Cognitive Psychology & Information Processing Theory

Information Processing Model
Sensory Memory

- A memory buffer holding sensory input
  - **Function:** Gather information from the environment
  - **Capacity:** large
  - **Duration:** short
  - **Getting it in:** sensation

- Iconic Memory (visual)-
  - ~0.5 seconds (video camera)
- Echoic Memory (auditory)
  - ~ 2 seconds (tape recorder)

Two important implications:

Teachers should recognize capacity limitations and rate of decay of new information so as not to overload students

Teachers should cue students to focus their selective attention to what is most important
Working memory

- Rehearsal—retaining information in WM
  - Maintenance rehearsal—repeating information over and over
    - In general: The longer information is held in working memory, the greater the chance it will make it into LTM.
  - Elaborative rehearsal—associating information to be learned with information already stored in LTM.
    - e.g. --associate meaningful information to item to be learned.
    - More associations=better chance of storage in LTM

2 Ways to “Beat the Bottleneck”
Automaticity

Overlearning information or operations to the point where they can be used with little mental effort

Long Term Memory

• Similar to a hard-drive on a computer
  • Function: hold information (the file cabinet)
  • Capacity: large (unlimited?)
  • Duration: long
  • Saving Information:
    • Maintenance Rehearsal
    • Elaborative rehearsal—encoding

  – Increasing the odds of saving it:
    • Time in WM
    • Number of times it enters WM
    • Meaningfulness --i.e. more connections
Knowledge Types

– **Declarative Knowledge** – “knowing that”
  1. *Episodic* – autobiographical memory, what you have personally experienced in your life.
     – “Movie reel” in your head
  2. *Semantic* – general world knowledge
     – includes vocabulary, language, relating concepts and idea to one another.

– **Procedural Knowledge** – “knowing how” – eg. Riding a bike
Making Information Meaningful

Organization
• Impose order and connections in new information

Elaboration
• Expand on existing schemas

Level of Activity
• Put learner in the most active (not passive) role possible in making connections

Organizing Information

• making connections among incoming bits of information. (internal connections)
  – Hierarchies—show progression from broad to specific
  – Sequences/outlines—shows linear progression of information.
  – Matrices—shows relationships between elements
  – Models—unified representation, shows how parts are related
  – Concept maps
Elaboration

• connecting new information to information you already know (background knowledge)-external connections
  – Analogies—recognizing similarities “It’s like…..”
    • Examples / “illustrations”
    • Stories
  – Activating prior knowledge—“what do we already know about…..”
  – Special cases—Mnemonics—Generated connections (use when there is no background knowledge)

Level of Activity

Depth of Processing
• Finding similarities and differences and generalizing:
  – “How are these alike?”
  – “How are they different?”
  – “What pattern do you see?”
• Explaining:
  – “Why?” (e.g., “Why do you suppose Mercury is so hot on one side and so cold on the other?”)
• Providing evidence:
  – “How do you know?”
    » Example: “How do you know that people’s perceptions vary?”
  – Evidence:
    » Some people saw the young woman in the picture, whereas others saw the older woman.
• Hypothesizing:
  – “What would happen if?”
    » Example: “What would happen if Mercury rotated on its axis as does the Earth?”
    » Hypothesis: The temperature wouldn’t vary so much. It would be very warm on all parts of the planet.
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LTM Enhancement

• Strategic Deliberate Practice
• Encode Visually and Verbally
• Block out Interference
• Focus on Organization, Elaboration, & Activity
• Learn in Depth
• Learn in Many Contexts
• Use Mnemonics for Facts
• Build Schemata & Interconnections
Metacognition

• Executive processes; oversees the memory system
• Is rather late developing
• Can be improved through instruction
The “Knowing” and “Adjusting” Processes:

- Knowing how well you are doing on your educational psychology test
- Predicting how difficult a chemistry project will be
- Understanding how much you know about former presidents
- Knowing what information is important to take away from class lecture
- Knowing how well you understand the directions for how to record on a VCR

Examples of Metacognition
Examples of Metacognition cont.

- Choosing one strategy over another when playing a board game
- Knowing if you have studied enough for the history exam
- Understanding and utilizing strategies that will make you a better setter in volleyball
- Knowing when your performance on the trumpet was up to par
- Knowing which Trivial Pursuit categories you are strong and weak at

"Having knowledge is only part of effective learning. It also is important to use one’s knowledge strategically and to understand the strengths and limitations of one’s knowledge."

(Bruning, Schraw, Ronning, 1999; p. 102)

This is the key distinction between metacognition and cognition.
Summary Recommendations from Information Processing Theories of Learning

- Overlearn to the point of **automaticity**
- Encourage **deeper processing**
- Help guide **selective attention**
- Remember that **meaning** drives learning & memory
- Develop not only knowledge but the ability to monitor one’s learning
- **Strategies** rule!