
Learning How to Learn
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Today we will…

- Concentrate on how we learn and how we can use that knowledge to help our students avoid frustration, procrastination and anxiety.

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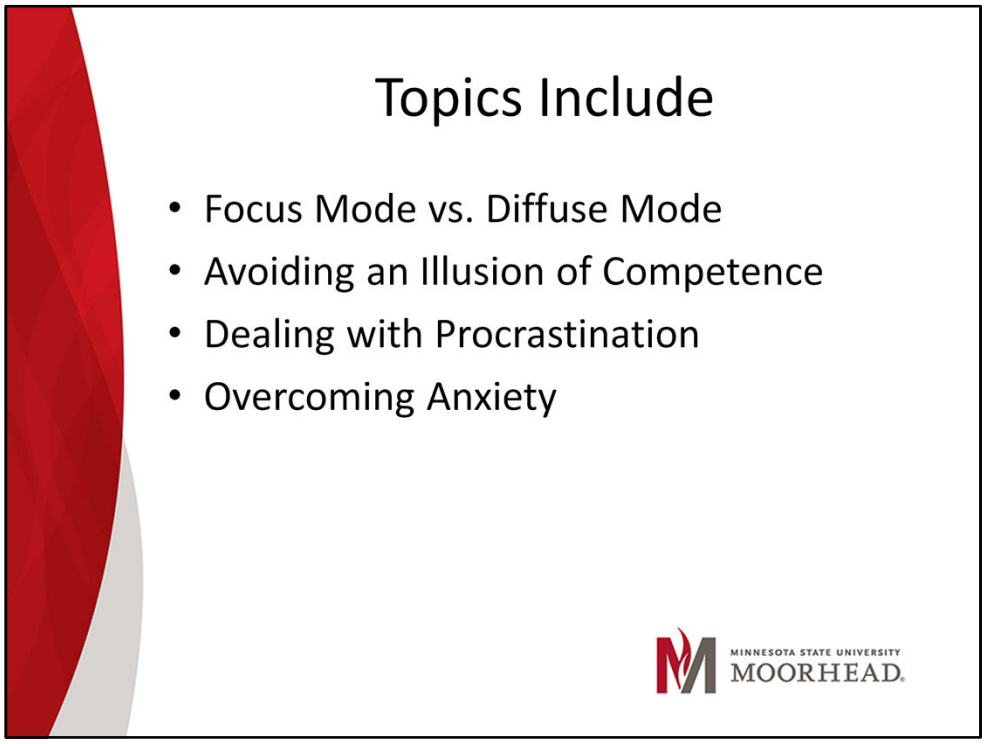
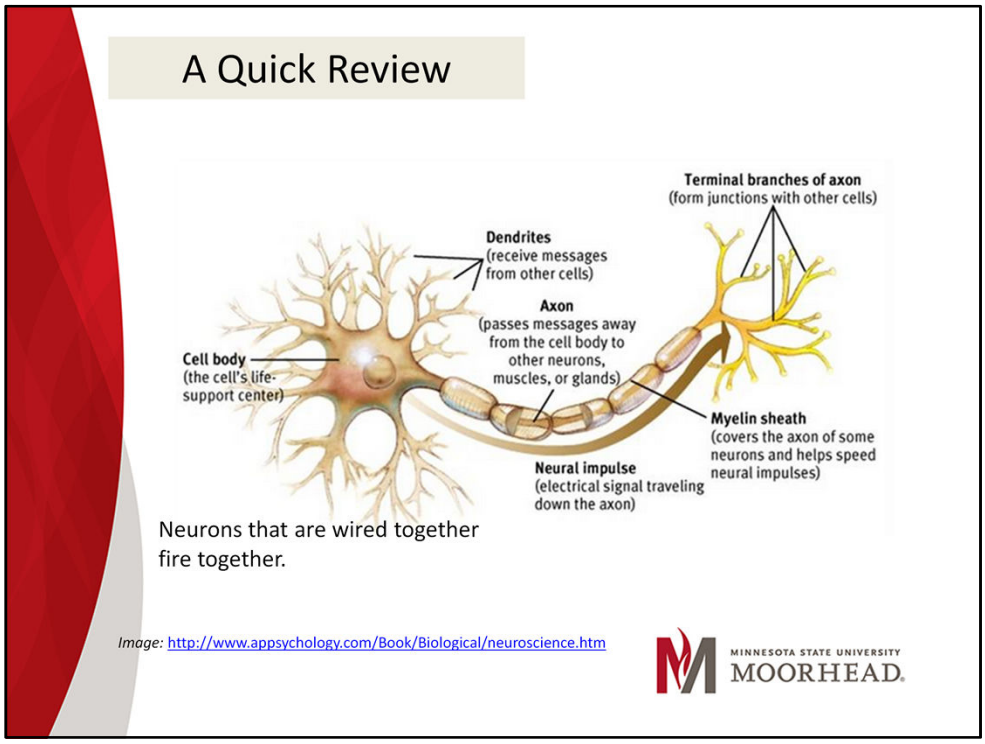


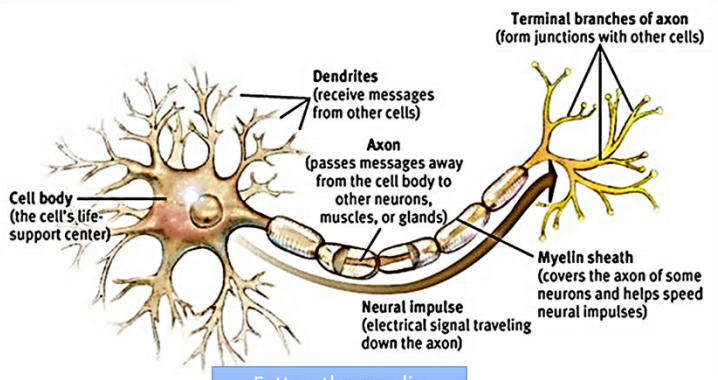
“developmental” vs. “remedial”



A neuron can transmit between 250 and 2500 impulses per second. Its possible to have up to one quadrillion (1 x 10^15) synaptic connections in one brain. So as we practice, … we trigger a pattern of electrical signals through our neurons. Over time, that triggers the glial cell duo to myelinate those axons, increasing the speed and strength of the signal. **Like going from dial-up to broadband**.
http://blog.bufferapp.com/why-practice-actually-makes-perfect-how-to-rewire-your-brain-for-better-performance

Build dendrites.

Neurons that wire together fire together.



Fatten the myelin sheath.

Image: http://www.appsychology.com/Book/Biological/neuroscience.htm

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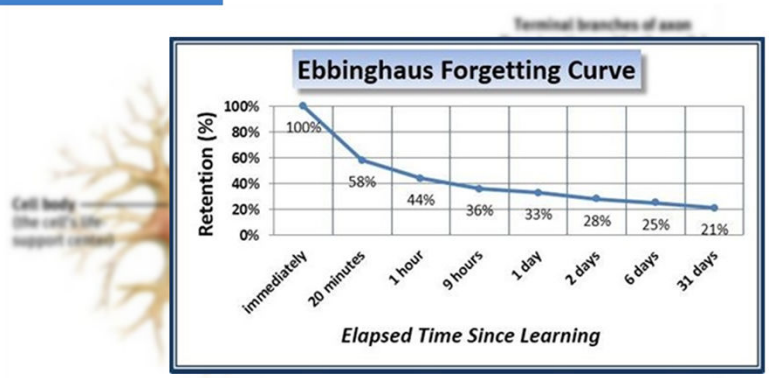
Use it or lose it.



https://www.trainingindustry.com/wiki/entries/forgetting-curve.aspx

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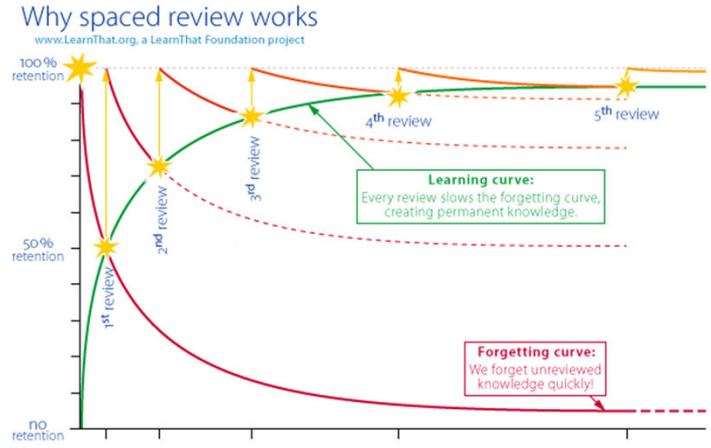
Did it 35 years ago…Saxon text
The spacing effect was first described by Hermann Ebbinghaus in 1885.

"AAABBBCCC" vs. "ABCABCABC"
"Making it Stick"

Block practice allows a student to get into a groove and get a false sense that they understand it.
Saxon has used interleaving for years.

Interleaving



http://thinkedu.net/blog/the-forgetting-curve-interleaving-vs-blocking/

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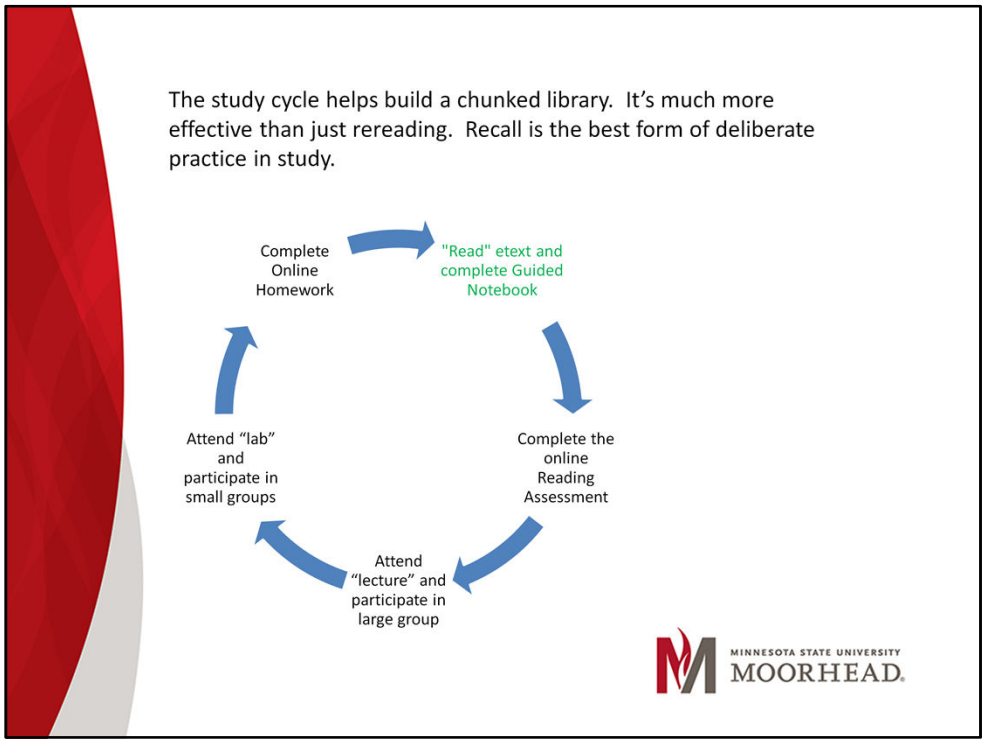

The study cycle may be familiar to many, but why does it work? How does each step of the study cycle figure in to the learning process and what it happening in the brain?

Truly great teachers make the material seem both simple and profound, set up mechanisms for students to learn from each other, and inspire students to learn on their own. Learning on your own is one of the deepest, most effective ways to approach learning. Persistence is often more important than intelligence. (Oakley, 2014)

Two Modes of Thinking Process

1. Focus Mode: highly attentive state

2. Diffuse Mode: resting state

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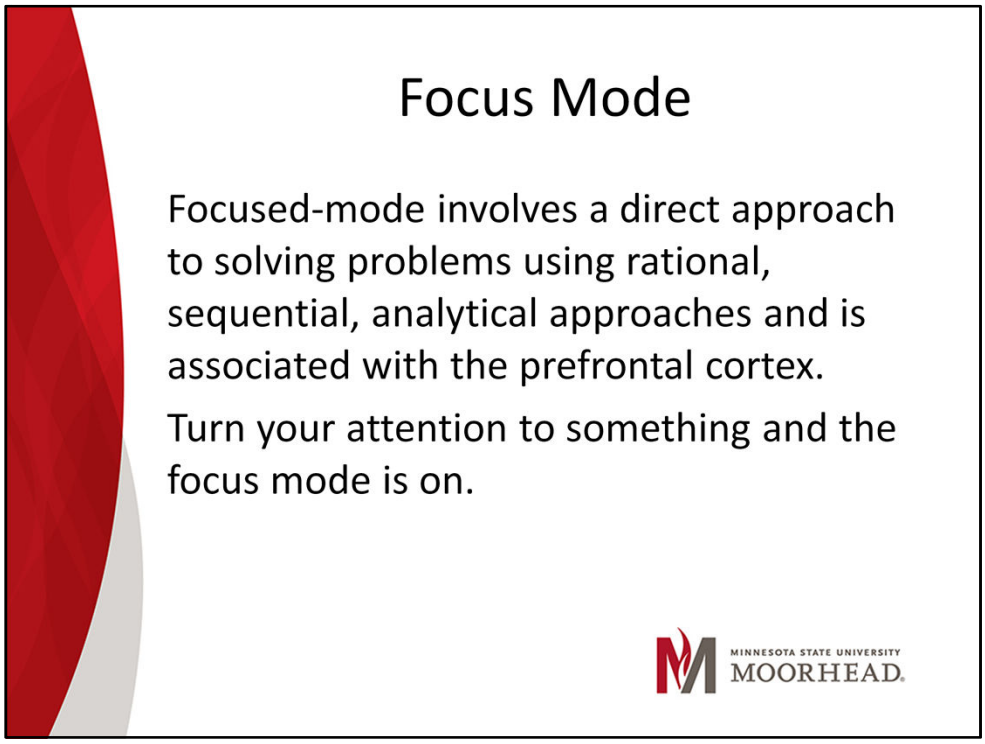
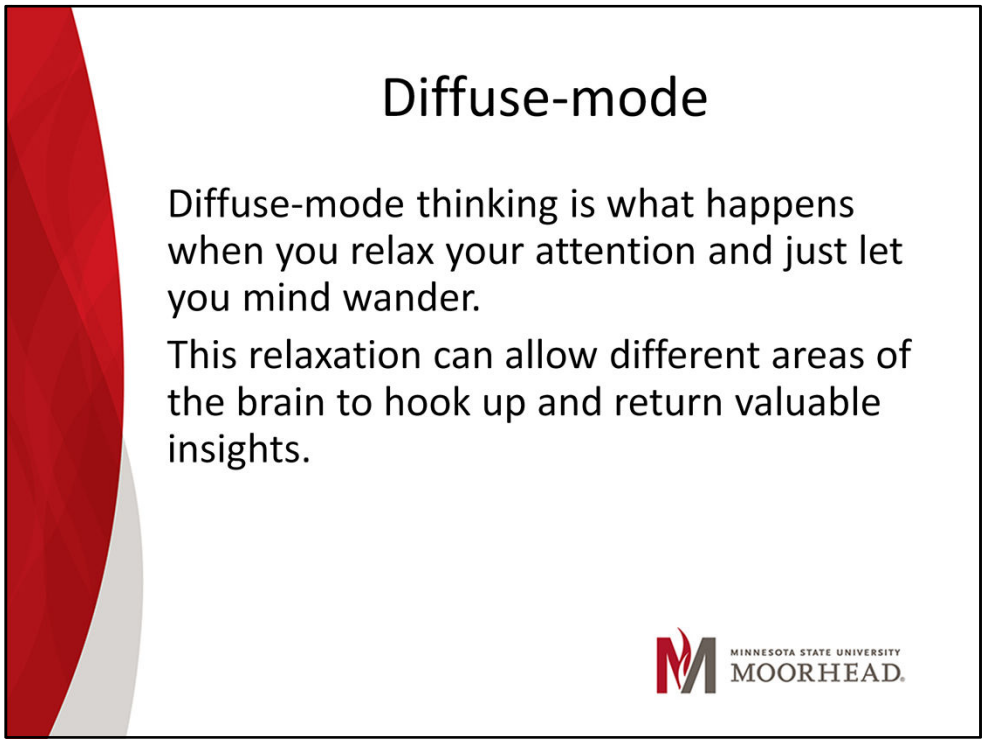
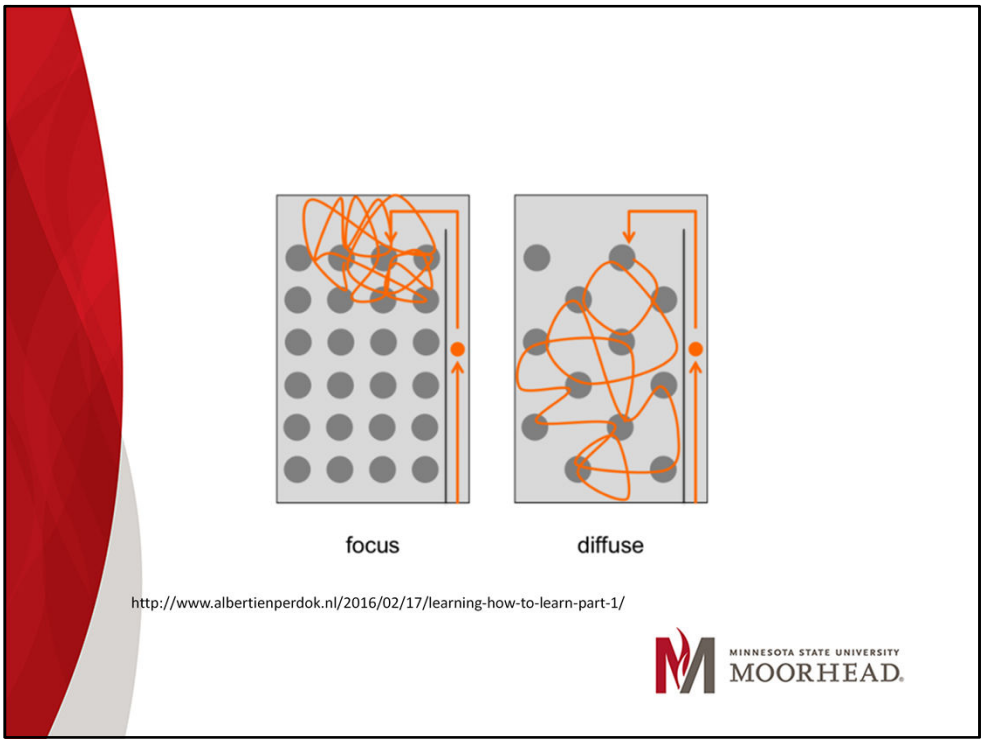


Although focused mode is a required and important element of first learning the material, being in focused mode too long can detract from learning. When staying in focused mode too long—such as when they are stuck on a math problem—this becomes more problematic than helpful. By intensely focusing on the problem for too long, we experience tunnel vision, and lose our ability to think outside-the-box in order to solve a problem.

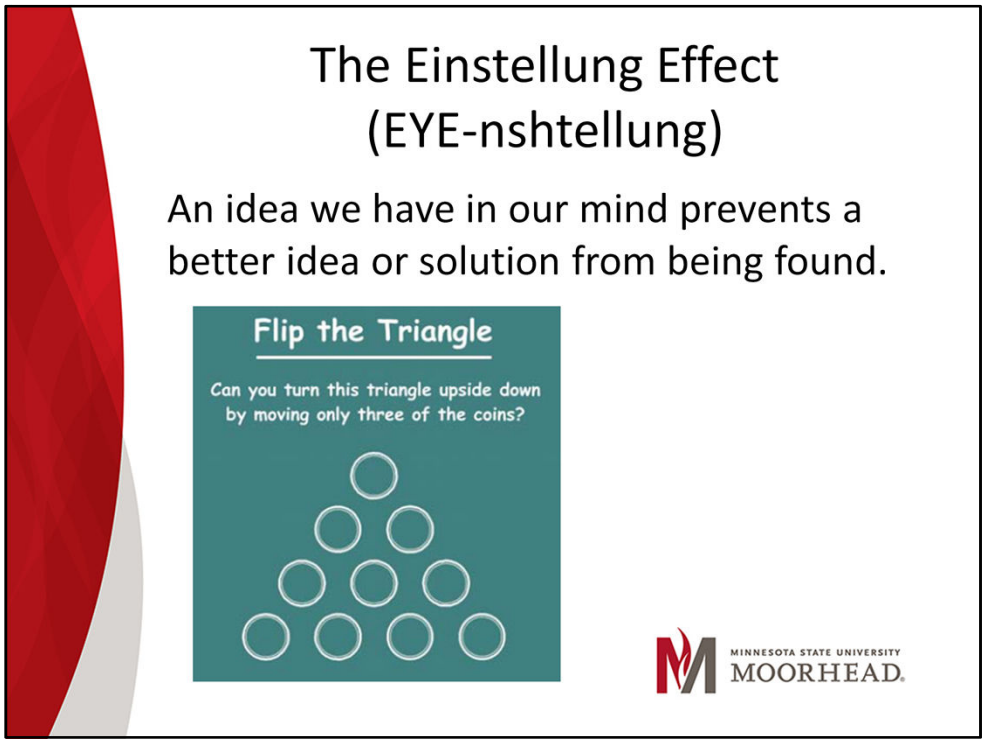


The diffuse mode cannot just be commanded to turn on. (Oakley, 2014)



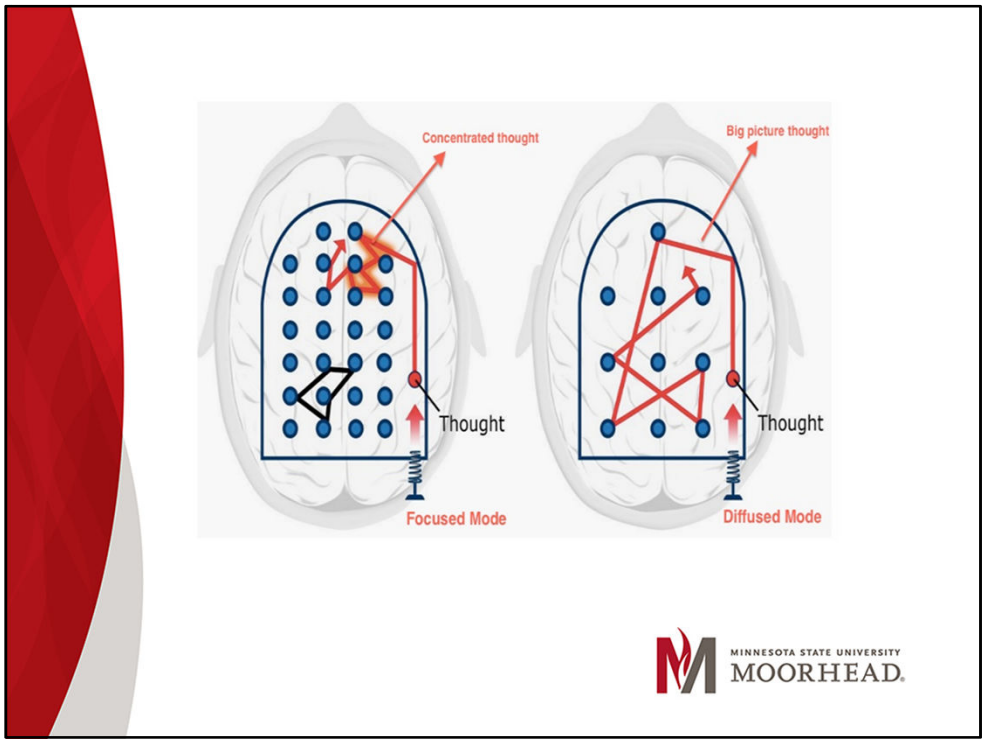
Alternating between focused and diffuse thinking is the best way to master a subject or solve a difficult problem. First, we use the focused mode of thinking to understand the basics of a topic without any distractions. Then we use the diffuse mode to passively internalize what we have learned and make connections to other things we already knew. Afterwards, we go back into focused mode and pare down the connections that we made to the best, most helpful ones.

Focus mode can be compared to a tightly focused beam on a flashlight versus a wide beam which represent the diffuse mode.



By focusing on a problem too long, we begin to work within an arbitrary set of parameters and assumptions/premises. However, it could be that the set of parameters we arbitrarily set is not the correct or be the best way to solve a problem. Thus staying in focused mode too long can be detrimental to learning. So the next time you are stuck on a problem, take a little break, let your mind go into diffused mode, and start again with a clean slate in focused mode.

Thiss sentence contains threee errors.



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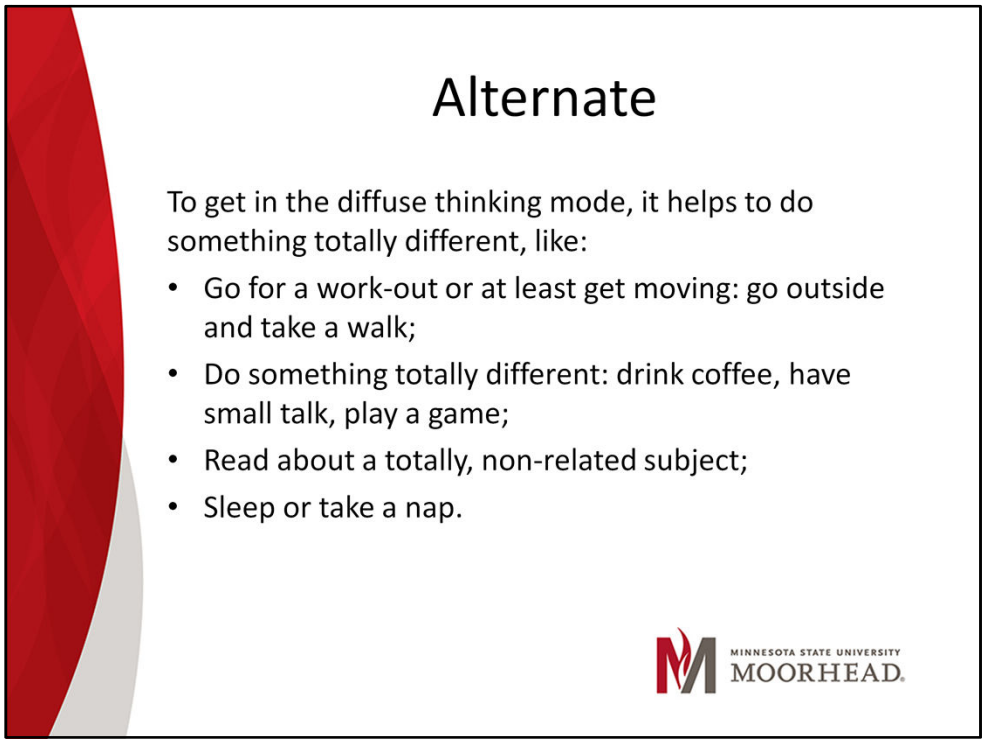
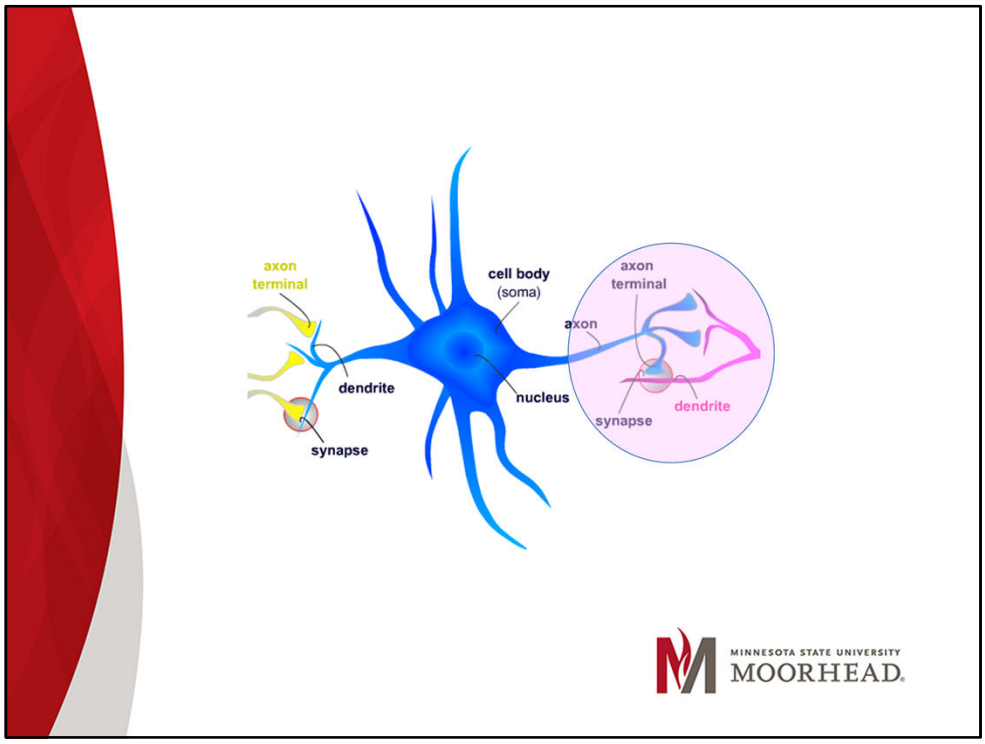


Unfortunately, you can't use both simultaneously, but you want to be able to switch between the two. (Parker, 2015)

Both are equally important. Stopping work for 10 minutes while you read a funny story or play a game online can give your brain enough respite to switch into diffused mode and start churning away.

Painter Salvador Dali, like Thomas Edison, used a nap and the clatter of an object falling form his hand to tap into his diffuse-mode creative perspectives.


axon terminal
cell body (soma)
axon terminal
axon
dendrite
nucleus
synapse
dendrite
synapse
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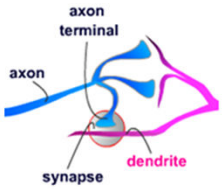
Neurotransmitters are chemical substances that transfer signals.

Gap (synapse) between axon and dendrite.



Neurotransmitters can become depleted. Need time to restore.

Some chemicals help, some hinder transfer of signals.

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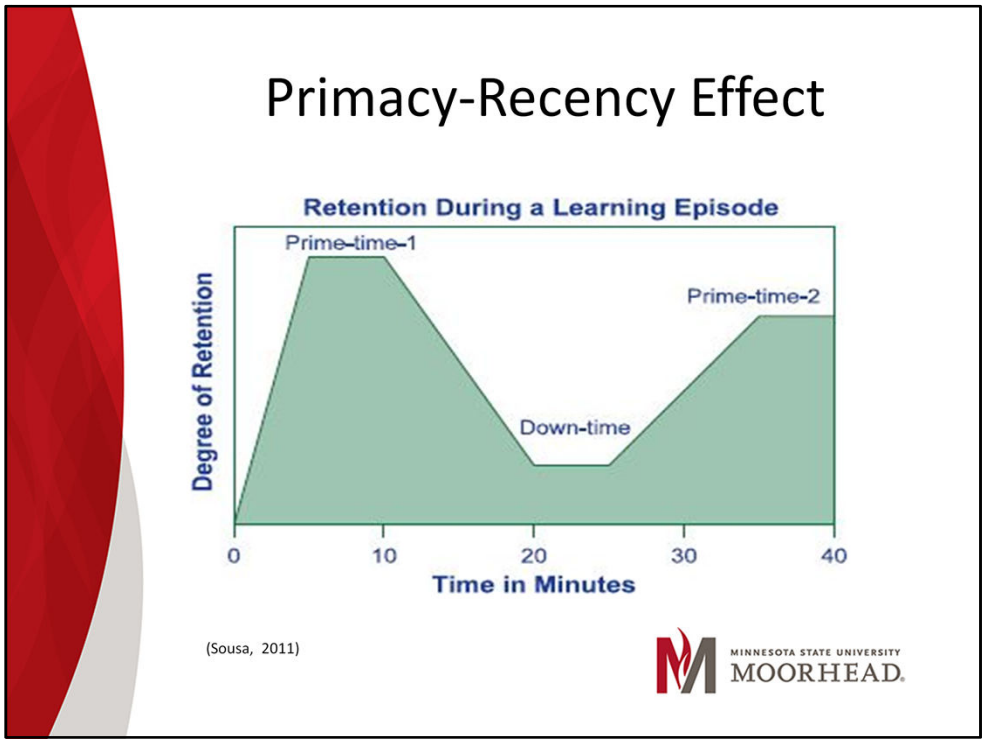
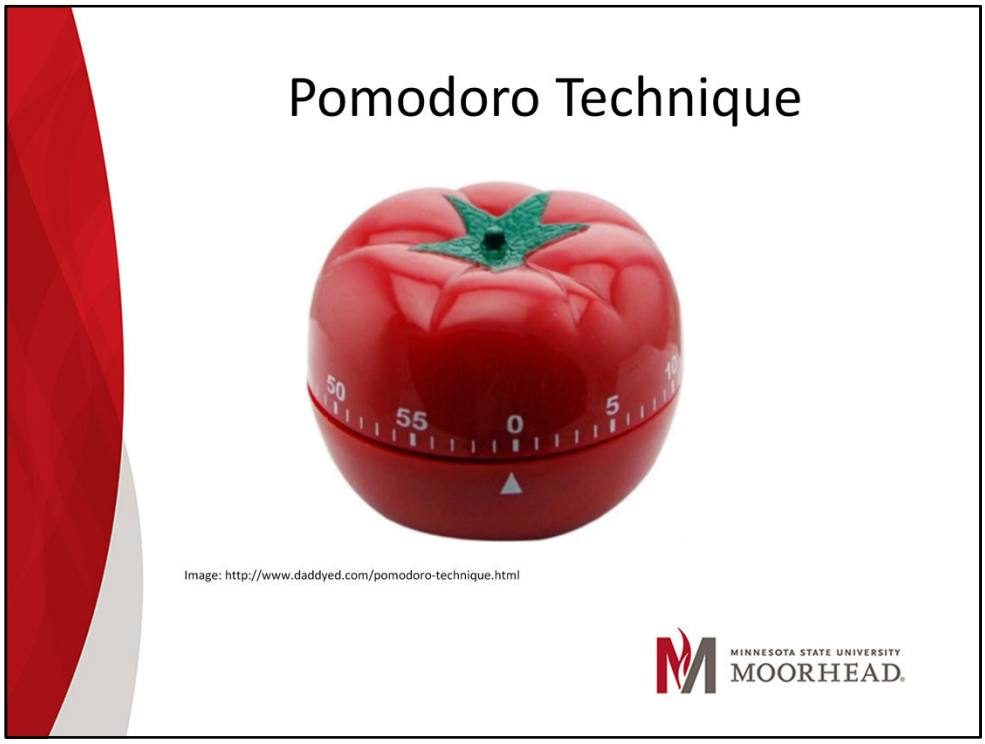


We remember best that which comes first, second best that which comes last, and least that which comes just past the middle. The first items are within the working memories capacity. As the learning episode concludes, items in the working memory are sorted or chunked to allow for additional processing of the arriving final items.



The “Pomodoro” (means tomato – named after a timer shaped as a tomato) is a technique that’s been developed by Francesco Chirillo to help you focus your attention over a short period of time.
Go a place that you can concentrate.
Set a timer for 25 minutes.
The stress of being under a timer has been found to be helpful. Learning under mild stress can help you learn to handle stress more easily.
Completely focus on task for 25 minutes with no distractions. Train yourself to ignore distractions.
When done. Take a break. Break time depends on the deadline that you are under.
Concentrates on process (the way you spend your time) vs. product (what you want to accomplish).
Allows you to go from focus to diffuse-mode.

ONE POMODORO CYCLE

Image: http://alifeofproductivity.com/pomodoro/

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Pomodoro Technique

- turn off your phone and any sounds or sights that might signal an interruption.
  - If you get distracted you're going to have difficulty making a chunk. When you are first learning something, you are making new neural patterns and connecting them with preexisting patterns that are spread through many areas of your brain.

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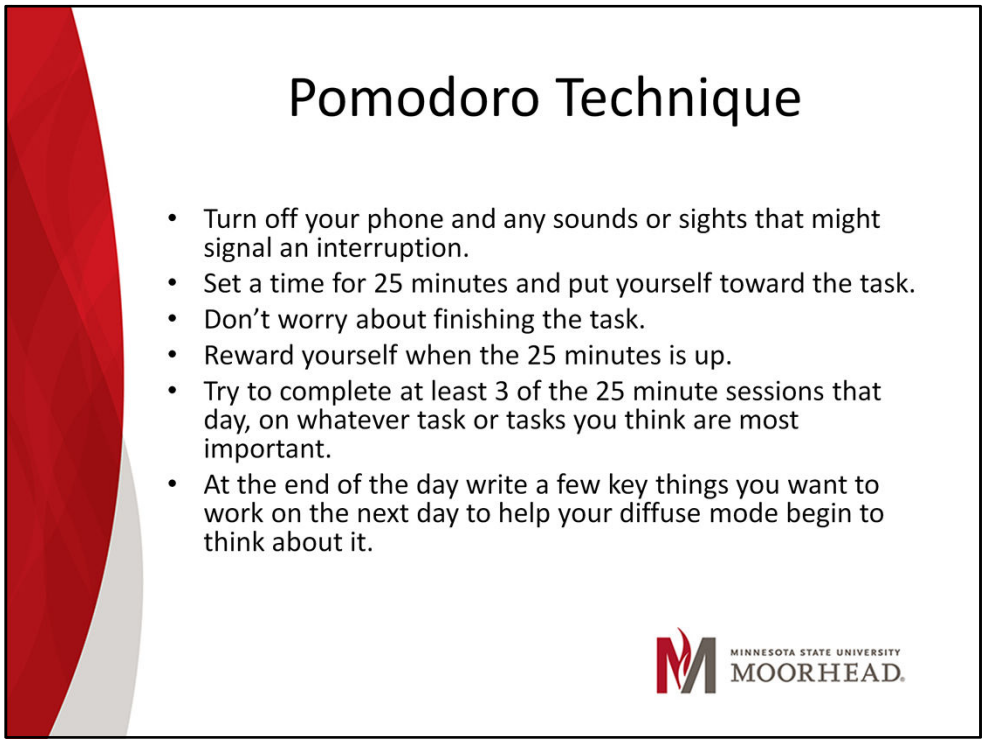
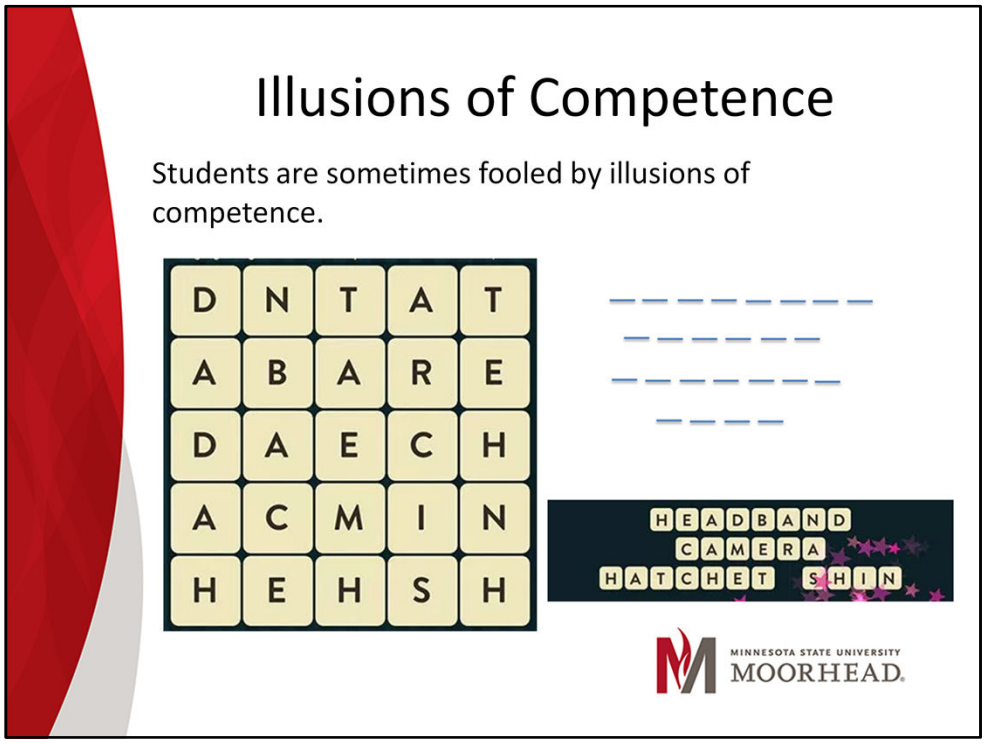
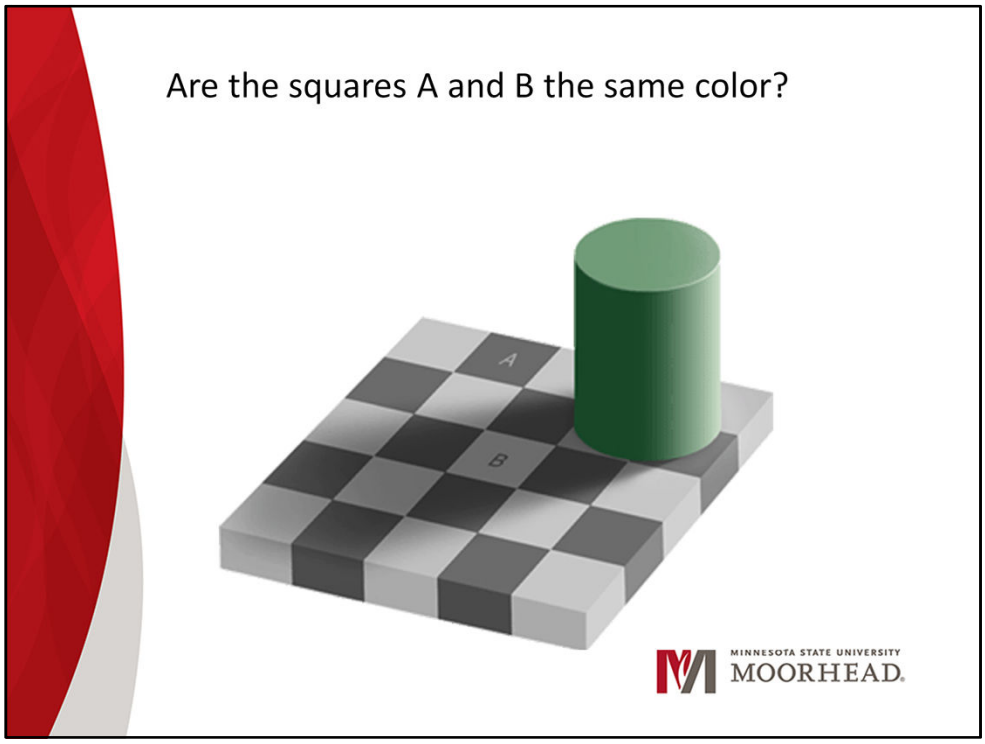


Get a glimpse of what you are learning before returning later to more fully understand it.
Take a "picture walk" through the section glancing at the section headings, graphics, diagrams and photos, summary and even questions at the end of the sections. This helps prime your mental pump.
Look through a section (chapter) quickly and then more step-by-step.
Guided notebook



Misplaced self-confidence in one's abilities can sometimes reach almost delusional levels. When a student whizzes through a homework or test problem and doesn't go back to check their work, they are acting a little like a person who is refusing to use parts of their brain.

Turned off some teaching aids in MyMathLab.



An optical illusion is the difference between reality and what the brain thinks it's seeing. The information gathered by the eye is processed in the brain to give an image that does not agree with a physical measurement of the source. There are three main types: literal optical illusions that create images that are different from the objects that make them, physiological ones that are the effects on the eyes and brain of excessive stimulation of a specific type (brightness, tilt, color, movement), and cognitive illusions where the eye and brain make unconscious inferences. https://www.brainbashers.com/showillusion.asp?62

Illusions of Competence

Students are sometimes fooled by illusions of competence.

Students often erroneously believe that they are learning by simple rereading material that is on the page. They have an illusion of competence because the solution is already there.

Or they get stuck on a problem so look up the solution and then "oh yeah, that makes sense", but they didn't actually come up with the solution themselves.

Students need to be able to explain their understanding or question someone.

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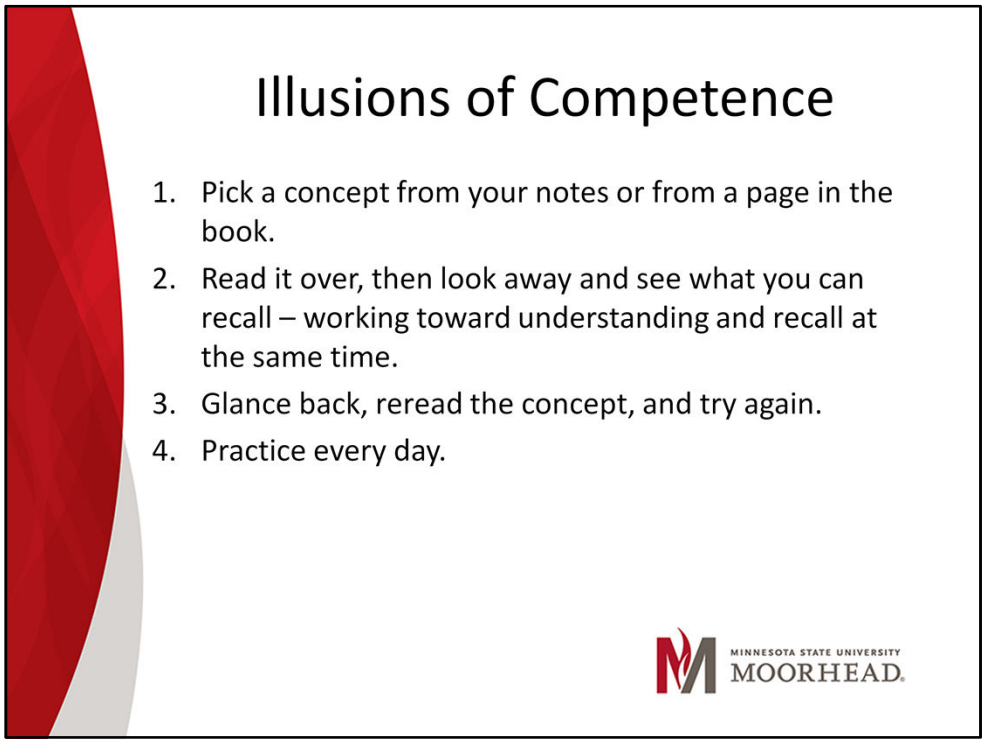
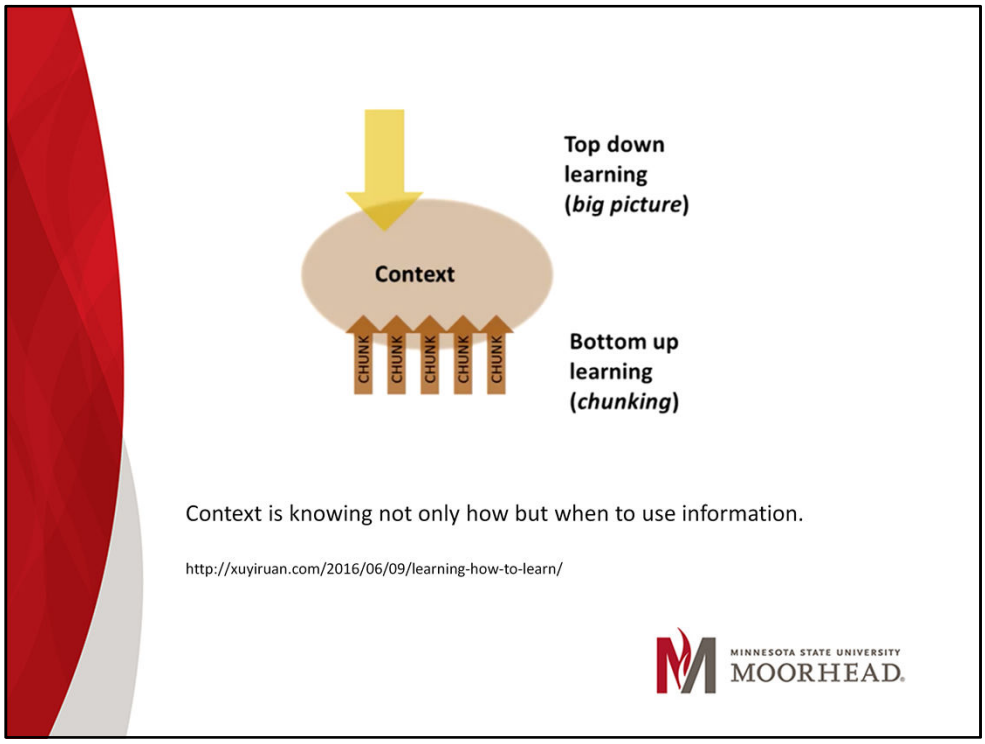


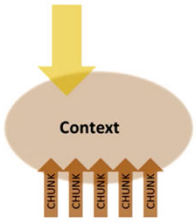
Guided notebook.



Bottom up Learning: a chunking process helps you to build up neural connections through **practice** and **repetition**
Top down Learning: allows you to see what you're learning and where it fits in.

Have students reflect on what they are thinking, metacognition

Practice, practice, practice. You are training your brain to recognize not only a specific problem, but different types and classes of problems.



Add.

$$\frac{x+3}{x^2+2x-3}+\frac{2x-3}{x^2-3x}$$

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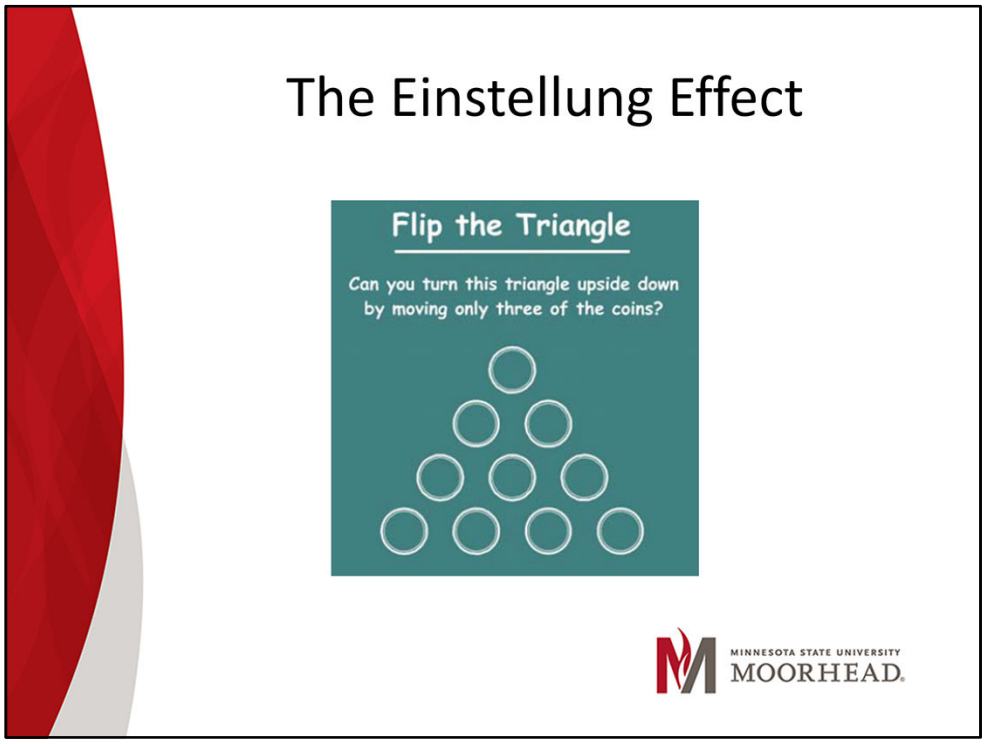
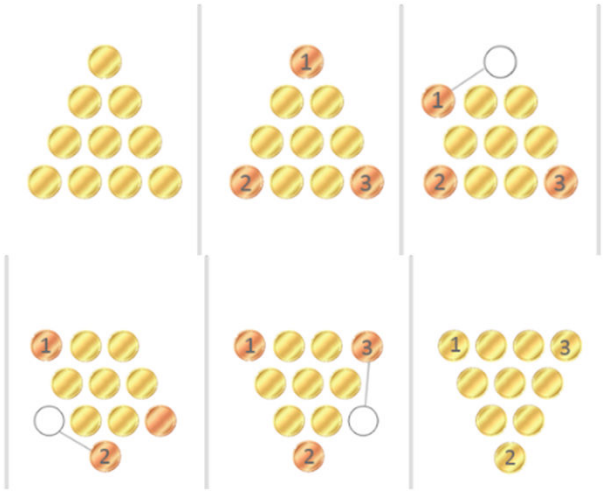


The Einstellung Effect
(EYE-nshtellung)

Can you turn the triangle upside down by moving just three coins?



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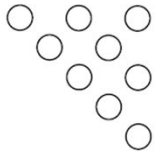
What is the minimum number of coins you can move to change this triangle into a square?



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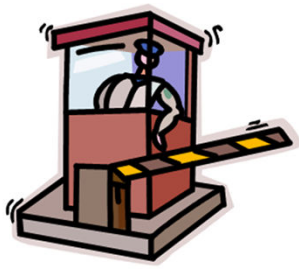
Amygdala

- Sensory receptor areas of the brain must travel through the amygdala to get to the prefrontal cortex.
- When the amygdala is in a state of stress, new information coming through the sensory intake areas of the brain cannot pass through the amygdala to gain access to the memory circuits.



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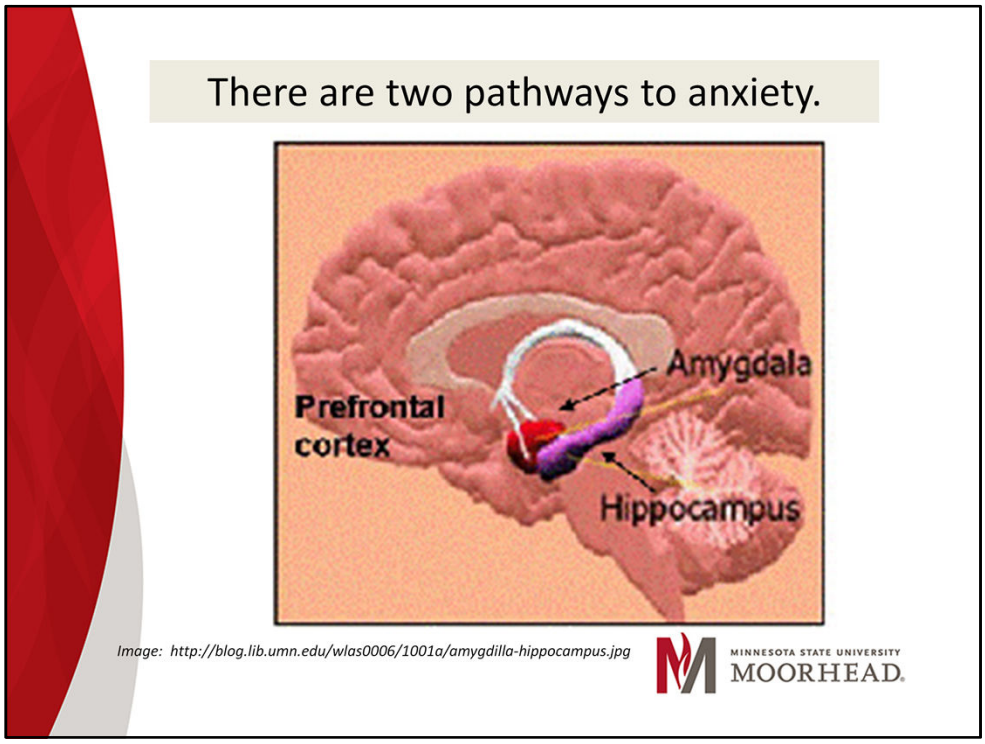
Subsequent research revealed that after presentation of pleasurable, comforting, positively reinforcing, intrinsically motivating stimuli, the amygdala could be moderately stimulated or warmed up to the alert state that actually facilitates active processing and neuronal transport of information. (Willis, 2006)

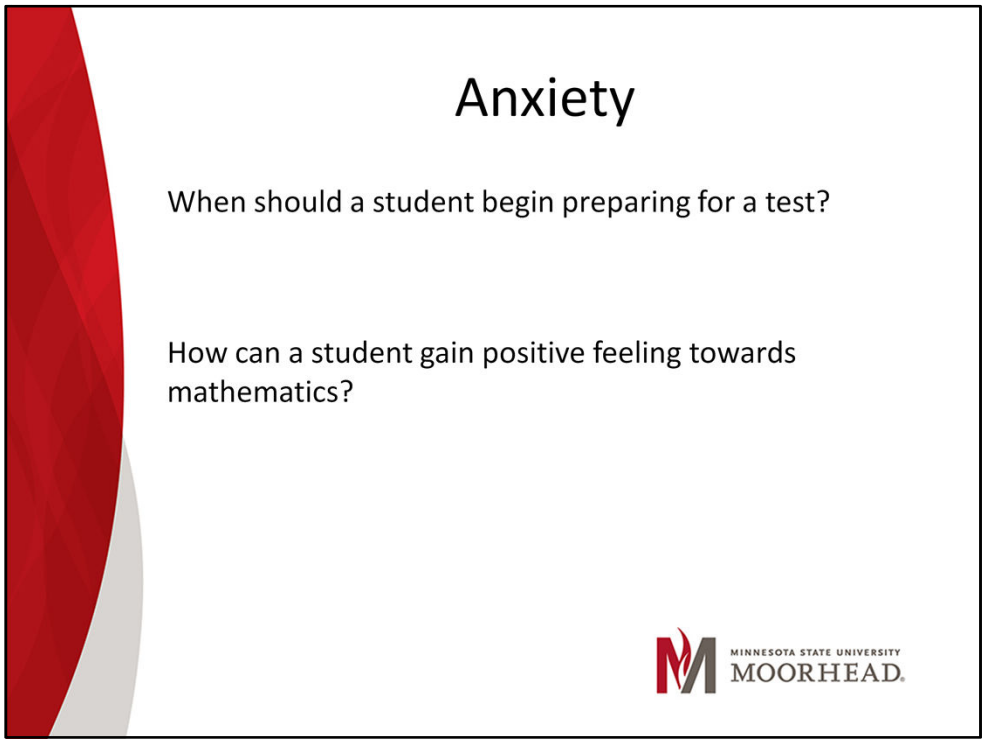
Amygdala hijacking – negative feelings cause the hormone cortisol to enter the bloodstream. Cortisol puts the brain into survival mode; this shifts the brain's attention away from learning so it can deal with the source of stress… Stress in the classroom or elsewhere, especially when associated with anxiety or fear, releases a chemical called TMT, or trimethyltin, into the brain. TMT disrupts brains cell development. In the

hippocampus region, through which data must pass to be encoded as memory, stress-related release of TMT – both acute and chronic – suppresses the growth of dendrites and maintenance of neuron health.
When students feel positive about a learning situation, chemicals called endorphins (provide feeling of euphoria) and dopamine (stimulates the prefrontal cortex) become active.
A stress state happens when a lesson is tedious, not relevant to their lives, confusing, or anxiety-provoking.



When we speak of the cortex pathway to anxiety, we're focused on interpretations, images, and worries that the cortex creates, or on anticipatory thought that create anxiety when no danger is present. The information passes through the amygdala, allowing your amygdala to react before your cortex can think. The amygdala forms and recalls emotional memories. The amygdala initiates the physical experience of anxiety. We have little control over the amygdala's rapid responses means that we experience our fear and anxiety responses, rather than consciously controlling them. (Pittman & Karle, 2015)

There's actually two amygdala but the reference is often singular.



Pin: "Testing is not teaching" but I believe testing is learning and isn't helping someone learn, teaching?

In education, **teaching** is the concerted sharing of knowledge and experience, which is usually organized within a discipline and, more generally, the provision of stimulus to the psychological and intellectual growth of a person by another person or artifact.

Anxiety

When stressed, we begin to lose the ability to connect pertinent ideas that is so innate to focused mode.

A little bit of stress allows us to perform at our peak, but too much stress inhibits our ability to think clearly.

This is why the brain doesn't work quite right when we are angry or afraid.

Thus, the idea of taking a break when frustrated is grounded in factual evidence. (Examined Existence, 2015)

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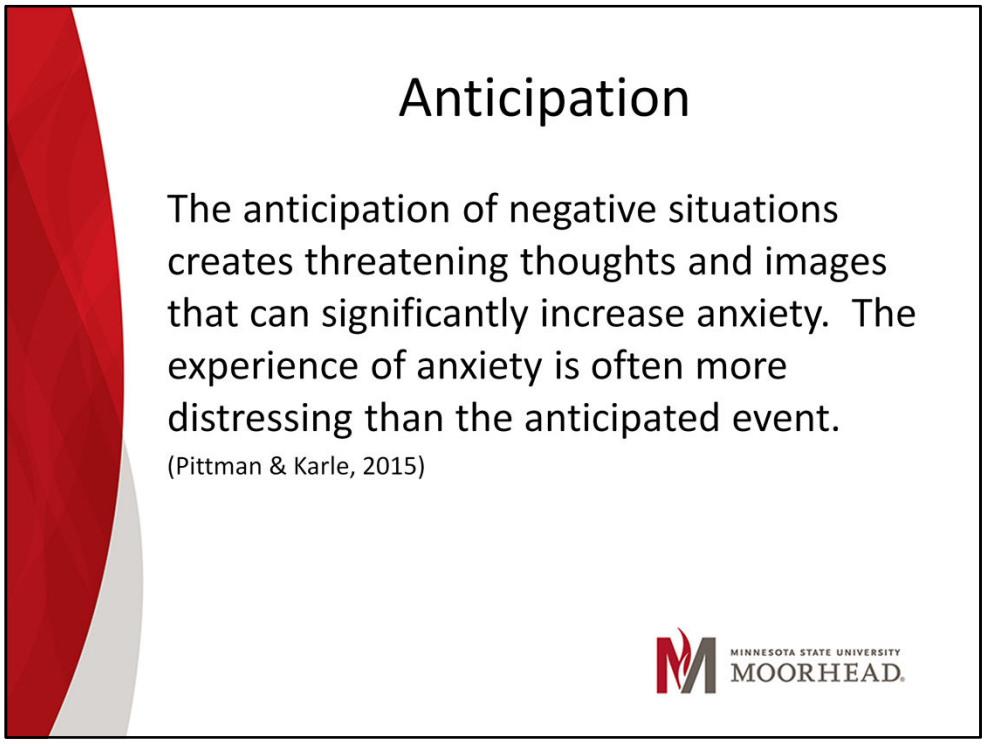
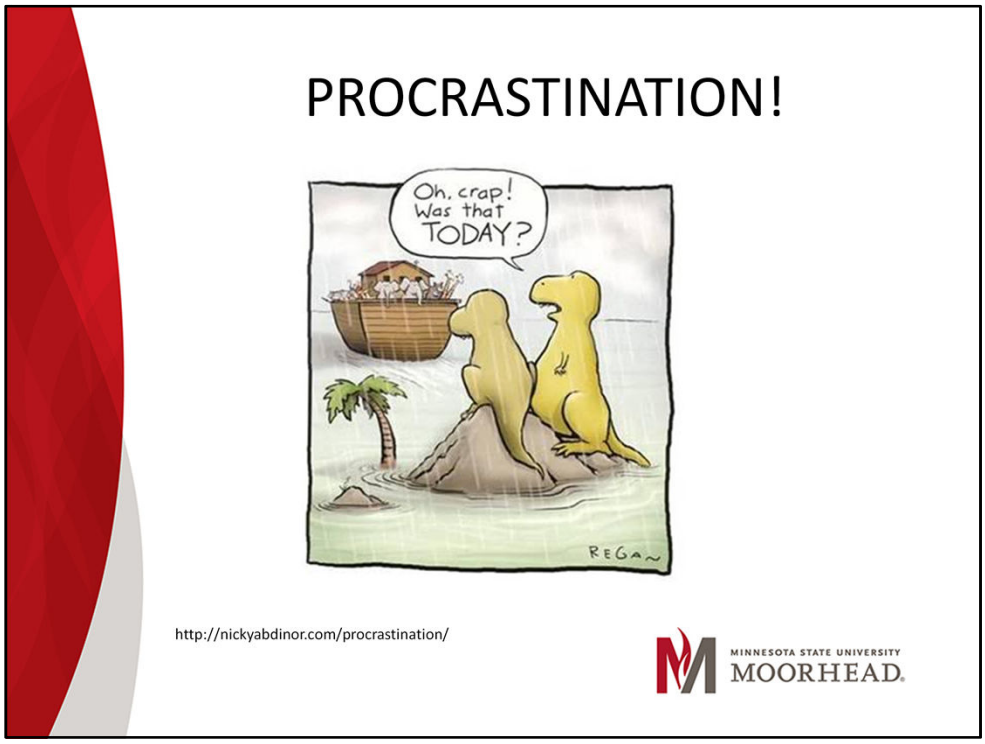
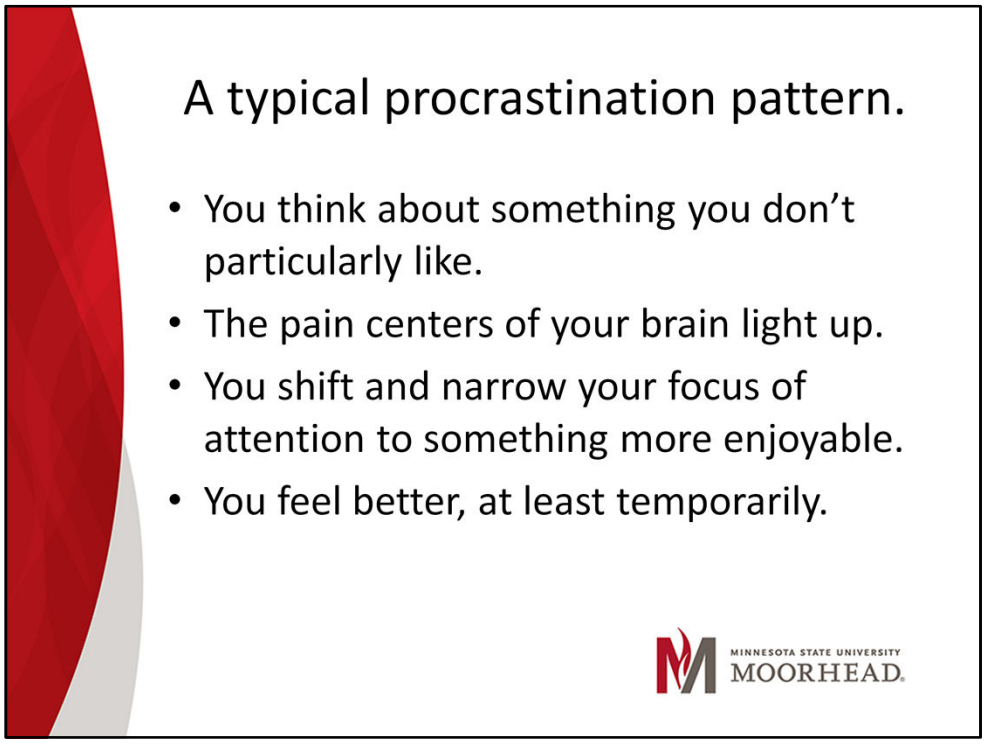


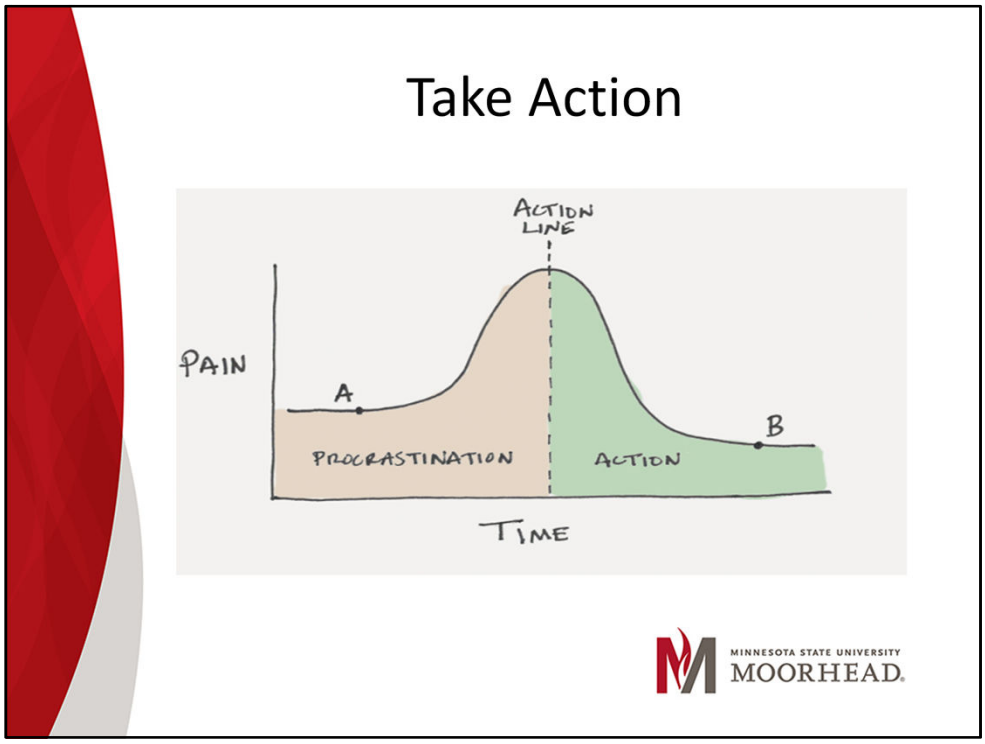
What lead to the student's predicament?



When you procrastinate, you are leaving yourself only enough time to do superficial focused-mode learning. If you cram for a test at the last minute or quickly breeze through your homework, you won't have time for either learning mode to help you tackle the tougher concepts and problems or to help you synthesize the connections in what you are learning. (Oakley, 2014)



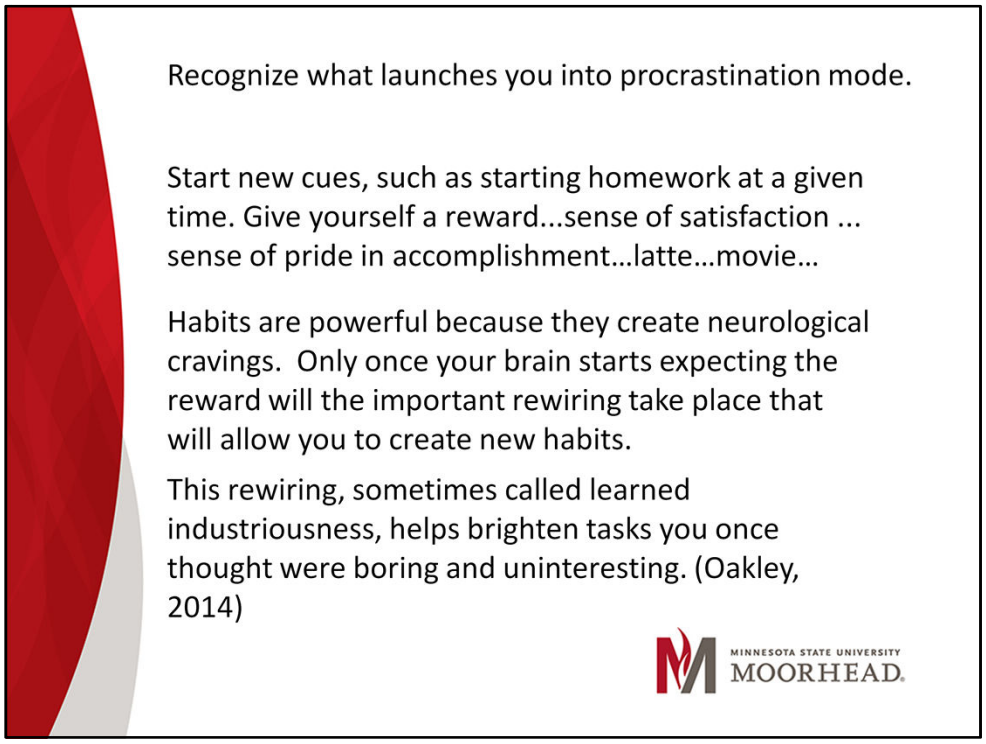
The anticipation is what is painful. "The dread of doing a task uses up more time and energy than doing the task itself." (Rita Emmett)



As soon as you cross the Action Line, the pain begins to subside. In fact, being in the middle of procrastination is often more painful than being in the middle of doing the work. Point A on the chart above is often more painful than Point B. The guilt, shame, and anxiety that you feel while procrastinating are usually worse than the effort and energy you have to put in while you're working. The problem is not doing the work, it's starting the work.

We procrastinate about things that make us feel uncomfortable. Mathphobes appear to avoid math because even just thinking about it seems to hurt. The pain centers of their brains light up when they contemplate working on math. It was the anticipation that was painful.

When the mathphobes actually did math, the pain disappeared. The dread of doing a task uses up more time and energy than doing the task itself.



The trick to overwriting a habit is to look for the pressure point – your reaction to a cue. The only place you need to apply willpower is to change your reaction to the cue. It takes a few of drudgery through a few cycles of the Pomodoro technique before starting to enjoy the work on something new. The better you get at something, the more enjoyable it can become. You need to believe the system can work

You delay practice and on a critical exam day, you choke because you haven't laid the firm neural foundations you need to feel comfortable with the material.

Procrastination is a single, monumentally important "keystone" bad habit.

Change it, and a myriad of other positive changes will gradually begin to unfold.

It's easy to feel distaste for something you're not good at, but the better you get as something, the more you'll find you enjoy it. (Oakley, 2014)

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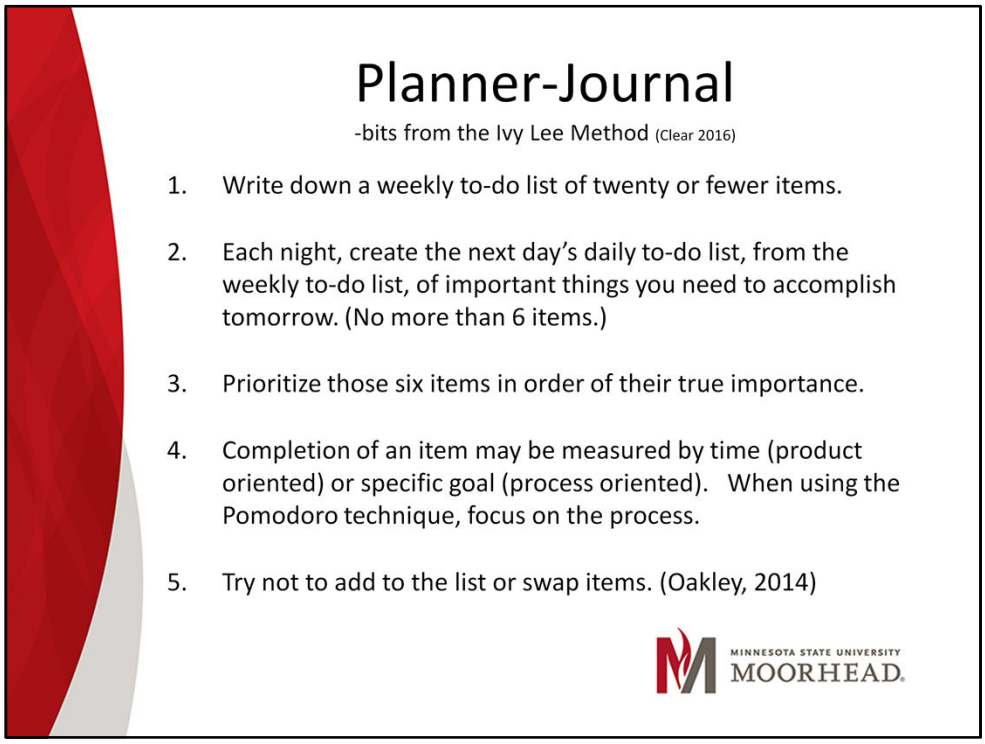


Checking things off a list can produce feel-good chemicals. Endorphines

Big tasks need to be translated into smaller ones that show up on your daily task list.

Set a quitting time. Those who are committed to maintaining healthy leisure time along with their hard work outperform those who doggedly pursue an endless treadmill. (Oakley, p. 134)

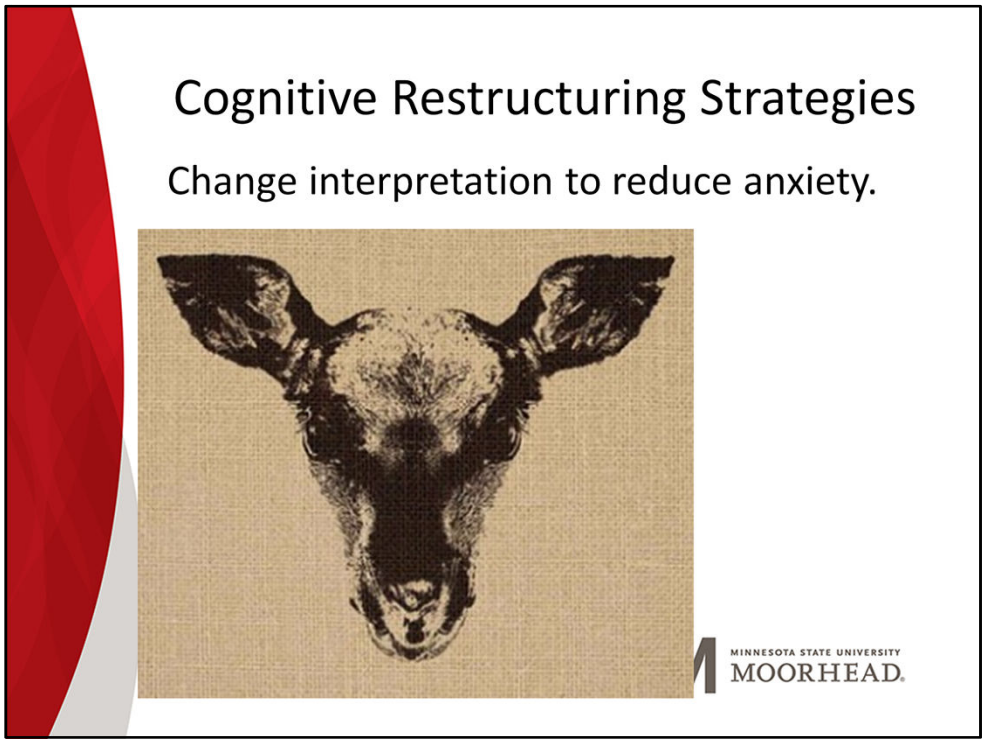
Based on the saying that if the first thing you do in a day is eat a frog, the worst of the day is behind you.

When anxious, we tend to breathe quickly and shallowly which may result in not getting enough oxygen and produces an uncomfortable sensation.
The movement of the diaphragm has a massaging effect on the liver, the stomach, and even the heart.

Effective diaphragmatic breathing will cause your stomach to expand as you inhale and retract as you exhale. Your chest shouldn't move much at all. Try to focus on breathing deep in a manner that expands your stomach as you fill your lungs with air.
The movement of the diaphragm has a massaging effect on the liver, the stomach, and even the heart.

Take a brief inventory of your entire body to see where you're holding your tension at the moment. (shoulders, jaw, lips, fist, toes..)
Tense and release the muscles to help relax.

Take yourself to another location in your imagination. Close your eyes and allow yourself to experience the special place in detail. End the session gradually by counting backward slowly from ten to one.

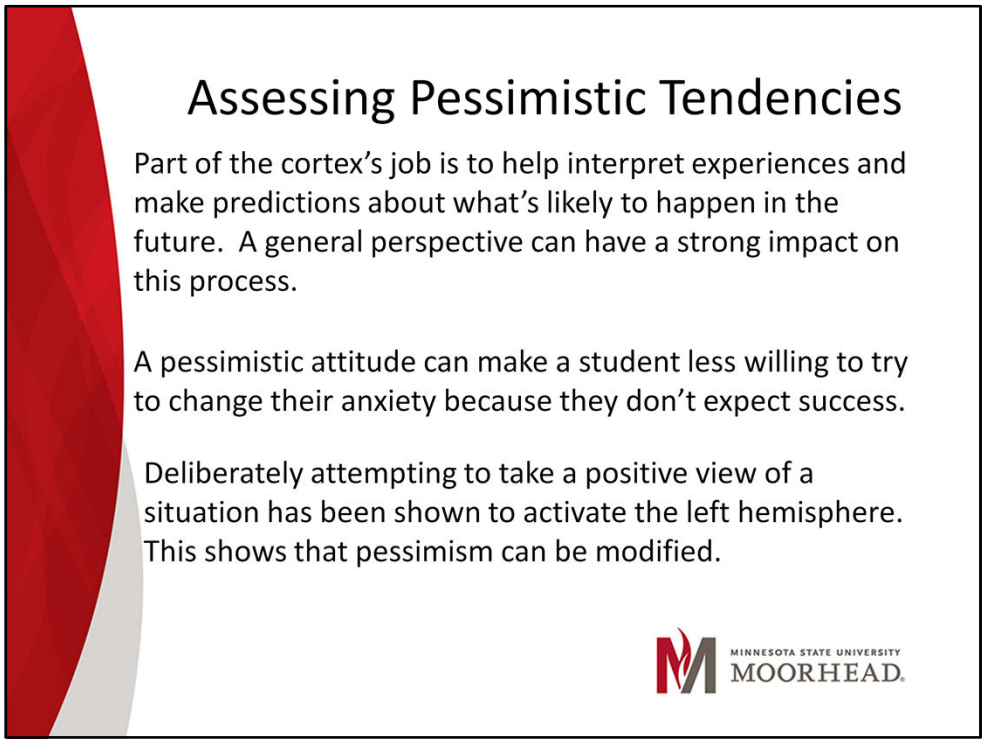


(Pittman & Karle, 2015)

Learn to control what you're imagining, thinking, or telling yourself. By changing your thoughts, you can establish new patterns of responding in the brain that become stable and enduring.

Example: A student looking at a graded paper with comments and corrections and thinking that the teacher must think she is a terrible student. Instead they could think of it as the teacher is giving helpful feedback, I can learn from this and do better.

Student picture teddy bear.



The nucleus accumbens, a structure in the frontal lobes is the pleasure center in the brain that's involved in hope, optimism, and the anticipation of rewards. It's where the neurotransmitter dopamine is released, and studies have shown that when brain levels of dopamine are higher, negative expectations are reduced and optimism increases. (Pittman & Karle, 2015)
Remind yourself that your thoughts don't determine what happens. You're an observor of your cortex, not a believer of everything it produces.

Dealing with Test Anxiety

1. Interpret the symptoms (sweaty palms, a racing heart and a knot in the stomach) by telling yourself a story. Instead of "this test has made me afraid", think "this test has gotten me excited to do my best".
2. Turn you attention to your breathing. Relax your stomach, place your hand on it, and slowly draw a deep breath. Your hand should move out, even as your whole chest is moving outward. This sends oxygen to critical areas of your brain. Practice the technique weeks before the test.
3. Mindfulness – reframe your reaction to intrusive thoughts vs trying to suppress them. "I have a big test next week"…intrusive thought: "If I flunk the test, I will wash out of the program, and I'm not sure what I will do then!"
4. Blink, shift your attention, and then double check your answer to see if it makes sense. Check your answer from a different perspective. Check your test from back to front.
5. If you haven't prepared well or gotten a good night's sleep, then all bets are off.

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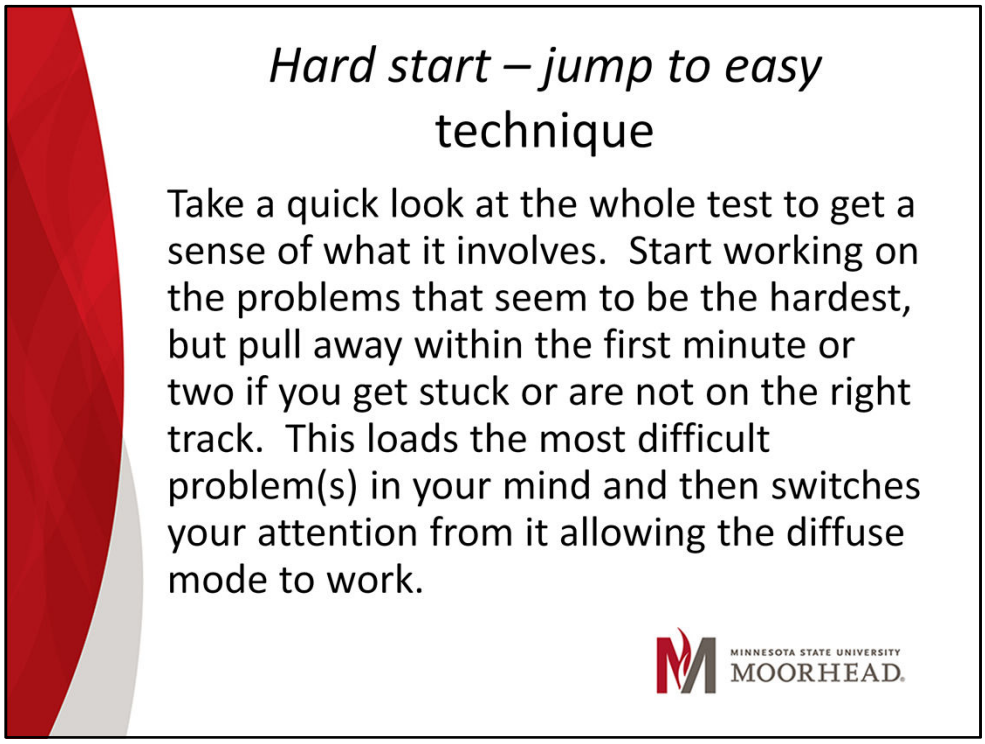

Try it first on homework (lab) problems

When taking a test, doing the easiest problems first may be counterproductive.

Starting with the tough problems first – then quickly jump to the easy one – to access the diffuse mode.

What can we do to help our students avoid unproductive anxiety?

Help them

1. experience success.
2. become accountable.
3. avoid procrastination.
4. be organized.
5. build problem-solving strategies.
6. develop good study habits.
7. understand how the brain learns.

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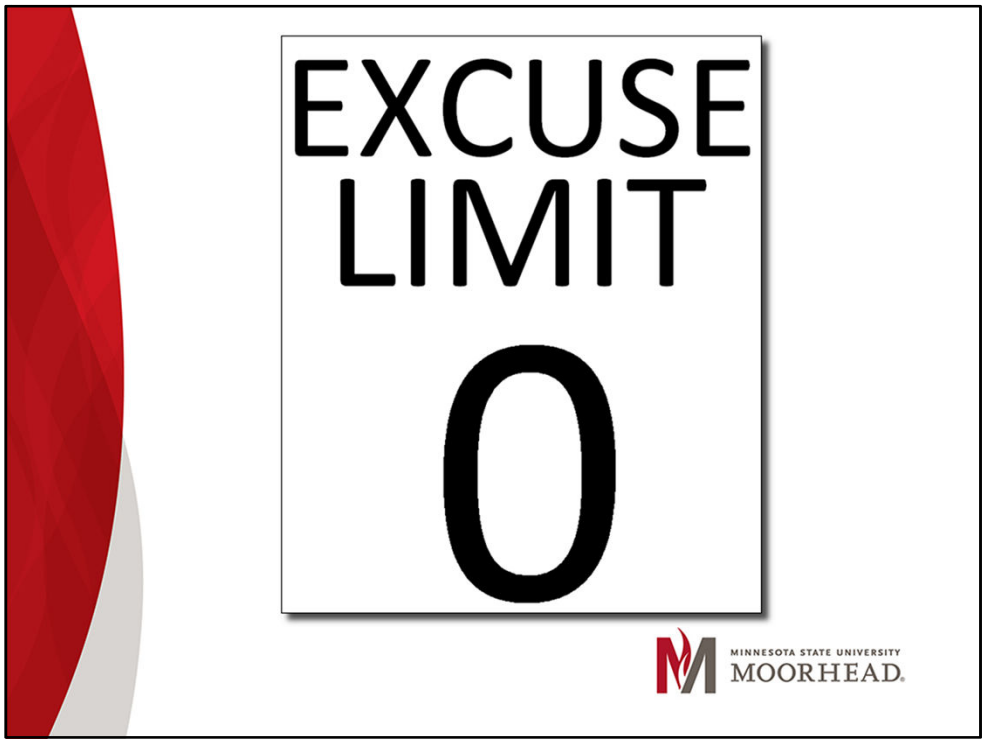
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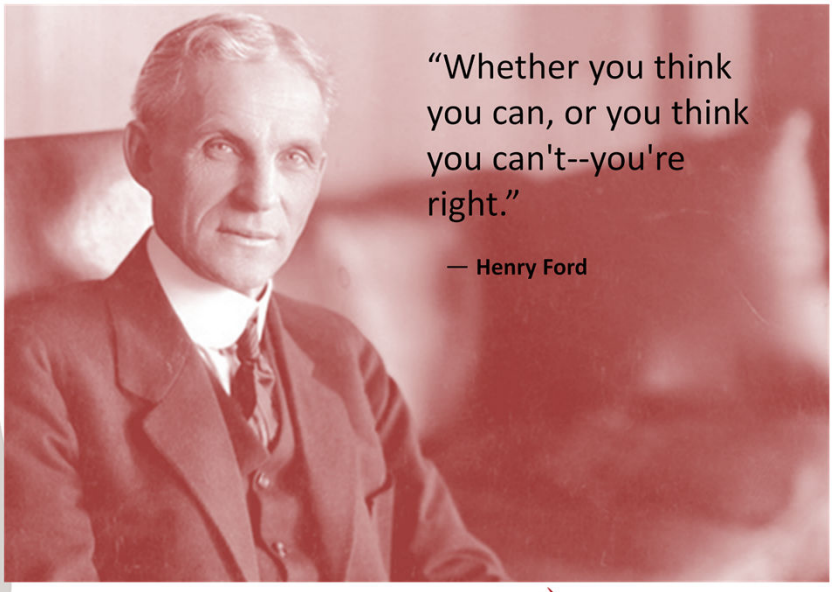

"Whether you think you can, or you think you can't--you're right."

— **Henry Ford**

Image: http://michiganhistory.leadr.msu.edu/henry-ford-in-the-village-of-clarkston/

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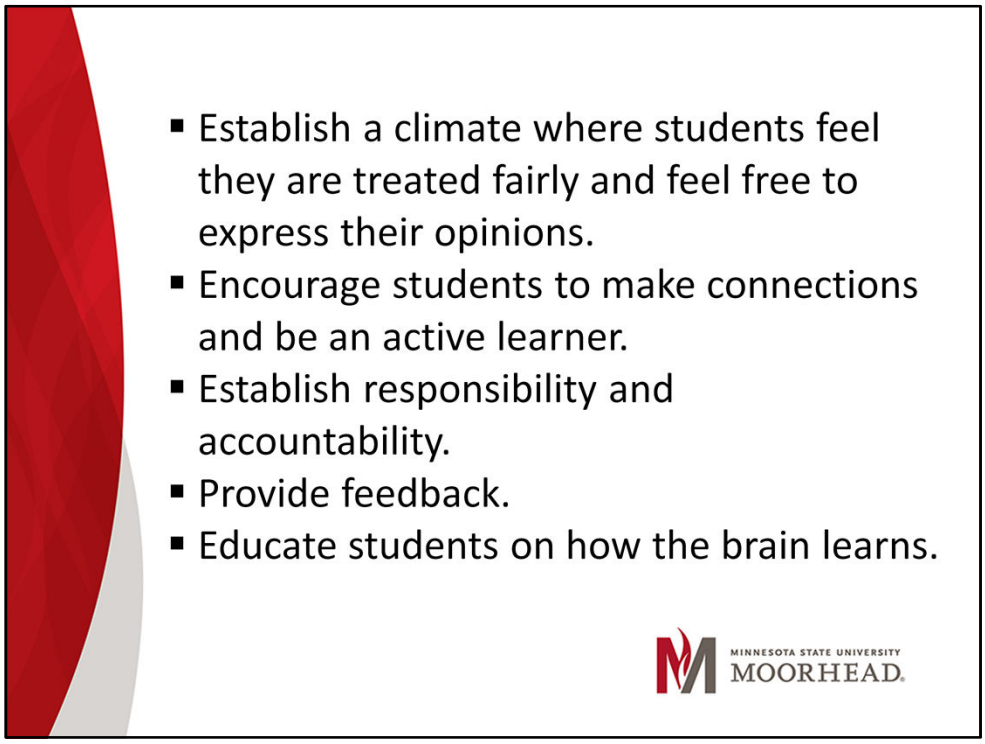
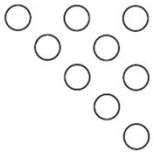


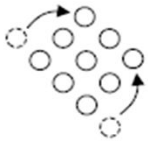
The best way to learn something well is to prepare to teach it. In other words, whoever explains, learns. (Sousa, How the Brain Learns, 2011)
In order for learners to gain insight into their learning and their understanding, frequent feedback is critical: students need to monitor their learning and actively evaluate their strategies and their current levels of understanding. (National Research Council, 2000)

The person who thinks, learns.

- Increase student engagement.
- Encourage them to try first and then ask for assistance.
- Ask questions.

What is the minimum number of coins you can move to change this triangle into a square?





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