

Drawing to Remember: Using Visuals in the Psychology Classroom to Increase Vocabulary Understanding

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Introduction

“We are made to find meaning in what we see.” -Andrea Kantrowitz¹

Sitting in the hospital room next to my mother’s bed, I hear her once again ask my husband how his mother, Clara, is doing. I see the pain on his face – that which my mother does not recognize – as he responds that she recently passed away. My mother’s face turns towards me, tears in her eyes and says how sorry she is, how she did not know. But she had been told multiple times already – that day and many other days. Marcus Tullius Cicero’s quote, “Memory is the treasury and guardian of all things”² resonates with me since the time my mother suffered a stroke that affected her brain, more specifically, her short-term memory. She was unable to process the memory, commit it to her long-term memory. At the time, I did not know this – how the memory system works and allows us to remember or forget. I was not teaching psychology to high school students like I do now. Memory is fascinating and frustrating all at the same time. My mother’s neurologist appointments left me angry with as much as we know there was so much more about the brain that they did not. I still feel this way when I teach my psychology students.

Rationale

Our school’s focus is science. This comes at a cost – meaning, there is no art program at my school...not even one art class. From my participation in *Comics: Cartoons & Graphic Novels from the Inside Out*, my hope is to bring a bit of the arts into my College Preparatory (CP) Psychology course. In the past, we have done some drawing with vocabulary cartoons. This happens just a few times a year in which students create connections to the psychology vocabulary by drawing a cartoon or better referred to for my high school students as a visual representation. I would like to extend this idea and have students do it on a continuous basis by creating mind maps of each of the units we complete in our course. Not only would they have an artistic outlet but they would also be creating a visual thinking tool; one in which they might be able to use in other classes and later in college. This mind map would help them to organize the information learned, helping them to better comprehend the large number of vocabulary words as well as in-depth psychological concepts that are new to them.

School Setting

Conrad Schools of Science (CSS) is a science/biotechnology magnet school serving almost 1300 students in grades 6 – 12. It is considered an urban school, situated on the outskirts of the most populated city in the state of Delaware, Wilmington, which is well known for its’ violence rates. CSS students come from all over our state’s county, New Castle, which houses six school districts. Since our state runs on a Choice Option, families can decide to apply to schools in

districts outside of their home one. As our school has become more popular, most students come from our own district, Red Clay Consolidated. One of the most unique things about our school is that approximately two-thirds of our students stay with us for seven years throughout the middle and high school levels. Community is a word that I believe highlights our school.

At the high school level, students can choose to focus on a variety of learning “*strands*” such as biotechnology, physical therapy/athletic healthcare, biomedical science, animal science, and computer science. Our high school is the only one in the state that is not a vocational-technology school to offer a Delaware Certified Nursing Assistant (CNA) program. Additionally, a variety of Advanced Placement (AP) courses are offered as well as multiple courses that are in conjunction with our local community college and university.

Learning Objectives

The American Psychological Association has Performance Objectives embedded into the domains that outline the course. I am mandated to follow these as I plan my units of instruction. In total there are six domains: Scientific Inquiry, Biopsychological, Development and Learning, Socialcultural, Individual Variation, Application of Psychological Science, and Cognition. In this unit which focuses on the concept of cognition, I will be using three of the content standards: (1) **Encoding of memory**, (2) **Storage of memory**, and (3) **Retrieval of memory**. These content standards are divided into performance objectives. Encoding involves: *Identifying factors that influence encoding, Characterizing the difference between shallow (surface) and deep (elaborate) processing, and discussing strategies for improving the encoding of memory*. The storage of memory entails a variety of items but the one of importance in this unit is the *strategies for improving the storage of memories*. Retrieval includes *analyzing the importance of retrieval cues in memory and the discussion of strategies for improving the retrieval of memories*.³

Students will be participating in a variety of activities to learn about these three standards and how they relate to one another as well as how they are relevant to their own lives. In doing so students will explain the processes of how one remembers and why one forgets information. They will learn about a variety of memory retention strategies including creating illustrations (e.g. Mind Maps), which they will employ. The main goal of this unit is to have them practice with and feel comfortable creating visual representations to demonstrate their understanding of psychological concepts. Most of the unit will have them do this but in the beginning they will be doing it with concepts, ideas, and experiences from their own lives first. This self-reference effect of the using the familiar may help those with insecurities with their own drawing (or perceived lack thereof) abilities.

Enduring Understandings are the big ideas of this curriculum unit and are taken from the American Psychological Association’s High School Psychology Standards. Students will understand the processes of encoding, storage, and the retrieval of information and that memory is a process that can be aided by employing a variety of activities (including creating illustrations).

Additionally, as I created this unit, I kept in mind that our district and state also support the Common Core Standards. This unit addresses **Integration of Knowledge and Ideas** **CCSS.ELA-Literacy.RH.11-12.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.** Students will read and view a variety of texts and illustrations to analyze their own thinking, remembering, and forgetting processes and practice with the creation of visual representations to keep track of their own learning.

Specifically, our textbook refers to the items that students need to know as “Learning Targets”. For this unit, these include: 31-1 Define memory, and explain how memory is measured, 31-2 Discuss how psychologists describe the human memory system, 31-3 Describe the differences between explicit and implicit memories, 31-4 Discuss the information we process automatically, 31-5 Discuss Explain how sensory memory works, 31-6 Describe our short-term and working memory capacity, 31-7 Describe the effortful processing strategies that help us remember new information, and 31-8 Discuss the levels of processing and their effect on encoding.⁴ This is a nice way for me to “break down” the unit so that students will be able to more easily categorize the different concepts.

These understandings lead to Essential Questions that guide students throughout this unit within each of our sessions. These questions are those that students will investigate through their reading and visual representations creation. These will be paired up with the Learning Targets above. They include: What is memory and how is it measured?, What are the processes of encoding, storage, and the retrieval of information? And How do these relate to me/my learning?, What are the strategies for improving the encoding of memory? Which one (s) work best for me? and, lastly, How can I incorporate the creation of visuals into my note taking and why should I do this?

One of my main ideas is that I want to be certain when introducing this topic to my students that I connect what they will be expected to do (create visual illustrations representative of vocabulary words) to memory research. I believe that this is going to be the most important point about the curriculum unit which I believe will be divided into three parts: (1) the psychological processes of memory including encoding, storage, and retrieval, (2) the familiarization and practicing of what Ivan Brunetti refers to as cartooning⁵ through Lynda Barry’s Daily Dairy Practice, and (3) the marrying of “cartooning” with psychological vocabulary terms and in this last portion to extend this to include the use of mind maps – a “creative and logical means of note-taking and note-making that literally ‘maps out’ your ideas.”⁶

Content Objectives

The Brain’s Memory Processes

Memory

Memory is defined as “the persistence of learning over time through the encoding, storage, and retrieval of information.”⁷ There are three ways in which psychologists measure the retention of

memory: *recall* (“retrieving information that is not currently in your conscious awareness but that was learned at an earlier time”) such as fill in the blank or short answer question; *recognition* in which one is able to identify the previously learned information – as in a multiple choice question in which the answer is there for one to choose; and relearning in which one learns the information more quickly because it is already there in one’s brain – it is learned for the second time. An example of this includes studying and/or reviewing for a final exam in which one has already learned the information and is now going over it again to spark the memory. The most famous study of this – one in which students need to become familiar with was conducted by Hermann Ebbinghaus over a century ago in which his test subject was himself! He randomly selected a list of syllables creating “nonsense words” and practiced them. He learned that the more he went over the words on Day 1, the less time he needed to relearn the list the following day. This is due to repeating the words or as psychologists say rehearsing them which causes overlearning. Think about your favorite song – you play it over and over again – singing the words to yourself or aloud. In doing so, you are repeating them over and over – committing it to memory. My favorite saying in class, which students must grow so tired of by the end of our time together, is *Repeat to Remember!* Research proves this to be true which is helpful when explaining it to them.

The *information-processing model* refers to human memory as a computer system to include *encoding* (getting information into the brain), *storage* (keeping the information there), and *retrieval* (getting the information out of the brain)⁸. However, our brain is different than a computer in that we parallel process not sequentially process. In parallel processing we focus on many things at the same time – e.g. angles, color, motion, etc. and because of these differences or limitations Richard Atkinson and Richard Shiffrin proposed a three-stage model with the first being *sensory memory* which is a brief recording of all the sensory information our brain takes in. Our sensory memory is directly linked to the working memory by taking in momentary images (iconic memories) and sounds (echoic memories). The second stage is the *short-term memory* where we need to rehearse the information to encode it – think back to Ebbinghaus. The last or third stage is the *long-term memory*. This space is infinite and all information that has been encoded is stored there to be retrieved at a later time.⁹

Over time, Alan Baddeley and others adjusted this model by including *working memory*, a component of short-term memory, describing it as a “central executive” which focuses attention. It is a part of one’s conscious, active processing taking in auditory and visual information as well as information from the long-term memory that has already been processed. Working memory depends on a variety of items including age with young adults having the best capacity.¹⁰

Encoding Memories

There are two types of processing – effortful and automatic. Effortful processing is what I explain to students as what they do in school to be ready for their classes. They need to be attentive and place a conscious effort in the processing of explicit memories, facts and experiences that you know and can “declare”. Studying takes effort! These can be expressed in words or symbols and can include items such as phone numbers, facts learned in class, the names of colleagues, amongst others. The other type of processing – automatic – is unconscious – one

does it without being aware. Procedural knowledge includes how to do things or how to perform a task such as making a sandwich or riding a bike, for example. In addition, automatic processing includes space – where something is located on a page. For example, one may be able to visualize where it is “located” when trying to retrieve it later. As humans we also automatically note the time – or the sequencing of the day, and the frequency or how many times something happens. These things happen without any conscious effort on one’s part¹¹.

Short-term memory can only hold information for a brief period of time and without rehearsing it will be forgotten. George Miller’s (1956) research concluded that we are able to remember about seven chunks of bits of information in the short-term memory¹².

There are a number of strategies that can be used to better remember new information such as chunking, mnemonics and hierarchies. *Chunking* refers to organizing information into “familiar, manageable units”¹³. Usually it happens without thought...for example, reading these words right now you are able to do just that. However, it can be done thoughtfully to remember a large number of items one wants to purchase at the grocery store. Chunking the list of 20 items into categories such as produce, grains, and dairy would be helpful. Mnemonics is a visual strategy that enables the brain to better remember information. The pictures in our brain are powerful in the memory process. The most famous of these is the peg-word system which has a jingle to remember including “*One is a bun; two is a shoe; three is a tree; four is a door; five is a hive; six is sticks; seven is heaven; eight is a gate; nine is swine; ten is a hen.*”¹⁴ To use this system one only needs to visually put the “items” one needs to remember into, on top of, below, or nearby the item it corresponds with, for example, a gallon of milk squishing a bun (for one). Hierarchies are graphic organized in which the information is listed in a way to demonstrate categories of importance. One of the most important points in improving memory is that the retention of information is heightened by distributed practice – learning a little bit at a time over time. Known as the spacing effect,¹⁵ it is one of the main goals of the unit – to have students recognize the importance of learning a little bit at a time over a period of time to help to begin to curb their procrastination practice! There are two levels of processing which affect encoding shallow and deep. Shallow encoding occurs on a basic level while deep processing allows one to encode the information semantically (for meaning). The deeper the processing the more likely one is to remember the information, making information personally meaningful. One way that I try to implement this strategy in our classes, is by having students record the vocabulary words and their definitions. In addition to this I have them fill in a third column with information that is supposed to connect the vocabulary term to something they have learned – having the brain realize that the new information is “attached” to some old information. This column is used for a personal connection but they do have many difficulties with making the connections to themselves – the vocabulary word to something about their own lives. Think for example, neuron. How would you connect this to a life experience? I explain to students if they find this difficult, then they could write an additional fact in the column. The true point of the activity is to ensure that there is the connection to something they may already know which helps to ensure that they will better remember the vocabulary words. This is the specific area that I want to improve upon and the reason for this unit. Having students draw an illustration should help them to better remember the vocabulary word and the concept.

Storing Memories

For students to understand the storage part of memory they need to memorize a few parts of the brain. The frontal lobes and *hippocampus* are the areas that store one's explicit memories. Psychologists refer to the hippocampus as the "save" button! It acts "as a loading dock where the brain registers and temporarily holds the elements of a to-be-remembered episode – its smell, feel, sound, and location."¹⁶ Long-term, however, they are not saved there. The movement of these memories is referred to as memory consolidation. Sleep aides in this process, helping to process items during deep sleep. Psychologists "suspect that the brain is replaying the day's experiences as it transfers them to the cortex for long-term storage."¹⁷ The *cerebellum* helps to form and store implicit memories. The *basal ganglia* specifically stores motor movement which helps to form procedural memories for skills. Our emotional memories – those that are formed when we are super excited or stressed are stored in the *amygdala*.

Retrieving Memories

There are a number of things that can assist one in retrieving memories. These include retrieval cues such as *priming*, *context-dependent memory*, *state-dependent memory*, and the *serial position effect*. Priming refers to readying someone, cueing them so that a person is influenced – their thoughts or memories¹⁸. For example, I usually draw two words on the board one at a time to influence what students might think about - e.g. bear and bare. Having them visualize/draw what comes to mind for each of them having them see for themselves what effect cueing someone can have. The context-dependent memory depends on the environment. Cues specific to an event and or person help one to remember details.¹⁹ The state-dependent memory refers to the idea of the "state" a person is in. To better remember something, someone should be in the same state they were in when the experience, information first happened. For example, the emotion happy or sad. If the emotion is replayed or expressed again – the individual may better remember the initial information.²⁰ Lastly, the serial position effect refers to the concept that one is more likely to remember items at the beginning because you are rehearsing the information as well as those at the very end of a list (recency effect) because those are the most recent²¹. For example, a shopping list – one repeats the ten items in their minds – over and over ...sort of forgetting the items in the middle.

The Drawing Brain – the Science Behind Visual Making and Memory

Drawing can help with remembering things as it engages the brain in multiple ways – the visual and motor parts – visual, spatial, verbal, semantic, and motoric. This helps an individual to better retain the concepts. As a relief to most of us non-artists, the skill level of the drawing is not important!²² Terada claims that "drawing is superior to activities such as reading or writing because it forces the person to process information in multiple ways: visually, kinesthetically, and semantically."²³ As a multi-modal activity, researchers have determined that the activity of drawing helps one to better remember information. It is an active process in which an individual needs to be recreate the word to a visual representation thus, making the vocabulary word and easier to remember because it can be better encoded into memory.

One of the things that is important is that the more connections one makes to the word being learned the better able to remember it. This is one of the reasons that I have my students have to define and make a connection for each of our vocabulary words. Sometimes – more rarely, students draw a visual representation to depict the vocabulary word. Usually, students write down another fact or connect it to something they may have learned in another class such as biomed or biology. One article refers to the use of interactive notebooks which could be an option with one side of page being written notes while the other side has drawings.²⁴

Fernandez, Wammes, and Meade conducted an experiment in which university undergraduates studied lists of common words e.g. truck and pear. They were able to remember twenty percent of the words they wrote down but forty-five percent of those they had drawn.²⁵ Dafoe describes this exercise as one that reflects the levels of processing students learn about in psychology and as previously mentioned: shallow or deep rehearsal. Shallow rehearsal is one in which a word may be read while deep rehearsal ensures that the words have been interacted with in multiple ways such as being read and evaluated.²⁶ In the homework notes that I have students complete students must write down the word, define it, and then connect it in some way to themselves. Some students do draw a small visual while others do not. I am proposing, after researching this unit, that they must draw something in addition to writing. One of the most promising components of this is that artistic ability does not matter. This is a relief – as a teacher and as a student! As a teacher, students are concerned about not doing something well or if someone else will judge them too harshly. As a student, not wanting to do something

Kantrowitz writes about grounded cognition in that all thinking processes are “grounded in our physical interactions with our environment.”²⁷ This includes perception (using our senses), movement (how our bodies move in space as well as our awareness of our body parts and their movements), and introspection (our ability to think and interpret our awareness).²⁸ Drawing allows for the use of all three of these parts of grounded cognition.

“When we draw, we construct meaning from marks and smudges on a two-dimensional surface. Through the coordinated movement of eye and hand, spatial relationships are discovered and described. We look, we make a mark, we look again. Underlying structures and configurations emerge beneath our hands. Examining the external traces of our own thoughts and perceptions, we see them anew. The physical act of drawing makes us more aware of the intricacies of our own minds, the complex interdependencies and recursive loops of perception and cognition. We learn to see the world around us with fresh eyes.”²⁹

Seeing things is important. “Vision is an action process. It is active in the sense of guiding the center of the eye to various regions of a scene to make available to the brain the rich detail required for certain visual tasks. IT is also active in the sense that ongoing decisions must be made (though often not consciously) as to which object or event should be at the center of visual awareness at any given moment.”³⁰

In regard to classroom practice, Marzano has completed quite a bit of research on how to improve student learning in the classroom. His research categories on instructional techniques that non-linguistic representation .75 (average effect size) 20 (percentile gain). Based on the Dual Coding Theory of information storage: This theory suggests that knowledge is stored in two forms~ a linguistic form and a non-linguistic form. The linguistic form focuses on storing words and phrases. The non-linguistic form focuses on storing information using mental pictures, images, and physical sensations³¹. The more we use both linguistic and imagery forms, the better we can think about and recall knowledge since the classroom involves people telling students the information or they are hearing it from teachers or reading it in involved/complex textbooks at the secondary level.

Teaching Strategies

Students need to learn how to work together to accomplish goals – those set by the teacher and by themselves. This is a basic requirement for many positions or jobs that they will hold in the future. Working together, relying on each other helps to build team working skills. In collaborative learning, each group member is accountable to each other, dependent upon each other and contributes the established goals. Everyone has some strength to share.³² Together, more is accomplished. Opportunities to learn about each other before and while working help to promote the camaraderie and cohesiveness necessary to work well together. Individual and group evaluations are necessary to monitor the group's work (product) and their progress in teamwork.

Drawing

Since our school has no art course, my students very rarely have a time to express themselves using visual representations or drawings. Seminar Leader, Greg SheInutt stated that “Art is about vulnerability – a learned optimism in which there is a growth mind set.”³³ It allows for students to continually see their progress over time while sharing something personal with others. In doing so, students are better able to get to know each other as well. This is particularly important in my College Preparatory (CP) Psychology classes because there are three grade levels in the same classroom and most of them do not know each other that well. With the newer psychological research that is available – we know that drawing is not only a good outlet for students but it also “can be an effective learning strategy when it comes to learning with texts.”³⁴ I think that Seminar Fellow, Regina Mulvena’s statement, “The simplicity of something can have so much meaning”³⁵ resonated with me and my perception of visual representations – how they can be helpful to students no matter how small or irrelevant they may seem. Talent is not correlated with the effectiveness of a visual representation and memory. Starting off with a Daily Dairy (as written about later) will have students remembering this fact – no talent, no worries!

Mind Mapping

The website, Thinking Business, describes mind mapping as “the ultimate thinking tool used to stimulate you to think, learn and communicate more effectively and efficiently.”³⁶ A **mind map** is a graphical way to represent ideas and concepts. It is a visual thinking tool that helps

structuring information, helping you to better analyze, comprehend, synthesize, recall and generate new ideas.³⁷

There are many reasons for creating mind maps to include taking meeting notes, book summaries, studying, goal setting, problem-solving, and brainstorming amongst others.³⁸ In the classroom, I would like to use it for students to take notes. Miles states that it is helpful for taking notes during a lecture or reading a chapter and also for a summarizing activity to prepare for a test.³⁹ As someone who finds them difficult to use while taking notes, I see it more as a summarizing activity, in which students will be able to make the connections between the multitude of vocabulary words they must learn, memorize, and be able to apply to new situations.

There are many benefits of using mind maps. Since it is a visual representation, it is easy to see the most to least important points – sort of in a hierarchical position. Additionally, one can see the connections made between vocabulary words, concepts, and ideas. Since our brains interpret colors and shapes, it also helps one to better remember the information listed.⁴⁰

There are a few points to remember when one is drawing a mind map. First, one should start in the middle of the page using the main term/concept – e.g. PSYCHOLOGICAL DISORDERS. After that, each of the related subtopics should surround the main one. For my example, these could include schizophrenia, anxiety, personality, somatoform, and dissociative. The lines connecting these should be large to indicate the importance of the connections. From these, other smaller details of each subtopic would be included.⁴¹ For example, from anxiety one could have smaller lines ending with words such as Obsessive-Compulsive Disorder (OCD), generalized anxiety disorder, Post Traumatic Stress Disorder (PTSD), Panic Disorder, and social phobia. Remembering to use colors, drawings, and symbols, keeping topic labels to a minimum – using a word or two or even a visual.

Classroom Activities

Text Pairing/Short Story to Video – Hyperthymesia: Funes the Memorious Short Story to Real Life Case

The author, Jorge Luis Borges, has a short story about a man who falls off of a horse. Due to his fall, he is now able to remember everything. Although some people may believe this to be a gift, for Funes, it is actually a curse. This condition is actually known as Hyperthymesia. We will go from reading this text to viewing two 60 Minutes videos.⁴² This idea of remembering and forgetting is a good way to begin the unit. These two texts will be paired with students listing what they have done the day before – listing their activities of the day. In this way, they may look at/understand the idea that in reality most everyone does not remember everything. This will be a perfect introduction to the following activity.

Daily Diary

The Daily Diary will help students to ensure that they will be better apt to remember things if they write them down or even draw them! To introduce the process of remembering and drawing, a practice that we implemented in our seminar will be used. Coming from the book, *Syllabus*, Lynda Barry introduces a daily diary format including listing a number of things a person has done, seen, a quote that was heard as well as some type of drawing from the day⁴³. This quick and easy formatting enables students to write down their memories of the day within five minutes.

DID	SAW
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
Something I HEARD (a quote)	A Drawing from My Day ⁴⁴

According to our seminar leader, Greg Shelnutt, it also allows for students to – even more importantly – begin drawing in a non-judgmental space. I believe this to be important because I have seen how students are terrified of being wrong or having others critique their work. I will be certain to model this for them to ensure that they will not be afraid – or at least be less afraid – to share their own work. This activity will happen over a period of time with students sharing their entries as they enter the room with different partners over the course of a few weeks. Not only will they be lessening their fears of sharing with others, but they will be getting to know each other better. As there are three different grade levels in this course, most students are not very familiar with each other. We spend quite a bit of time trying to connect with one another at the beginning of the year, but this will continue to be helpful with breaking down barriers.

Textbook Reading/Mind Mapping

Not only is mind mapping a strategy in this unit, it is also an activity that I want students to be able to engage in on a continuous basis as it requires multiple modalities and will help students to better ensure that they remember the information.

Teacher/Student Resources

American Psychology Association (APA) High School Standards.

<https://www.apa.org/education/k12/national-standards>

These are the recommended standards for high school psychology courses to follow.

Barry, Lynda. *Syllabus: Notes from an Accidental Professor*. Montreal: Drawn & Quarterly, 2015.

This was one of the texts that was introduced in our seminar. The text provides a short daily diary framework which students can record things in a rapid pace while also allowing them to draw/doodle.

Borges, Jorge Luis. "PDF," June 1942

<http://vigeland.caltech.edu/ist4/lectures/funes%20borges.pdf>

This short story tells about Ireneo Funes who, after a fall from a horse, is able to remember EVERYTHING.

Brunetti, Ivan. *Cartooning: Philosophy and Practice*. Yale University Press, 2011.

General information about cartooning.

Dafoe, Taylor. "Drawing Helps Us Remember Details Better Than Writing or Taking Photos, a New Study Shows." *Artnet News*. January 08, 2019. Accessed May 12, 2019.

<https://news.artnet.com/art-world/study-finds-drawing-helps-memory-1433938>.

This article demonstrates the benefits of drawing versus writing to help one better remember.

"Drawing Is Better than Writing for Memory Retention." *ScienceDaily*. December 06, 2018.

Accessed May 12, 2019.

<https://www.sciencedaily.com/releases/2018/12/181206114724.htm>.

This article demonstrates the benefits of drawing versus writing to help one better remember.

Enns, James, T. *The Thinking Eye The Seeing Brain: Explorations in Visual Cognition*. New York: W.W. Norton & Company, 2004.

This book has numerous chapters explaining the process of seeing and interpreting what one sees.

Introduction to Mind Mapping The Thinking Business

www.thethinkingbusiness.com/mind-mapping/mind-mapping-intro (accessed May 13, 2009).

General information on what is a Mind Map and how to create one as well as why are they beneficial.

Handling, Steven. "The Drawing Effect :Litemind <https://litemind.com/what-is-mind-mapping/> accessed on October 9, 2019.

This article demonstrates the benefits of drawing versus writing to help one better remember.

Kantrowitz, Andrea. "The Man behind the Curtain: What Cognitive Science Reveals about Drawing." *Journal of Aesthetic Education*, Vol. 46, No. 1, Spring 2012 University of Illinois.

This article demonstrates the benefits of drawing versus writing to help one better remember.

Marzano, <http://yescharteracademy.org/wp-content/uploads/2018/02/Appendix-1D-Marzano-Instructional-Strategies-Report.pdf> (accessed on October 19, 2019).

Demonstrates data that supports the use of non-linguistic representation use in classroom instruction.

McCloud, Scott, and Mark Martin. *Understanding Comics: The Invisible Art*. New York, NY: William Morrow, HarperCollinsPublishers, 2018.

This book - in comic style format - explains the nuances of comics.

"Mental Maps and Cognitive Gaps." Psychology Today. Accessed May 12, 2019.

<https://www.psychologytoday.com/us/blog/shadow-boxing/201601/mental-maps-and-cognitive-gaps>.

Using mental maps for effective studying.

Myers, David, G., and C. Nathan DeWall. *Myers' Psychology for the AP Course*. New York, NY: BFW/Worth Publishers, 2018.

Classroom textbook.

Miles, Carven. *Mind Mapping: Comprehensive Beginners Guide to Learn Simple and Effective Methods in Mind Mapping*.

The benefits of using mind maps.

"Mind-Mapping." The Thinking Business. Accessed May 12, 2019.

<https://www.thethinkingbusiness.com/mind-mapping>.

The benefits of using mind maps.

NPR/Memory <https://www.npr.org/tags/158779944/memory>

Information on the process of memory.

Radio Lab Memory and Forgetting WNYC Studios

<https://www.wnycstudios.org/podcasts/radiolab/episodes/91569-memory-and-forgetting>

Information on the process of memory.

Terada, Youki. "The Science of Drawing and Memory." Edutopia. March 14, 2019. Accessed May 12, 2019. <https://www.edutopia.org/article/science-drawing-and-memory>.

The benefits of drawing and improving memory.

"The Drawing Effect: How Doodling Can Improve Your Thinking and Memory." The Emotion Machine. November 30, 2018. Accessed May 12, 2019.

<https://www.theemotionmachine.com/the-drawing-effect-how-doodling-can-improve-your-thinking-and-memory/>.

The benefits of drawing and improving your memory.

Meter, Peggy Van, Maja Aleksic, Ana Schwartz, and Joanna Garner. "Learner-Generated Drawing as a Strategy for Learning from Content Area Text." *Contemporary Educational Psychology* 31, no. 2 (2006): 142–66. <https://doi.org/10.1016/j.cedpsych.2005.04.001>.

Appendix

American Psychological Association's High School Psychology Standards. Students will understand the processes of encoding, storage, and the retrieval of information and that memory is a process that can be aided by employing a variety of activities (including creating illustrations).

Our district and state also support the Common Core Standards. This unit addresses **Integration of Knowledge and Ideas CCSS.ELA-Literacy.RH.11-12.7:** *Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.* Students will read and view a variety of texts and illustrations to analyze their own thinking, remembering, and forgetting processes and practice with the creation of visual representations to keep track of their own learning.

These understandings lead to Essential Questions that guide students throughout this unit within each of our sessions. These questions are those that students will investigate through their reading and visual representations creation. These will be paired up with the Learning Targets above. They include: What is memory and how is it measured?, What are the processes of encoding, storage, and the retrieval of information? And How do these relate to me/my learning?, What are the strategies for improving the encoding of memory? Which one (s) work best for me? and, lastly, How can I incorporate the creation of visuals into my note taking and why should I do this?

¹ Kantrowitz, Andrea. "The Man behind the Curtain: What Cognitive Science Reveals about Drawing." *Journal of Aesthetic Education*, Vol. 46, No. 1, Spring 2012 University of Illinois.

² https://www.brainyquote.com/quotes/marcus_tullius_cicero_156306 (accessed October 10, 2019).

³ <https://www.apa.org/education/k12/national-standards> (accessed May 3, 2019).

⁴ Myers AP textbook 326 – 364.

⁵ Ivan Brunetti (handout from seminar).

⁶ <https://www.mindmapping.com/>

⁷ Myers AP textbook, 326.

⁸ Ibid, 327.

⁹ Ibid, 237.

¹⁰ Ibid, 327.

¹¹ Ibid, 331.

¹² Ibid, 332.

¹³ Ibid, 333.

¹⁴ Ibid.

¹⁵ Ibid, 334.

¹⁶ Ibid, 340.

¹⁷ Ibid.

¹⁸ Ibid, 344.

¹⁹ Ibid.

²⁰ Ibid.

²¹ Ibid, 347.

²² Steven Handel The Drawing Effect: How Doodling Can Improve Your Thinking and Memory <https://www.theemotionmachine.com/the-drawing-effect-how-doodling-can-improve-your-thinking-and-mememory/> (accessed on May 13, 2019).

²³ Terada, Youki. "The Science of Drawing and Memory." Edutopia. March 14, 2019. Accessed May 12, 2019. <https://www.edutopia.org/article/science-drawing-and-memory>.

²⁴ Ibid

²⁵ Ibid

²⁶

Dafoe, Taylor. "Drawing Helps Us Remember Details Better Than Writing or Taking Photos, a New Study Shows." Artnet News. January 08, 2019. Accessed May 12, 2019. <https://news.artnet.com/art-world/study-finds-drawing-helps-memory-1433938>.

²⁷ Kantrowitz, Andrea. "The Man behind the Curtain: What Cognitive Science Reveals about Drawing." *Journal of Aesthetic Education*, Vol. 46, No. 1, Spring 2012 University of Illinois.

²⁸ Ibid.

²⁹ Ibid.

³⁰ Ennes, 2004.

³¹ Marzano <http://yescharteracademy.org/wp-content/uploads/2018/02/Appendix-1D-Marzano-Instructional-Strategies-Report.pdf>

³² <http://www.studygs.net> (accessed July 13, 2009).

³³ Greg Shelnutt, Seminar Leader – Seminar April 15, 2019.

³⁴ Matko, Narciss, Ropar, and Ainsworth

³⁵ Mulvena, Regina. DTI Fellow – Seminar – April 29, 2019.

³⁶ Introduction to Mind Mapping The Thinking Business www.thethinkingbusiness.com/mind-mapping/mind-mapping-intro (accessed May 13, 2009).

³⁷ Introduction to Mind Mapping The Thinking Business www.thethinkingbusiness.com/mind-mapping/mind-mapping-intro (accessed May 13, 2009).

³⁸ Carven Miles, *Mind Mapping: Comprehensive Beginners Guide to Learn Simple and Effective Methods in Mind Mapping*, 6.

³⁹ Ibid, 5.

⁴⁰ Ibid, 24.

⁴¹ Introduction to Mind Mapping The Thinking Business www.thethinkingbusiness.com/mind-mapping/mind-mapping-intro (accessed May 13, 2009).

⁴² <https://www.youtube.com/watch?v=2zTkBgHNsWM>,
<https://www.youtube.com/watch?v=en23bCvp-Fw>
(accessed November 13, 2019).

⁴³ Lynda Barry, *Syllabus*, 62.

⁴⁴ Ibid, 63. (adapted from)