LEARNING OBJECTIVES

What principles underlie information processing theories?

How does attention affect learning?

How is perception explained by cognitive theories of learning?

What are the different memory stores? How are memories made, stored, and retrieved? How may we improve memory storage and retrieval?

How may learning events in and out of school be explained in terms of cognitive processes according to the information processing theory?
MODULE 8. INFORMATION-PROCESSING THEORIES

Introduction

Towards the late 20th century, the emphasis in psychology began to veer towards the cognitive view. From behavior, the focus gradually shifted to thought processes, with particular interest on memory (Huitt, 2003). The emergence of the cognitive perspectives of learning was partly due to the failure of behaviorism to sufficiently explain complex phenomena, e.g., language learning and problem solving, as well as differential responses of people to a common stimulus. The principal concern of proponents of cognitive theories are internal (mental) processes that intervene between stimuli and responses. Behaviorists view learning as consequences of responses stimuli impinged on man. Cognitivists view learning as consequences of man’s active attendance to and reorganization of information into meaningful knowledge, coupled with an innate desire to understand the world (Schunk, 2012, 165). Outcomes of processing information include remembering, concept-formation, reasoning, problem-solving, and a host of other complex knowledge or skills.

KEY ASSUMPTIONS OF COGNITIVE LEARNING THEORY

- Learners are active seekers and processors of information. They manipulate, monitor and strategize processes applied to information.
- Prior learning influences how new understanding develops.
- The capacity to process information gradually progresses, thus allowing learners to increasingly acquire knowledge and skills (Santrock, 2011).

MAIN COGNITIVE APPROACHES TO LEARNING

- Social learning— Learning is influenced by the interactions among behavior, environment, and the individual
- Information-processing approach - Attention, memory, thinking, and other cognitive processes characterize how people learn
- Constructivist approaches - The development of knowledge and understanding involves the process of construction
  - Cognitive constructivist approach – emphasizes cognition/mental processes.
  - Social constructivist approach –emphasizes the collaborative and other social processes. (Holzman, in Santrock 2011, p. 218)

Learning is a change in people’s mental structures instead of changes in observable behavior.

Social learning and constructivism are discussed in separate modules. In this module, we shall focus our attention on the information processing approach to learning.
Module 8: Information Processing Theories

INFORMATION PROCESSING

Information processing theory assumes that human learning is analogous to computer processing; i.e., information is received, stored in memory, and retrieved as needed. As individuals gain maturity and experience, both the capacity and speed of information processing capabilities grow. In information-processing theory, capacity and speed comprise cognitive resources, which are posited to be strong determinants of memory and other cognitive skills (Santrock, 2011, p. 255).

Nearly twice as many synaptic connections between neurons are made than ever will be used. Connections that are used become strengthened and survive; unused ones become replaced by other pathways or disappear.

Santrock. Chapter 2, p. 35

The processing speed of the human brain is usually assessed through reaction-time tasks; respondents, for example, are asked to push a button as soon as they see a stimulus such as a light.

Both biology and experience contribute to growth in cognitive resources (Bjorklund, 2011). Think about how much faster you can process information in your native language than in a second language. [Changes] in the brain ... provide a biological foundation for increased cognitive resources (Zelazo & Lee, 2011). As children grow and mature, important biological developments occur both in brain structures, such as changes in the frontal lobes, and at the level of neurons, such as the blooming and pruning of connections between neurons that produces fewer but stronger connections (Nelson, 2011). Also... myelination (the process that covers the axon with a myelin sheath) increases the speed of electrical impulses in the brain. Myelination continues at least through adolescence (Paus, 2009)

Santrock, 2011, p. 255

THINK

> Why should processing speed be important? (or cognitive resources?)

> How much faster can you process information in your native language or dialect than in a second language, e.g. English? (Do you feel you will understand this course better if we conducted it in your preferred language?)
Cognitive Processes: The Mechanisms of Change

HOW IS INFORMATION PROCESSED?
Information is moved from one store to another through cognitive processes like attention and perception, encoding, storage and retrieval.

1. Sensory memory receives information via sense receptors.
2. Through the processes involving attention and perception, information is moved from sensory memory to short-term memory (STM). STM is a working memory (WM).
   - what one is aware of
   - has limited capacity
   - has dual-processing capabilities
   - improved efficiency with automaticity, chunking
3. Knowledge is encoded and stored in long-term (permanent) memory (LTM) for future retrieval. When LTM is activated, it is moved to WM where it becomes integrated with new information.

Executive (control) Processes involved in the Mechanisms of Cognitive Change
- **Attention**: focusing mental resources
- **Perception**: pattern recognition to make meaning from stimuli/envIRONMENTAL inputs; requires inputs to be held in sensory register and compared with prior knowledge from LTM.
- **Rehearsal**: retaining information through repetition
- **Encoding (LTM)**: making connections to create meaningful context in long-term memory (LTM)
- **Forgetting**: failure to recall – debatable if merely due to a lack of good retrieval cues
- **Complex cognition** - imaging (visually representing information), decision-making, metacognition, self-regulation, and motivational strategies, most of which are discussed in greater depth in the chapter on complex cognition.
Attention

Attention strongly determines how well information is processed cognitively. An important aspect about attention that we should take note of is the aspect of limited capacity. Hence, individuals have to allocate this limited resource.

Types of allocation

- **Selective attention** – selective focus on a specific, relevant aspect of environmental stimuli, ignoring the irrelevant stimuli (e.g., listen to one speaker in midst of several people talking)

- **Divided attention** – paying attention to more than one event simultaneously, multitasking (e.g., listening to music and studying a lesson)

- **Sustained attention** vigilance; maintaining focus over a sustained period of time, a problem characterizing children with ADHD

- **Executive attention** – deployment of attention to effectively engage in cognitive tasks such as planning, allocating attention to goals, error detection and compensation, monitoring progress

Researchers have found increased focal activation in the prefrontal cortex from 7 to 30 years of age.

Chapter 2, p. 36

Which of these allocations are most important for the effortful control that is necessary to effectively engage in complex tasks?

Adapted from Santrock, 2011, p. 258

Strategies to Help Students Pay Attention

- Encourage students to pay close attention and minimize distraction.
- Use cues or gestures to signal that something is important.
- Help students generate their own cue or catch phrase for when they need to pay attention.
- Make learning interesting.
- Use media and technology effectively as part of your effort to vary the pace of the classroom.
- Focus on active learning to make learning enjoyable.

(Santrock, 2011, p. 260)

HELPING STUDENTS PAY ATTENTION

Review each strategy recommended above.

> Use what you know about information-processing theory to justify each strategy.
> Give concrete (specific-action oriented) examples to elucidate each strategy.
“Memory is the retention of information over time… Memory anchors the self in continuity. Without memory you would not be able to connect what happened to you yesterday with what is going on in your life at present. Today educational psychologists emphasize that it is important to view memory not in terms of how children add something to their memory but rather how they actively construct their memory (Ornstein & Light, 2010; Ornstein & others, 2010).”

From Santrock, 2011, p. 263

**CLICK TO READ: AN OVERVIEW OF MEMORY**

It assumes that information is stored in different types of *memory stores*:

- Sensory memory
- Working memory
- Long-term memory

The *major components* of information processing include:

- attention
- perception
- short-term (working) memory
- long-term memory

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Santrock, 2011, p. 263
WHAT IS MEMORY?

by K. Cherry (2012) in About.com

Memory refers to the processes that are used to acquire, store, retain and later retrieve information. There are three major processes involved in memory: encoding, storage and retrieval.

In order to form new memories, information must be changed into a usable form, which occurs through the process known as encoding. Once information has been successfully encoded, it must be stored in memory for later use. Much of this stored memory lies outside of our awareness most of the time, except when we actually need to use it. The retrieval process allows us to bring stored memories into conscious awareness.

The Stage Model of Memory

While several different models of memory have been proposed, the stage model of memory is often used to explain the basic structure and function of memory. Initially proposed in 1968 by Atkinson and Shiffrin, this theory outlines three separate stages of memory: sensory memory, short-term memory and long-term memory.

- Sensory Memory
  Sensory memory is the earliest stage of memory. During this stage, sensory information from the environment is stored for a very brief period of time, generally for no longer than a half-second for visual information and 3 or 4 seconds for auditory information. We attend to only certain aspects of this sensory memory, allowing some of this information to pass into the next stage - short-term memory.

- Short-Term Memory
  Short-term memory, also known as active memory, is the information we are currently aware of or thinking about. In Freudian psychology, this memory would be referred to as the conscious mind. Paying attention to sensory memories generates the information in short-term memory. Most of the information stored in active memory will be kept for approximately 20 to 30 seconds. While many of our short-term memories are quickly forgotten, attending to this information allows it to continue on the next stage - long-term memory.

- Long-Term Memory
  Long-term memory refers to the continuing storage of information. In Freudian psychology, long-term memory would be call the preconscious and unconscious. This information is largely outside of our awareness, but can be called into working memory to be used when needed. Some of this information is fairly easy to recall, while other memories are much more difficult to access.
The Organization of Memory

The ability to access and retrieve information from long-term memory allows us to actually use these memories to make decisions, interact with others and solve problems. But how is information organized in memory? The specific way information is organized in long-term memory is not well understood, but researchers do know that these memories are arranged in groups.

Clustering is used to organize related information into groups. Information that is categorized becomes easier to remember and recall.

This strategy can be used effectively when trying to memorize long lists of information. For example, imagine that you are trying to memorize a long grocery list. One way of making the information more manageable would be to cluster items into related groups. For example, you might make separate clusters for vegetables, fruits, grains, meats and dairy items.

Let's take a look at another example of clustering. Read the following list of words:
grapes table bus apple chair airplane desk banana sofa car train plum lamp motorcycle strawberry dresser bicycle peach

Chances are that you automatically grouped these items into three clusters: fruits, furniture and modes of transportation.

Again, consider the following group of words:
Desk, apple, bookshelf, red, plum, table, green, pineapple, purple, chair, peach, yellow

Spend a few seconds reading them, then look away and try to recall and list these words. How did you group the words when you listed them? Most people will list using three different categories: color, furniture and fruit.

One way of thinking about memory organization is known as the semantic network model. This model suggests that certain triggers activate associated memories. A memory of a specific place might activate memories about related things that have occurred in that location. For example, thinking about a particular campus building might trigger memories of attending classes, studying and socializing with peers.
1 ENCODING

Encoding: getting information into memory.

**Encoding processes:**

- **Rehearsal** – repetition of information intended to extend the time it is retained in memory. However, *rote repetition* of information without association to meaning tends to be forgotten more easily. People tend to remember information better through other encoding processes, such as deep processing and elaboration, which are described next.

- **Deep Processing** – involves meaning making, conceptual or semantic processing. Along the continuum of levels of processing theory (Fergus Craik and Robert Lockhart in Santrock, 2011, p. 264), the intermediate level of processing involves recognition of the stimulus and associating it with certain labels (e.g. boat rhymes with boat). On the other end of the continuum, shallow processing involves not much more than detecting the sensory or physical features of the stimulus (e.g. boat consists of lines and curves that we call the characters b o a and t).

- **Elaboration** - refers to the extensiveness of information (e.g. by providing examples and non-examples to enhance a definition); self-referenced examples (personal experiences) have been found to be particularly more effective. Learners, for example, remembered keywords better when they used them in their own *meaningful* sentences than when they study just the keyword and its definition. Elaboration adds to the information; with more information, memory retrieval is easier because it is easier to differentiate the information from others similar to it.

- **Constructing Images** – a form of elaboration that involves image codes rather than verbal codes. Allan Paivio (in Santrock, 2011, p. 265) that more detailed and distinctive codes tend to be remembered better.

- **Organization** – information organized in meaningful ways tend to be remembered better.
Options to organize information.

- outlining
- hierarchical arrangement
- tabulation

*Can you make your own suggestions to add to the list?*

*In what other ways can you organize information?*

**Chunking** is also a way of organizing information. It works by making large amounts of information manageable and meaningful. For example:

<table>
<thead>
<tr>
<th>HOW EASY CAN YOU REMEMBER THESE SETS OF LETTERS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) E L I M S W O R R O M O T T E G R O F K O O B Y T I C</td>
</tr>
<tr>
<td>2) CITY, BOOK, FORGET, TOMORROW, SMILE.</td>
</tr>
</tbody>
</table>

Which set of letters was easier to remember? Did you realize that both sets contained the same letters, except that the second set has been organized in manageable (5 words versus 30 letters) and meaningful chunks (meaningful words versus nonsense letters)?

*Why is it important to organize large amounts of information in “manageable” chunks?*

**Clustering** involves organizing information in memory into related groups. Memory is clustered into groupings during recall from long-term memory.

*Cherry (2012)*

1. **Recite the numbers from zero to ten.** How fast were you able to do that? Did you make any errors?
2. **This time, recite the numbers from zero to ten in alphabetical order.** How quick were you able to do that. Did you make any errors?

Which order represented meaningful organization?
2 STORAGE

Storage of information in memory refers to retention. How long is information retained in memory? We have earlier identified three memory storage systems. Each of these stores represents different time frames:

- **Sensory memory** involves visual, auditory, and other sense information held in their original form, essentially for the duration of the actual experience. Attention is very important with respect to sensory memory, because it is momentary (very brief).

- **Short-term memory** is a limited capacity system that, in comparison with sensory memory, lasts longer.

**LOOK UP “MEMORY SPAN” OR “MAGIC SEVEN”**

*Why do phone numbers almost always have 7 digits?*

- **Working memory** is closely associated with short term memory. Santrock (2012, p. 266) says, “Working memory is a kind of mental “workbench” where information is manipulated and assembled to help us make decisions, solve problems, and comprehend written and spoken language."

- **Long-term memory** refers to relatively permanently retained information, believed to be capable of holding vast amounts of information. In addition, retrieval is notably fast.

**SHORT AND LONG-TERM MEMORY** by K. Cherry in About.com

**What Is Short-Term Memory?**

Short-term memory, also known as primary or active memory, is the information we are currently aware of or thinking about. In Freudian psychology, this memory would be referred to as the conscious mind. The information found in short term memory comes from paying attention to sensory memories.

**The Duration of Short-Term Memory**

Most of the information kept in short-term memory will be stored for approximately 20 to 30 seconds, but it can be just seconds if rehearsal or active maintenance of the information is prevented. While many of our short-term memories are quickly forgotten, attending to this information allows it to continue on the next stage - long-term memory.

**The Capacity of Short-Term Memory**

The amount of information that can be stored in short-term memory can vary. An often cited figure is plus or minus seven items, based on the results of a famous experiment on short-term memory. In an influential paper titled "The Magical Number Seven, Plus or Minus Two," psychologist George Miller suggested that people can store between five and nine items in short-term memory. More recent research suggests that people are
capable of storing approximately four chunks or pieces of information in short-term memory.

**Distinction between Short-Term Memory and Working Memory**

Short-term memory is often used interchangeably with working memory, but the two should be utilized separately. Working memory refers to the processes that are used to temporarily store, organize and manipulate information. Short-term memory, on the other hand, refers only to the temporary storage of information in memory.

**What Is Long-Term Memory?**

Long-term memory refers to the continuing storage of information. In Freudian psychology, long-term memory would be call the preconscious and unconscious. This information is largely outside of our awareness, but can be called into working memory to be used when needed. Some of this information is fairly easy to recall, while other memories are much more difficult to access.

**The Duration of Long-Term Memory**

Through the process of association and rehearsal, the content of short-term memory can become long-term memory. While long-term memory is also susceptible to the forgetting process, long-term memories can last for a matter of days to as long as many decades.

**Types of Long-Term Memory**

Long-term memory is usually divided into two types - declarative (explicit) memory and procedural (implicit) memory.

- **Declarative** includes all of the memories that are available in consciousness.

  Declarative memory can be further divided into episodic memory (specific events) and semantic memory (knowledge about the world).

  **Episodic memory** is a category of long-term memory that involves the recollection of specific events, situations and experiences. Your first day of school, your first kiss, attending a friend's birthday party and your brother's graduation are all examples of episodic memories. In addition to your overall recall of the event itself, it also involves your memory of the location and time that the event occurred. Closely related to this is what researchers refer to as autobiographical memory, or your memories of your own personal life history. As you can imagine, episodic and autobiographical memories play an important role in your self identity.

- **Procedural memory** involves memories of body movement and how to use objects in the environment. How to drive a car or use a computer are examples of procedural memories.

  Procedural memory is a type of long-term memory of how to perform different actions and skills. Essentially, it is the memory of how to do certain things. Riding a bike, tying your shoes and cooking an omelet are all examples of procedural memories.
Types of knowledge in LTM (long-term memory)

- **Declarative (Explicit) knowledge** – “schemas”: organized network of related facts, concepts, or ideas
  - **episodic memory** – “where and when”; person’s identity with the past
  - **semantic memory** – general knowledge

- **Procedural (Implicit) knowledge** – know-how about operations and the performance of tasks, such as how to cook a meal or how to write a poem

Episodic and semantic memories compared, at a glance.
MEMORY RETRIEVAL: RETRIEVING INFORMATION FROM MEMORY

by K. Cherry in About.com

Once information has been encoded and stored in memory, it must be retrieved in order to be used. Memory retrieval is important in virtually every aspect of daily life, from remembering where you parked your car to learning new skills. There are many factors that can influence how memories are retrieved from long-term memory. In order to fully understand this process, it is important to learn more about exactly what retrieval is as well as the many factors that can impact how memories are retrieved.

MEMORY RETRIEVAL BASICS

So what exactly is retrieval? Simply put, it is a process of accessing stored memories. When you are taking an exam, you need to be able to retrieve learned information from your memory in order to answer the test questions. There are four basic ways in which information can be pulled from long-term memory. The type of retrieval cues that are available can have an impact on how information is retrieved. A retrieval cue is a clue or prompt that is used to trigger the retrieval of long-term memory.

- **Recall:** This type of memory retrieval involves being able to access the information without being cued. Answering a question on a fill-in-the-blank test is a good example of recall.
- **Recollection:** This type of memory retrieval involves reconstructing memory, often utilizing logical structures, partial memories, narratives or clues. For example, writing an answer on an essay exam often involves remembering bits on information, and then restructuring the remaining information based on these partial memories.
- **Recognition:** This type of memory retrieval involves identifying information after experiencing it again. For example, taking a multiple-choice quiz requires that you recognize the correct answer out of a group of available answers.
- **Relearning:** This type of memory retrieval involves relearning information that has been previously learned. This often makes it easier to remember and retrieve information in the future and can improve the strength of memories.

PROBLEMS WITH RETRIEVAL

Of course, the retrieval process doesn't always work perfectly. Have you ever felt like you knew the answer to a question, but couldn't quite remember the information? This phenomenon is known as a 'tip of the tongue' experience. You might feel certain that this information is stored somewhere in your memory, but you are unable to access and retrieve it.

While it may be irritating or even troubling, research has shown that these experiences are extremely common, typically occurring at least once each week for most younger individuals and two to four times per week for elderly adults (Schacter, 2001). In many cases, people can even remember details such as the first letter that the word starts with. (Brown, 1991).

Even though memory retrieval is not flawless, there are things that you can do to improve your ability to remember information.
Module 7: Cognitive Theories

EDS 103 – Theories of Learning

Serial Position (Primacy-Recency) Effect

The accuracy of recall, studies have shown, varies according to the position of items in a list. The order in which information is learned determines how reliably it will be recalled.

- The words read last are still in a person’s short-term memory, while the words read first made it into the long-term memory. These are the recency and primacy effects.
- The middle words fall somewhere in between and are not as well remembered. Of course, some words may be easier to remember than others due to associations people already have with them.

This phenomenon is referred to as the Primacy/Recency or Serial Position Effect, which supports the contention that there are two kinds of memory happening.

READ!

Article by David A. Sousa


How does the dual-store model explain

> primacy effects?
> recency effects?

Define, differentiate, and elucidate with examples.

AN EXPERIMENT

- Present a list of words (written or spoken) to a group of students/friends. (Ex: cat, apple, ball, tree, square, head, house, door, box, car, king, hammer, milk, fish, book, tape,
- arrow, flower, key, shoe)
- Ask them to write down as many words as they can remember.
- List down how many remembered the 1st word, the 2nd, etc.
- Graph the order of words and the number of people who remembered the words on a graph. Is there a pattern?

http://brainu.org

ON VIDEO: A DEMONSTRATION OF THE PRIMACY EFFECT

http://www.youtube.com/watch?v=ymjKUshTw5Y
EXPLANATIONS FOR FORGETTING: REASONS WHY WE FORGET

What are some of the major reasons why we forget information? One of today's best known memory researchers, Elizabeth Loftus, has identified four major reasons why people forget: retrieval failure, interference, failure to store and motivated forgetting.

1. Retrieval Failure

Have you ever felt like a piece of information has just vanished from memory? Or maybe you know that it’s there, you just can’t seem to find it. The inability to retrieve a memory is one of the most common causes of forgetting.

So why are we often unable to retrieve information from memory. One possible explanation retrieval failure is known as decay theory. According to this theory, a memory trace is created every time a new theory is formed. Decay theory suggests that over time, these memory traces begin to fade and disappear. If information is not retrieved and rehearsed, it will eventually be lost.

One problem with this theory, however, is that research has demonstrated that even memories which have not been rehearsed or remembered are remarkably stable in long-term memory.

2. Interference

Another theory known as interference theory suggests that some memories compete and interfere with other memories. When information is very similar to other information that was previously stored in memory, interference is more likely to occur.

There are two basic types of interference:

- **Proactive interference** is when an old memory makes it more difficult or impossible to remember a new memory.
- **Retroactive interference** occurs when new information interferes with your ability to remember previously learned information.

3. Failure to Store

Sometimes, losing information has less to do with forgetting and more to do with the fact that it never made it into long-term memory in the first place. Encoding failures sometimes prevent information from entering long-term memory.

In one well-known experiment, researchers asked participants to identify the correct U.S. penny out of a group of incorrect pennies (Nickerson & Adams). Try doing this experiment yourself by attempting to draw a penny from memory, and then compare your results to an actual penny.

How well did you do? Chances are that you were able to remember the shape and color, but you probably forgot other minor details. The reason for this is that only details necessary for distinguishing pennies from other coins were encoded into your long-term memory.
4. Motivated Forgetting

Sometimes, we may actively work to forget memories, especially those of traumatic or disturbing events or experiences. The two basic forms of motivated forgetting are: suppression, a conscious form of forgetting, and repression, an unconscious form of forgetting.

However, the concept of repressed memories is not universally accepted by all psychologists. One of the problems with repressed memories is that it is difficult, if not impossible, to scientifically study whether or not a memory has been repressed. Also note that mental activities such as rehearsal and remembering are important ways of strengthening a memory, and memories of painful or traumatic life events are far less likely to be remembered, discussed or rehearsed.

Processes, Events, Examples

Below are

- the stages or internal processes that take place in information processing
- their corresponding instructional events (Instructional events are any activities during which learning takes place), and
- examples of actions that might cause the process to take place.  


<table>
<thead>
<tr>
<th>Internal (learning) processes</th>
<th>Instructional event</th>
<th>Action example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptance</td>
<td>Gaining attention</td>
<td>Use abrupt stimulus.</td>
</tr>
<tr>
<td>Expectancy</td>
<td>Informing learners of the objectives</td>
<td>Tell learners what they will be able to do after learning.</td>
</tr>
<tr>
<td>Retrieval to working memory</td>
<td>Stimulating recall or prior learning</td>
<td>Ask for recall of previous knowledge or skills.</td>
</tr>
<tr>
<td>Selective perception</td>
<td>Presenting the stimulus</td>
<td>Display the content with distinctive features.</td>
</tr>
<tr>
<td>Semantic encoding</td>
<td>Providing learning guidance</td>
<td>Suggest a meaningful organization.</td>
</tr>
<tr>
<td>Responding</td>
<td>Eliciting performance</td>
<td>Ask learners to perform.</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>Providing feedback</td>
<td>Give information feedback.</td>
</tr>
</tbody>
</table>
TOP 10 MEMORY IMPROVEMENT TIPS

Do you find yourself forgetting where you left your keys or blanking out information on important tests? Fortunately, there are things that you can do to help improve your memory. Before your next big exam, be sure to check out some of these tried and tested techniques for improving memory. These strategies have been established within cognitive psychology literature to improve memory, enhance recall and increase retention of information.

1. **Focus your attention on the materials you are studying.**

   **Attention** is one of the major components of memory. In order for information to move from short-term memory into long-term memory, you need to actively attend to this information. Try to study in a place free of distractions such as television, music and other diversions.

2. **Avoid cramming by establishing regular study sessions.**

   According to Bjork (2001), studying materials over a number of session's gives you the time you need to adequately process the information. **Research** has shown that students who study regularly remember the material far better than those who do all of their studying in one marathon session.

3. **Structure and organize the information you are studying.**

   Researchers have found that information is organized in memory in related clusters. You can take advantage of this by structuring and organizing the materials you are studying. Try grouping similar concepts and terms together, or make an outline of your notes and textbook readings to help group related concepts.

4. **Utilize mnemonic devices to remember information.**

   Mnemonic devices are a technique often used by students to aid in recall. A **mnemonic** is simply a way to remember information. For example, you might associate a term you need to remember with a common item that you are very familiar with. The best mnemonics are those that utilize positive imagery, humor or novelty. You might come up with a rhyme, song or joke to help remember a specific segment of information.

5. **Elaborate and rehearse the information you are studying.**

   In order to recall information, you need to encode what you are studying into long-term memory. One of the most effective encoding techniques is known as elaborative...
rehearsal. An example of this technique would be to read the definition of a key term, study the definition of that term and then read a more detailed description of what that term means. After repeating this process a few times, you'll probably notice that recalling the information is much easier.

6. Relate new information to things you already know.

When you are studying unfamiliar material, take the time to think about how this information relates to things that you already know. By establishing relationships between new ideas and previously existing memories, you can dramatically increase the likelihood of recalling the recently learned information.

7. Visualize concepts to improve memory and recall.

Many people benefit greatly from visualizing the information they study. Pay attention to the photographs, charts and other graphics in your textbooks. If you do not have visual cues to help, try creating your own. Draw charts or figures in the margins of your notes or use highlighters or pens in different colors to group related ideas in your written study materials.

8. Teach new concepts to another person.

Research suggests that reading materials out loud significantly improves memory of the material. Educators and psychologists have also discovered that having students actually teach new concepts to others enhances understanding and recall. You can use this approach in your own studies by teaching new concepts and information to a friend or study partner.

9. Pay extra attention to difficult information.

Have you ever noticed how it's sometimes easier to remember information at the beginning or end of a chapter? Researchers have found that the order of information can play a role in recall, which is known as the serial position effect. While recalling middle information can be difficult, you can overcome this problem by spending extra time rehearsing this information. Another strategy is to try restructuring what you have learned so it will be easier to remember. When you come across an especially difficult concept, devote some extra time to memorizing the information.

10. Vary your study routine.

Another great way to increase your recall is to occasionally change your study routine. If you are accustomed to studying in one specific location, try moving to a different spot during your next study session. If you study in the evening, try spending a few minutes each morning reviewing the information you studied the previous night. By adding an element of novelty to your study sessions, you can increase the effectiveness of your efforts and significantly improve your long-term recall.

by K. Cherry (2012), in About.com
Principles
There are two major degrees of memorization: recognition and recall.

In recognition for a list, the name of the list and an item from the list are both presented to the learner, who indicates whether or not the item belongs to the list: "Which of the following were Presidents of the United States: Abraham Lincoln, Fred Washington, . . . ?" For an ordered list, two or more items from the list are presented or performed, and you indicate whether or not they are in the right order. In recall for a list, the name of the list is presented, and you have to retrieve the items from your own memory: "List ten Presidents of the United States below" or "Change the oil in your car."

Does association learning occur the same way? An association, in its simplest form, has two elements which must be paired together (associated with each other): a stimulus, which is presented to the learner, and a response (either mental or physical), which is provided by the learner. A state with its capital, a person with her name, a painting with its artist, a symbol with its name, and the letters of the alphabet with the finger movement necessary to type each on a standard keyboard are all cases in point. In its more complex forms, an association can have many elements which are all to be associated with each other, such as a person, a place, a date, and (the name of) an event. In this case, you usually have one stimulus and multiple responses. For example, "the discovery of America" might be associated with "Christopher Columbus," "1492," "Queen Isabel of Spain," and "the Nina, Pinta, and Santa Maria."

In recognition for an association, the stimulus and a response are both presented, and you indicate whether or not they are a correct match, or you match up the correct ones. "Was the Declaration of Independence signed in 1770?" is such an item. In recall for an association, the stimulus is presented, and you have to retrieve the response from your own memory. "When was the Declaration of Independence signed?" is a case in point.

In spite of these differences, association learning is similar to list learning in that it is a rote (non-meaningful) form of learning which is committed to memory primarily by repetition. It is also acquired gradually over time with practice, and it can be learned to the point of recognition or to the point of recall.

Learning a rote procedure may require learning two things: when to do each action, and how to do each action. But in many cases, the learners may already know how to do each action,
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such as an experienced computer user learning how to use a particular web browser to search the Internet. That learner just needs to learn what actions to take when, not how to take them. Click Next to continue.

http://en.wikiversity.org/wiki/Invariant_Tasks:_Principles_for_Learning

As highlighted within the video, the following instructional tactics facilitate memorization. These tactics collectively are referred to as the "Drill and Practice Model of Instruction."

- **Select** subject-matter content and decide what to teach based on need

- **Routine** tactics include:
  - Presentation: Present the subject matter and give directions on the focus area
  - Practice: Allow time to review the material and actively practice
  - Feedback: Provide informational and motivation feedback (see below)

- **Enrichment** tactics for difficult content include:
  - Chunking: Break content into smaller "chunks"
  - Repetition: Repeat the practice steps
  - Mnemonic: Incorporate memory aids
  - Prompting: Prompt learner to respond

- **Motivational** tactics should build learner:
  - Confidence
  - Satisfaction

- **Review** material

  From http://en.wikiversity.org/wiki/Invariant_Tasks:_Tactics_for_Teaching

GAME EXAMPLE TO FACILITATE MEMORIZATION OF FACTS

Note how the routine Drill and Practice tactics of presentation, practice and feedback are present within the game. In addition, repetition, review and feedback (both informational and motivational) are built into both the play of the game, as well as the debrief session

From http://en.wikiversity.org/wiki/Invariant_Tasks:_Tactics_for_Teaching
Self-Assessment

Answer the following to assess how well you have learned the unit. You need not post your answers, but you may want to raise questions or engage in discussion for clarification.

“**You know me. I'm your neighbor!**”

You are in a hurry to get home, so you make a quick stop at a supermarket you don't normally go into. There, working at the register in your lane, is a person who looks very familiar, but you can't quite place the person with a name and a place. As the line moves and you get closer to this person, you become very uncomfortable, because you realize that you should know her name and recognize where you know her from. As it turns out, the cashier has a name tag on, but the last name doesn't ring a bell. Now it's your turn in line. The cashier recognizes you and the fact that you are bewildered and says, "You know me. I'm your neighbor, Marta. I'm Al's Mom. . ."

Explain your bewilderment based on information processing views of learning.

**IMAGE TO TEXT**

*Guided by the figure below,*

> how many memory storage components does the theory propose?
> express in your own words Atkinson and Shiffrin’s Theory of Memory.

Source: Atkinson and Shiffrin’s Theory of Memory (Santrock, 2011, p. 269)
MULTIPLE CHOICE QUESTIONS #1 – COGNITIVE PROCESSES

1. Information processing is most closely aligned with
   a. behaviorism.
   b. cognitive psychology.
   c. social cognitive theory.
   d. ecological theory.

2. According to the information-processing approach, a 15-year-old can compute faster than a 10-year-old because the
   a. 15-year-old’s brain has had more time to develop, and the 15-year-old has had more experience working with numbers.
   b. 15-year-old has had more experiences of both positive and negative reinforcement.
   c. 15-year-old’s brain has lost many of its original connections and undergone demyelination.
   d. 15-year-old has had much more time to develop rote memory skills.

3. Ms. Cruz wants her students to know their basic math facts without having to stop to think about them. Therefore, Ms. Parks plays many math games with her second-grade students, such as addition and subtraction bingo, math bees, and card games. What is Ms. Parks’ goal in playing these games with her students?
   a. to help her students to develop automaticity in knowing their math facts
   b. to encourage strategy construction
   c. to foster encoding skills
   d. to improve metacognitive skills, such as self-awareness

From Santrock, 2011, p. 257

MULTIPLE CHOICE QUESTIONS #2 – ATTENTION

1. Ms. Samson teaches first grade. Often while she is working with one group of children, she must monitor the behavior of the rest of the class, occasionally intervening in some manner. Sometimes she has three or four students at her desk, each needing something different from her. This does not seem to faze her in the least. She can talk to one student while tying another’s shoes and monitoring the behavior of the rest with no problem. What skill has Ms. Samson mastered?
   a. divided attention
   b. selective attention
   c. sustained attention
   d. personal attention

2. Mark shifts his attention very quickly from one thing to another. The more colorful and noisy the thing, the more likely it is to draw his attention. He rarely attends to any one thing for more than a few minutes. From this description, Mark is most likely to be a
   a. toddler.
   b. preschooler.
   c. elementary-school-age child.
   d. adolescent.

From Santrock, 2011, p. 262
Open Thread Discussions

The forum is open for any related discussion and must not be limited to the following suggestion/s. You may generate your own questions/discussion threads.

1. What implications do differences in declarative and procedural knowledge have for instruction? Where should our emphasis be as far as learning is concerned?

2. Consider the different ways attention is allocated (selective, divided, sustained, and executive). Cite how each operated in learning situations. Use your understanding of these processes to explain how learning is either enhanced or impaired in the situations you cited. Make recommendations when appropriate.

3. How may we use our understanding of primacy-recency effect in the classroom?

4. Plan ways to improve your current (a) teaching practice and (b) learning strategies by applying some principles from this module. (c) Identify the principle.

Guide for your e-Journal

For your e-journal entries, you may use the following as guides, but feel free to express other thoughts (and feelings) about learning as they have been stimulated by the topics in this chapter. Keep in mind that learning is very personal and your e-Journal should be reflective of those personal learning events.

- In terms of your ability to learn, are there ways that you wish you were more like a computer? Or are you better than any computer in all aspects of processing information? Explain.

- Who was your first teacher? What was your first classroom like? What is your remotest childhood memory? How long did it take you to retrieve those information? What does that reveal about the nature of long-term memory?
Module 7: Cognitive Theories

REQUIRED READINGS

Chery, K. (2012). In About.com
Memory: An Overview of Memory
http://psychology.about.com/od/cognitivepsychology/a/memory.htm
What Is Short-Term Memory?
What Is Long-Term Memory?
http://psychology.about.com/od/memory/f/long-term-memory.htm
What Is Episodic Memory?
http://psychology.about.com/od/eindex/g/episodic-memory.htm
What Is Procedural Memory?
http://psychology.about.com/od/pindex/g/procedural-memory.htm
Memory Retrieval: Retrieving Information from Memory
http://psychology.about.com/od/cognitivepsychology/a/memory_retrieval.htm
What Is Clustering?
http://psychology.about.com/od/cindex/g/clustering.htm
Explanations for Forgetting: Reasons Why We Forget
http://psychology.about.com/od/cognitivepsychology/tp/explanations-for-forgetting.htm
Top 10 Memory Improvement Tips
http://psychology.about.com/od/cognitivepsychology/tp/memory_tips.htm


References


Direct Instruction. pp 209-227
Cognitive Strategies. p. 197-201

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Media

Connie’s Head Injury.
http://abavtooldev.pearsoncmg.com/sbx_video_player_v2/simpleviewer.php?projectId=MPL&clipID=connie.flv&ui=2

Memory.
http://abavtooldev.pearsoncmg.com/sbx_video_player_v2/simpleviewer.php?projectId=MPL&clipID=memory.flv&ui=2

Memory and Exercise.
http://abavtooldev.pearsoncmg.com/sbx_video_player_v2/simpleviewer.php?projectId=MPL&clipID=memory_exercise.flv&ui=2

Memory Hazard.
http://abavtooldev.pearsoncmg.com/sbx_video_player_v2/simpleviewer.php?projectId=MPL&clipID=memory_hazards.flv&ui=2

Estrogen and Memory.
http://abavtooldev.pearsoncmg.com/sbx_video_player_v2/simpleviewer.php?projectId=MPL&clipID=estrogen_memory.flv&ui=2

Teaching Invariant Tasks
http://blip.tv/iuistjen/invariant-tasks-199626

Game example to facilitate memorization of facts
Critical of overt behaviors as a means to explain learning, Gestalt psychologists proposed that rather than look at isolated events, it is more important to look at patterns.

**THINK**

_in the teaching-learning context when/why is it more important to look at patterns?_

**PHI PHENOMENON**

Phi phenomenon demonstrates that subjective experiences cannot be explained by referring to the objective elements involved. Observers perceive movement even though none occurs.

**FUN WITH IMAGES**

Visit [http://www.psy.ritsumei.ac.jp/~akitaoka/riken2010.html](http://www.psy.ritsumei.ac.jp/~akitaoka/riken2010.html) to enjoy more of these images!

_How does Gestalt Psychology explain the phenomenon of your experience with these images?_