

## Memory and Review

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The sensory storage system operates without conscious effort. If something is noticed because it is momentarily of interest (such as a phone number), it goes into short-term memory and is forgotten once the call is made. If the number is to be retained, it must be rehearsed or associated with prior knowledge before it can be stored in long-term memory. The input will be retained only if rehearsal takes place. The goal of school-related activities is long-term memory. Information cannot be retrieved easily unless it is organized so the associations can be made. This is why study skills and mnemonic skills (memory aids) focus on helping students associate new information with old knowledge, and on providing opportunities to rehearse or practice the associations.

When it comes time to review material students have read or obtained for class lectures, many students just read through their text or notes again and call that reviewing. This is, for most students, passive reviewing. The student will have a better chance of remembering the material if he/she becomes actively involved. In previous sections, we have talked about some ways to get students involved in their learning such as asking questions before they read, paraphrasing information, using a system of highlighting, and making up test questions. This section will contain some other ideas for helping students understand and remember information.

### An Effective Way to Teach

### Keyword Mnemonic Method

The author's experiences have shown the keyword mnemonic method to be very effective in teaching vocabulary words. When middle and high school students used the keyword mnemonic method to study 14 difficult vocabulary words for eight minutes, they remembered 82% of the definitions; after two weeks, the retention rate was still 80%. Students not using the method recalled only 21% of the meanings!

The keyword mnemonic method has proven to be an excellent tool for students who have difficulty learning new vocabulary words. It is based on the principle of replacing a difficult association (i.e., between a new vocabulary word and its definition) with two easier associations. This is made possible by the use of a "keyword"—a common word that sounds like part or all of the vocabulary word.

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**For example:**

Vocabulary Word	Keyword	Definition
<b>Barrister</b>	<b>Bear</b>	<b>Lawyer</b>
Acoustic link (sound-alike)	Imagery link (picture)	

The first association is a sound-alike, acoustic link between the vocabulary word and the keyword. The link is based on the sound the words have in common. The second link is an imagery link. The student makes a mental picture with the keyword and the definition interacting.

In this example, the student might picture a bear in a suit acting like a lawyer. Later, when the student hears or sees the vocabulary word, he/she will remember the keyword that sounds like the vocabulary word (Barrister-Bear). When the student remembers the picture with the keyword (Bear-Lawyer), he/she will then link together the word pairs and recall the definition of the vocabulary word (Barrister-Lawyer).

### Utilizing the Keyword Method

1. Select a list of vocabulary words and their definitions (preferably synonyms). Words with concrete, visual meaning work best. A good list length is 15 words.
2. Choose a keyword for each vocabulary word. A keyword should sound as much like the vocabulary word as possible. Ideally it will sound like the first syllable. It should be easy to form a memorable image connecting the keyword and the definition. Concrete words that can be pictured work best.
3. Teach your students the keyword method. You might call the keyword a “linking word” (like a link in a chain). Use several examples. Tell them the keywords to use and the images to visualize.
4. Have your students use the keyword method to study the vocabulary list. Tell and show them a vocabulary word, its keyword, and the definition. Be sure they clearly see a mental picture before you move on the next word.
5. When testing the list, present each vocabulary word and ask the students to recall both the keyword and the definition.

## **Keyword Method Vocabulary List**

The following is an example to demonstrate how to develop keywords (acoustic links) and their imagery links:

Vocabulary Word	Keyword	Image	Definition
Electorate	Electricity	Voters lined up at the voting booth getting an electric shock.	Voters
Edifice	Face	A building crashing on its own face.	Building
Duct	Duck	A duck stuck in a concrete pipe.	Pipe
Apex	Ape	An ape sitting on two boards that make a point.	Point
Lexicon	Mexican	A Mexican with a dictionary in his backpack.	Dictionary
Citadel	City Hall	An army attacks a fortress when the city bell rings.	Fortress
Palisade	Palace	A palace with a big, tall fence around it. Fence	Fence
Fife	Five	A flute with little fives coming out of it.	Flute
Ague	Egg	An egg with a thermometer in its mouth complaining how hot it is.	Fever

## **Mnemonic Instruction—Remembering Facts**

Research has shown mnemonic instruction to be effective in teaching students to remember content-area facts. The following example of learning with mnemonics is from a unit on minerals. The object of the lesson is for students to remember the color, use and hardness of different minerals. The students should first be taught concrete rhyming peg words for the numbers one through ten.

One bun	=	Six sticks	=
Two shoe	=	Seven heaven	=

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Three tree	=	Eight = skate
Four door	=	Nine = sign
Five hive	=	Ten = hen

For the mineral **Apatite**, the students could be told to visualize a picture and the corresponding data.

### **Apatite (ape):**

- Hardness level five
- Brown color
- Used for fertilizer

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The students are then taken through the following steps:

1. The sound association, or keyword for apatite is **ape**. The students are directed to visualize a big brown ape pouring a bag of fertilizer on a beehive.
2. The retrieval process should be rehearsed by asking questions such as:
  - “What number is apatite on the hardness scale?”
  - “First think of the word clue for apatite—ape. Now visualize the picture of the **ape**.
  - “Find the peg word hive—what number is associated with it?” (Table on page 3)
  - “What is in the picture that reminds you about the use of apatite?”

## Associations

A great deal of research has found that images are the single most important factor determining free recall. William James found that the mind of man is an “association machine.” This means that if we want to learn anything new we should associate it with something we already know. Another educator, Samuel Johnson, found that the main art of memory is the “art of attention.” We tend to remember the unusual and forget the common and mundane. Thus, relating facts, information, vocabulary words, etc., to something ridiculous and unusual will enable students to remember and understand.

## Word Clues

Single word clues are also helpful in remembering things. For example:

<b>The Great Lakes:</b>	<b>Directions: _</b>
Huron	North
Ontario	East
Michigan	West
Erie	South
Superior	

## Silly Sentences

To remember rules for math, grammar, etc., encourage students to make up silly sentences that can be easily memorized and visualized. The following are eleven examples that illustrate how silly sentences can aid in memorization:

1. Silly sentences can be used to remember the conversion rules for changing big units into equivalent smaller units.

♦ Hours to Minutes (60 minutes x 3 hours=)

♦ Pounds to Ounces (16 ounces x 4 pounds=)

♦ Meters to Centimeters (100 cm. x 5 meters=)

In order for students to remember the conversion rule—**Big to Small... Multiply**—have them picture and remember the phrase, “**Big Students March**”

2. To remember small things renamed as equivalent larger units—**Small to Big...Divide**—have students picture and memorize, “**Saint Bernards Drive.**”

This mnemonic device also works for remembering information in other content areas. Most children learned the names of the lines of the treble clef in music by remembering “**Every God Boy Does Fine.**” It can work just as well for organizing and remembering other information.

3. If students need to remember the first six governors of Oklahoma—**Hard Candy Will Rot Wooden Teeth.**

Charles Haskell

Lee Cruce

Robert Williams

James Brooks Robertson

John Walton

Martin Trapp

4. To spell “geography”—**George Elliot’s Oldest Girl Rode A Pig Home Yesterday.**

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5. To remember the first five Presidents of the United States in order—  
**W**hales **A**lways **J**uggle **M**ice & **M**onkeys.

Washington

Adams

Jefferson

Madison

Monroe

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6. The seven continents—Elvis Always Ate Apples Alone, Never Sharing.

Europe

Australia

Africa

Antarctica

North America

South America

7. To recall planets in order from the sun—My Very Educated Mother Just Served Us Nine Pizzas.

Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Pluto

The following are additional example of various mnemonic devices for different subject areas:

8.

Element	Symbol	Memory Cue
Lead	PB	Plumbers Use Lead Pipes
Tin	Sn	Tin Snips
Silver	AG	Silver Hair with Old Age
Potassium	K	A Kettle is a Pot

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9. To memorize the seven principles of capitalism—*Fuzzy People Feel So Good Petting Caterpillars*.

Freedom of Enterprise

Private Property

Freedom of contract

Savings Leads to Investment

Government's role as Umpire

Profit Motive

Competition

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10. To recall historical events and dates—

Lincoln-Douglas Debates, 1858

Lincoln Inaugurated President, 1861

Lincoln Assassinated, 1865

**Poem Cue:**

*Lincoln Debate in Fifty-Eight*

*Lincoln's the one in Sixty-One*

*Lincoln alive in Sixty-Five?*

11. To remember the states, use these silly sentences:

*Washington Only Came North In Mountain Wilderness Until Carl Ate Noodle Macaroni:*

Washington

Oregon

California

Nevada

Idaho

Montana

Wyoming

Utah

Colorado

Arizona

New Mexico

*Tilly Only Kept Nuts, Sour Dates, New Donuts*

Texas

Oklahoma

Kansas

Nebraska

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South Dakota

North Dakota

## Learning Logs

Learning Logs or Content Journals are an excellent way for students to review and evaluate the material read or covered in class. Typically, students make entries into their logs two or three times a week. By writing down ideas and concepts they've learned, as well as questions about concepts they don't understand, students are better prepared to integrate new concepts with what they already know. This in turn enables students to retain information for future use.

If Learning Logs are going to be effective, they need to be reciprocal undertakings. As the teacher, you need to respond to what is written, think of this response as dialogue, yet try to avoid comments like "Good job" or "Keep trying." Here is an excellent example for Learning Log instructions prepared by a chemistry and anthropology teacher. "Think" Writing explains what she wants, why she wants it, and when it should be done.

### "Think" Writing

#### Chemistry Log

The writing you'll do in your Chemistry Log will provide a way for you to think about what you're learning, to question what you don't understand, and to integrate new concepts and ideas with what you already know. This writing will be **thinking** on paper; therefore, don't worry about mechanical correctness or spelling. Deal with ideas and questions instead.

"Think" writing means:

- Summarizing what you've learned.
- Integrating new ideas with ones you already understand.
- Questioning the significance of what you learn.
- Discovering questions about what you know.
- Discovering questions about what you don't understand.

"Think" writing will help you:

- Understand the material.
- Ask relevant questions.

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- Make new knowledge part of you.
- Retain what you learn.
- Improve your ability to write in all subjects.

When should you write? Write when:

- You're confused. Write to discover what specific points you don't understand.
- New concepts are introduced.
- You question the importance of an idea.
- You're preparing for a test.
- You're relaxed and in the mood to write.

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The students will need to be assured this is only "thinking" on paper, so they don't need to be too concerned about correctness or spelling. It should be ungraded, except to note that something was written. Students may need to be guided into using Learning Logs by discussion, as a group, concepts, ideas, and questions that might be written in the logs. The following are some suggestions of questions that students can ask themselves:

- What did I learn today?
- What words in science caught my attention?
- (Reaction to class activities.) What did I think of the film, test, etc.? Was it valuable?
- How can I explain the assignment in my own words?
- How did today's information on minerals fit in with what I already know?

Here are some sample entries and responses:

- Student's Entry: We studied about passive voice today. Passive voice reminds me of lying in a hammock in a summer day with no energy and not a care in the world. You just lie there and let the wind rock you. You just take life as it comes. You have to be indifferent because you don't have any control at all.  
Teacher's Comment: Well, Jamie, what happens if you get thirsty lying in the hammock? Can you do anything about it and retain passive voice?
- Student's Entry: I liked our lesson about organs today. I was surprised that a leaf is an organ. I knew that lungs and hearts and things like that are organs. But I sure didn't know that hands and arms and tree roots were organs. And why isn't the liver a gland if it can make things our body needs? Our book said a gland is a tissue that can produce different substances.

## Cover and Write Study Technique

One method for individual, active review is the cover and write study technique. Rather than writing the word, date, name, or information over and over to review (as many student do), the student is able to:

- **Check** his/her own learning.
- **Eliminate** learned material.
- **Flag** information needing additional work.

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Students may find the cover and write study technique helpful when studying spelling or any other rote material. The steps for students to study with this technique are as follows:

1. Look at the word.
2. Cover it up.
3. See if you can write the word without looking.
4. Look at the word.
5. Check to see if you got the word right.
6. If you did, go on to the next word.
7. If you didn't, look at the word again and either sound it out by syllables or visualize it.
8. Then cover the word again.
9. See if you can write the word without looking now.
10. Look at the word to check if you got the word right.
11. If you still got it wrong, circle or check the word and go on to the next word or task.
12. When you are finished with the list, go back and practice writing the word(s) you missed.

## See-Thru Study Sheets

See-Thru study sheets may be used to review concepts that the students have been exposed to previously. This technique provides immediate feedback, takes a minimal amount of time to implement, and can be easily completed by students. It is also extremely inexpensive. The technique is based on the fact that red college theme binders (acetate type) effectively screen out pink and yellow water-based highlighter pens. Thus see-thru study sheets are extremely effective for review or re-teaching of content-area material and make excellent independent study guides. Students can easily use see-thru study sheets to quiz themselves on any type of information, providing immediate feedback.

To make see-thru study sheets, write problems or questions on either standard size paper or on index cards using a dark marker. Write the answers with either a pink or yellow water-based marker. When the study sheet paper or cards are under the plastic theme cover, only the problems or questions are visible. The answers appear

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when the paper or cards are pulled out from under the theme cover. (We recommend that you do not experiment with different colors. These are the only ones we have found that will work!)