The Role of Memory in Learning

Let’s start with a little quiz

Question. Which of the following are you likely to hear in an ABLE classroom?

A. “Huh?”
B. “What did you say?”
C. “You never told us to ….”
D. “I don’t remember”
E. All of the above

Correct Answer: What were my choices again?

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Date: 2/26/11
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Today we will be using several metaphors to help you to remember the main components of the memory process. We will be identifying, and elaborating on, the parts of the workbench and storage cabinet pictured above. But the real workbench and storage bins that are important are the ones located in your, and your student’s, brains.
In order to complete this training you will need to complete (by e-mailing your answers to Pat Capito) a short “post-test.” The questions will be found inside this slide presentation and will be clearly marked with the symbol found below.

The idea of the post test is not to “hassle” you, but rather, to encourage you to think about the material that is presented.

A main theme of this presentation on Memory is the fact that learning is not a passive activity where someone pours information into your mind. Rather, learning requires action on your part, attention, information swapping, analysis, organization, storage and retrieval of your ideas and/or data. So, think of the post-test as “five minutes on the mental treadmill” that will make your learning easier and hopefully help it to be retained a bit longer.

When you see this image, you will be presented with a “post-test” question to answer for Act 48 credit.
Here is what we will be talking about today:

1. The important role that memory plays in the processing of information (the big picture)

2. The introduction of attention, memory and executive processing (the prerequisites for learning anything)

3. Two types of short term memory and the role that each plays in learning (the work table and the pigeon holes of your mental workbench)

4. Long term memory and retrieval (the storage cabinets where you keep your “stuff” for later use)

5. Implementation strategies (what do you do after this webinar ?)
Let’s start with some questions

Do you remember the “arithmetic problem” that you just gave to Wilma, the one she was unable to answer because she can’t convert a fraction to a decimal number. Well, possibly Wilma may not have an math problem at all!

And that “reading problem” where Mark seems to read the words but has little comprehension. Well, that may not really be a reading problem?

Many difficulties that appear to be academic problems may really be memory problems in disguise.

Watch for this image…it suggests a situation where all is not as it seems at first glance. You will be asked to comment on the situation.
You might find a lot of clutter, disorganization, fragments of information, leftovers from yesterday’s lunch, half done projects, traces of bad experiences, forgotten directions and old manuals. Not a very pretty sight! If students are to learn, they will need to clean up, shape up (that means practice and discipline) and get organized.
Let's start with the "big picture" or "the view from 30,000 feet." By that I mean a quick overview of how today's topic fits (it's memory in case you forgot) into the bigger concept of "learning."

Today, we are going to be talking about memory as a very integral component of the larger Information Processing System. You might think of it as an important sub-system that impacts all of the other parts of a much more complicated system.

Memory is not a single or static thing. Memory is always working, either in the background, or buried inside consciousness where your brain is scanning for the need to "remember." Don't think of memory as a light bulb that can be turned on or off. Think of it as a light bulb that is always on, it just varies from dim to dazzling and sometimes you even forget that it is there.

But memory never acts alone, it has to have raw material to work with. That raw material is invisible, but it is there. It's made up of ideas, information, sensations, sights, sounds and feelings.

With all that stuff coming in, being a neuron has got to be like standing under Niagara Falls.
Information Processing Model

Psycholinguistic Model

Executive Processing

Memory

Association

Higher Level Cognitive Processes

Reception
Decoding

Analysis
Cognition

Expression
Encoding
Information needs to get in

Information needs to be analyzed, massaged, thought over and “sliced and diced”

Information needs to get out (be Expressed)
BUT ACT NOW !!

If you stay with us for the next 45 minutes we will double your knowledge !!

Rather than just the basic IPM package shown to you in the last slide, we will double your understanding of the memory process and take it to even deeper levels.

NO WAIT !!, WE HAVE A SPECIAL OFFER FOR OUR ABLE WEBINAR PARTICIPANTS… WE WILL TRIPLE YOUR UNDERSTANDING, and automatically add 3 new components to you order.
Attention, Memory, and Executive Processing

Information Processing Model
Psycholinguistic Model

Executive Processing

Higher Level Cognitive Processes

Attention

Visual
Auditory
Tactile

Motor
Written

Attention, Memory, and Executive Processing

Recollection Decoding
Analysis Cognition
Expression Encoding
You need to sense what is important and then make sure it gets onto your “radar screen” or “workbench” by attending.

You can’t save everything. You need to know what to throw out, what to “juggle” and what to put into long term storage for future use.

You need an internal “boss,” “parent” or “conductor” to organize and orchestrate the whole process.
Attention --- Memory --- Executive Processing

Remember the number 3"
There are 3 prerequisites to learning anything
So, let's talk a bit about “Awareness,” a process that precedes “Attention.” Awareness and Attention work as a team.

If you look around, you will become more aware (no pun intended) of the fact that a lot of people spend a lot of money keeping their organization’s message in front of you.

You might say, the entire advertising agency is built around creating awareness. Why is this? Because the more you to “be aware,” or the greater the extent that your invisible “screening mechanism” sees something as being important, the more it is likely to let that piece of information move to a higher level of processing.

We often used the term “on your radar screen” to imply this kind of subtle awareness of relevance that moves a bit of information into focus.

The 64 million dollar question for teachers is:

“Are you even on your student’s radar screen?”
What was the magic number to remember?

3

Three Processes: Reception, Association, Expression

Three functions: Stuff comes in, stuff gets sliced and diced, and stuff goes

Three prerequisites: Attention, Memory, and Executive Processing
So, you might look at “attention” as an open door that may lead to some very good things.

And you might look at “awareness” as the perception or feeling that there is even a door there that might be useful.

Question 1. How might issues of “immaturity” and “awareness” be related?
Awareness, Attention and Concentration (which is sustained attention) serve as the doorway through which all information must pass. If that door is closed, nothing will get in, and if it does not get in, it cannot be processed.

So, the first step in remembering something is to have an awareness that it may be important.
Question? What is my office phone number?

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You were provided with the phone number earlier, but I didn’t tell you that it was important. There was also other visual material for you to look at, so you weren’t “aware” of what was important. Because you were not aware you did not focus, and because you did not focus, the process of remembering was never started.
In terms of our workbench metaphor, we need to do **three** things:

1. Have some idea as to what is appropriate to put onto our work area,
2. Screen out the relevant from the irrelevant feelings, impressions, sounds, letters, words, sensations, etc.
3. Focus on things, grab them, and put them onto the surface of the work area

This is the awareness and attention component that is the first stage of remembering.

Experiences, feelings, ideas, words, sounds, sights, emotions, sensations. We need to sort out the good, the bad and the ugly.
Mr. Williams, the teacher, asks Todd to answer a question that the class is working on. Todd’s reply is, “Sorry Mr. Williams, I didn’t remember all of the question, could you repeat it please.

Todd comes into your class and is totally engaged with his cell phone. He is told to put the phone away, but simply puts it under his materials, thinking that the teacher does not notice. He looks at his phone every few seconds.

What is the nature of Todd’s memory problem?
Attentiveness is often said to be the tool that engraves information into memory. Thus, attention deficits can radically reduce memory performance.

You now know that attentiveness begins with awareness, but we are now going to discuss more obvious components of memory. You need to remember that alertness, attentiveness and concentration are critical at ever stage not just input. They are not like a switch you turn “on” and “off,” or a doorway that you pass through once. If attention falters, at any stage of information processing, it is likely that the idea will disappear, and memory will come to a halt.

What is the important concept here? **It is not just initial attention, but it is sustained attention that is important.**

And, sustained attention is not an area of strength for many students in ABLE classes.
In your own words answer these two questions:

Q. 2 What are the three stages of information processing?

Q. 3 What are the three additional important processes that are present at all of those levels and significantly impact the effectiveness of information flow between stages?
Short Term Memory

Hurry, hurry before it goes away!!!

"And tomorrow we will be having a surprise test."

"The memorabilia auction was a huge flop."
We have to pull things from our temporary storage and bring it back onto our active work area. But, it's not quite that simple!

You mind has lots of temporary storage places and “pigeon holes” in which to put bits of information. But, it can’t stay there for long.
If you are aware and if you attend to an event, a piece of information or a feeling, it moves to short term memory where your mind has only a few seconds to analyze it and possibly do something with it.

The life or death of a bit of information is determined in those very critical seconds.
Things that are pulled from attention are either actively worked on, held in short term memory, or switched back and forth between the two.

Short term memory areas where items are stored in order to eliminate work area clutter.

Currently Active Work Area

Stuff that could be pulled into short term memory
But, it’s not quite that simple
Material in short term working memory is continuously “juggled” and “swapped,” all the while being “remembered.” Information is put back into short term memory.

Material is retrieved from short term memory and put back onto the work area.

Currently Active Work Area

Work area, with items that are not currently being worked with.

Stuff that could be pulled into short term memory.
But, it’s still not quite that simple
All of this “juggling” or shifting of focus into and out of short term memory storage areas is called ACTIVE SHORT TERM or WORKING MEMORY. It is an extremely important mental ability.

Many students in ABLE classes show weakness in this area because:
1) they lack awareness that it even exists,
2) like a flabby muscle, they have never exercised it adequately,
3) they have never developed it because there was never an expectation that it be proficient, or
4) they possess some type of physiological memory deficit.

So, what can you do with your students?
1) Discuss memory with your students
2) Provide opportunities for exercising their memory
3) Have high expectations for student performance
4) Look deeper into suspected memory problems
So, your short term memory is very important because short term memory is where information is: quickly reviewed, put into temporary storage while more information is being screened, organized and processed, and in many cases is where old information is brought back onto the work table so that it can be modified further by combining it with new information.

A lot of the “heavy lifting” involved in memory happens in active working memory.

**Short term memory:** Temporary Storage

**Active working memory:** Volatile (it can disappear in a second) recollections of facts, symbols, experiences that are being processed in order to make new information.
So, you might be correct in thinking that thinking is One Big

But just remember: In order to swap it, you need to know what it is, and where and how to find it
Some Questions About Awareness and Attention

1. What is my phone number? (you’ve had 2 exposures)
2. What color shirt was Todd wearing?
3. What was outside the doorway in the attention slide?
4. What was being sold in the “As Seen On TV” slide?
5. Who were the men shown on the “Remember 3 slide?”

878-2005, Yellow, Garden Path, ShamWow, Moe-Larry- and Curley

Take your number correct and multiply by 20%

Content

1. What are the three main stages in information processing?
2. What are the three related processes that overlay all the processes?
3. What are the two major types of memory?
4. What type of memory does the workbench table represent?
5. What type of memory is represented by taking something from one or more workbench pigeon holes and moving it back to the work area?

Take your number correct and multiply by 20%
One of the most important mental processes that humans have is the capacity to mentally watch ourselves think. You will need that skill to perform the following examination of **short term memory**. Work on solving the problem but at the same time watch (and remember) what it is that your mind is doing, i.e. remembering data, recalling facts, creating new partial answers, swapping data, etc.

**Some tasks that will tap your short term memory abilities:**

1. Say these numbers out loud, close your eyes, then repeat them
   5 8 3 2 9 7

2. Read the following sentence, close your eyes, then repeat it aloud:
   “Bob drives a 2010 green Ford.”

3. Solve this math problem in your head 5 plus 4 plus 3

4. Here are the names of 5 U.S. presidents: read their names, then close your eyes wait about 5 seconds and repeat their names:
   Jimmy Carter, Gerald Ford, Bill Clinton, George Bush and Barak Obama

Comment on your short term memory
Those were fairly easy short term memory tasks. In the next slide you will again be asked to “watch yourself think” as you complete tasks that require active working memory. While you do the tasks, monitor what is going on in terms of your mental processes, in effect, work on solving the problem but at the same time watch and remember what it is that your mind is doing, i.e. remembering specific data, recalling facts, thinking about not forgetting, creating new partial answers, juggling information, swapping data, etc. You will probably find the new tasks to be more difficult than the preceding slide because both the actual task and the self monitoring will compete for your available mental energy and the ability to focus.

Try to remember the “tricks” that you use to help you to recall information.

Watch specifically for the instant where the content simply “is lost.”

Develop your own definition of Active Working Memory and try to explain the process to someone else.
Here are some tasks that will tap your Active Working Memory. Remember the words “juggling” and “swapping” because they describe the family of mental processes that you will use in order to complete the tasks.

1. Count backwards from 100 by 7

2. Read this sentence, and then repeat it aloud without looking at the screen:
   “On a cold March evening, at about 7:20 PM, Mrs. Willdophen called Mr. Willow, her long time attorney and favorite tennis opponent.”

3. Solve this math problem in your head 467 times 49

4. Recall these presidents: Jimmy Carter, Gerald Ford, Bill Clinton, George Bush and Barak Obama, but now (without looking at the list) repeat their names in alphabetical order.

Q4. Explain the difference between simple Short Term Recall and the much more complex Active Working memory
Working or Short-Term Memory

Within seconds the relevant information is passed to the short-term memory where it may temporarily remain or rapidly fade, depending on the individual's priorities.

Short-term working memory is used to analyze this new information or to use it with other new or existing information. In some cases, the information is simply “swapped,” while in other cases new modified information is created. An example might be, the intermediary pieces of data that are created as a two or three stage math problem is solved.

Several common steps help retention in the short-term memory. These include rehearsal or repetition of the information and sorting or categorization into systematic chunks. The sorting process is usually called coding or chunking.

A key limitation of the working memory is that it takes 5-10 seconds to properly code information. If the coding process is interrupted, that information is lost after about 20 seconds.
Contemporary cognitive research, summarized in Salisbury (1990), has stressed the critical importance of the working memory. Working memory is critically important in language development and in reading, and failures in working memory are often responsible for learning disabilities.

Human beings do all their active thinking and problem solving in working memory. The quality of the input into working memory and of the operations that go on there determine the quality of learning and problem solving.

There are three critical phases in the effective use of working memory:

(1) getting information correctly into this short-term area,
(2) handling the information appropriately while it is there,
(3) moving information correctly from working memory to long-term storage, and using the information in working memory to generate some kind of output.

What does the literature say?

Sounds like Memory itself has the same 3 major phases of processing, “stuff has to get in, stuff has to be organized (as well as sliced and diced), and stuff has to be taken out.”
The working or short-term memory is not only time limited, it also has limited capacity, usually about seven bits or chunks of information. A seven-digit telephone number is an example. As indicated, the time limitation may be overcome by rehearsal. The coding process is useful in a learning situation and may involve recoding to adjust the information to individual experiences. This is when actual learning begins to take place. Therefore, recoding may be described as a process of relating incoming information to concepts or knowledge already in memory.

Methods of coding vary with subject matter, but typically they include some type of association. Use of rhymes or mnemonics is common. They may consist of the use of acronyms, the chronology of events, images, semantics, or an individually developed structure based on past experiences. Developing a logical strategy for coding information is a significant step in the learning process.

All of the memory systems are intimately related. Many of the functions of working or short-term memory are nearly identical to long-term memory functions, but the former deal with information that is not yet established in memory.
Let’s look at some other views of short-term memory.

First, it is necessary to get information correctly into the working memory. We move information from the sensory register (your eyes or ears record sensations) to the working memory by focusing attention on it.

Teachers can facilitate this transfer by doing something to direct attention: for example, by highlighting key words, by pointing to crucial items, getting students emotionally involved, raising their voice, or simply by saying, "Look at this!" or "This is important!"

In addition to focusing attention on information from a sensory register, we can bring information into short-term memory through the process of retrieval from long-term memory.
Teach your students handy memory tips they can use anywhere!

Outlines, organizational charts, and mind maps significantly reduce the demands placed on verbal memory because they both visualize the content and organize the information (and being organized helps it to be recalled and retrieved)
Recency (how long ago the information was last processed)

The principle of recency states that things most recently learned are best remembered. Conversely, the further a student is removed time-wise from a new fact or understanding, the more difficult it is to remember.

It is easy, for example, for a student to recall the sequence to follow in solving a math problem used a few minutes earlier, but it is usually difficult for them to remember an unfamiliar one used a week earlier.

The instructor needs to repeat, restate, or reemphasize important points to help the student remember them, but needs to check how successful the student’s were in remembering the information before starting to present new material.

Q5 List two additional classroom techniques that reflect an understanding of the importance of “recency” in achieving student retention.
How often should information be checked?

a) Two weeks later, as part of a multiple choice test.
b) At least 2 or 3 times during the actual lesson and then again in the summary.
c) As often as you can “loop around” and present the same information again.
d) Several times during the lesson, again a few times the next day, and once or twice a week for the next two weeks.

What do you think is the correct answer?

Oh, I hope you didn’t answer “a”
Factors that are related to memory

Intensity: (the “wow” factor in memory)

A vivid, dramatic, or exciting learning experience teaches more than a routine or boring experience. A student is likely to gain greater understanding by solving a real life problem or applying a process to complete a project rather than merely reading about them.

The principle of intensity implies that a student will learn more from the real thing than from a substitute.

The traditional “lecture” format does not allow many opportunities to apply their new knowledge. Because of that, they easily forget what had been presented.

The instructor should use imagination in approaching reality as closely as possible and by adding realism and motivating opportunities to apply their new learning.
Intensity of an event, makes things stay on a person’s radar screen (or never get there in the first place).

Activity and student involvement increase the the level of intensity. Combine student involvement with increased frequency of information presentation and you will have addressed two key factors in achieving better retention.
FIGHT NITE SPECIAL

ABLE INSTRUCTOR VS

MTV

FAMILY DEMANDS

BOYFRIEND/GIRLFRIEND

HANGING OUT

VIDEO GAMES

MP3 PLAYERS AND IPODS

FACE BOOK AND SOCIAL NETWORKING

ON A SCALE OF 1 TO 10 – HOW EXCITING IS YOUR TEACHING?
Factors that are related to memory

Effectiveness

The effectiveness of the instructional device or material is critical for the memory process. Carefully selected charts, graphs, pictures, or other well-organized visual aids are examples of items that could help the student understand, as well as retain, essential information. Ideally, instructional aids should be designed to cover the key points and concepts and should be straightforward easy for students to remember and recall. Generally, instructional aids that are relatively simple are best.

But, the extent to which the instructional aide will be effective with a given student, will be determined by each student’s perception of the tool used. It is not teacher’s act of showing a chart that is the pivotal point, it is the students awareness of the relevance, and the valuation of knowing that specific knowledge that will “make or break” a learning opportunity.
Reasons for the Use of Instructional Aids

When properly used, they help gain and hold the attention of students.

Instructors should keep in mind that they are salespersons for ideas, and many of the best sales techniques that attract the attention are well worth considering.

One caution—the instructional aid should focus the student’s attention on the subject; it should not be a distracting gimmick.
Readiness

Individuals learn best when they are ready to learn, and they do not learn well if they see no reason for learning. Getting students ready to learn is usually the instructor’s responsibility. If students have a strong purpose, a clear objective, and a definite reason for learning something, they make more progress than if they lack motivation.

Readiness implies a degree of single-mindedness and eagerness. When students are ready to learn, they meet the instructor at least halfway, and this simplifies the instructor's job.

Under certain circumstances, the instructor can do little, if anything, to inspire in students a readiness to learn. If outside responsibilities, interests, or worries weigh too heavily on their minds, if their schedules are overcrowded, or if their personal problems seem insoluble, students may have little interest in learning.
The cognitive domain, described by Dr. Benjamin Bloom, is one of the best known educational domains. It contains a hierarchy of mental processes that vary from simple recognition (at the low end) to high level abstract reasoning (at the top end).

For most people, cognitive improvement is both motivational and rewarding. Most people like to learn and like to solve problems.

Tasks presented to students can be TOO HARD or they can be TOO EASY, but when they are JUST RIGHT they can be very rewarding. If you find the cognitive “sweet spot” for each student, their recall can be enhanced.
Using the Affective Domain

Remember the photo of the person getting the traffic ticket? Yes, anger, joy, fear, excitement, feeling needed, given respect, being listened to, being known as an individual, and lots of other emotions can play a vital role in memory enhancement.

Literature suggests that positive emotions are more effective than negative emotions. Thus, having the personal satisfaction may be more rewarding than a test. A lecture followed by a paper and pencil test is almost devoid of affective “hooks.” A class project, where students rotate between responsibilities and are mentored by the teacher, is loaded with affective opportunities for the student to “buy in.”

Q6 What elements in the picture on the right, act to enhance memory and learning?
Using the Psychomotor Domain (Motor Memory)

Psychomotor or physical skills always have been important in learning. They involve a different type of memory, “motor memory” which, with practice, can make a complex series of movements automatic and standardized.

Frequently, motor memory is required to carry out a series of movements needed to complete a procedure. As physical tasks and equipment become more complex, the requirement for integration of cognitive and physical skills increases. The word “practice” is almost always linked to “motor memory” but usually, the sequence is concurrently processed internally using language and cognition. Thus, “motor memory” often works simultaneously with short term memory or active working memory.

How to hold the ball, where to put your feet, what to look at, sensing how the ball feels and how hard to push, how to breathe, how to adjust finger tip pressure, are all memorized through practice.

Q7 How might “motor memory” be integrated with teaching the multiplication problem to the right.
Now let’s move on to long term memory
Now we will move on to long-term memory, the more permanent memory that exists in the background ready to do two things, 1) store bits of information and 2) retrieve those bits when appropriate to work being done on the work table and send it back to active working memory.
Short term Memory

Where Working Memory Takes Place

Long Term Memory
Long-Term Memory

What then is distinctive about the long-term memory? This is where information is stored for future use. For the stored information to be useful, some special effort must have been expended during the coding process in working or short-term memory. The coding should have provided meaning and connections between old and new information. The more effective the coding process, the easier the recall.

However, it should be noted that the long-term memory is a reconstruction, not a pure recall of information or events. It also is subject to limitations, such as time, biases, and, in many cases, personal inaccuracies. This is why two people who view the same event will often have totally different recollections.

You might think of long term memory as something that seems to “just happen,” but upon closer scrutiny you see that in many cases effort is needed to make sure that the necessary links and associations with existing information is established.
Let’s see how strong your long-term memory is, and use the exercise as a tool for you to think about your memory.

http://www.readfaster.com/culturalliteracy/

Did you ever know the material?

Did an answer just “pop into your mind?”

Did you have to search around a bit? If you did, what techniques did you use?

While you were searching, were you evaluating possibly answers, weighting them in terms of their probability of being right. Where was all this activity taking place?
Long-term memory includes both our memory of recent facts, which is often quite fragile, as well as our memory of older facts, which has become more consolidated. Long-term memory consists of three main processes that take place consecutively: encoding, storage, and retrieval (recall) of information.
The purpose of encoding is to assign a meaning to the information to be memorized. For example, you might encode the word "lemon" as “fruit, roundish, yellow”. If you could not recall the word “lemon” spontaneously, then invoking one of the indexes that you used to encode it (such as “fruit”) should help you to retrieve it. How effectively you can retrieve information depends on how deeply you have encoded it, and hence on how well you have organized it in your memory. The process of encoding refers not only to the information being memorized, but also to its environmental, cognitive, and emotional context. Also, using mnemonic devices to associate ideas and images helps us to create links that facilitate encoding. One classic example is the device used to recall musical notes on the lines of the treble clef, “Every Good Boy Deserves Food”

Even when information has been well encoded, it can still be forgotten.
Retrieval of information encoded in long-term memory is traditionally divided into two categories: recall and recognition. Recall involves actively reconstructing the information, whereas recognition only requires a decision as to whether one thing among others has been encountered before. Recall is more difficult, because it requires the activation of all the neurons involved in the memory in question. In contrast, in recognition, even if a part of an object initially activates only a part of the neural network concerned, that may then suffice to activate the entire network.

This slide introduces a concept that is extremely relevant to educators, depth of knowledge. How is the depth manifest in learning environments?
Types of tests of knowledge ranging from “True – False” (50% chance of being right, multiple choice (20% chance of being right) or essay exams (you either know it or you don’t).

Vocabulary mastery and the significant difference in difficulty between “receptive vocabulary” and “expressive vocabulary.”

The difficulty encountered in getting many students to write. It involves all of the requirements of speaking and additionally requires the ability to recall and recode a written symbolic system.
Recognition

Recall

Recognize a Relationship

Awareness

Find Details

Associate Details

Express Details

True False
Multiple Choice
“I’ve heard it before”

Essay
Real Life problem solving
Elaboration of meaningful substance
Storage can be regarded as the active process of consolidation that makes memories less vulnerable to being forgotten. It is this consolidation that differentiates memories of recent facts from memories of older ones. The latter have been associated with a larger amount of pre-existing knowledge. Sleep, and in particular the rapid-eye-movement (REM) phase of sleep, along with reviewing (such as studying for exams) play a large role in consolidation.

Lastly, retrieval (recall) of memories, whether voluntary or not, involves active mechanisms that make use of encoding indexes. In this process, information is temporarily copied from long-term memory into working memory, so that it can be used there. The more a memory has been encoded, elaborated, organized, and structured, the easier it will be to retrieve. Thus, we see that forgetting can be caused by failures at any of these stages: poor encoding, insufficient consolidation, or difficulties in retrieval.
Exercise

The principle of exercise states that those things most often repeated are best remembered. It is the basis of drill and practice. The human memory is fallible and the factor of “decay” of knowledge is always present.

The mind can rarely retain, evaluate, and apply new concepts or practices after a single exposure. Students do not learn to solve complex concepts or skills with only one exposure to the material.

They learn by applying what they have been told and shown over periods of practice. Every time practice occurs, learning continues.

The instructor must provide opportunities for students to practice and, at the same time, make sure that this does not become dull and “boring” to the student.
Brain imaging techniques utilizing regional blood flow changes are capable of seeing what areas are working harder during certain memory tasks. When a subject is given a working memory task, one analogous to the telephone operator giving you a new number that you have to remember long enough to dial, the frontal lobe areas just in front of the motor strip seem to work harder, as do the areas in the back end of the sylvian fissure. Both Broca’s area and Wernicke’s area, in the old formulation of language areas, are involved in working memory of this type.

As educators, we do not need to know the physiology and biochemistry that is where memory actually occurs, but the statement above, and current trends in neuropsychology point clearly to the need to develop (and maintain) vital cognitive processes. Memory is at the top of the list of critical cognitive processes.
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Success Stories

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- Achim Enthaler

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Lumosity partners with researchers at Stanford, UCSF, Harvard, and Columbia, among other prestigious universities.

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Medi-CareFirst | Abbott

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Disuse

The theory of disuse suggests that a person forgets those things which are not used. The high school or college graduate is saddened by the lack of factual data retained several years after graduation. Since the things which are remembered are those used on the job, a person concludes that forgetting is the result of disuse. But the explanation is not quite so simple. Experimental studies show, for example, that a hypnotized person can describe specific details of an event which normally is beyond recall. Apparently the memory is there, locked in the recesses of the mind. The difficulty is summoning it up to consciousness.

Interference

The basis of the interference theory is that people forget something because a certain experience has overshadowed it, or that the learning of similar things has intervened. This theory might explain how the range of experiences after graduation from school causes a person to forget or to lose knowledge. In other words, new events displace many things that had been learned. From experiments, at least two conclusions about interference may be drawn. First, similar material seems to interfere with memory more than dissimilar material; and second, material not well learned suffers most from interference.
5. Implementation strategies (what do you do after this webinar?)

A few related thoughts on the importance of memory

Some comments on classroom relevance

A review of essential points

A quick review of vocabulary

Possible future follow-up professional development
The role of memory in “Intelligence”
1. Establish a solid conceptual map of the memory elements that we have discussed.

2. Think about your instruction and your student’s behavior in terms of the 3 stages of information processing and the 3 overarching prerequisite components.

3. Revisit the topic of memory and it’s role in instruction regularly, and with each visit try another instructional modification and watch for any impact that it might have.
Organize Content into Small Chunks. Structure the new information in small, related chunks so that it is optimized for working memory. Don’t overload the working memory with irrelevant content. The brain is sorting and organizing the information. If it’s not relevant, or there’s too much of it, it interferes with the learning process.

Build Upon Prior Knowledge. Create processes where the learner can practice using the information in a context that integrates it with prior experience. Case studies and practices exercises are good because they can be structured to combine the new information with the learner’s current understanding.

Provide Real-World Context. The goal is to get the learner to pull information out of long-term memory and transfer it to a real world context. Create exercises and real-world scenarios that help the learner apply the new information into a workplace context. Problem-solving scenarios help develop thinking skills that can be transferred to the real world. If you want your learners to learn and use the course content after they’re done with the course, make sure that you create the learning courses to be memorable. Consider how much information you share and how you present it to the learner.
Meaningful Repetition Aids Recall

Each repetition gives the student an opportunity to gain a clearer and more accurate perception of the subject to be learned, but mere repetition does not guarantee retention. Practice provides an opportunity for learning, but does not cause it. Further, some research indicates that three or four repetitions provide the maximum effect, after which the rate of learning and probability of retention fall off rapidly.

Along with these five principles, there is a considerable amount of additional literature on retention of learning during a typical academic lesson. After the first 10-15 minutes, the rate of retention drops significantly until about the last 5-10 minutes when students wake up again. Students passively listening to a lecture have roughly a five percent retention rate over a 24-hour period, but students actively engaged in the learning process have a much higher retention. This clearly reiterates the point that active learning is superior to just listening.
Information Processing Model

Psycholinguistic Model

Executive Processing

Higher Level Cognitive Processes

Attention, Memory, and Executive Processing

Level 4

Attention

Reception Decoding

Analysis Cognition

Expression Encoding
Information is Available

Some Enters

In Immediate Memory

Short Term Memory

Short Term Active Working Memory

Active Cognition Awareness Focus

Long Term Memory

Develop your own graphic of the components and sequence of memory
This is what a well developed memory looks like
Intention
Focus
Concentration
Awareness
Short-Term Memory
Active Working Memory
Long Term Memory
Episodic Memory
Motor Memory
Mnemonic
Recency
Repetition
Application
Intensity
Affective Memory
Effectiveness
Readiness
Depth or Cognitive Load
Physical Exercise and Diet
Information Swapping
Integrated Concurrent Data Sharing
Storage
Retrieval
Chunking
Practice and Exercise
Visualization and Mind-Mapping
Content Overload
Consolidation
Disuse
Interference
Semantic Memory
Encoding
Information Processing
Receptive Stage
Associative Stage
Expressive Stage
Executive Processes
Workbench Metaphor
Concentration
Thank You For Participating

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