

This is **NOT**  
your old  
**Science Class!**

Today's science is much different  
from what we experienced

# 7<sup>th</sup> Grade Science

- L** My style of teaching involves brain based learning, constructivist & experiential learning.
- Z** This incorporates inquiry, investigation, problem solving, cooperative learning and simulation.  
(defined later)
- 
- M** ie: Worksheets don't build dendrites!
- S** No: multiple choice or T/F tests or quizzes, or rote memorization based assessments.
- N** Yes: to processing skills, conceptualization, problem solving, practical application & developing critical thinking skills.

# Science Class; “as it was back then”

- Students read aloud from texts
- Students memorized long lists
- Content was presented in lectures
- Tests required rote memory recall
- Using the “Scientific Method”
- “Cook book” Lab experiences merely confirmed what students have read or been told in lecture
- Goal of assessment is to grade students



*Source: BioEd; Baylor College of Medicine*

# Instructional Approach

## More

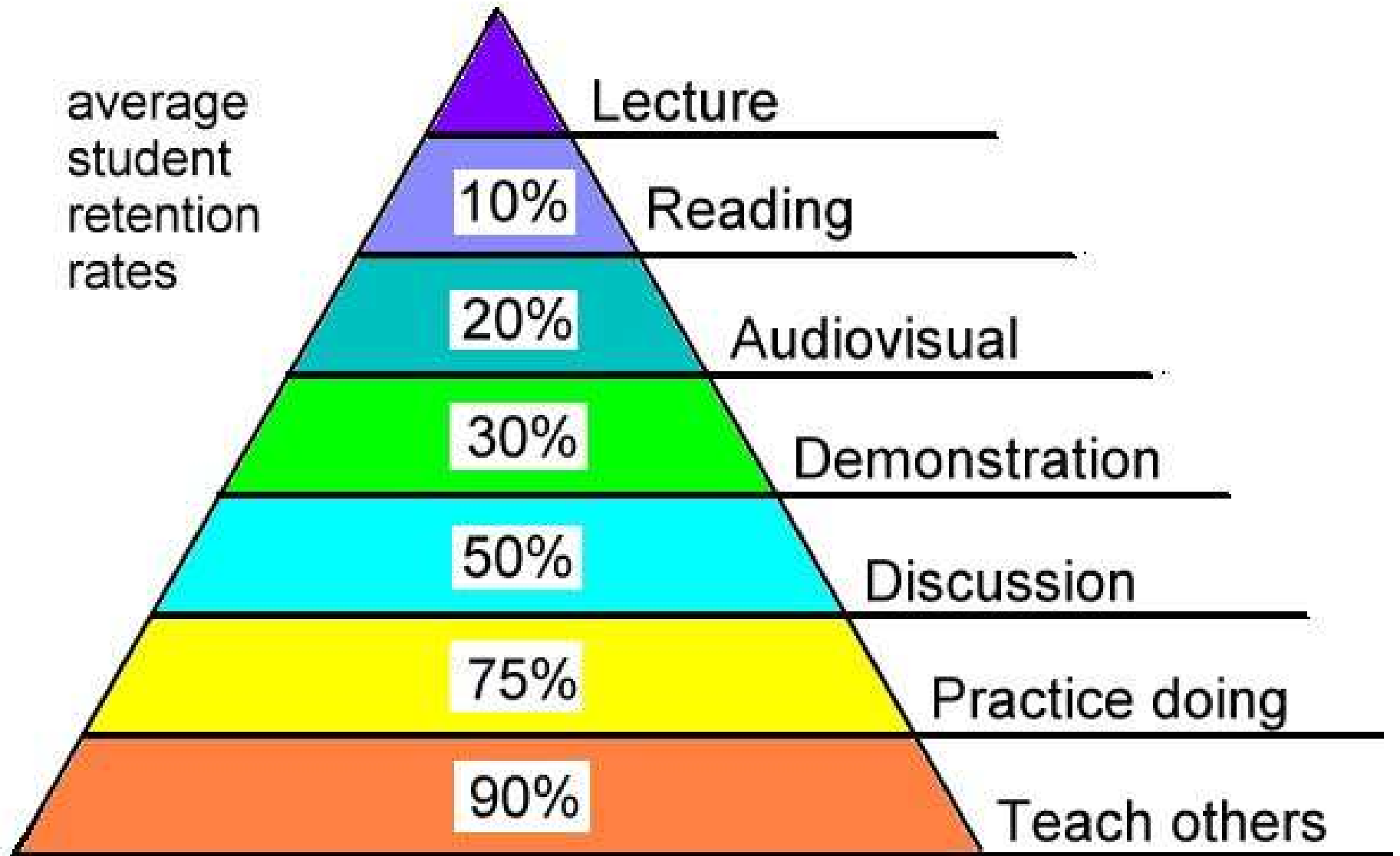
- Investigation of questions
- Inquiry & problem based learning
- Understanding concepts
- Fewer topics (in depth)
- Long-term investigations
- Learning by doing
- Interpreting evidence
- Assessing understanding
- Teacher as reflective leader

## Less

- Lectures
- Individual learning
- Knowing facts
- Multiple topics
- Short investigations
- Cookbook science
- Getting an answer
- Assessing discrete knowledge
- Teacher as technician

*Source: BioEd; Baylor College of Medicine*

# Learning Pyramid



Source: National Training Laboratories, Bethel, Maine

# Meaningful Learning VS Rote Learning

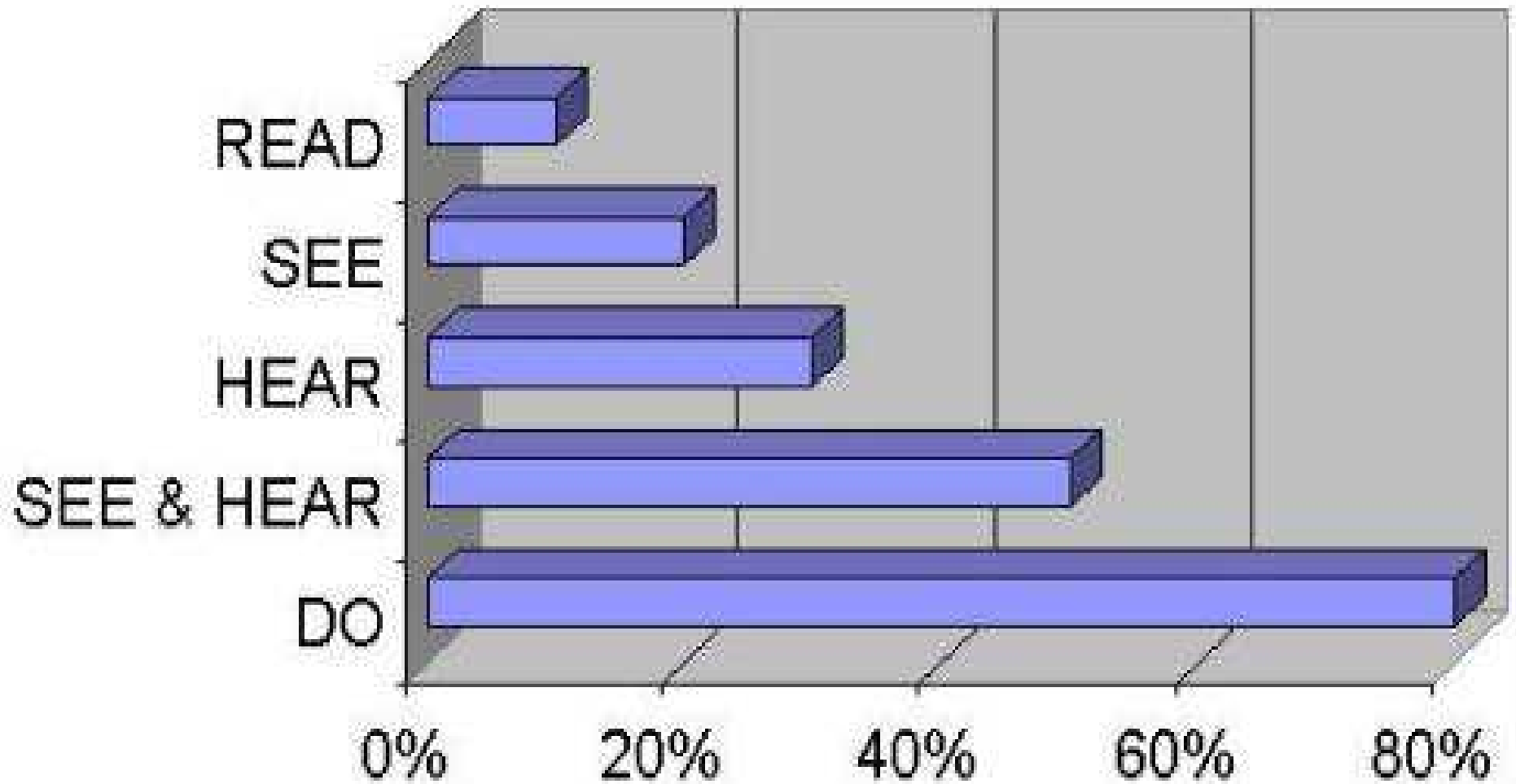
## ■ Meaningful Learning:

- Non-arbitrary, non-verbatim, substantive incorporation of new knowledge into cognitive structure.
- Deliberate effort to link new knowledge with higher order concepts in cognitive structure.
- Learning related to experiences with events or objects.
- Affective commitment to relate new knowledge to prior learning.

## ■ Rote Learning:

- Arbitrary, Verbatim, non-substantive incorporation of new knowledge into cognitive structure.
- No effort to integrate new knowledge with existing concepts in cognitive structure.
- Learning not related to experience with events or objects.
- No affective commitment to relate new knowledge to prior learning.

## Students Remember...



# Active Learning VS Teacher Centered

## ■ Active Learning:

- Participating in inquiry investigations.
- Writing to learn, preparing and giving presentations, group discussions. Finding practical applications to information.
- Formulating explanations. Finding applications that aid subsequent learning.
- Performing investigative or inquiry lab activities. Using science knowledge to solve real problems.
- Assessing performances of understanding and capability to apply science knowledge.

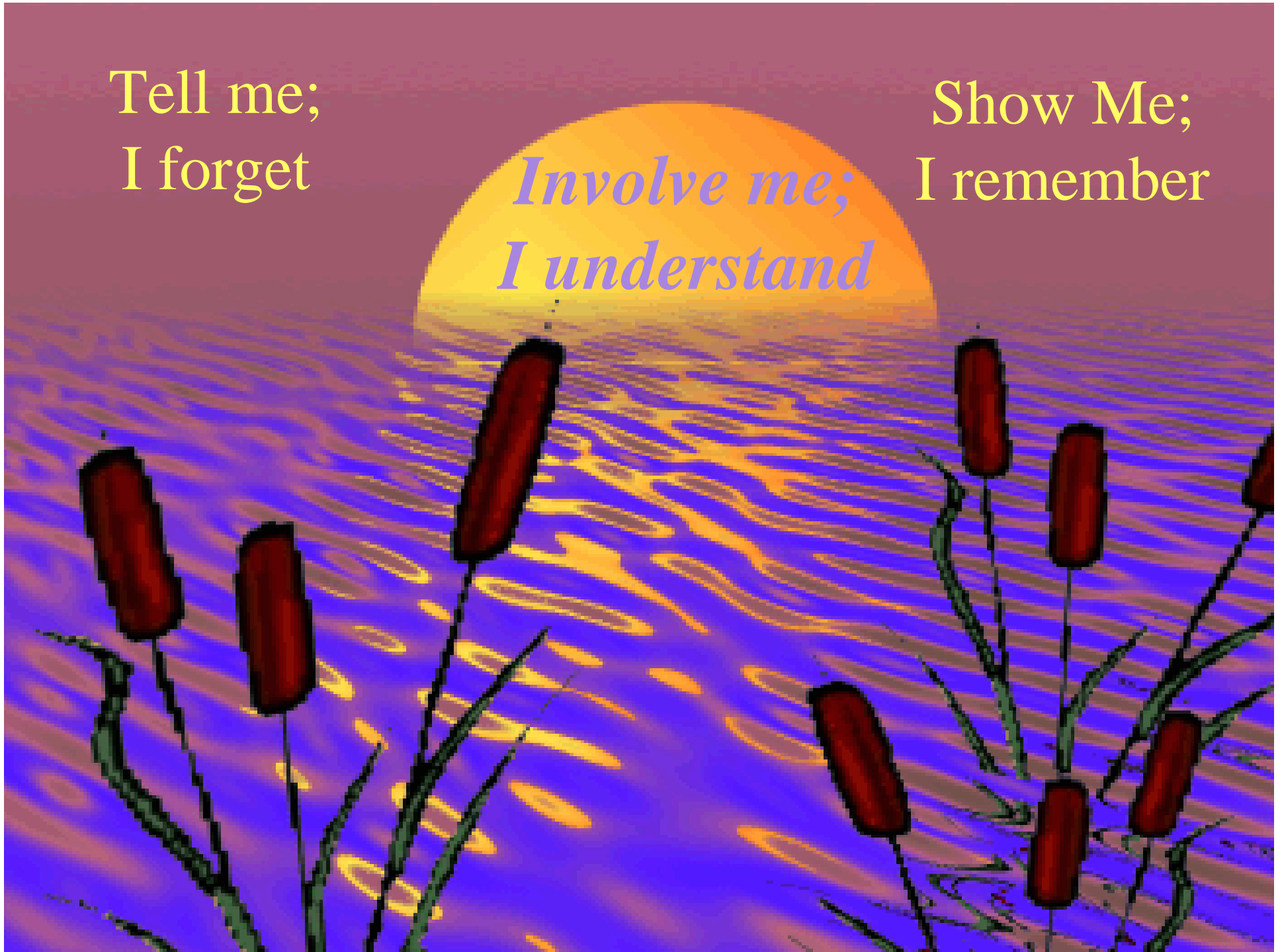
## ■ Teacher Centered

- Lectures & Demonstrations.
- Assigned Reading.
- Answering questions and problems that advance students' information base.
- Assigned hands on activities and cookbook laboratory activities.
- Testing for recall of facts and concepts.

Tell me;  
I forget

*Involve me;  
I understand*

Show Me;  
I remember



# Critical Thinking

- **Critical Thinking** is a complex process that is based on objective standards and consistency. It includes making judgments using objective criteria and offering opinions with reasons. Critical thinking involves putting together information to arrive at a whole new concept, idea, or understanding.
- It often involves four stages that include:
  - **Preparation:** gathering and examining the needed information
  - **Incubation:** mulling over the idea and making connections to other experiences
  - **Illumination:** the "Aha!" when the new idea comes to light
  - **Verification:** methods for testing the idea

# Science Teaching Tools

- ✓ **Constructivism**: Building present knowledge by using what they know today. Relevance is the key to gaining student attention and motivation
- ✓ **Inquiry**: Investigations are employed to solve realistic problems incorporating experimentation, reflection, writing, discussion, cooperative learning, simulation, critical thinking, and interaction
- ✓ **Problem Based Learning**: Solving real problems designed to improve processing, comprehension, problem solving, thinking and decision making skills
- ✓ **Brain Based Learning**: Incorporates the latest methods in how the adolescent brain learns

# A Cycle of Inquiry



# Assessment for Learning

Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupil's learning.

It thus differs from assessment designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence.

—Paul Black and Christine Harrison, *Science Inside the Black Box: Assessment for Learning in the Science Classroom*

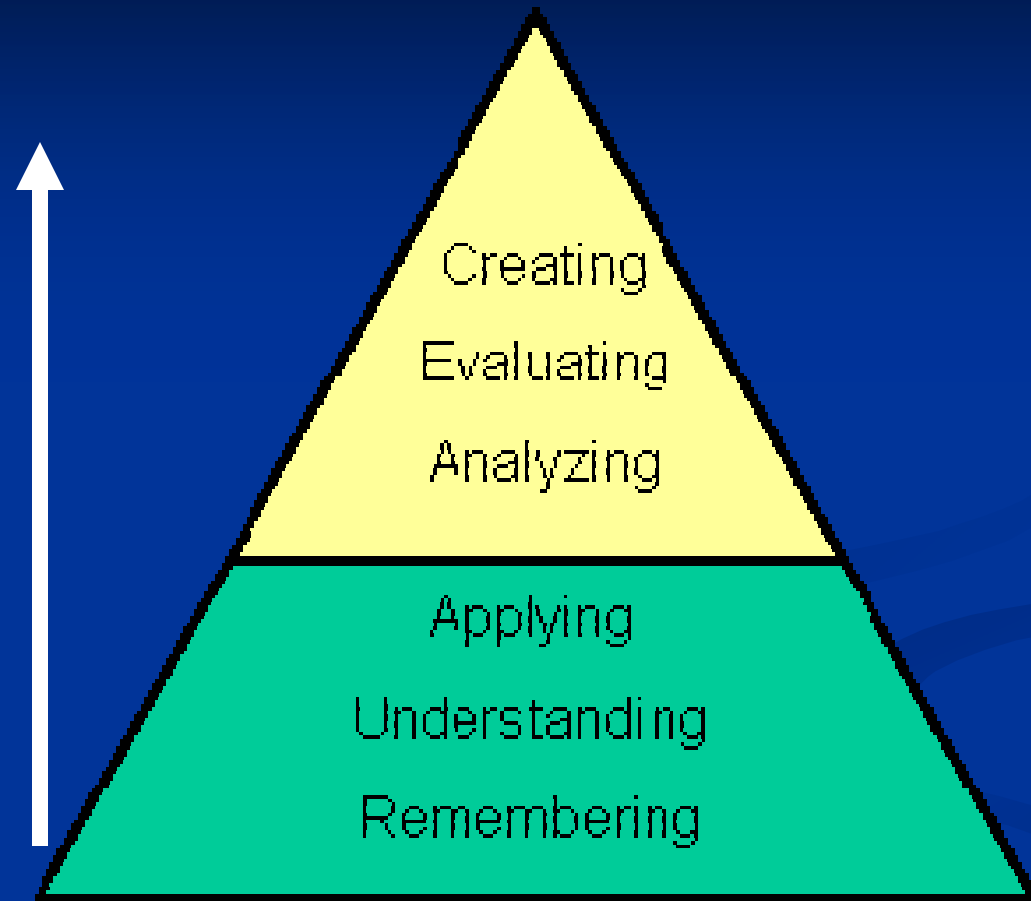
# Assessment in Science

- Pre-Assessment is a survey prior to a unit study. This establishes a baseline for constructivist knowledge.
- Formative Assessment takes place throughout the unit of study. This can be in the form of “Sci-Primers”, “Mini Oral Dissertation”, “Performance Proofs”, “Enrichment”, “Sci-Logs” etc.
- Summative Assessment is often in the form of a “Lab Practical”, or a similar performance based assessment where students demonstrate their understanding. Multiple choice, FITB or True/False questions do not provide an accurate assessment of scientific knowledge and understanding that middle school students have achieved from the science unit.

# Assessment Within A Cycle of Inquiry



Complexity



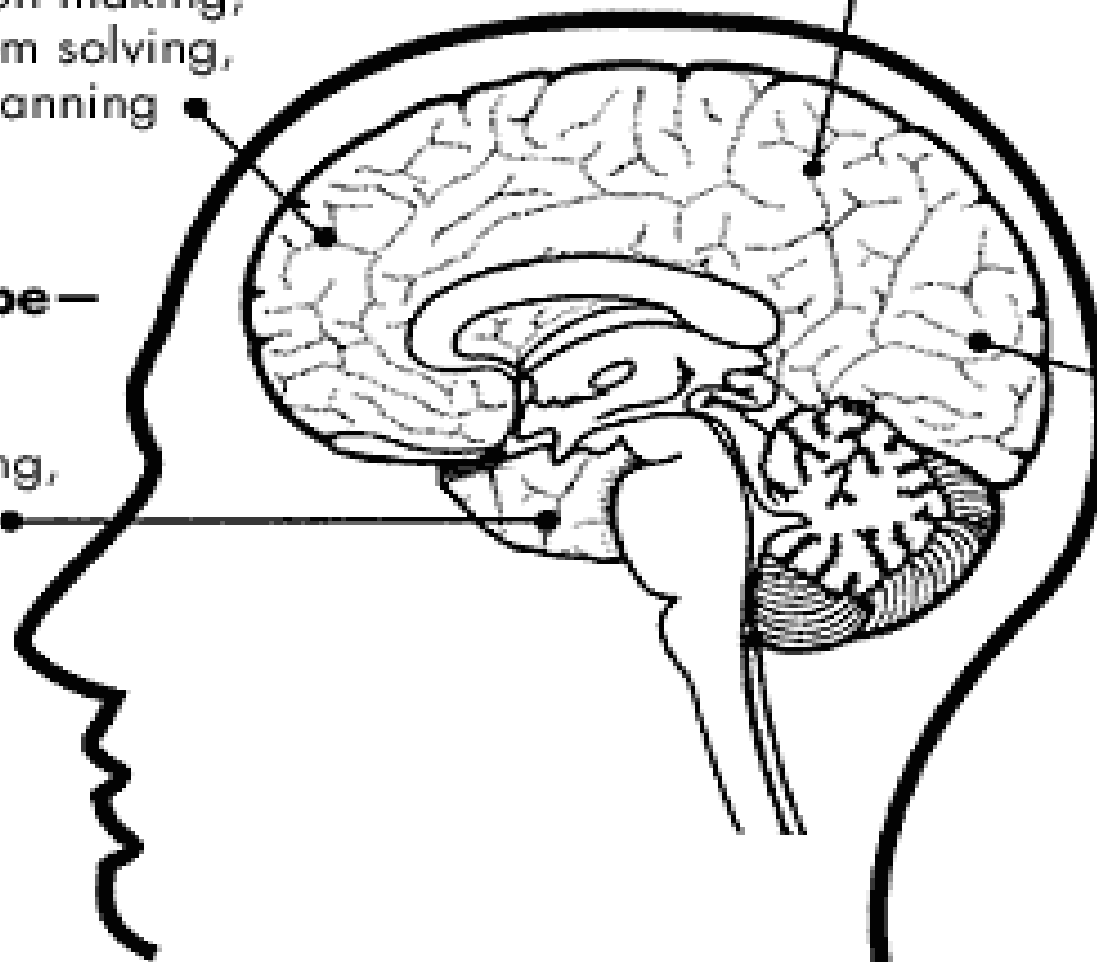
Revised Bloom's Taxonomy

**Frontal lobe**—  
having to do with  
decision making,  
problem solving,  
and planning

**Temporal lobe**—  
having to do  
with memory,  
emotion, hearing,  
and language

**Parietal lobe**—  
concerned with  
the reception and  
processing of sensory  
information from  
the body

**Occipital lobe**—  
concerned  
with vision



# Brain Based Learning

- **As the human brain searches for order in the patterns of the world, and knowledge and skills are acquired through experience, learning naturally occurs.**
- **In his book “Brain Based Learning (2000) Eric Jensen defined a brain-based approach as “learning in accordance with the way the brain is naturally designed to learn” (p.6).**
- **A brain based approach encourages educators to consider the way the brain works when making educational decisions. “By using what we know about the brain, ...we can reach more learners, more often and with less misses.**
- **Quite simply it is learning with the brain in mind.” Although Jensen cautioned educators not to base a school on brain-based learning research alone, to ignore the findings would be irresponsible.**

# Principles to Brain Based Learning

- **Principle 1: The brain is a complex adaptive system**
- **Principle 2: The brain is a social brain.**
- **Principle 3: The search for meaning is innate.**
- **Principle 4: The search for meaning occurs through patterning.**
- **Principle 5: Emotions are critical to patterning.**
- **Principle 6: Every brain simultaneously perceives and creates parts and wholes.**

# Principles to Brain Based Learning

- **Principle 7: Learning involves both focused attention and peripheral perception.**
- **Principle 8: Learning always involves conscious and unconscious processes.**
- **Principle 9: We have at least two ways of organizing memory.**
- **Principle 10: Learning is developmental.**
- **Principle 11: Complex learning is enhanced by challenge and inhibited by threat.**
- **Principle 12: Every brain is uniquely organized.**