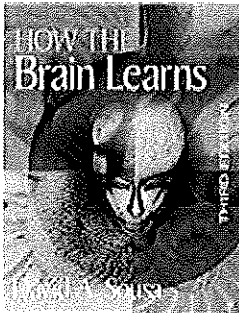


# How Do Children Learn?

## Looking at Brain Research: How the Brain Processes Information



### Importance of the Environment

There are probably more differences in human brains than in any other animal partly because the human brain does most of its developing in the outside world.

—Robert Ornstein and Richard Thompson  
*The Amazing Brain*

### The Senses and Sensory Register

- Our senses constantly collect tens of thousands of bits of information from the environment every second, even while we sleep.

*(The material in this presentation was abstracted from David A. Sousa's book, How the Brain Learns, 3<sup>rd</sup> Edition: Corwin Press, 2006)*

- The senses do not all contribute equally to our learning. Over the course of our lives, sight, hearing and touch (including kinesthetic experiences) contribute the most.

### **Prior Knowledge and Experience**

All incoming sensory information (except smell) uses the individual's past experiences to determine the data's degree of importance.

### **Short-Term Memory/Working Memory**

- Short-term memory primarily includes immediate memory and working memory.
- The individual's experiences determine its importance. If the item is of little or no importance within this time frame, it drops out.

***You cannot recall information  
that your brain does not retain***

### **Emotions and Memory Processing**

Threats and emotions affect memory processing. There is a hierarchy of response to sensory input.

**Survival**—Students must feel physically safe and emotionally secure before they can focus on the curriculum.

**Emotion**—How a person “feels” about a learning situation determines the amount of attention devoted to it.

EMOTION drives  
ATTENTION drives  
LEARNING drives  
MEMORY

## **Emotions and Learning**

### **Classroom Climate**

Positive climate/feelings leads to Endorphins:

- Gives feeling of euphoria
- Stimulates frontal lobes making experience pleasurable and successful

Negative climate/feelings leads to Cortisol:

- Raises anxiety level
- Refocuses frontal lobes to flight or fight
- Activity is focused on the cause of the stress and little attention is given to the learning task.

Emotionally stressful school environments are counterproductive because they can reduce students' ability to learn. (Sylwester, '94)

## **Motivation**

Emotions determine how students feel about the learning situation and the amount of time they will spend on it.

School activities that draw out emotions, e.g., simulations & cooperative projects, can provide important contextual memory prompts that help students recall information during related events in the world.

### ***Implications for teaching: How to connect content to emotion?***

- Teachers need to use strategies that get students emotionally involved (invested) in the curriculum content.
- Teachers can use simulations, role-playing, journal writing, music, games, and real world experiences—all examples of strategies that can help students connect emotions to content.

- These strategies enhance learning because they tie memories to the kinds of emotional contexts in which they will later be used.

### **Limited Capacity of Working Memory**

Information in working memory can come from the sensory/immediate memories or retrieved from long-term memory.

- Working memory is temporary and can deal with items for only a limited time. However, any discussion of time limits for processing new information has to include motivation.
- People who are intensely motivated about a subject can spend hours reading and processing it. That's because motivation is essentially an emotional response.

### ***Implications for Teaching: Less is More!***

Keep the number of items in a lesson within the capacity limits of students and they are likely to remember more of what they learned

- Package lessons into 15-20-minute components

## **Long-Term Memory and Storage**

EMOTION drives

ATTENTION drives

LEARNING drives

MEMORY

## **Selection for Long-Term Memory**

How does the student decide to code items in long term memory?

Learner Makes a Decision: Should items in working memory be encoded to long-term storage for future recall, or should they drop out?

Criteria for Retention: Student asks two questions: Does this make sense? and Does this have meaning?

- Does this make sense? Does it “fit” into what learner knows about how world works?
- Does it have meaning? Is it *relevant* to the learner?

**Meaning is More Significant.**

Note: It is possible to remember an item because it makes sense but has no meaning. (Remember names in games.)

It is also possible to remember an item that makes no sense but has meaning for you.  
(Nonsense poems.)

Brain scans: when new learning is readily comprehensible (sense) and can be connected to past experiences (meaning) there is substantially more cerebral activity followed by dramatically improved retention  
(Maquire, Frith, & Morris, 1999).

***Implications for Teaching: Past experiences always influence new learning.***

- Every day, students listen to things that make sense, but lack meaning.
- Teachers spend about 90% of their planning time devising lessons so that students will understand the learning objective (make sense of it).
- For teachers to convince the learner's brain to persist, they have to help students establish ***meaning***.

- What we already know acts as filter to help us attend to things that have meaning (relevancy) and discard what doesn't.

## **Curriculum**

- If we expect students to find meaning, we need to be certain today's curriculum contains connections to ***their*** past experiences, not just ours.
- Help students to make connections between subject areas by integrating the curriculum which increases meaning and retention.

## **Retention in Long-Term Memory**

Research on retention shows that the greatest loss of newly acquired information or a skill occurs within the first 18 to 24 hours.

- If a learner cannot recall new learning after 24 hours, there is a high probability that it was not permanently stored and can never be recalled.



- Memories are not stored as a whole in one place. Different parts of a memory are stored in various sites which reassemble when the memory is recalled.
- Long-term memory is a dynamic, interactive system that activates storage areas distributed across the brain to retrieve and reconstruct memories.

***Implications for Teaching: Use unannounced quizzes to test for retention***

If teachers want to test whether information actually has been transferred to long-term storage, the tests need to:

- Come as a surprise to the learner, with no warning or preparation time.
- Be given no sooner than 24 hours after the learning.
- Test precisely what should have been retained

## **Rationale:**

- If the learners have warning about the test, they are likely to review the material just before the test.
- The test may determine the amount of information the learners were able to cram and hold in working memory and not what they recalled from long-term storage.
- While testing without warning may seem insensitive, it is the only way teachers can be sure that long-term storage was the source of the test information that learners provided.
- Teachers can explain to students that unannounced tests help them see *what* as well as *how much* they have retained and learned over a given period of time.

***Unannounced quizzes, then, should help the students assess what they have remembered, rather than be a classroom management device to get students back on task.***

## **Self-Concept and Past Experiences.**

Our self-concept is shaped by our past experiences.

- Positive or negative reactions from others (passing or failing a test) produces strong emotional reactions that the brain encodes and stores with the cognitive event.
- These emotional cues are so strong that we often re-experience the original emotion each time we recall the event.

### ***Implications for Teaching: Accepting or rejecting new learning***

- Students will participate in learning activities that have yielded success for them and avoid those that have produced failure.
- If past experiences produced failure, then the sensory register is likely to block the incoming data. The learner's self-concept is closed off to the receptivity of the new information.

***When a curriculum concept struggles with an emotion, the emotion trumps.***

**EMOTION**  
**drives**

**ATTENTION**  
**drives**

**LEARNING**  
**drives**

**M E M O R Y**