

Learning with Mnemonics in a Therapeutic Modalities Course: A Case Report

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As the profession of athletic training evolves, so does the number and complexity of educational components required to be a successful athletic trainer (AT). Being a competent AT often requires recalling and integrating information not only when the Board of Certification examination looms, but also in clinical practice. In fact, as ATs we are often required to recall and utilize large quantities of information learned one, five, or perhaps ten years earlier, in situations where it is impossible to search for a specific fact or skill to manage the situation.

The ability to recall information in a meaningful way whether as an AT or student, often in situations when time matters can occur through the use of a memory aid known as Mnemonics.¹⁻² Mnemonics are techniques utilized by many medical and non-medical professionals and students to improve memory by encoding information with associations between new and previously learned information in long-term memory.³ Mnemonics can be utilized at any time in the learning process; assuming an individual takes adequate time to learn and refine the skills necessary to make the use of the strategy worthwhile. The array of available mnemonic strategies will allow a student to acquire a large amount of information, integrate it in a meaningful way, and then retrieve it at a later day at will.²⁻⁴ Many professions use mnemonics as a learning strategy, without even realizing it, to teach and reinforce information related to disciplines such as neonatal resuscitation,⁵ nursing,^{4,6} dermatology,⁸⁻⁹ medicine,¹⁰⁻¹³ psychiatry,¹⁴ and even sports medicine.¹⁵

The purpose of this case report is to demonstrate the use of different mnemonic learning strategies in a therapeutic modalities course used to improve an athletic training student's learning outcomes. The report will first present the student's background

information followed by the mnemonic interventions used and the results obtained by the student. The principles underlying mnemonics is further discussed. Appropriate institutional review board approval was obtained.

CASE REPORT

Background

A 22-year-old female athletic training student enrolled in a therapeutic modalities course reported to the course instructor's office five days prior to a unit examination focusing on the management of musculoskeletal pain. Julie (pseudonym) expressed a sincere concern with her inability to grasp, retain, and recall a large portion of the more moderate-to-difficult pain and pain management concepts even after repeatedly reading through the textbook and course notes. Some of the specific examples encountered by Julie included recalling the function of afferent and efferent nerve impulses traveling to and from the brain, differentiating between the different sensory and noxious organs, the ascending spinal pathways, and the pain theories, particularly the Gate Control Theory. Julie scored a 26%, (class mean = 62.8% [17.05]) on a pre-test examination.

Intervention

As the course instructor, I met with Julie for approximately one hour reviewing the concepts of concern. In order to help Julie organize the information she was having difficulty remembering into something more meaningful for her, several types of mnemonic strategies were examined, including: (1) keyword, (2) first letter, (3) ridiculous association and (4) link-word mnemonics.

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Full Citation:

Berry D. Teaching and learning: Learning with mnemonics in a therapeutic modalities course: A case report. *Athl Train Educ J*. 2010;5(3):90-93

In keyword strategy, Julie was shown how to link new information to keywords already encoded to memory, followed by generation of a visual image to connect the word(s) to be learned with its definition or concept¹⁶ (Figure 1). We then discussed the concept of first letter mnemonics, a simple yet effective strategy using the first letters of the words to be remembered together to form a word or word-like unit¹⁷ (Figure 2). For the concept of ridiculous association we used a vivid poem to strengthen the link between the content to be memorized and the images in the poem. Here is an excerpt of the ridiculous association poem:

*I got stung by a bee, oh what a shame,
the pain caused by A-delta is now what I must blame.
Rubbing my arm causes A-betas to control the pain
by helping to limit delta, because A-betas aren't all that lame.*

Finally, link-word mnemonics were used to learn a series of items in order, using a visual image of adjacent items on a list (Table 1).

Results

Julie's post-exam score was 92% (class mean 90.1[5.57]). Julie reported in a debriefing session that her primary reason for success on the post-exam were the mnemonic strategies she had learned prior to the unit examination. She reported that many of the questions asked on the examination required her to recall information she learned with the mnemonic strategies. Julie also reported that she applied the mnemonic strategies to several other pain and pain management concepts she was having problems

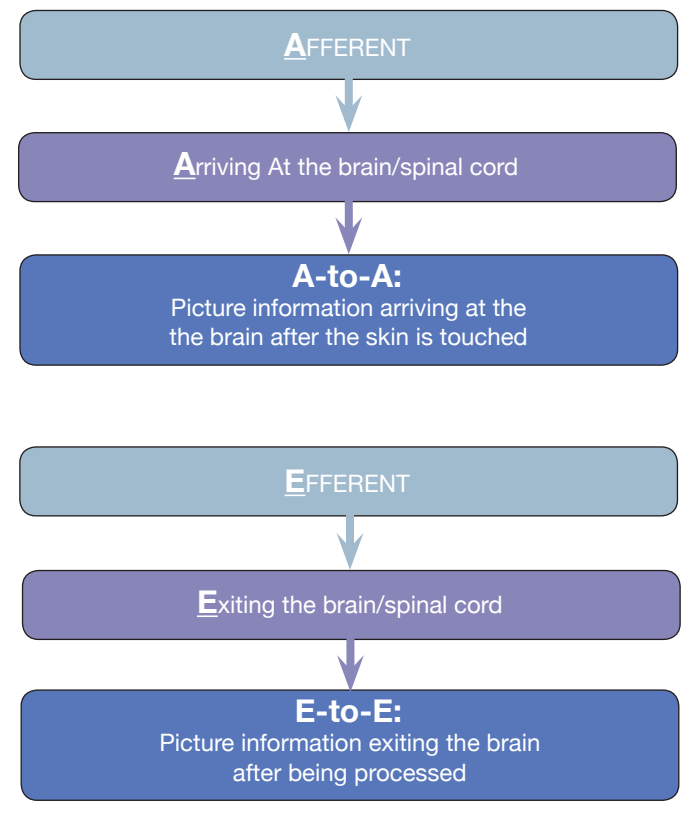


Figure 1. Keyword Mnemonic Strategy to Recall How Nerve Impulses Travel to and From the Brain

Neospinothalamic Pathway

- **F**ast
 - **A-D**elta
- “**N**athan **F**alls **A**lmost **D**aily” or **NFAD**

Paleospinothalamic

- **S**low
 - **C-F**iber
- “**P**aul’s **S**lipping **C**auses **F**ear” or **PSCF**

Figure 2. First Letter Mnemonic Strategy to Recall Spinal Pain Pathways

with, as well as other classes she was having difficulty with. She reported utilizing the concepts of ridiculous association more often than the other three techniques. She enjoyed the ability to create meaningful associations using her own interpretation(s) of the content, thereby allowing her to recall the information at a later date.

Discussion

Mnemonic strategies organize and integrate the transformation of difficult to remember information into something that is more meaningful for individuals to recall at a later date by using associations between new and previously learned information in long-term memory.^{2-3,6,18-19} In healthcare, mnemonic strategies have been used to reinforce a plethora of concepts including a systematic approach to and remembering key points during patient care and assessments^{1,6-7,13, 20} and patient compliance.²¹ Educationally, mnemonics can have a significant impact on student learning¹⁸ and can improve recall and bolster the student’s self-confidence,^{4-5,19 22} which in the healthcare field is important because the ability to recall new information is often more difficult due to the unfamiliarity of the content. In fact, Levin¹⁸ points out four factors affecting a student’s ability to remember difficult

Table 1. Link-Word Mnemonic Strategy to Recall Peripheral Nerve Characteristics.

Fibers	Diameter (µm)	Conduction Velocity (µs)	Function
A-alpha	12-20	70-120	Touch
A-beta	6-12	36-72	Touch/pressure
A-delta	1-5	6-36	Pain-Fast
C-fiber	0.3-1.0	0.4-1.0	Pain-Slow
Familiar Link			
Alphabetical Order	Biggest-to-Smallest	Fastest-to-Slowest	Sensation-to-Pain

information: (1) the amount of information, (2) unfamiliarity with the information, (3) abstractness, and (4) the complexity of the information. Certainly, a newly matriculated athletic training student would face all four of these obstacles when confronted with the immense amount of information required to continue through the academic sequence.

Mnemonic devices or strategies are divided into different types of activities, which relate to the two activities of the human brain: unitizing and symbolizing.²³ First, organizational mnemonics allows individuals to organize and interrelate new information so material can be recalled later.²⁴ The second type is referred to as encoding mnemonics. Encoding mnemonics transform low-imagery, abstract material into a more memorable form. Once in this form, organizational mnemonics are then used to store the information in the memory for recall at a later time.²⁴ However, it should be noted that in specific cases it is necessary for encoding mnemonics to occur first before the organizational model can be applied. Examples of organizational mnemonics include: (1) peg-word mnemonics, (2) story mnemonics, and (3) link-word mnemonics.^{2,24} Encoding mnemonics have the ability to turn abstract words into high-imagery substitutes that then make the abstract words easier to remember at a later date.²⁴

In this case study, Julie utilized four different mnemonic strategies. These include: (1) keyword strategy, (2) first letter, (3) ridiculous association, and (4) link-word mnemonics.

Keyword

In the keyword strategy students are asked to link new information to keywords already encoded to memory. This is followed by the generation of a visual representation of the information to connect the word(s) to its definition or concept.¹⁶ In this example, Julie needed to recall how nerve impulses travel between the skin and brain. To accomplish this, a four step process was used (Table 2).

Julie was shown how to link new information to keywords she already had encoded in her memory, followed by generation of an image to connect the word(s) to be learned with its definition or concept. She was taught the definition of the new words (ie, afferent and efferent). Then she was asked to remember the keyword(s) and envision a picture, the brain in this case, and how it relates to the definition. The visual representation consisted of an image of information traveling to the brain when the skin is touched. The final component was recalling the association. This was accomplished by taking the word “afferent,” recalling the image of information going to the brain when the skin is touched and realizing that the **A** in “**A**fferent” is paired with the **A** in “**A**rriving” at the brain and that “afferent” information is sensory informing traveling toward or “**A**t” the brain (Figure 1).

Table 2. Keyword Four-Step Process¹⁶

1.	Think back to the keyword
2.	Think of the picture
3.	Remember what else was happening in the picture and
4.	Produce the definition

First Letter Mnemonics

A first letter mnemonic are a simple yet effective strategy that uses the first letter of words to be remembered to form a word, or word-like, unit.¹⁷ Acronyms and acrostics are two types of strategies often utilized. An acronym is a word derived by taking the first letter from each word that you want to remember and making a new word from all those letters.^{4,25} For example, AVPU, SAMPLE, OPQRST, AEIOU-TIPS, and RICE are used to recall different aspects of emergency medicine (Table 3). In athletic training, management of a concussion requires immediate and delayed memory recall, but how many of us have difficulty remembering the five words we have asked the injured athlete to remember? A great practical application of first letter mnemonics would be creating an acronym to remember the 5 words, specifically using the athletic training credential and the state where the athletic trainer resides. For example, ATC-MI could stand for **A**pple, **T**iger, **C**rab, **M**aid, **I**nsect.

Acrostics support memory recall of large quantities of information by creating an entire sentence where the first letter of each word is the targeted information.^{4,25} As educators we use this mnemonics strategy more than we think, especially in healthcare. Ever heard of “**O**n **O**ld **O**lympus **T**owering **T**op **A** **F**inn **A**nd **G**erman **V**iewed **A** **H**orse”, a strategy for the recalling the 12 cranial nerves, **O**lfactory, **O**ptic, **O**culomotor, **T**rochlear, **T**rigeminal, **A**bducens, **F**acial, **A**uditory (Vestibulocochlear), **G**lossopharyngeal, **V**agus, **A**ccessory, **H**ypoglossal? A search of the Internet found over 200 sites with “**R**andy **T**ravis **D**rinks **C**old **B**eers”, the framework of the brachial plexus (**R**oot, **T**runk, **D**ivision, **C**ord, **B**ranches) and **O**ld **P**eople **F**rom **T**exas **E**at **S**piders, the bones of the skull (**O**ccipital, **P**arietal, **F**rontal, **T**emporal, **E**thmoid, **S**phenoid). The lists of these acronyms and acrostics in healthcare are endless but useful. A study examining the effects of first letter mnemonics on the content achievement of at-risk nursing students found that the treatment group who were taught the memory strategy over a seven-week period demonstrated a significant improvement in outcome scores compared to the low-achieving students who were not using the strategy and the students considered high-achievers.²⁶

In this case study, first letter mnemonics were used to recall the pain spinal pathways. Julie created both an acronym and acrostics to remember the spinal track for ascending pain information (Figure 2).

Ridiculous Association

Ridiculous association uses vivid and ridiculous images, poems, stories, etc to strengthen the association between content to be recalled and the association utilized.⁴ Almost anything can be used to make the ridiculous association as long as it provides meaning for the student. For example, to remember the position of the erector spinae muscles (ie, iliocostalis, longissimus, spinals) in the lumbar spine, visualize a pilot attempting to land a plane on the left runway on the athlete’s back who needs to use the **I**nstrument **L**anding **S**ystem (**ILS**). Moving from lateral to medial we have (1) **I**liocostalis (lumborum), (2) **L**ongissimus (thoracis), and (3) **S**pinalis (dorsi). Ridiculous association can also be used

Table 3. Emergency Medicine Acronyms

Acronym	Purpose	Meaning	
AVPU	Assessment of a patient's level of consciousness	A lert V erbal P ain U nresponsive	
SAMPLE	Components of a secondary assessment	S ymptoms A llergies M edication P ast pertinent history L ast oral intake E vents leading to the injury/illness	
OPQRST	Assessment of a patient's symptoms	O nset of symptoms P rovocation Q uality of symptoms R adiation S everity (0-10 scale) T ime	
AEIOU-TIPS	Causes of a patient's loss of consciousness	A alcohol, airway, anaphylaxi E epilepsy, electrocution I insulin (too much, too little) O overdose, oxygen (hypoxic) U uremia (other metabolic pathology) T trauma, tumor I infection P poisoning, psychiatric S syncope, seizure, shock, stroke	
RICE	Immediate treatment for musculoskeletal injuries	R est I ce C ompression E levation	OR R est I mmobilization C old E levation

to recall the location of the neurovascular structures of the femoral triangle. Visualize a **VAN** traveling up the right femur moving from distal to proximal. When the **VAN** reaches the femoral triangle the femoral **V**ein, **A**rtery, and **N**erve are running medial to lateral. In this case, rather than an image, Julie created a ridiculous poem to helped link the multiple components of the Gate Control Theory.

Link-Word Mnemonics

Link or chain mnemonics use paired associations to link together items which need to be recalled at a later time in a particular order. This strategy has two components assuming that learning a task is to master new material. First, the strategy must help students link familiar material to unfamiliar material.² Second, the strategy must provide an association with the new material's meaning.² This association is typically in the form of some type of visual imagery where the adjacent item(s) within a list are interacting (in order) in a meaningful way for the students.

For example, Julie needed to recall the characteristics of different sensory and noxious organs associated with pain management.

The familiar link in this case was Julie's ability to understand the alphabet and concepts of biggest-to-smallest and fastest-to-slowest. The association to establish the meaning of the new material was easy once the familiar link was established. The sensory and noxious organs when identified by type, **A-Alpha**, **A-Beta**, **A-Delta**, and **C-Fiber** can be placed in alphabetical order. The link, **A-Alpha** comes before **A-Beta**, **A-Beta** before **A-Delta**, and **A-Delta** before **C-Fibers**. This linkage then automatically places the organs in order based on size and transmission speed (Table 1). Thus, when Julie was confronted with a question such as "True or False: A-Delta information travels faster than A-Beta" all she needed to do was visualize the alphabetical order of the organs to know that the A-Beta is before A-Delta so A-Delta is going to be smaller and slower than A-Beta.

CONCLUSION

Mnemonic strategies used to enhance recall by connecting new knowledge with familiar words and images are a simple, yet powerful learning tool. That "aha" moment, when students make an association with an educational concept is priceless and is

something that will last forever. Many of the strategies utilized here do take some time to learn. However, the benefits of allowing students to think freely while associating cognitive knowledge with ideas and materials that are relevant to a student's life is what makes this teaching and learning strategy very useful for remembering information.

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