

# STAFF RESOURCES

## How We Learn: Our Memory System

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**I**nformation Processing Theory describes the physiology behind how we learn, including how our memory system works. Many of our students at MSSD have significant problems that interfere with their ability to take in information, process it through the memory system and/or put it into long term memory. This could be due to global cognitive deficits or a specific brain injury such as a stroke or severe trauma.

Memory is a very complex neurological construct composed of several interactive parts, but the three major portions of the system are short term memory, long term memory and working memory. Information comes into the system through the five senses. This sensory information is quickly evaluated by the brain for relevance to the current learning situation. If the information is relevant, it continues on to short term memory. If it is unimportant,

the information fades and is not brought into consciousness. Students (and adults) with attention deficits might have problems at this point as they could have difficulty screening out currently irrelevant information.

Additionally, many people with attention deficits do not process important information deeply enough for it to move into short term memory. So, they might miss important information (verbal instructions) and take in irrelevant input (the custodian cleaning in the hall).

### Short Term Memory

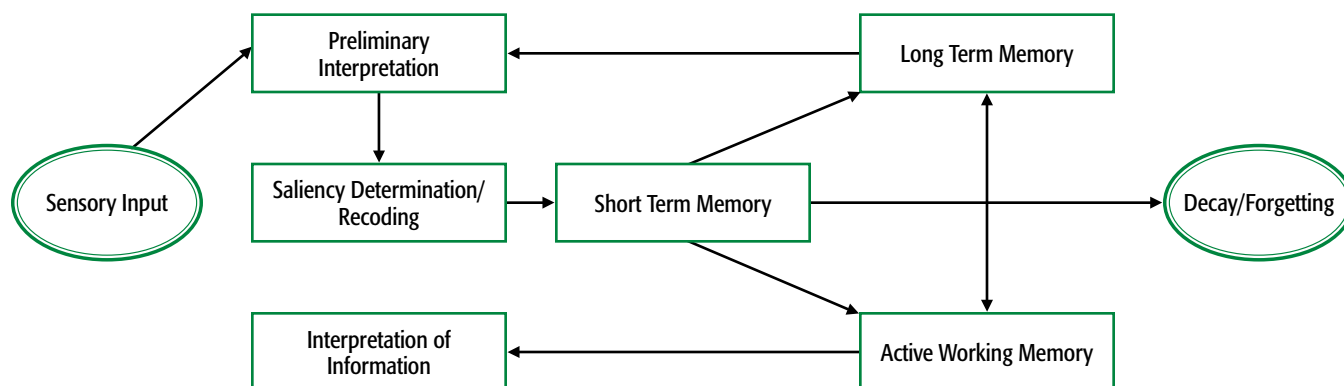
Short term memory is very small and lasts for approximately 30 seconds. The average adult can hold seven pieces of information in short term memory (the size of a phone number) while young children might only be able to hold two or three. The amount that can

be remembered increases as the child gets older. These seven pieces of information could be more than seven digits or numbers if strategies (such as chunking) are used. After about 30 seconds, the information deteriorates unless it undergoes additional processing or rehearsal. Information may also move from short term memory into either long term memory or working memory.

### Long Term Memory

Long term memory is where information is stored over long periods of time. However, there is no one place in the brain that is the memory section. Memories are stored all over the brain although certain types of memories tend to be stored closer together, such as music and visual or verbal memories. This is why a stroke victim might be unable to remember how to say a word in conversation but can sing a song →

### Interactions Among the Parts of Memory in the Brain



without a problem. It takes extended time in order to totally consolidate information into long term memory, and the knowledge might be lost if there has only been one exposure to the concept. This is the reason why students with seizures could require significant repetition of material in order to learn. Seizures disrupt short term memory and impact material that has not been fully consolidated into long term memory.

## Working Memory

Working memory is the third portion of the memory system. It is the part of the structure where information is brought together from long term and short term memory and manipulated. For example: when working on a math problem, a student would input the numbers given from short term memory and then draw on long term memory to decide the procedures needed to solve the problem. Then, the student would maneuver the information to come up with a solution.

When writing, even more information must be retrieved and manipulated. The student must retrieve knowledge about the topic, grammar and syntax rules, procedural knowledge on how to write a paragraph, and graphomotor input on how to form the letters. A sentence is actually “written” as a rough draft in working memory prior to being written on the page. Therefore, writing requires a great deal of memory resources from several different parts of the brain; it requires more cognitive resources than any other skill. This is why many of our students have great difficulty even learning to write their own first name.

While memory consists of three interactive parts, each part can be broken down into two other sections: visual and verbal. Some people have no problem consolidating or retrieving visual information, but they have great difficulty with verbally loaded tasks. This could manifest in writing as a story with simplistic content and repetitive wording but correct writing mechanics (grammar and punctuation).

In addition to visual and verbal memory, long term memory is filed in four main ways (there could be deficits in the ability to acquire or utilize information in any of these areas):

- 1) Paired memory (associations between words and their meanings)
- 2) Procedural memory (how to do things such as drive a car)
- 3) Categorical memory (factual/ declarative memory)
- 4) Rules and patterns (phonics rules or social behavior)

The three-part system (short term, long term and working) is actually the simple, linear version of how your memory system functions. Actually, all three portions are intertwined. In short term memory, extensive use is made of information found in long term memory to recognize objects and concepts. These areas are not really discrete, and there is much overlap.

## Problems

Memory deficits or breakdowns can be found at any point in the system. The problem might be with:

- processing information deeply enough to move it into short term memory.

- movement of knowledge from short term to long term memory.
- consolidation of material into long term memory over an extended time period.
- retrieving information from long term memory.
- organizing the information retrieved.
- keeping information in working memory long enough to complete a task.

Additionally, long term memory difficulties could include consolidation or retrieval of specific types of information only, such as verbal or visual input. A person with visual-retrieval problems might inconsistently remember how to write letters or numbers or how to spell a word. Verbal-retrieval difficulties could manifest as a problem in finding the correct words to use in conversation or in writing.

Information is stored in the brain through the creation of a connection between neurons. The more exposures to the information, the stronger the connection becomes and the easier it is to pull the information out of long term memory. Most of our students require many, many repetitions of information to create these connections; it might take years to master a task. For others, it could be brain damage that prevents the movement of information from one portion of the memory system to another.

It is important to know how people obtain information and what obstacles could prevent them from learning. By doing so, we can better understand the nature of our students’ disabilities in order to help them succeed.



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