Supplemental Materials
for
Metacognition Modules: A Scaffolded Series of Online Assignments Designed to Improve Students' Study Skills

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Appendix 1: Module assignments.

Module 1

Please watch the following two videos:
Beliefs That Make You Fail…Or Succeed
https://www.youtube.com/watch?v=RH95h36NChI&list=PL85708E6EA236E3DB&index=2
What Students Should Understand About How People Learn
https://www.youtube.com/watch?v=9O7y7XEC66M&index=3&list=PL85708E6EA236E3DB

Write a response after watching the videos, considering the following questions:
What are your beliefs about how you learn? What was your initial answer to the question, “What is the most important factor in successful learning?” and what was your reaction to Dr. Chew’s answer? Consider the study behaviors that Dr. Chew described – do you do any of these? Do you think you should change any of your study behaviors, based on what you have learned from these videos?

Module 2

Please watch the following video:
The Biology of Learning 1: The Sensory Brain and the Learning Cycle
https://vimeo.com/138256320/bf76575da3

After watching the video, write a response that addresses the following:
Consider what you learned in the video and think about how it relates to your personal experience. First, think of a situation where you learned something very well. Then, think of a situation where you thought you knew something well, but then found out you didn’t. Use your new knowledge of the learning cycle and sensory brain to explain each of those situations. What lessons can you apply that will help you succeed in this and other college courses?

Module 3

Please watch the following video:
The Biology of Learning 2: Neuroplasticity
https://vimeo.com/138256403/ca63c1e290

After watching the video, write your journal reflection addressing the following questions:
In your own words, describe what neuroplasticity is, and why you should know about it as a student. Consider your study habits – what behaviors are you doing that help you to develop useful neural connections? What additional behaviors could you incorporate to promote useful neural connections?

Module 4

Please watch the following video:
Memory and Learning
https://vimeo.com/138260658/c89584a33a

After watching the video, write your journal reflection addressing the following questions:
Describe how the information you learned from the first two videos is related to the information presented in this video, and how you might use all of this information to your advantage to become an expert thinker. Are there behavioral changes you can make to take advantage of what we know about the brain, memory, and learning?
Module 5

Please watch the following two videos:
Cognitive Principles for Optimizing Learning
https://www.youtube.com/watch?v=1xeHh5DnC1w&list=PL85708E6EA236E3DB&index=4
Putting Principles for Learning into Practice
https://www.youtube.com/watch?v=E9GrOxhYZdQ&list=PL85708E6EA236E3DB&index=5

After watching the video, write your journal reflection addressing the following questions:
What in-class and out-of-class behaviors can you personally do to promote elaboration, automaticity and overlearning? For each behavior, explain why it would work based on what you learned in the biology of learning and the memory videos.

Module 6

Module 6 does not have any videos!

Consider the following question as you prepare your journal response:
Over the course of the semester, you’ve had the opportunity to watch videos on learning from a variety of perspectives, and maybe were able to use some of the information to improve your own study behaviors. Whether you’re new to college, or new to Biology, starting a new course of study can be especially challenging. Please reflect on your abilities to handle the challenge of this course and other science courses you may be enrolled in. Have your study behaviors changed over the course of the semester? Whether yes or no, please explain why or how.
The following rubric was used for grading purposes. Students could earn up to 10 points per journal entry. The journals combined counted as 5% of the students’ final grade.

<table>
<thead>
<tr>
<th></th>
<th>Novice</th>
<th>Competent</th>
<th>Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question</strong></td>
<td>Entry doesn’t answer the question asked (1pt)</td>
<td>Entry answers the question superficially or doesn’t address question completely (2pts)</td>
<td>Entry thoroughly answers question asked. Entry conveys thought and reflection about the question topic (3pts)</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Entry appears to be train of thought, with no overall organization or conclusion (1pt)</td>
<td>Entry flows in a more challenged manner, with some sentences seeming out of place. Less of a sense of the journal entry leading to a conclusion (2pts)</td>
<td>Entry is clearly written, with good flow. Thoughts presented in logical order, and are leading towards a conclusion. (3pts)</td>
</tr>
<tr>
<td><strong>Follows Rules</strong></td>
<td>(n/a)</td>
<td>Did not submit in proper format, or cut and pasted entry into blackboard page. (0.5 pts)</td>
<td>Submitted in Word (.doc or .docx) or text (.rtf) format, as an attachment, as instructed. (1pt)</td>
</tr>
<tr>
<td><strong>Grammar</strong></td>
<td>There are more than 3 surface distractions. Student should take advantage of writing center assistance. (0 pts)</td>
<td>There are 2-3 surface distractions. (1pt)</td>
<td>There are none or only 1 surface distractions present (spelling, typos, grammar, punctuation, etc.) (2pts)</td>
</tr>
<tr>
<td><strong>Word Count</strong></td>
<td>The entry is less than 150 words (0pts)</td>
<td>The entry has between 150 and 250 words (0.5 pts)</td>
<td>The entry has at least 250 words (1pt)</td>
</tr>
</tbody>
</table>

It should be noted that students can gain points for ‘question,’ ‘organization,’ and ‘follows rules’ even when they turn in very poor reflections. In this case, we recognized that they did attempt the assignment, and are awarding minimal points for that fact. Students who did not turn anything in earned zeros.
## Appendix 3: Assessment rubric.

The following rubric was used for assessment of learning for each of the individual module goals.

<table>
<thead>
<tr>
<th>Module Learning Objective</th>
<th>Unacceptable</th>
<th>Needs Improvement</th>
<th>Approaching Competence</th>
<th>Acceptable Competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Did not identify beliefs about their learning</td>
<td>Incorrectly evaluated whether their belief undermines or facilitates their learning</td>
<td>Identified a belief about their learning without evaluating it, or evaluated several beliefs with varying accuracy</td>
<td>Correctly evaluated whether their belief undermines or facilitates their learning</td>
<td></td>
</tr>
<tr>
<td>1.2 Did not identify learning behaviors</td>
<td>Incorrectly evaluated whether their behavior undermines or facilitates their learning</td>
<td>Identified a learning behavior without evaluating it, or evaluated several behaviors with varying accuracy</td>
<td>Correctly evaluated whether their behavior undermines or facilitates their learning</td>
<td></td>
</tr>
<tr>
<td>2.1.1 Did not address the prompt to discuss something they learned well</td>
<td>Described something they learned well without including any information about how their behavior led to that outcome</td>
<td>Identified behavior(s) without explanation of how their behavior resulted in the learning outcome</td>
<td>Explained how own behaviors resulted in learning something well using the concepts from the video</td>
<td></td>
</tr>
<tr>
<td>2.1.2 Did not address the prompt to discuss a time they discovered having false confidence in their learning</td>
<td>Described something they thought they knew well without including any information about how their behavior led to false confidence</td>
<td>Identified behavior(s) without explanation of how their behavior led to false confidence in their learning</td>
<td>Explained how own behaviors led to false confidence in their learning using concepts from the video</td>
<td></td>
</tr>
<tr>
<td>2.2 Did not address the prompt to apply their understanding to a forthcoming academic learning situation</td>
<td>Rejected the idea of their behavior being connected to the learning cycle in the context of a forthcoming academic learning situation</td>
<td>Overgeneralized behaviors or overemphasized any aspect of the learning cycle without connecting their behaviors to particular learning tasks within the context of a forthcoming academic learning situation</td>
<td>Articulated their understanding of the connection between particular behaviors and learning tasks, within the context of a forthcoming academic learning situation</td>
<td></td>
</tr>
<tr>
<td>3.1 Did not address the prompt to discuss the relationship between learning and dendritic growth</td>
<td>Incorrectly described how the brain grows and changes (does not explain neuroplasticity correctly)</td>
<td>Described how the brain changes without connecting it to learning (partially describes neuroplasticity in their own words)</td>
<td>Described how learning results in physical changes in the brain (define brain plasticity in their own words)</td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>Did not address the prompt to discuss their own behaviors</td>
<td>Incorrectly described how their own behavior results in brain growth and change</td>
<td>Oversimplified neural plasticity or overgeneralized physiological processes without addressing how study behaviors promote neural connection</td>
<td>Described how their own behavior promotes neural connections in the brain</td>
</tr>
<tr>
<td>4.1.1</td>
<td>Did not reference any material from previous videos</td>
<td>Only included information from a single previous video</td>
<td>Incorporated some information from previous videos, but not all</td>
<td>Included information from all preceding videos</td>
</tr>
<tr>
<td>4.1.2</td>
<td>Did not connect video material memory creation and organization to previous video material</td>
<td>Incorrectly connected information about memory creation and organization to previous video material</td>
<td>Partially connected elements of memory creation and organization with material from previous videos</td>
<td>Connected (related) the video material about memory creation and organization to material from all previous videos</td>
</tr>
<tr>
<td>4.2</td>
<td>Did not discuss either making meaningful connections in information or making neural connections</td>
<td>Discussed either making meaningful connections in information, or making neural connections in the brain, but not how the two processes are linked</td>
<td>Partially described the connection between linked meaning and linked neurons, but excluded some necessary information</td>
<td>Fully explained how the connection of information in memory is the same as the process of connecting neurons in the brain</td>
</tr>
<tr>
<td>4.3</td>
<td>Did not identify behavior(s) that promote or undermine meaningful connections in memory</td>
<td>Incorrectly identified behavior(s) as promoting or undermining meaningful connections in memory</td>
<td>Provided a limited or simplistic description of behavior(s) that promote or undermine meaningful connection</td>
<td>Correctly identified behaviors as promoting or undermining meaningful connections in memory</td>
</tr>
<tr>
<td>5.1</td>
<td>Did not explain how behaviors promote elaboration</td>
<td>Incorrectly explained how behaviors promote elaboration</td>
<td>Partially explained how behaviors promote elaboration</td>
<td>Correctly explained how behaviors promote elaboration</td>
</tr>
<tr>
<td>5.2</td>
<td>Did not explain how behaviors promote automaticity</td>
<td>Incorrectly explained how behaviors promote automaticity</td>
<td>Partially explained how behaviors promote automaticity</td>
<td>Correctly explained how behaviors promote automaticity</td>
</tr>
<tr>
<td>5.3</td>
<td>Did not explain how behaviors promote overlearning</td>
<td>Incorrectly explained how behaviors promote overlearning</td>
<td>Partially explained how behaviors promote overlearning</td>
<td>Correctly explained how behaviors promote overlearning</td>
</tr>
<tr>
<td>6.1</td>
<td>Indicated belief that learning is outside of their control (demonstrate a fixed mindset)</td>
<td>Suggested that some aspects of learning are still outside of their control (demonstrate a partially fixed mindset)</td>
<td>Indicated an understanding that learning is an outcome of their own behavior</td>
<td>Indicated an understanding of how learning is an outcome of their own behavior</td>
</tr>
<tr>
<td>6.2</td>
<td>Did not discuss their own study behaviors</td>
<td>Described study behaviors without justifying them in the context of the impact of active strategic learning behaviors</td>
<td>Justified study behaviors based on a partial understanding of the impact of active strategic learning behaviors</td>
<td>Justified study behaviors based on their understanding of the impact of active strategic learning behaviors</td>
</tr>
</tbody>
</table>
Appendix 4: Interrater reliability data for randomly sampled journals read by both researchers.

<table>
<thead>
<tr>
<th>Rubric Criteria</th>
<th>N (Paired Observations)</th>
<th>Cohen’s Kappa (K)</th>
<th>Significance (p &lt; _)</th>
<th>Reliability Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>29</td>
<td>0.491</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>1.2</td>
<td>29</td>
<td>0.422</td>
<td>0.01</td>
<td>Moderate</td>
</tr>
<tr>
<td>2.1.1</td>
<td>32</td>
<td>0.423</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>2.1.2</td>
<td>32</td>
<td>0.493</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>2.2</td>
<td>32</td>
<td>0.574</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>3.1</td>
<td>21</td>
<td>0.276</td>
<td>0.10</td>
<td>Fair</td>
</tr>
<tr>
<td>3.2</td>
<td>21</td>
<td>0.479</td>
<td>0.01</td>
<td>Moderate</td>
</tr>
<tr>
<td>4.1.1</td>
<td>25</td>
<td>0.439</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>4.1.2</td>
<td>25</td>
<td>0.541</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>4.2</td>
<td>25</td>
<td>0.734</td>
<td>0.001</td>
<td>Substantial</td>
</tr>
<tr>
<td>4.3</td>
<td>25</td>
<td>0.639</td>
<td>0.001</td>
<td>Substantial</td>
</tr>
<tr>
<td>5.1</td>
<td>23</td>
<td>0.447</td>
<td>0.01</td>
<td>Moderate</td>
</tr>
<tr>
<td>5.2</td>
<td>23</td>
<td>0.626</td>
<td>0.001</td>
<td>Substantial</td>
</tr>
<tr>
<td>5.3</td>
<td>23</td>
<td>0.570</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>6.1</td>
<td>26</td>
<td>0.502</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>6.2</td>
<td>26</td>
<td>0.454</td>
<td>0.001</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Note: Cohen’s Kappa (K) was chosen to represent interrater reliability because the procedure met the criteria for this statistic; the data were nominal and in symmetrical crosstabulation, the two raters were fixed and completed paired observations, and ratings were independent of each other. Differences of two or more on any criteria from a student’s journal assignment were resolved through discussion. K can range from 0 (no agreement) to 1.0 (perfect agreement), and the significance value denotes the probability of the value of K truly differing from zero. Any probability less than a 5% chance (p < 0.05) represents a statistically significant difference.
Appendix 5: Sample student work, Journal assignments 1-6.

We have provided a range of examples of representative student work from each of the journal assignments. Each of these sample reflections is from a unique student. Comments about our assessment of the example are provided at the beginning of each module response.

Module 1, example 1

This student discusses learning styles as critical to learning. Despite robust research results that demonstrate that learning styles do not exist, many students are taught this in high school. As a result, they believe they are only able to learn in certain ways, and this can limit their learning. Because of their belief that learning style is outside of the student’s control, this thinking is associated with fixed mindsets.

Before watching this video I believed that I was more of an auditory learner than a visual learner from past experiences, particularly in middle school and high school. I believed this because I never really got anything out of reading from a textbook for example, but I would always understand it when a teacher explains the topic and gives clear examples. I would literally get nothing out of reading a passage, I would read it but I wouldn’t take in any information from the text itself. My initial answer to the question was, “learning in a way that matches your own learning style”, I’m actually quite skeptic about his answer I don’t really believe that what you think when studying matters I believe that if you understand the concept you’re good. I actually do two of the study behaviors that Dr. Chew described, “minimizing distractions; maximizing focus”, I’ve tried to watch television while doing homework I noticed that I wouldn’t get anything done so I just turn it off. “Developing accurate metacognition”, I tend to get uneasy and frustrated when I don’t fully understand something from class, I would go on to websites such as Khan Academy so that they’d explain it better.

I think I can change my studying behavior by having less distractions when doing work or studying in general, as Dr. Chew stated that having too many distractions such as a cellphone or a laptop may disrupt the learning process and it would take me longer to study without actually being efficient.

Module 1, example 2

Our second student is a typical student who likely has a strong identity as a successful student, despite admitting that they were successful in the past without having to work hard at learning. Without any metacognitive intervention, this is likely a student who would struggle with the transition to college. From the context of their entry, they are likely open to the intervention and learning about how to learn better.

High School didn't exactly challenge me. In fact, I wouldn't be surprised if I studied more in the past week than I did in my entire High School career. Grades came easy and the work could be done in a matter of minutes. Because of this I wasn't able to relate to anything Dr. Chew had to say. However, college quickly changed that. I now spend the majority of my time studying in some way or another. It is fairly new to me but i still found that Dr. Chew made some interesting points.

When he first proposed the question “What is the most important factor in successful learning?”, I originally thought that a drive to succeed must be present. The way I look at it, failure is not an option and that mentality has been helping me alot. I also use one of Dr. Chew’s techniques in that I set a goal and work till it is accomplished. If I keep a schedule, I can usually get what I need done day by day. This also has aided me in terms of procrastination because doing the work on a set schedule makes it a lot more manageable throughout the week.

My answer clearly differed from Dr. Chew’s but some aspects did tie into each other. I feel that success and knowledge go hand in hand. Therefore, in order to truly succeed I need to acquire knowledge along the way. Whether it be through careful reading or constant repetition, my job isn’t over until the information is understood. The only thing I would like to improve on that Dr. Chew mentioned is how consistently I get distracted. I need to learn to shut everything around me off and focus. This would allow me to get things done quicker and undoubtedly benefit me for years to come.
Module 1, example 3

Our third example for module 1 is a student that carries some misconceptions about learning, specifically the need to match their learning style and that mere quantity of time spent matters. The idea that quality of study is more important than quantity should be encouraged, as many of the subsequent assignment address quality of study behavior.

Before watching Dr. Chew’s videos, I was convinced that learning was based on how long you studied, and how well your study habits fit into your learning style. I thought these were the most important factors contributing to an individual’s academic success. After watching Dr. Chew’s videos, I now know that it is not necessarily how long you study, rather it is what you study, that helps with the learning process. What Dr. Chew means when he says that what you study is the most important, he is saying that how a student thinks about the information in front of them is the critical component to learning. If, as a way of studying, we focus on the definition of a concept rather than focusing on how the concept relates to other ideas within the subject material or in our surrounding world, we would not understand the information as well as we would if we used the latter method to study. Personally, I agree with Dr. Chew’s statements, the idea of focusing on the connections terms make with other aspects of subject material makes sense to me. Before watching Dr. Chew’s videos, I would say I was the person in the video who made notecards of definitions, and would spend hours memorizing those definitions. Now that I know that this is not the most effective use of my study time, I will definitely have to adjust my studying behaviors, and spend more time learning how concepts relate to both the rest of the class and the world around me.

Module 1, example 4

Our final module 1 example is another example of a fixed mindset combined with a belief in learning style. What is notable about this essay is the focus on rather superficial behaviors (distractions) in self-evaluation rather than on the desired behavior (what is being thought about.)

I believe that I learn best when there are hands-on activities because it fully engages my mind and it gives me something to relate the topic back to. I also enjoy lectures as long as they are not dull and monotone because it is helpful to hear someone else explain a topic, rather than just reading information. However, I personally think that people learn better depending on what type of learner they are because everyone’s brain responds to things differently. My initial answer to Dr. Chew’s question is that it is important to pay close attention to the material as you study. I assumed that in order to have a successful study session, you have to solely concentrate on the material that you’re studying. However, after watching these films, I learned that the most important thing about learning is to think about what you’re studying. If you are concentrating on outside distractions, you will not efficiently study and you won’t retain information very well. I’m not surprised by this outcome because it actually does make sense- if you are reading a textbook but thinking about soccer practice, you won’t remember anything you read because your brain is only comprehending what you’re thinking about (soccer practice, not the textbook). I am definitely guilty of various poor study habits. I devote a lot of my time to studying but I often get distracted from what I am working on, which makes my studying take even longer than anticipated. After watching these videos, I hope that I can change my habits in order to become a more efficient studier and a better learner.

Module 2, example 1

The student in this example probably understood the impact of the learning cycle on learning, and likely has some metacognitive awareness. However, they provided a hypothetical and generic situation rather than referencing a specific scenario from their prior experience. That is, they did not answer the question asked. They also did not address the prompt to describe a time when they thought they had learned something but discovered they had not.

Often, my thoughts can be scattered when I am learning—especially if I am forced to learn something that I am not entirely interested in. This short video explains how each part of the brain is responsible for each certain
reaction, both physical and mental. By using the analogy of the reactions between the brain and the presence of the pie, I am able to understand how not only one part of the brain works on a particular situation presented. Each section of the brain is dedicated to solving a certain problem or stimulus that is presented.

When I am completely interested in learning something, I am solely focused on the subject. Therefore, each section of my brain is responding to the stimuli present if there is a concrete knowledge initially presented. In reference to the videos from Journal #1, in order to fully learn or study something, the most important factor that can determine success for one’s memory is to be aware of what one is thinking about while trying to grasp new information. This scenario is explained in this journal’s video in a different context, but with the same main idea. If I am fully interested in a topic, I will remember the information longer because each part of my brain was engaged.

However, when I am not interested in a topic, my mind wanders and I am not able to completely focus on the information that is being presented. This situation is explained in the video because if my brain is not completely engaged in the initial concrete knowledge portion of learning, then the information will not successfully transfer throughout my brain, therefore leading to poor memory and unsuccessful learning.

After watching this video, I have learned that the base of learning is to have a concrete learning experience which would include a completely focused mind and a solid presentation of information through ways such as lectures or readings. Once the base is formed, the information will be processed through the brain in response to stimuli. I think that this video will help my learning habits in both this course and others because now I am aware of how complex the learning process is. Each part of the brain works hard to complete a task in order to produce an end product that can be both effective and efficient in the end. I will try to become a more focused learner so that I can retain information better and so that I can use my brain more effectively.

Module 2, example 2

_In this reflection, the student accurately described one cycle, but in their prior experience scenario, missed the fact that iteration of the cycle is necessary. They do, however, reference the need for repetition as necessary for learning in the last sentence._

From this video entitled “The Sensory Brain and the Learning Cycle”, I learned about how the human brain actually functions, interprets and acts on information it receives in the form of stimuli. Looking back on my personal experiences, a time when I learned something well was during an in-class lecture and discussion regarding a play my AP English class read in high school. I now realize that I learned about the play so well because I completed the Kolb’s Learning Cycle. I took in the concrete, sensory experience of hearing the lecture/discussion between myself and those around me and began reflectively observing the experience (connecting it to things I already knew so I could understand it). Then I began to synthesize and evaluate the information in my Frontal Cortex and develop my own ideas about the themes and inner-meanings of the play in order to begin active testing and discuss my abstractions with the students around me. I feel like I learned about the play very well and I could easily discuss major points about it now even though it has been two years. A time in which I thought I knew something well but in reality I really did not know it well actually occurred to me while I was taking a grammar test in a Spanish class. This is because I did not fully complete the Kolb’s Learning Cycle in my brain when learning a new tense in Spanish. I never completed the third stage in which I should have generated ideas about the tense itself. Instead I only focused on memorizing the spelling and stem-changing of the verb tense and I never fully learned when to use the tense. Now when I learn new tenses in Spanish class, I try to emphasize when to use the grammar and how to apply it in contextual sentences and I find I learn the information more efficiently.

In this same manner, I can apply the learning cycle when learning new concepts in this course and my other college courses. I only need to remember to effectively complete all four stages of the learning cycle: having a concrete experience, reflectively observing, synthesizing and evaluating, and active testing. And then, the cycle will begin again and I will be ready take in and learn even more information.

Module 2, example 3

_This student correctly identifies that learning takes place when new knowledge is connected to existing knowledge. However, they explain the inability to learn chemistry as being due to a lack of any chemical knowledge. This student has missed the idea that connections can be made to any prior knowledge, or even that the more personal the connection, the more powerful that connection may be._
The video relates to my learning experience because it elaborates on the learning process. When it comes to learning things very well, I always relate to biology because that is something that I learn very well. The video mentions how I receive information from the outside world and enters my sensory cortex, then my temporal cortex tries to relate the sensory input and associate it with whatever it is I am trying to learn. I learn things very well because I have the prior knowledge that is to be associated with it. In a situation where I thought I knew something but didn’t was in chemistry. I received the sensory input, but I had a hard time associating the material with my prior knowledge because I had none on that particular subject. I had no concrete experience with chemistry and as a result, had no idea what I was doing with things related to that topic. I also couldn’t synthesize any evaluations for the information that I didn’t know. In order to succeed in college, I will have to study more. This will increase the amount of prior knowledge I have. This will prove to be helpful so that when I learn something, I have prior knowledge to associate it with, making it easier for me to learn. It seems that the more you read and study, the more prior knowledge you will obtain, which will make it easier to increase the amount of information you can relate to and in chance, increase your learning abilities. This means that the key to succeeding in college is to read and increase your prior knowledge.

Module 3, example 1

This reflection hits all of the concepts and ideas we hope that students are taking away. The student is able to identify that behaviors that lead to repetition and connection are going to have the greatest impact on developing neural connections.

Neuroplasticity is the changing of synapses and neural pathways in the brain. At one time it was believed that the intelligence level of a person could not be changed, but it is now known that the opposite is true. The brain operates on a “use it or lose it” system. If knowledge is not used after it is learned, the shrinking of the unused cells while sleeping will result in that information being forgotten. Additionally, if the information is used, new neuron connections with extensive dendrite structures are made and the information will be stored safely and will be there when one goes to retrieve it.

Students should know about neuroplasticity because it will help them feel more confident when struggling with a subject. If everyone knew that they have the potential to learn better and their intelligence level is not fixed, they would be more apt to persevere through a tough assignment and not just think of themselves as stupid. Students would also have a better understanding of why active learning and studying is so important and why just looking over notes quickly before a test does not work. The connections need to be constantly used and not just looked at once or twice with the expectation of remembering everything.

Personally, I believe that my best habit that promotes the formation of new connections between neurons is doing examples of recently learned material. This forces me to not only make connections with the material, but also make connections with older material that the new material builds off of. I wish that I took the time to look over all of my notes from each class at the end of the day. This would allow me to see the material right before I go to sleep and make sure that information is protected and is not forgotten over night. I think it would also be useful to look at the notes from the previous day of a class before going into class on the current day. This would make all of the information come back and allow the brain to make connections back to the old material while learning new material.

Module 3, example 2

This student does not have a strong of a grasp of the process of neuroplasticity and dendritic connection, but has gained some knowledge from the video, most importantly that the brain can change as a result of their own behavior. The student does recognize the need to study every day, but also places a strong emphasis on the more superficial behaviors of sleep and exercise.

After watching the video I understand neuroplasticity to be the brains ability to grow and get larger as well as stronger. This ability is crucial for everyday life. It allows us to get smarter and have stronger brains. As a student it is important for me to know this for many reasons. First and foremost it is just pure motivation to learn. If more people knew that their brain could get larger literally swelling from information I believe that more people would study and actively try to learn, not just the night before a test. Next I think that it is very important to just have a general idea of how the brain works and what exactly is going on in the brain. I also believe that it is important to understand that if one doesn’t use their brain then they could lose function and strength. It wasn’t covered in the
video but I imagine that people who use their brain throughout life and constantly learn can avoid many issues when they are older like Alzheimer’s for instance.

Personally I do many things to promote brain function. For starters I workout everyday which was proven to be beneficial. Next I use my brain everyday for studying and learning new information. After class everyday I try to spend time in the library going over topics covered in class.

There are a few things that I could be doing to improve my mental performance. For starters I could definitely get more sleep. On average I get between seven and eight hours a night. The next thing I could do is to definitely get to the library every night, I try to do that but it doesn’t always happen. The topic covered in the video was fascinating and I truly think I learned a lot from the information.

Module 4, example 1

*This reflection hit all of the points we’re hoping students will understand.*

The main objective of the three part video series entitled “The Biology of Learning” is to teach and explain how the human brain actually learns. The series also analyzes how the brain takes in the information it receives to be stored. The first video primarily discusses how a stimulus enters the brain through the sensory cortex and is then interpreted to all the different sections of the brain through the Kolb’s Learning Cycle. The second video explains how the brain can actually grow in size the more it is exercised due to increased size of neuron cells. In finally, the third video addresses the more psychological side of learning in terms of encoding information, retrieving it when needed, and storing it in the brain’s schema.

The third video is related to the prior two in that it discusses the same processes of how information is learned, applied and stored but just through another method of study. Rather than the biological processes of learning, the third video looks at learning through a psychological lens and focuses in on the differences between implicit and explicit long-term memory. The most basic way to differentiate the two is to think of implicit memory as being non-declarative or difficult to describe in words. This includes procedural skills and reflexes. Explicit memory is more declarative and can be thought of as more general, basic knowledge. Personal memories can fit into the explicit category as well. Through all that was presented in the video series, we can better understand how to truly become an expert thinker. In summation, the videos say that a few things separate a novice and an expert thinker. Compared to a novice thinker, an expert thinker has practiced with the information much longer and has made more connections with the information to previous knowledge. Because they use it far more often, they have a better access to the information in their brain. With the help of these methods, anyone can become an expert thinker about a topic of their choosing.

Personally, I need to make some changes in my study habits in order to fully learn the information I am attempting to and file it away in a proper schema in my brain. To do this, I need to actively practice with the information long before an exam- not just the day before. While doing this, I should make sure I am reflectively observing the information I’m trying to learn and connect it to things I already know in order to understand it. I have also learned that practicing the information repeatedly is like lifting weights for my brain. I can increase the size of my brain by doing this, and also improve my memory function. Finally, by intentionally paying attention while taking in sensory information, I can avoid important material being accidentally discarded in the process of switching it from short-term to long-term memory. By completing all of these tasks, I will become more of an expert thinker in all aspects of my studying. I now know how my brain functions biologically and psychologically in order to keep practicing these habits throughout my life.

Module 4, example 2

*At first glance, it appears that this student has written a good reflection on the memory video, however there is limited connection to the previous two videos. The learning cycle is not explicitly mentioned, and there is only a single line about branching dendrites, which doesn’t convey confidence that the relationship between dendritic growth and memory is well understood.*

In the first two videos, I learned about how the brain works when it comes to studying, remembering, and retaining the information that I am being taught. The videos made me think about how I can improve my study habits, how I
can remember things in a more significant way, and how I can better myself as a student now. I learned that if I do not repeat, or think about what I have learned, it could be lost.

In this new video, I learned that you are always listening, you can never turn your ears off, like you can your eyes. You always have information coming into your brain, some however; we choose to ignore if it does not seem important to us. For us to store information, we must first pay attention, we must listen to what is being said to us, we must then think about what that means, really explore what we are being taught in order for it to enter into our brain. Next, in order to keep it there, we must understand what we have just stored; we must study it, talk about it, think about, and be able to retrieve it. In order to retrieve the information that is stored into our memory, we must fully understand what it is that we are trying to retrieve.

As we store information into our “long-term memory filing cabinet”, it is very organized and there are many different features that go along with retrieving that information. Some of those memories are reflexes and conditioning, these in which you do not have to think about in order to do, and in which usually make you relate two different feelings, objects, words, etc. Others in that long term memory are personal connections, you can remember something because it was on your birthday, or because something very important happened to you on that same day, you not only remember that day, but you can also relate it to other memories.

Truly understanding what you learn, and by the certain steps that we began with. With lots of repetition and practice, we can turn explicit memory into implicit memory. This can relate to school as well, the more that you study something or practice; the more likely it is to remain in your long term memory, and the more connections you can make. The better your understanding is for a subject, or for one topic, the more likely you will be able to relate that to another subject and another, branching out your neurons and dendrites, and allowing your brain to work more effectively when trying to retrieve information needed.

Module 5, example 1

_This student accurately addressed the prompt, and used information from previous videos to accentuate her understanding._

After watching these videos, I learned about how effective deep processing strategies are while learning and studying. Deep processing leads to connective learning, while shallow learning strategies such as just reading over notes or text does not make deep cognitive connections. Methods such as elaboration, distinctiveness, personal connections, and the retrieval and application of information are considered deep processing strategies. Through elaboration, you are able to make meaningful associations with what you are studying which will enhance memory because you will be able to understand academic facts through real-life connections. Also, through distinctiveness, you are making a clear contrast between what you are studying and other concepts which creates a deep are processing outcome because you will be able to differentiate between similar facts.

Through personal connections, you are able to study based on relating information to personal experiences so you can remember and recall the facts easily and more efficiently. Lastly, through the retrieval and application of information, you will study based on how you expect to use or apply concepts by closing your notes or textbook and recalling the information that you just went over.

In order to promote elaboration inside of class, I should take generalized notes and write down any examples that the professor may present. If there is time available in class, I could also write down small notes on an example that I thought of while listening to a lecture or presentation. To promote automaticity in class, I will get into a habit of active listening and notetaking in order to be a successful learner. Automaticity is the use of a process that is so highly practiced that it occurs without any conscious effort. In order to promote overlearning inside of the classroom, I can use automaticity in order to keep my brain engaged in the lessons being taught so that my brain is well exercised and will retain information better. Through overlearning, it will prevent forgetting material because you continue to study beyond the point of just knowing information so it can be recalled quickly and easily.

Outside of the classroom, I will refer to real-life examples relating to the concepts that I am studying in order to promote elaboration. I will also make my own notes and form my own questions about concepts that may be similar to each other in order to distinguish between them. Automaticity and overlearning go hand-in-hand together because if you go over notes and study efficiently enough, it will be a process that does not take any conscious effort and you will prevent forgetting concepts because you are always exposing yourself to the information.

Overall, elaboration will biologically work because it creates synapses and dendrite connections in the brain when making real-life connections to concepts. Automaticity will work biologically because it is exercising the muscles and connections in the brain because of repetition of studying and practicing recalling facts. Lastly, overlearning
will work biologically because the brain will have created enough dendrite connections that information will not be forgotten since the brain will have been well-trained and exercised.

**Module 5, example 2**

*This student also is able to clearly identify behaviors that lead to elaboration, automaticity and overlearning, however they do not connect the material on their own to the underlying biology. This reflection could be used in discussion to help make those connections.*

Elaboration is making meaningful associations between the concepts you study and other related topics. In other words, relating concepts that have many similarities helps memorizing the concepts more easily. When you make connections it helps you to remember information. An out-of-class behavior that I can practice to promote elaboration would be to take detailed notes on Acrobatic activities in order to relate it to the classwork I do in class. By taking notes on Acrobatic, it will help me to relate it to the class activities, which will make learning more efficient. I will learn the concepts from different perspectives and develop meaningful associations between the Acrobatic activities and the class works in class. An in class behavior that can promote elaboration is to do the activities in class careful and to take down notes of questions or activities I had trouble understanding. By taking notes of the activities in class will allow me to related it to my homework which allows me to not only do my homework well but to accumulate the information faster since I will be recalling the concepts I learned in class by doing my homework.

Automaticity is a process so highly practice that it occurs automatic. In other words, driving back home can come automatic to a person since they have done it so millions of times that the directions comes automatic to the driver and they don't need any help getting there. The more you retrieve memories the more permanent they become. An out-of-class behavior to promote automaticity would be to re-do an over and over again in order to memorize the answers until it comes naturally to me. An in class behavior would be to go over my answers in an activity many time in order to know the wrong answers of each question in order to avoid getting them wrong the next time. Overlearning is the process of continuing to study although the information is already comprehended. For example, if I start to study really hard for my biology final in the first week of October, by the time I take the final I would be able to recall the information easily. An out-of-class behavior that can promote overlearning would be to study my notes every time I have a break. By doing this not only would I be learning but I will be prepared to answer any exam question, since I'm not only studying to know the concept. A in class behavior would be to do certain activities or homework that I struggle to understand multiple times this way, I will be well acquainted.

**Module 6, example 1**

*This student has internalized the metacognitive lessons successfully.*

During my high school career I was given the opportunity to take IB courses. These courses were college level classes and were pretty difficult. Once I graduated and was awarded my diploma I was extremely motivated and confident for college. Once I got here and started my first semester it was a huge challenge for me to adjust, and I didn’t understand why. It wasn’t until this semester that I learned more about memory, and study habits that will help me that I understood the huge time crunch that comes with being in college as opposed to the spaced out year given for high school. I realized that my memory is flawed and that I need to rehearse the things I study until I have overlearned it to become a master of a certain topic. I am still adjusting to the changes in my study habits; however, I am noticing that in biology in particular, the study changes I have been doing have really improved the ease at which I write my mini essays. I still have been getting good grades like before; however, before I would have to use my notes to help my writing process. Now, on Mondays I don’t even open my notebook because I know the information off the top of my head. My biggest problem I have still is procrastination, but now that I have an understanding of why procrastination is so bad it has been easier to motivate myself to get the work done sooner rather than later.
Module 6, example 2

This student also likely has a strong understanding of the metacognitive concepts we have covered in the videos. They are capable of looking at their own behavior and rationalizing why the behavior may facilitate or undermine their own learning.

College is a huge change of pace. A new student needs to be focused, persistent, and hardworking in order to succeed. All of these things are done in attempt to thoroughly learn the material, although some ways of doing this are more effective than others. As a result of this Biology class, I have adopted a few new study habits to ensure that I succeed in a college setting.

As a Highschool student I spent very little time studying, but the shift to College forced me to take up such an awful pastime. Luckily, as I was making this change I also had the help of a number of educational videos that talked of the most efficient studying methods. Possibly the most important thing I took from these videos was how ineffective cramming is as a study method. Due to certain brain processes, information must be repeatedly looked over in order for it to become committed to one's long term memory. Cramming may allow you to squeak by the test but the information is not gonna be there for long afterwards. Another thing one of the videos talked about was the importance of sleep to brain development. It states that neural connections are formed during sleep so in order for one to sustain a healthy mind, they must rest it regularly. Although the latter may just be an excuse for me to sleep more, both of these things I learned have came in handy throughout my first semester in college. I hope to expand on these techniques and better my study habits over the next few years.

Module 6, example 3

This student wrote about how their studying strategies and behaviors changed over the course of the semester, but nothing in their description demonstrates an understanding of how the brain works and why those strategies may or may not facilitate learning. The student didn’t say anything wrong in the strictest sense, but what is there illustrates a shallow understanding of the metacognition principles the modules covered.

Over the course of the semester I have found that I spend a lot of my free time doing homework or studying. This is completely unlike high school where I was able to finish all my homework before even leaving school. In college, school is a lifestyle. If your are not in classes you are mostly doing work. It is such a massive change that you need to mold yourself around your classes. When I first started Bio 150 I was overwhelmed with the amount of work.

Any free moment I had I did homework. I didn’t procrastinate at all, and I was able to get assignments done way in advance so that if a big project came up I wasn’t going to be swamped with work. I would do homework or study while at the gym riding the stationary bike. or during breakfast and dinner. As the semester progressed, I spaced the work out more so I wouldn’t spend 5 hours on homework at a time. My sleep schedule got better so my brain functioned better when it came time to do work. I also exercised more which also helped with my long term memory. This helped me to retain more of the information given to me. There was less multitasking so the information I retained I understood more. I spent more time on one topic. So, over the semester my study habits changed from overloading myself to becoming healthier in mind and body. Overall, this helped with studying.