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# Study Strategies for the Secondary Student: Enhancing Memory

by Dr. Alice L. Hamachek

Like it or not, we live in an "information explosion" era and each year an extraordinary amount of new information and technical knowledge becomes available. As educators, we teach for the present, but we also prepare students to live in the future. Therefore, much of this new information will need to be learned and readily retrieved in order to function effectively in a continually changing world.

There are many high school students who struggle from day to day to read, understand and remember the millions of words contained within the pages of their assigned readings. Reading the material is not usually the problem, for most students are capable of decoding and understanding the words on the printed page. Many students, however, spend countless hours reading the material, only to have forgotten its contents immediately or shortly thereafter. Then, when students are challenged to recall what was read, either for class discussions or testing purposes, a problem emerges. Why didn't the time spent in reading produce greater results? Thus, the question must be raised: how can we as educators help students to more effectively use their time to not only read, but to study and remember the information that was deemed important enough to assign?

Most teachers give reading assignments, talk about the lesson topic, assign written work and administer examinations. Some teachers also teach general study skills either in isolation or by integrating them into their

courses. Unfortunately, much study skill instruction is not effective (Devine, 1987). Often the timing is incidental and little effort is spent on explaining and demonstrating the "why and how" aspect of learning. Also, review and follow-up activities are frequently nonexistent.

With the current focus on literacy, it would seem like an important step forward if every secondary teacher would teach basic principles of study for effective learning and retention. Teachers can't control fixed factors such as heredity and social class influences. However, teachers can teach, within the daily operations of the classroom, specific study strategies in an organized, systematic manner.

Study strategy instruction should take place on two levels: (1) **WHAT TO DO** and (2) **HOW TO DO IT**. The first is an awareness level and the second is a behavioral level. The **WHY** should be incorporated into both levels. Then, of course, students need to recognize that good study strategies, to be truly effective, must become automatic and habitual.

Study skills are defined as those specific reading skills that increase memory and provide access to successful retrieval of that which is stored in memory. They are those competencies associated with acquiring, synthesizing, organizing, recording, and accessing information and ideas. Study strategies can be seen as those specific skills that go beyond, even though they likely

incorporate, the use of basic comprehension processes in some structured way (Irwin and Baker, 1989).

In the past ten years our understanding of the reading process has changed dramatically. Reading is no longer thought of as the rote application of isolated skills. Instead, recent research shows us that reading is a meaning-getting process requiring awareness and strategic use of reasoning. Thus, it seems like a discussion of study strategies necessitates a brief overview of memory since memory is fundamental to reasoning.

### **MEMORY:**

There is no discrete central nervous system center called memory. Instead, there exists a diversity of memory systems (Ornstein and Thompson, 1984). However, all information seems to go through stages on its way to memory and concentration plays a crucial role. "The true art of memory," said Samuel Johnson, "is the art of attention." Nothing scientists have learned in the intervening 200 years has dispelled Johnson's conclusion: we remember what we concentrate on (Begley, 1986, p. 54).

A major function of memory is to process information. Stimuli are picked up by sensory receptors and transferred to the brain. When information is registered, it enters a storage system. This storage system is traditionally classified into three categories: sensory memory, short-term memory, and long-term memory. Sensory memory is very brief and is exemplified by the ability to hold the beginning of a word in memory while reading the end of it. Short-term memory, although a little longer, holds information in a temporary storage, just long enough to carry out a particular task such as dialing an unfamiliar telephone number. Short-term memory is extremely limited both in its duration and capacity, especially when it is compared to the nearly limitless capacity and duration of the long-term memory (Landy, 1984).

### **Acquisition:**

For purposes of this article, three important aspects of memory will be discussed. They are acquisition, rehearsal, and retrieval. The process of acquisition consists of collecting

pieces of relevant stimuli and making a concerted effort to process them. Acquisition relates closely to selective attention, but also is highly dependent on exposure and experience. Once sets of stimuli have been received, they are then registered into memory. Effective registration depends upon depth of processing and, once again, attention is of the utmost of importance (Levine, 1987). Data entering the central nervous system usually undergo coding; that is to say that data need to be packaged into a usable format or system of representation (Landy, 1984). This reduces the load of incoming information and enables one to relate it to previously stored data.

### **Rehearsal:**

Rehearsal is another essential component of memory. This consists of overt or covert repetition of information to register it more firmly in memory. During this learning stage, varied repetition is likely to enhance the process. Two aspects of rehearsal are maintenance and elaboration. In maintenance, the student simply repeats the information over and over. In elaborative rehearsal, the student creates rich associations or adds additional ideas to the information ( Craik and Watkins, 1973). It is at this stage that mnemonics, little memory techniques, clearly enhance rehearsal and likely facilitate subsequent recall.

Long-term memory contains virtually all of our learning. As information passes in our short-term memory, a conscious or unconscious decision must be made. Should the information be remembered? If the information is to be remembered, then it must be consolidated and transferred to a more durable code where it is classified for long-term storage (Carlson, 1984).

George Miller (1956), in a landmark paper titled "The Magical Number Seven: Plus or Minus Two," pointed out that the short-term memory span was limited in the number of items that it could hold. His contribution was to demonstrate that it was the number of items (between five and nine) that was the limiting factor, not the amount of information contained within those items. Thus, one could increase the amount of

information by packaging it into larger "chunks." Good learners are particularly effective in their clever use of coding chunks of information which allows them to stretch the limits of the short-term memory.

### **Retrieval:**

Finally, memory involves retrieval. "Finding" information that has been stored in memory is a constant struggle for many. This capacity varies and depends on the amount of information available for the search and the skill and depth with which it was stored. Free recall occurs when the student retrieves information with no apparent clues. However, the use of substantial hints may be required and then information is retrieved through cued recall. To varying degrees, the quality of retrieval depends on the effectiveness of the original registration and consolidation (Levine, 1987). Storage and retrieval strategies compliment each other and, thus, the stronger the memory imprint, the greater the probability of accurate recall at a later time.

We now turn our attention from a discussion of basic memory principles to a presentation of specific study strategies that enhance memory and positive performance in academic studies.

### **SPECIFIC STUDY/MEMORY STRATEGIES:**

The brain is not like a sponge absorbing information until it eventually becomes saturated. Rather, it is a vast network of complex interconnections (Restak, 1984). Memory works in the same way. Every new fact or concept learned adds to and links up with the existing network. Thus, when a student encodes something new, it not only forms a link to the existing network, but it also provides another hook onto which still more associations can be hung or connected (Rose, 1985).

### **Association:**

Any new piece of information can be remembered if it is associated to something already known or remembered. This is a basic rule of memory. Sharp recall comes from storing information in a rich elaborative form which relates the new information to something that is already familiar (Tulving, 1962). The following examples illustrate the importance of associations in memory.

If you took piano lessons you probably remember your teacher helping you learn the treble clef names of the space notes by associating the word **FACE** and the names of the line notes by associating the acrostic sentence **EVERY GOOD BOY DOES FINE**. In spelling, the word **PIECE** perhaps was remembered by associating **A PIECE OF PIE** or employing the phonic rule generalization **I BEFORE E EXCEPT AFTER C**. To remember that Mount Fujiyama is 12,365 feet high, it may have been associated with a calendar --12 months and 365 days in a year. Why can you quickly identify the country of Italy and the state of Michigan? Do boot and mitten come to mind? Picture **HOMES** on the Great Lakes and you have a great mnemonic to assist with naming **Huron, Ontario, Michigan, Erie, and Superior** as the lakes.

If the technique of associating the unknown to the known is continually practiced, a trained memory will soon emerge (Lorayne and Lucas, 1974). It's as simple as that. Trained memory systems do not have to be unnatural in any way. Actually, all one is doing is systematizing a natural process. Once a system or pattern of organization is established, it can more easily be applied in a conscious manner to academic studies.

### **Visual Imagery:**

Visualization is powerful, if a student has the capacity to "see pictures in the mind's eye." This has long been illustrated by the saying "a picture is worth a thousand words." When mental images are formed during reading, recall is increased. Teachers also report that imagery instructions often increase enjoyment and use of elaboration (Irwin and Baker, 1989). When enjoyment and elaboration are present, concentration is improved and comprehension is enhanced. It is important to remember that though some students may form images when they are reading stories and novels, they may be less likely to image when reading content area materials. However, it may be more crucial to image when studying content material since it often contains much information that must be memorized.

### **Link System:**

The idea that thoughts may be associated

to each other in such a way that one thought will trigger the next thought is the basis of the Link system of memory (Lorayne and Lucas, 1974). Incorporating illogical associations as well as making those associations interactive are effective ways to enhance the linking process. For example, to remember the words velocipede, rapscallion, geoducks and lexicon, you might visualize a rapscallion riding a velocipede over geoducks while reading his lexicon. Since most of the things that we read and study are logical and follow a "normal" pattern of thought, silly associations that incorporate action create a unique coding link.

### Peg System:

A peg system is a way to help memorize and retain information from a list that must be learned in a specific sequence. A key word is attached to a sequential number which collectively becomes a "permanent peg." In order to make any peg system useful, the student will need to think of interesting associations, make them meaningful and then rehearse them so that they will be locked into long-term memory. Once the "pegs" are in long-term storage, they can be used to associate any list of items that needs to be remembered. Here are ten "pegs" that could be taught to students.

1. won
2. two
3. tree
4. star
5. foot
6. six-pack
7. 7-UP
8. ate
9. 9-iron
10. tent

The following is a brief explanation of some associations that may make the "permanent pegs" meaningful for students. 2. Won is a homonym for one and provides action. 2. Two remains two or is thought of as a tuu. 3. Tree is the word threè with the h left out. 4. Four is associated with a four star rating. 5. Foot is connected to the song phrase "five foot two, eyes of blue." 6. Six-pack is related to a six-pack of beverage. 7. 7-UP is a favorite soda. 8. Ate is the homonym for eight. 9. 9-iron is associated with golf. 10.

tent is the word ten with a t added at the end to form a concrete item that can easily be visualized.

For example, suppose the history teacher asked the students to know the first ten Presidents of the United States in order. They are as follows: WASHINGTON, ADAMS, JEFFERSON, MADISON, MONROE, ADAMS, JACKSON, VAN BUREN, HARRISON, and TYLER. This is an excellent opportunity to use a peg system since sequence is important.

Now that the "permanent pegs" can be recalled immediately, study time will be spent in forming associations to connect the peg words to the Presidents -- the known to the unknown. Here is an example. However, it is important to remember that there are many ways to form meaningful associations.

1. WASHINGTON **won** the war.
2. There were **two** ADAMS.
3. JEFFERSON is climbing a **tree**.
4. MADISON is a **star** at Madison Square Gardens.
5. MONROE rows his boat with his **foot** on Monday.
6. The ADAMS name appears again so they celebrated with a **six-pack**.
7. JACKSON'S son Jack likes **7-UP**.
8. VAN BUREN **ate** eight burritos in his van.
9. HARRISON was playing golf with his **9-iron**.
10. TYLER was sleeping in a **tent**.

If students still find it difficult to remember the individual associations, encourage them to put several sentences together to form a sentence story or link those together to form a longer story. Be sure to visualize the action of the story and add appropriate emotion to personalize it. Dramatization through visualization is a practical mnemonic that needs no external aids, for it only requires the power of the imagination.

### METAMEMORY:

No discussion of memory and study strategies would be complete without emphasizing the importance of teaching students about metamemory. Metamemory is a subcategory of metacognition. Metacognition refers to knowledge about all cognitive

processes, their products, and anything related to them and metamemory refers to that aspect of metacognition that is related to getting information into and out of memory (Zechmeister and Nyber, 1982). The more students are aware of basic operations and processes of memory, the influence of present knowledge on future knowledge, and voluntary strategies that can help memory, the better they will be able to monitor and use their own study time.

### SUMMARY:

Study strategies are for those specific reading skills that increase memory storage and retrieval. Memory techniques are crucial for the secondary student. The more information a student can remember, the better he/she will likely be able to perform in class and on written examinations. Memory involves a vast network of interconnections. Acquisition, rehearsal, storage and retrieval are important aspects of memory. Specific study strategies that enhance memory include association, visual imagery, the Link system and peg systems. Metamemory provides important feedback for the student who is interested in monitoring his/her own learning. In order for students to more effectively function in a continually changing world, it is imperative that teachers teach students the **WHAT, HOW** and **WHY** of effective learning.

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