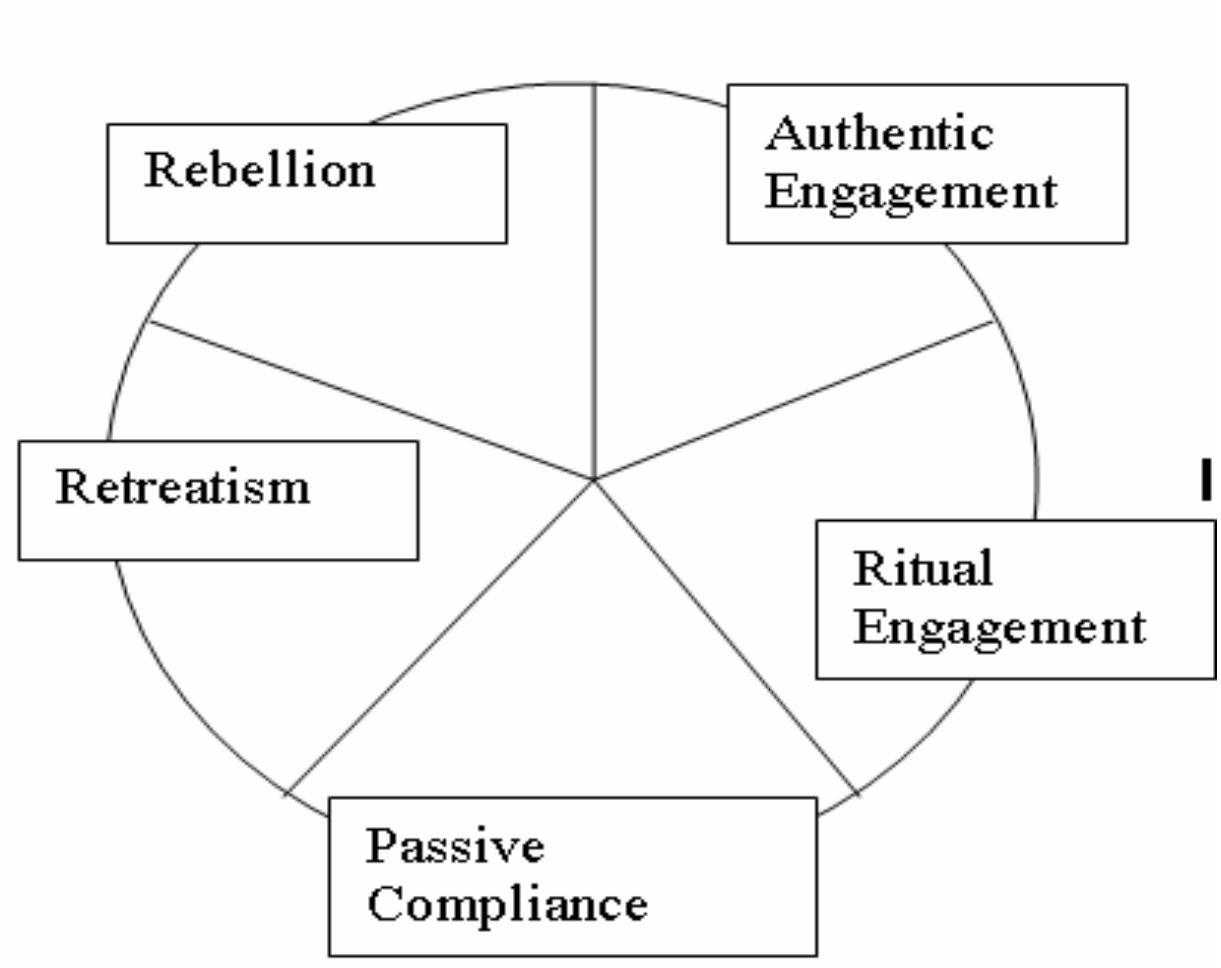
- Long-term memory is information stored along with other information derived from personal experience and education
- Short-term memory is temporary and pragmatic information
- Working memory is used to solve the problem at hand
- Elaboration is required to link long and short-term memory

# Why Organize Curriculum Around Concepts?

(García, 2002 and NRC, 2000)

- Students see the big picture so they can make sense of English language instruction
- Content areas (math, science, social studies, literature) are interrelated
- Vocabulary is repeated naturally as it appears in different content area studies
- Curriculum can be connected to students' lives, making curriculum more interesting
- ELLs are more fully engaged and experience more success because curriculum makes more sense
- Since concepts deal with universal human topics, lessons and activities can be adjusted to different levels of English language proficiency

# Engagement




Schlechty, 2002

# Highly Engaged Classroom

(Schlechty, 2002)

- A classroom in which most students are authentically engaged most of the time, and some students are engaged some of the time.  It is also a classroom that has little or no rebellion, limited retreatism, and limited passive compliance.

# The Well-Managed Classroom

(Schlecty, 2002)

- The well-managed classroom appears well managed, not because students are authentically engaged but because they are willing to be compliant. As long as the teacher and the principal fail to ask the right questions of the students, the absence of authentic engagement will likely not be noticed.

# The Pathological Classroom

(Schlechty, 2002)

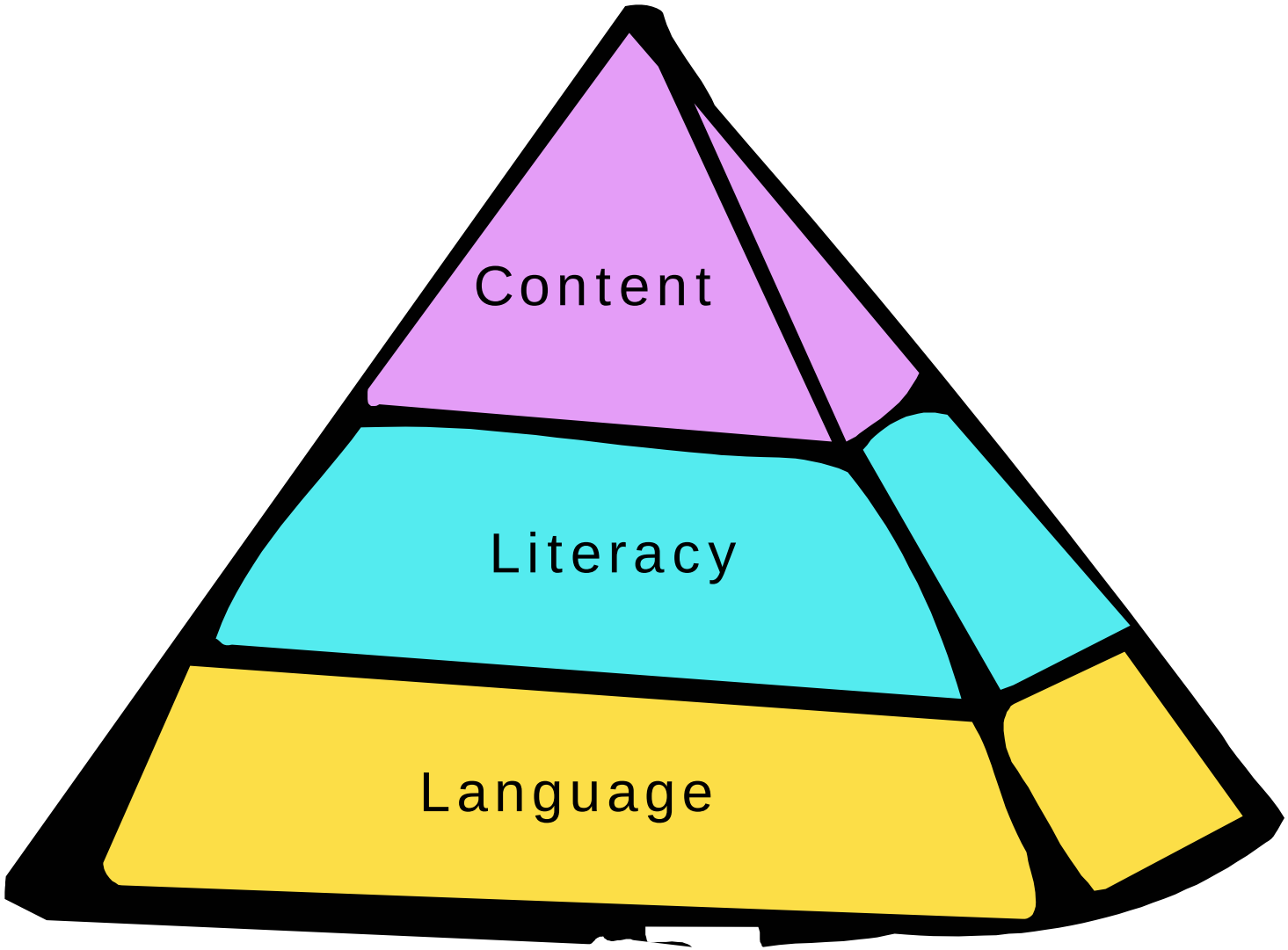
- The pathological classroom looks very much like the well-managed classroom except for the presence of patterned rebellion. In the pathological classroom, many students actively reject the task assigned or they substitute another activity to replace what has been officially assigned or expected (or both). (Cheating is a form of rebellion.)

# False Assumptions About Bilingual Learners

- The “tabula rasa” theory of language learning (Freire)
- The “oral proficiency is enough” hypothesis (Cummins)
- The “phonics first” fallacy
- The “storage and retrieval” myth (NRC)

# Academic Needs of English Language Learners

Mora, 1999



# The Language of Mathematics

Ron, 1999

- The language of mathematics is not acquired effortlessly and naturally through social interaction, but rather learned and taught in school as a separate register and often as a consciously memorized vocabulary.

- …mathematical terms are not items of everyday language, even though mathematical operations are part of our every day lives.

# Mathematics as a Language

Vocabulary—Vertex

Syntax—4+3=7x3=21

Semantics—table

# Synonyms

| ***Mathematics*** | ***Real-life*** |
|---|---|
| **Vertex** | Corner |
| **Perimeter** | Around |
| **Table** | |
| | |
| | |

# Language and Literacy

(Mora, 1999)

Building language and literacy in mathematics involves:

- Learning language
- Learning about language
- Learning through language

# Learning Language

- A progression of linguistic and communicative competencies through identifiable stages of development
- Interrelationship between linguistic and cognitive development
- Occurs through structured opportunities for language acquisition as well as explicit teaching/learning experiences
- Depends on comprehensible input at one level of complexity beyond the learner's level of linguistic competence

# Learning About Language

- Develops metalinguistic awareness in the three cueing systems
- Builds a knowledge base in phonology, morphology, grammar & syntax, and semantics in both languages
- Makes explicit contrasts and comparisons between language systems
- Focuses on acquisition of problem-solving strategies in literacy tasks
- Involves on-going assessment of learners' growth and development

# Learning Through Language

- Making schematic and conceptual connections through theme units
- Eliciting and expanding responses to literature through core book units and genre studies
- Planned for ample opportunities for aesthetic and efferent responses to literature
- Based on an inquiry approach to multicultural literature and content themes
- Content area reading expands vocabulary and builds critical thinking skills

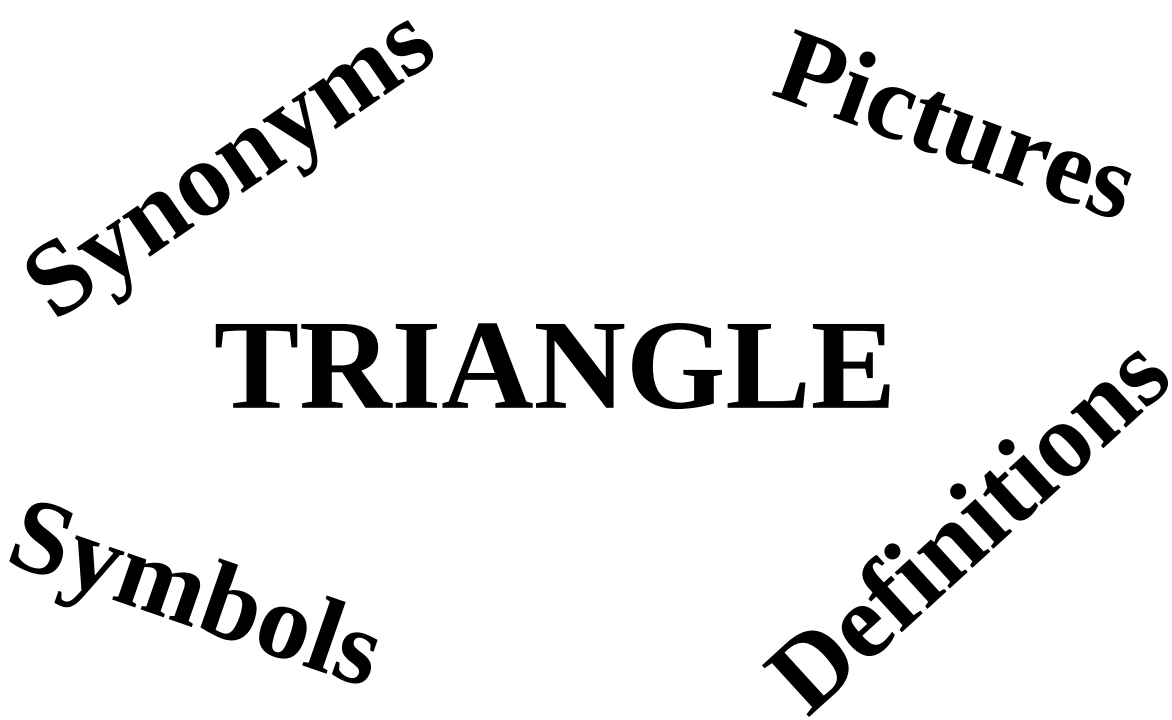
# Concept

The cognitive construct associated with a particular concept includes all the mental images, representations, impressions, as well as all the properties and associated processes, or concept-image (“elaborate structures”, according to cognitive theory).
Pedro Campillo Herrero y Pedro Pérez Carreras

# A Concept

- A concept is an organizing idea; a mental construct that is
  - Timeless
  - Universal
  - Abstract
  - Represented by 1 or 2 words
  - Examples share common attributes

# Vocabulary (Concept)

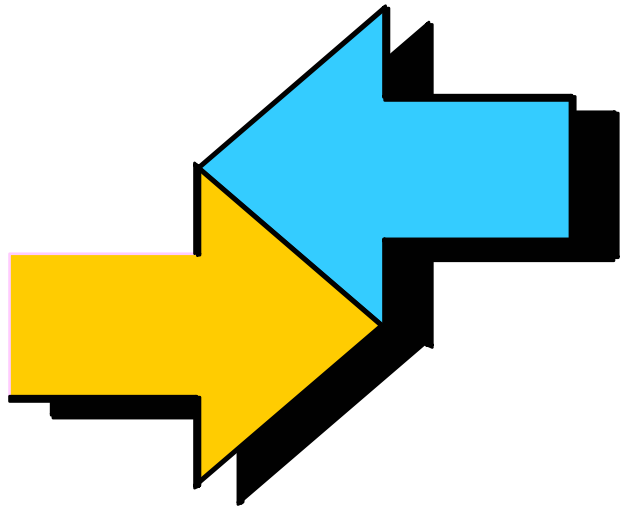


# The Language-Concept Connection

Basic Principles of Preview-Review
(Mora, 1999)

To teach an unknown concept,

use the known language.



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# Language-Concept Connection

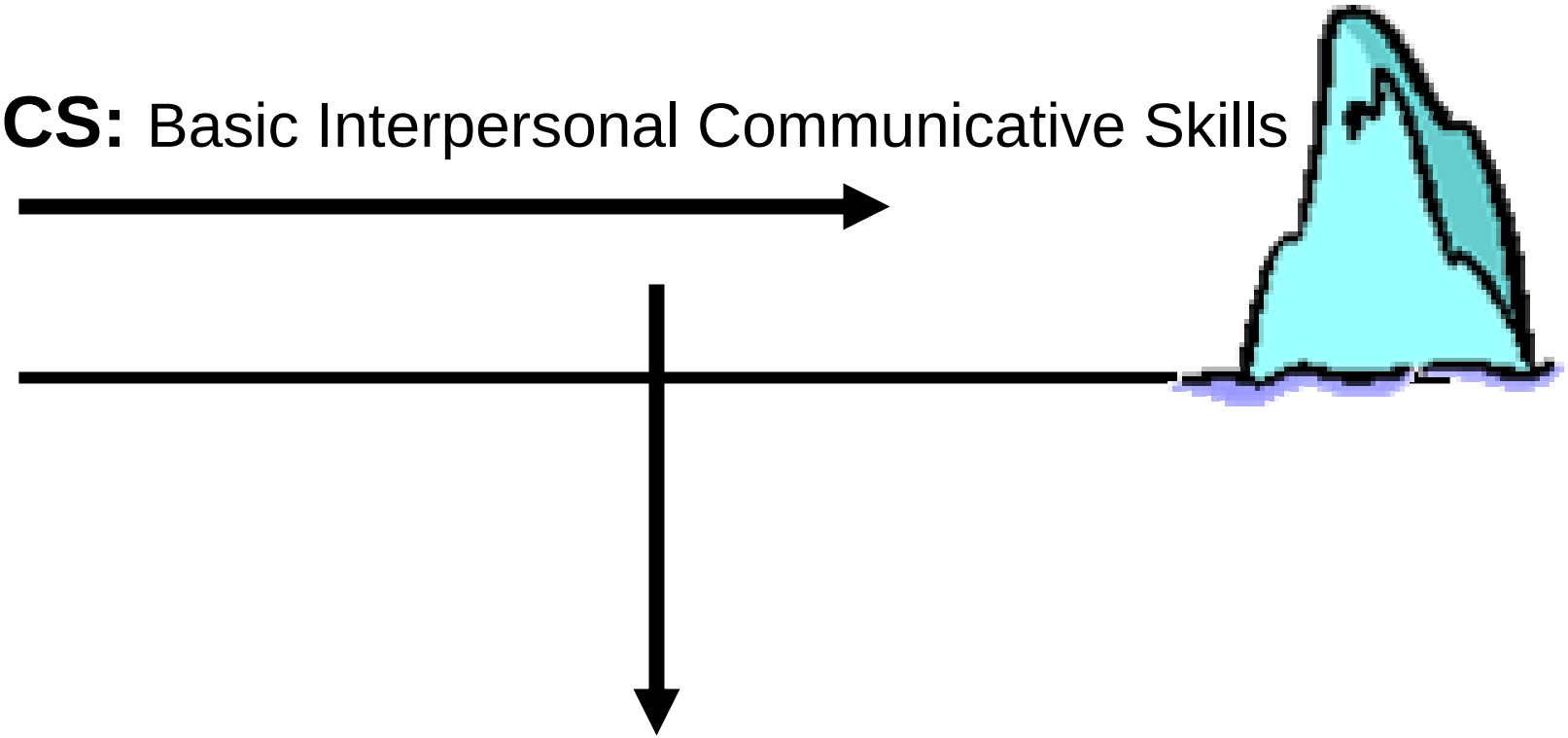
## Instructional Model

(Mora, 1999)

| *Domain* | *Language* | *Concept* | *Learning* |
|---|---|---|---|
| A | Unknown | Unknown | Limited: Modify Instruction |
| B | Known | Unknown | Concept Development |
| C | Unknown | Known | Language Development |
| D | Known | Known | Concept & Language Mastery |

(Cummins, 1981)

**BICS:** Basic Interpersonal Communicative Skills



**CALP:** Cognitive Academic Language Proficiency

Cognitively Demanding

# Communicative Competence

(Canale & Swain, 1980)

- Grammatical competence
- Sociolinguistic competence
- Discourse competence
- Strategic skills
- Oriented toward attaining a specific goal
- Is conditional, sequential and flexible

# Research on Cross-linguistic Transfer

- There is a positive transfer between L1 and L2 in several areas: phonemic awareness; decoding through phonics and word recognition strategies; use of cognates and general comprehension strategies.

# Problem Solving and Critical Thinking

- Being able to communicate thinking during problem solving by using the language (register) of the different academic content areas to explain reasoning in solving a problem rather than merely offering an answer (could include a drawing or diagram to explain).
- Capacity to reason mathematically or scientifically, being able to think logically, able to perceive similarities and differences of an object or a problem, able to choose options based on these differences and reasoning about the relationship among items (able to talk about the mental processes).

# Aspects of Learning and Teaching Problem Solving

A. How to decode the problem (a reading skill)

B. How to translate the answer to a meaningful end (a writing skill). Asking student to verify and justify his answer in writing helps student clarify his answer.

# Problem Solving Involves Logic

Most story problems contain words like ***and***, ***not***, and ***or***

***In order to solve problems, students must master logical means for finding a solution.***

# The Five Strands of Mathematical Proficiency
(TEXTEAMS, Problem Solving)

**Understanding:** Comprehending mathematical concepts, operations, and relations – knowing what mathematical symbols, diagrams, and procedures mean.

**Computing:** Carrying out mathematical procedures, such as adding, subtracting, multiplying, and dividing numbers flexibly, accurately, efficiently, and appropriately.

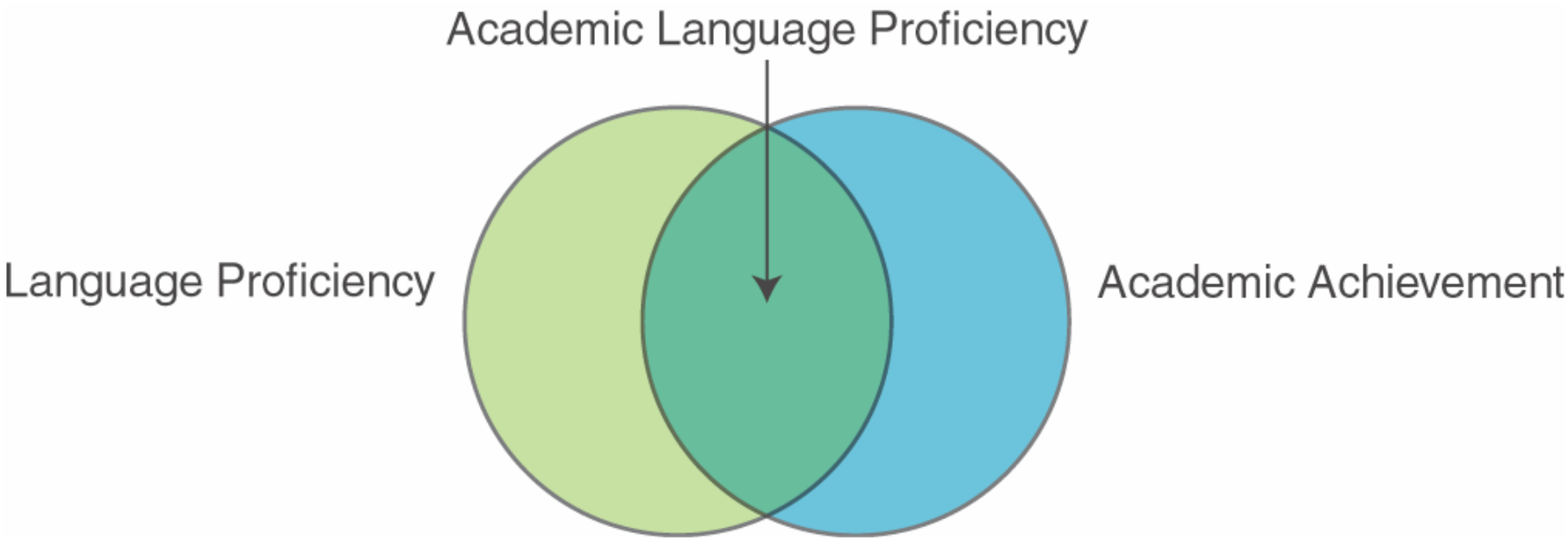
**Applying:** Being able to formulate problems mathematically and to devise strategies for solving them using concepts and procedures appropriately.

**Reasoning:** Using logic to explain and justify a solution to a problem or to extend from something known to something not yet known.

**Engaging:** Seeing mathematics as sensible, useful, and doable – if you work at it – and being willing to do the work.

# The Argument for Academic English Language Proficiency

(SIOP, Texas Education Agency)



# What are the strands of high quality instruction?

(Benson and Benson, 2000)

- I Integration
- D Differentiation
- E Engagement
- A Alignment
- S Strategies that work

An engine doesn't run smoothly unless all cylinders are working properly.

| ***What are the I D E A S?*** | | | |
|---|---|---|---|
| **Integration** | **Forging "WITH" not "FOR" students Paolo Freire** | Students' , Teacher's, and School System's culture integrated to teach/learn at conceptual levels of understanding * | *How are intra and interdisciplinary concepts integrated with culture and contextual factors?* |
| **Differentiation** | **Cultural Pluralism Gardner, Valenzuela, Valencia, Vygotski** | Caring focused on student motivation and interests: multiple intelligences, brain-based, cultural assets in their ZPD | *What variety of activities indicate that differentiation is taking place? How do you assure that each student's learning needs are met?* |
| **Engagement** | **Culturally Responsive Krashen, Cummins, Miramontes, Tinto, Schlechty** | Culturally relevant thematic units of study based on Bloom's knowledge and cognitive dimensions at the concept level and Schlecty's characteristics of engaging work | *What specific instances can you cite to indicate that students are engaged at the concept level? What generalizations are students able to verbalize? What percentage of students indicate that they are authenticly engaged?* |
| **Alignment** | **TEKS, TAKS, District Roadmaps, etc.** | Curriculum, Instruction, Assessment, Resources | *How do you know that your lesson is aligned to the state, district, and grade level curriculum, instruction, and assessment requirements? How do you assure that there are no gaps, redundancy or inappropriate levels of CIA?* |
| **Strategies that work** | **Research-based strategies for English Language Learners CALLA and Sheltered English Instruction** | Cognitive, metacognitive, and social-affective strategies | *What strategies insure that students connect at factual, procedural, cognitive, and metacognitive dimensions of knowledge?* |

# How do we get constant improvement of student academic performance?

- Implement an improvement process
  - consistency and high quality are a result of a commitment to standards and procedures
- Move ahead evenly on all cylinders
  - I*D*E*A*S
    - Integration: Concept Based Unit, Culture, Planning
    - Differentiation: GT, SE, ESL, Learning Styles and Ability
    - Engagement: Structure, Motivation, Significance, Caring
    - Alignment: Curriculum, Instruction & Assessment
    - Strategies that work: Best practice from dominant culture and minority cultures

# What is the improvement process?

- Collect and analyze data
- Set goals and objectives
- Create strategies and activities
- Implement the plan
- Check student progress as you go (formative assessment) and make minor adjustments.
- Do a summative assessment and return to the top

# Let’s start with Integration

The topic of integration includes identifying concepts, building generalizations, and writing guiding questions.

# Let's think some more . . .

(Erickson, 2002)

- What is concept-based curriculum and instruction? How does it raise standards for curriculum, instruction and assessment by developing critical, creative and conceptual thinking abilities?

- How do we create quality concept-based units, that maintain the integrity of discipline-based standards, concepts and skills?

# What are the components of CBU?

- How can we use concepts and “Enduring Understandings” (Big Ideas) in unit design to focus instruction and develop deeper levels of thinking?
- How do we write quality Guiding or Essential Questions that lead student thinking from lower to higher levels?
- How do we write quality Performance Tasks that measure concepts, knowledge and skills?

# What is the structure of knowledge?

(Erickson, 2002)

- Theory
  - –Principle/Generalizations
    - Concepts
      - – Topic
        - » Facts

# The Structure of Knowledge
(Erickson, 2002)

- Acceleration can be mathematically represented by the slope of a line.
- The slope of a graph at a particular point indicates the instantaneous rate of change.
- Slope Derivative Line Graph
- Measurement of Distance and Speed

# Mathematics Concepts

- Number
- Proportion
- Pattern
- Quantification

Ratio

Symmetry

Order

System

# TEKS Math Structure

- 5 Concepts
  - Number, Algebraic, Geometric, Measurement, Probability & Statistics
- 4 Operations
  - Addition, Subtraction, Multiplication, Division to solve problems
- 4 Applications
  - Estimate, Determine solution strategies, Use mathematical representations, Evaluate reasonableness

# What are the reasons for having a concept based unit?

(Erickson & Wiggins)

- Reasons for changing the emphasis in instruction from memorization of facts, to the use of facts as a tool to develop deeper, conceptual understanding
- Facts:
  - The fact-based curriculum changes too rapidly
  - A solely fact-based curriculum fosters lower-level thinking
  - A fact-based curriculum maintains the fragmentation of knowledge

# Facts and Concepts
(Erickson, 2001 and 2002)

- Universal concepts remain constant even though the fact base that supports them may change over time
- Concepts foster the development of generalizations that apply across the field of knowledge
- Concepts and generalizations stimulate higher level thinking by causing students to rise above the fact base to gain understanding
- Concepts and generalizations ‘integrate’ thinking and allow for the transfer of knowledge

# What does a ‘conceptual lens’ do?

(Erickson, 2002)

- Looking at a topic through a ‘conceptual lens’ engages the personal intellect and emotions of the student . . .
  - Deeper level of understanding
  - Retain the factual information because it has relevance, and
  - Show a greater love of learning

# **The Value of Concept-Based Instruction** (Erickson, 2002)

- Engages the personal intellect and emotions of the student; increases motivation for learning
- Requires a higher level of thinking
- Teaches students how to see patterns and connections between facts and ideas
- Provides relevant focus for content study

# **The Value of Concept-Based Instruction** (Erickson, 2002)

- Facilitates the transfer of knowledge
- Meets different ability levels
- Creates a brain schema for processing new information
- Develops verbal and written fluency
  - Develops the art of conversation
  - Deepens reading comprehension

# Integration
(Erickson, 2002)

- . . . Looks at a topically-based theme, problem, or issue through an integrating, “conceptual lens” such as *Interdependence* or *System*
- The conceptual lens pulls thinking to the integration level

# How deeply do we understand understanding?

- If we understand deeply, we can
  - Explain
  - Interpret
  - Apply
  - Look at it from more than one perspective
  - Empathize
  - Reflect on our own thinking about the topic

# Why do they seem to forget?

(National Research Council, 2000)

- We don’t retain what we don’t deeply understand.
- Students won’t retain math facts or skills unless they understand math concepts
- We have to resist the urge to cover more in order to teach in a way that supports understanding
- Students are capable learners when they become competent at the conceptual level
- We must learn through all four dimensions of knowledge: factual, procedural, conceptual, and metacognitive in order to retain and transfer concepts.

# Strategies for Math and Science

CALLA, 1994 and Sheltered Instruction Observation Protocol, 2002

**Vocabulary Development**

- Verbal Visual Word Association
- Image Streaming
- Interactive Word Wall
- Word Sorts
- Teaching Common Affixes
- Cognates

**Concept Development**

- Magnet Summaries
- Concept of Definition Map
- Frayer Model
- Concept Attainment
- Feature Analysis
- Anticipation Guide

**Notes and Responses**

Integrating Writing in the Content Areas

- K-W-L Chart
- Quick Writes
- Two-Column Notes
- Power Notes

**Manipulatives and Movement**

- Brain-Based Connections
- Tactile/Kinesthetic Connections
- Practice/Application of Sheltered Instruction English

# Metacognitive Learning Strategies

(Chamot & O'Malley, 1994)

- **Require "thinking about thinking"**
- **Planning for learning by setting objectives**
- **Organizing the learning task by creating an outline or structure**
- **Monitoring one's own learning by evaluating achievement of learning goals**

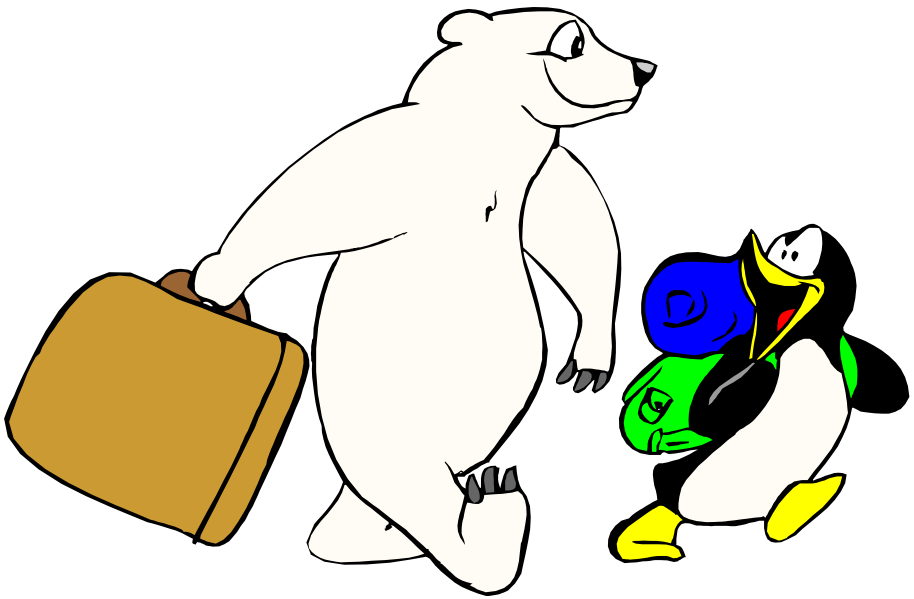
# Cognitive Learning Strategies

(Chamot & O'Malley, 1994)

- **Manipulating the material to be learned in a specific learning task**
- **Linking new learning to prior knowledge related to particular concepts or processes**
- **Relating learning processes to linguistic demands in the domains of listening, speaking, reading and writing**

# Social/Affective Learning Strategies

(Chamot & O'Malley, 1994)



- **Interacting with others to assist in learning**
- **Developing cooperation and collaboration skills and processes**
- **Asking questions for clarification**
- **Using affective (emotional) control to accomplish the learning task**

# Metacognitive Strategies

(Chamot & O'Malley, 1994)

- **Planning**: Advanced organization; selective attention; self management
- **Monitoring**: Checking for comprehension; monitoring production, self-monitoring while speaking and writing
- **Evaluating**: Checking back; reflecting on what one has learned, judging how well the task has been accomplished

# Cognitive Strategies

(Chamot & O'Malley, 1994)

- **Resourcing**: Using reference materials such as textbooks, dictionaries and encyclopedias
- **Grouping**: Classifying words, terminology, quantities, or concepts according to their attributes
- **Note-taking**: Writing down key words and concepts
- **Elaboration**: Relating new ideas and concepts to known information and making personal associations

# Cognitive Strategies, Cont.

(Chamot & O'Malley, 1994)

- **Summarizing**: Making mental, oral or written summary of information gained at certain points in learning process
- **Deduction/Induction**: Use a rule/Make a rule
- **Imagery**: Make a mental picture from the information
- **Auditory Representation**: Mentally replay a word, phrase or piece of information
- **Making Inferences**: Use context clues to guess meaning and predict upcoming information

# $L_2$ Acquisition

## REMEMBER:

Comprehension precedes production…

Production must be allowed to emerge in ***STAGES;***

Class content must be based on ***COMMUNICATIVE GOALS***; and

Activities and environment must work together to produce a ***LOW ANXIETY LEVEL***.

## Resources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Sheltered Instruction Observation Protocol (SIOP), Texas Education Agency and RESCIV.

TEXTEAMS: Rethinking Elementary Mathematics. The Charles A. Dana Center, The University of Texas at Austin. Austin, Texas.


Internet Resources

www.utdanacenter.org
www.mismates.net
www.tenet.edu/teks/math
www.emis.de/journals/DM/index.htm
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# THANK YOU!

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