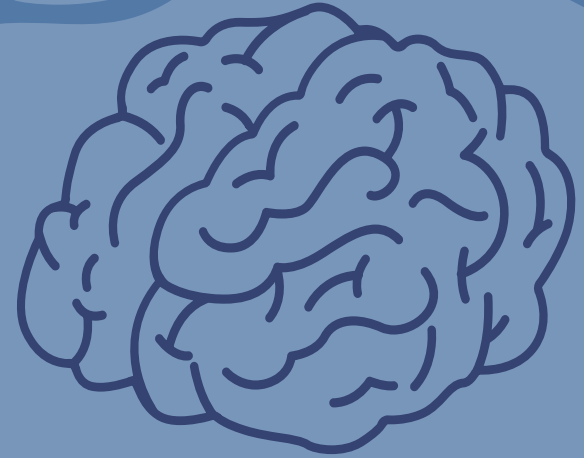


# Leveling the Learning Field with Mind Brain Education Science

SAIS 2023:  
Academic Support Conference



Anna Claire McKay  
& Connie Fink

# Agenda

---

## 1 Introduction

*Who we are and setting intentions*

## 2 The Timeline

*How did we get here?*

## 3 Bringing it to Students

*5 MBE Lessons in the Classroom*

## 4 True or False?

*Test your MBE knowledge*

## 5 Meet Aunt Bea

*12 teaching strategies for all learners*

## 6 MBE Shifts

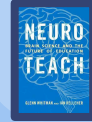
*A classroom teacher perspective*

## 7 Student Voices

*Long term impact*



# How We Got Here



CTTL!



Learning and the Brain

Scope and sequence?

1

3

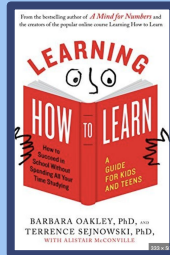
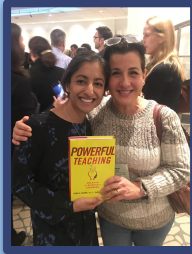
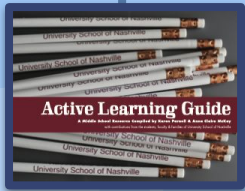
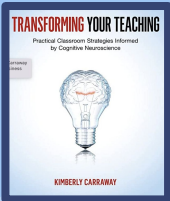
5



1 vs 320  
Good for one?  
Good for all?

2

4



ResearchED

# FOCUS OF LESSONS



**LESSON 1** Adolescent Brain & Pathway of a Memory

---



**LESSON 2** Attention and Retrieval & “ME J”

---



**LESSON 3** “ME J” & Myelination

---



**LESSON 4** Neuron Anatomy & Role of Sleep in Memory Formation

---



**LESSON 5** Anatomy of the Learning Brain

# PEDAGOGY OF LESSONS

Classroom = metaphor for mind

---

“All thoughts included and expected here”; images and words

---

Explore, encode, retrieve using multiple modalities

---

“Errorful learning”, fast feedback, work in layers

---

Build skills: guided note-taking, retrieval practice, group work, etc.

---

Personal connections and real life relevancy

---

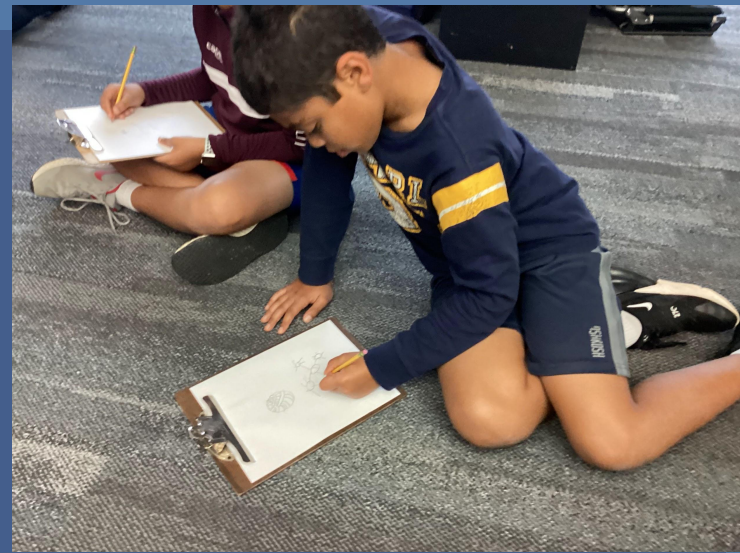
Art enhances understanding



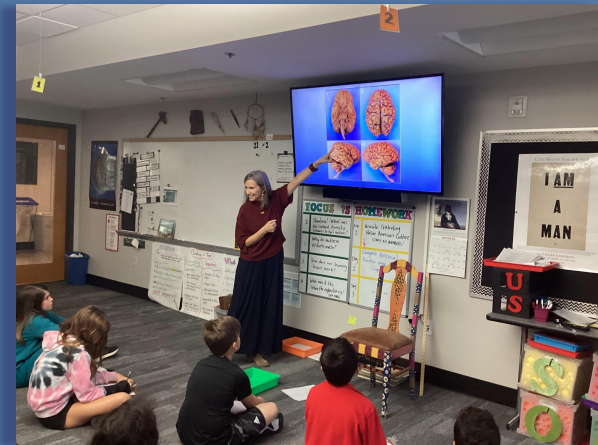
## **LESSON 1:** Adolescent brain & the pathway of a memory

- Generate an inclusive shared landscape
- Basic brain facts: adolescent brain & personal power
- Pathway of a memory & our agency
- Guided notes

What do  
YOU  
think?



Build shared  
knowledge and  
adjust  
understanding.



What do  
WE  
think?



Kavya Shah 0-15 11-2-22

Q: What do you think the outside of your brain looks like? Texture, color, size?

Answer:

Big as my head, maybe a little smaller

pinkish

wormish look

squishy

Has multiple parts

Looks like a whole bunch of tubes

Q: What do you think it looks like on the inside? What it does, how it works?

Answer:

similar to the outside

wormish

Has white weird things.

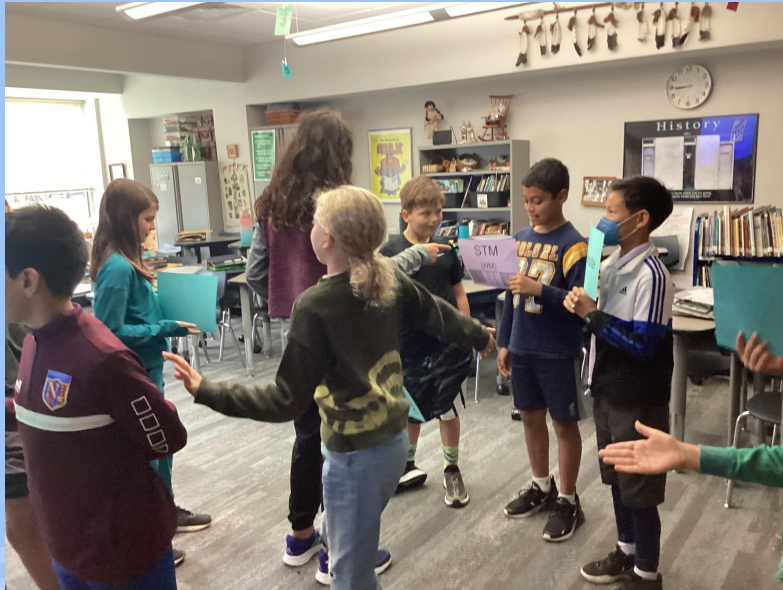
Nurons

Has dendrites

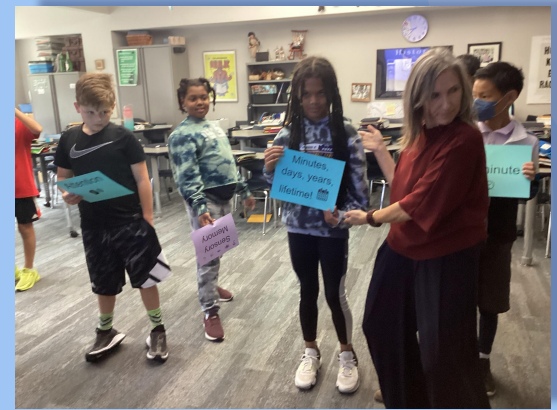
3 things that make the brain structure?

1. Experiencing & learning new things.
2. Environment
3. Genetics

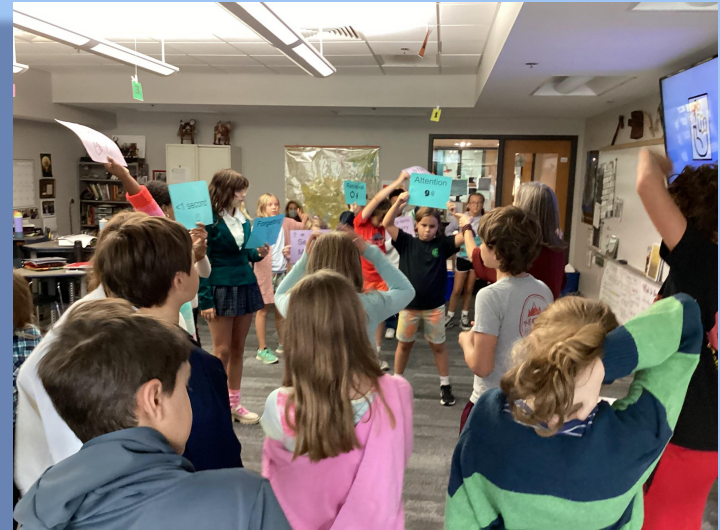
Hmmm...exploring and wondering together.



Providing clarity:  
scaffolded support



Student application and  
real life connections





**Brain Info**

Brain Structure =  $GEE$

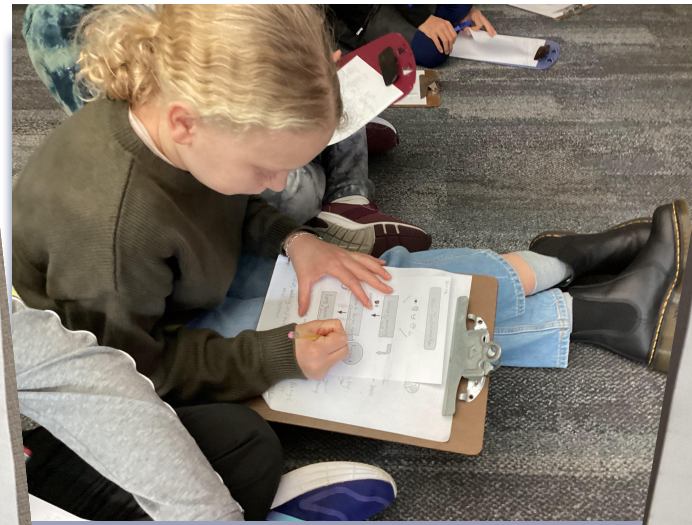
$exp + \text{practice} + \text{genetic} + \text{exert}$

#1 way to change your brain = **Effort**

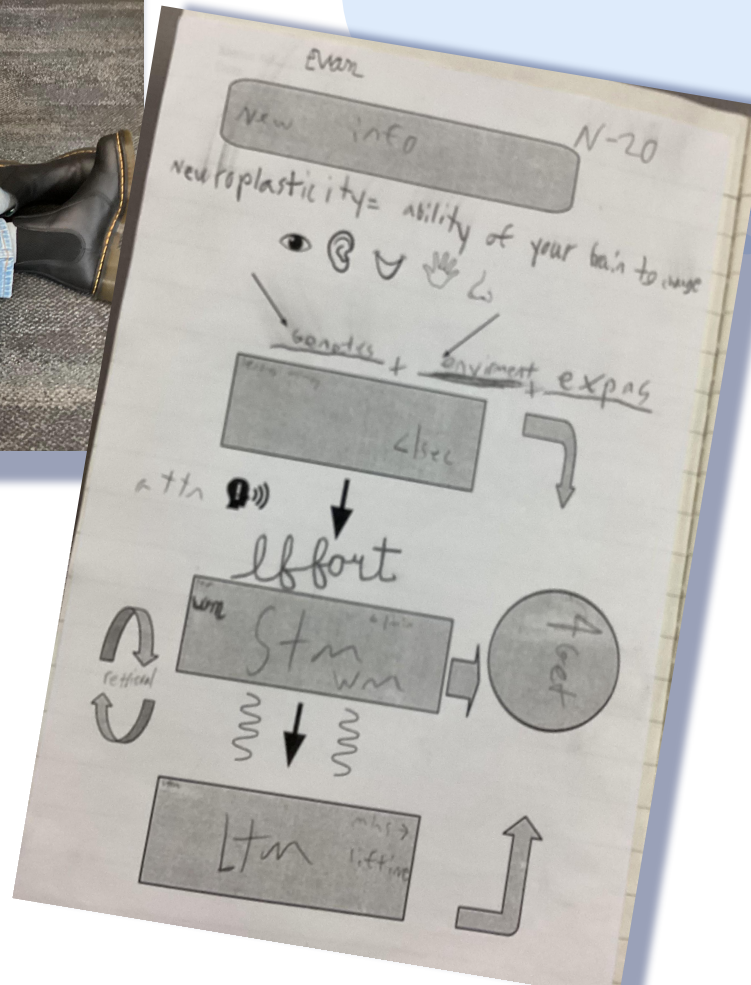
Neuroplasticity is the ability to  $\Delta$  our  $\text{B}$  (GEE+E all contribute).

What is special about the adolescent brain (ages 10-19)?

- Take less effort to L new things
- more open to  $\Delta$  for the " or "
- (use or lose)
- new  $\text{NS}$ , strengthen  $\text{N}$ , reorganizing  $\text{N}$



**Guided Notes and Changing Up the Classroom**



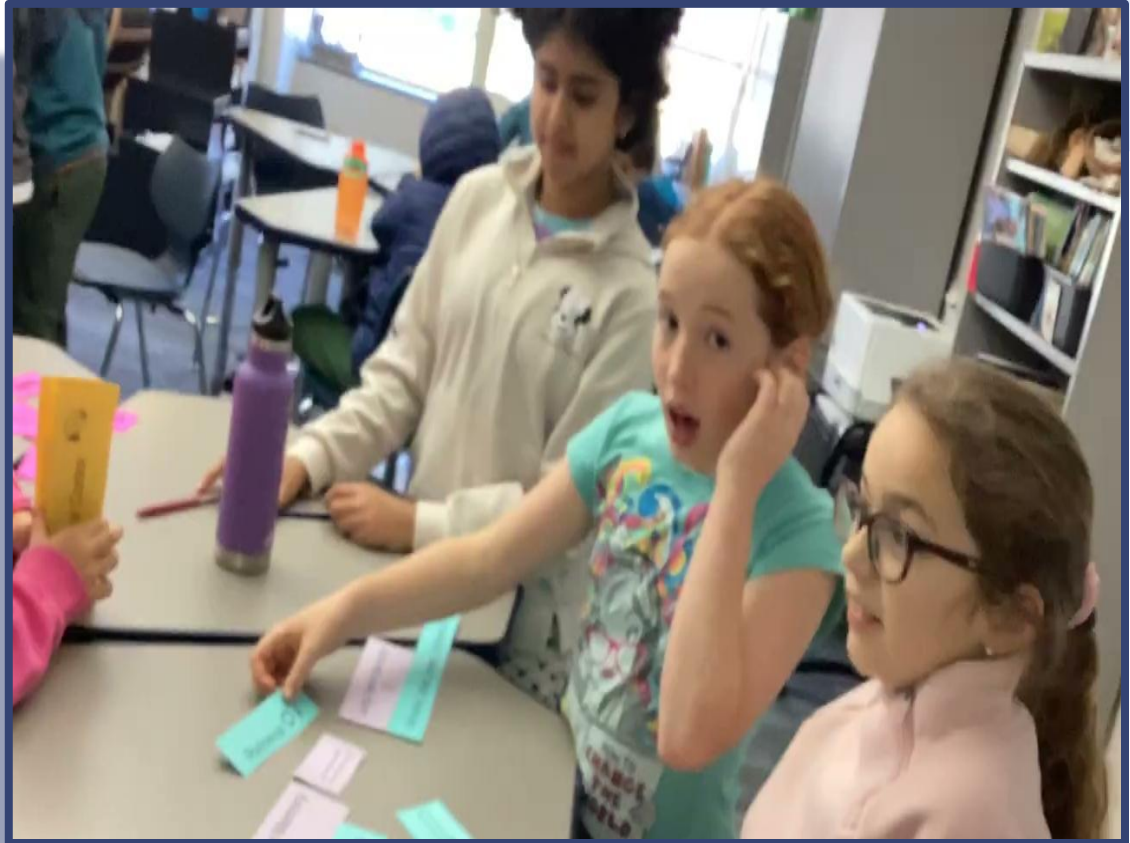


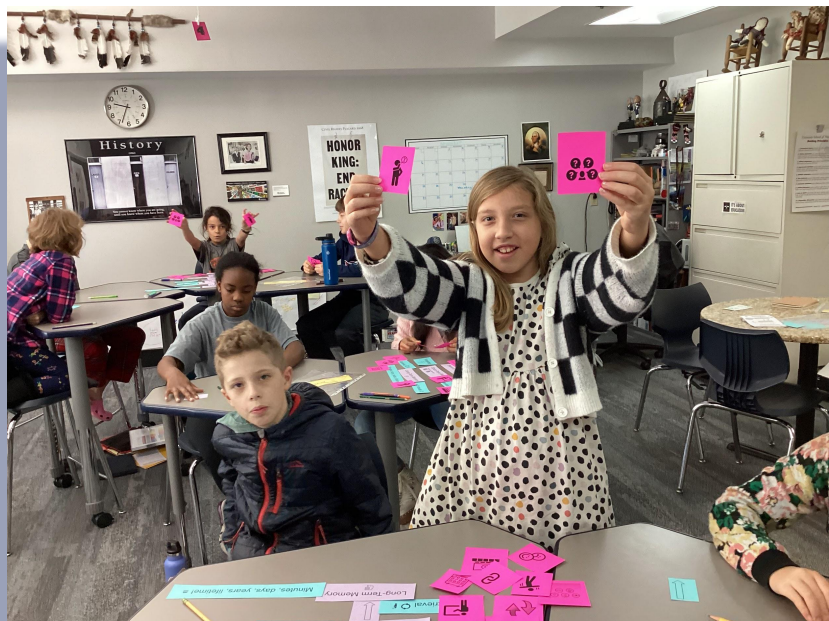
## LESSON 2: Attention, retrieval, & personal agency

- Brain dump to review basic brain facts and memory pathway
- Pathway of a memory in layers: attention & retrieval strategies
- Guided notes
- Plant seeds for myelination

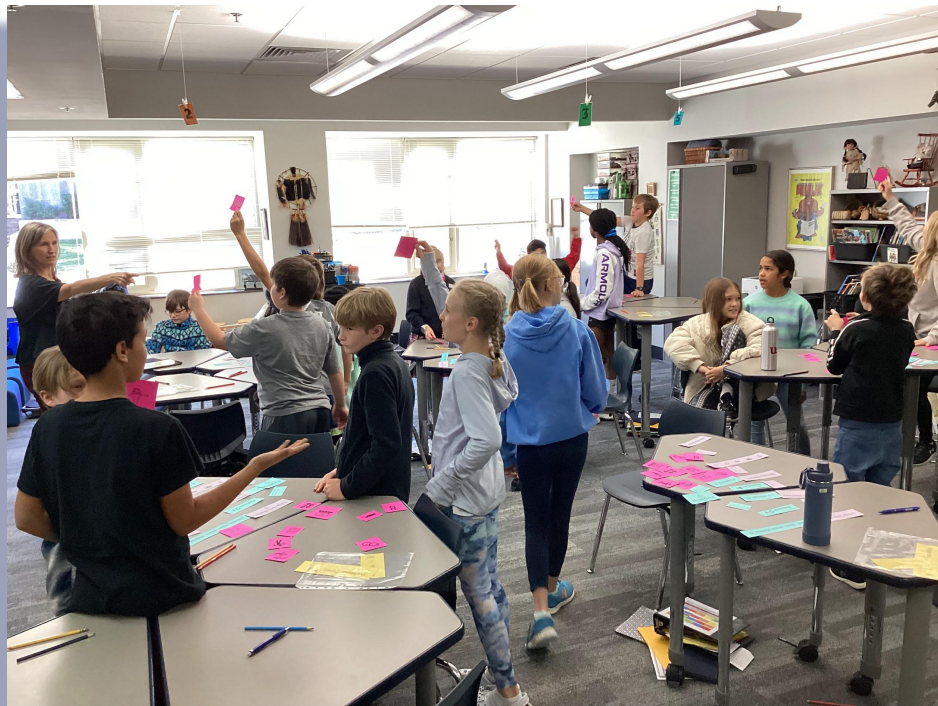


Thinking  
aloud....

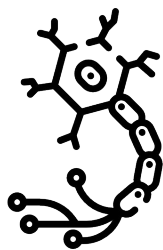




Layered learning in action!



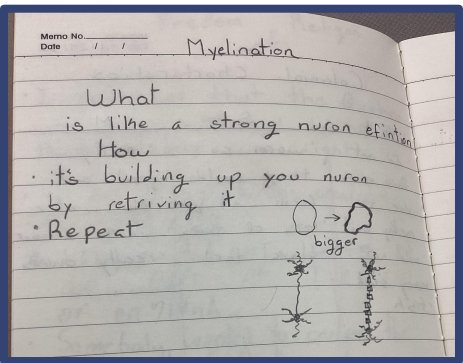
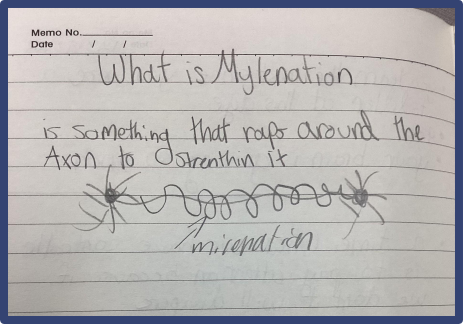
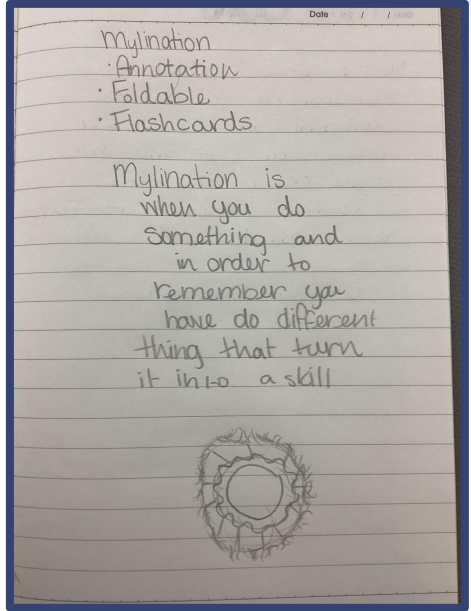
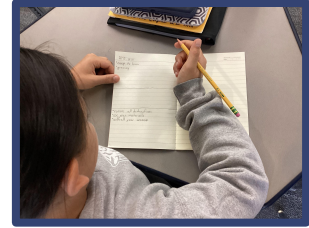
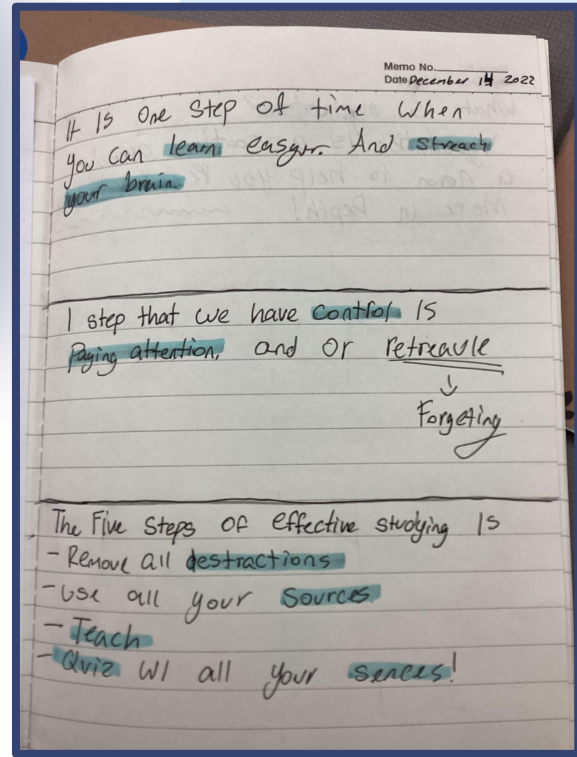
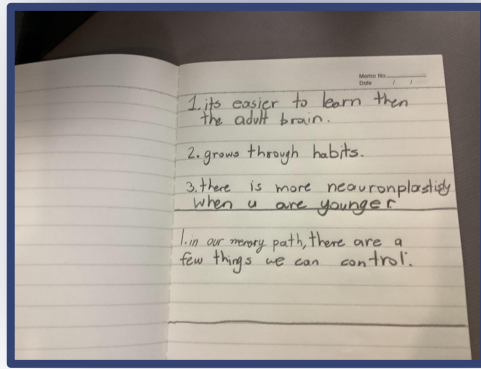
Retrieval,  
agency, and  
application



## LESSON 3: Myelination

- ME-J: Quick but Quality
- Ball Toss & Memory Connection
- What is myelination?
- Build understanding through art and story

# Memory Effort Journal: retrieve previous learning and prime for new learning



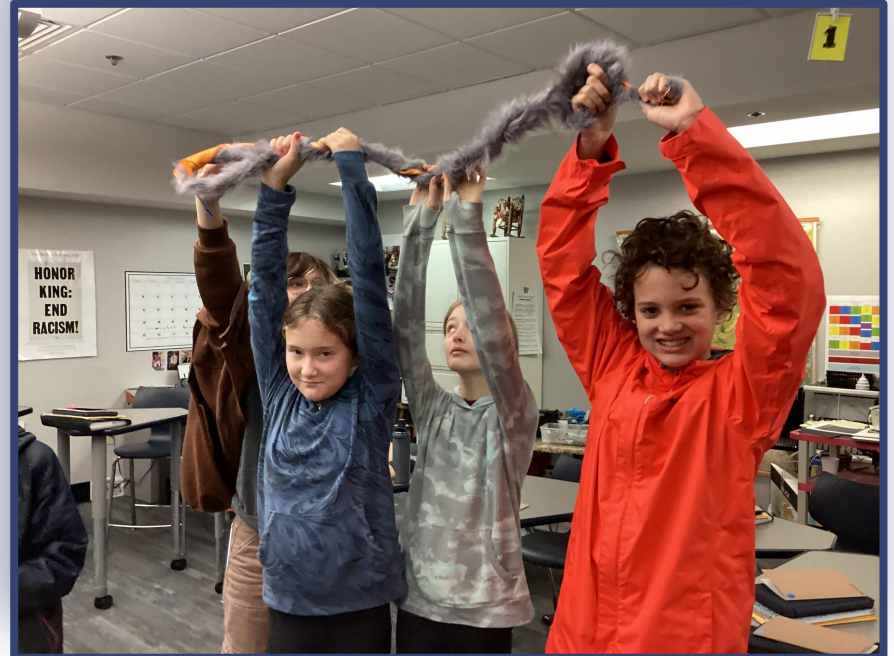
Words & images; revised,  
errorful thinking!



Classroom as  
brain space.  
Ball toss  
game to  
show  
myelination  
of neural  
networks.



Using art and story to apply new myelination knowledge.





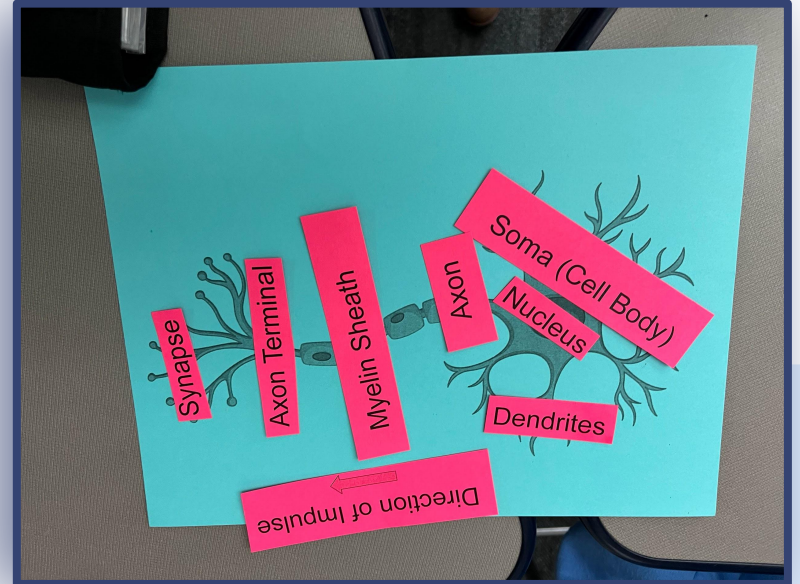
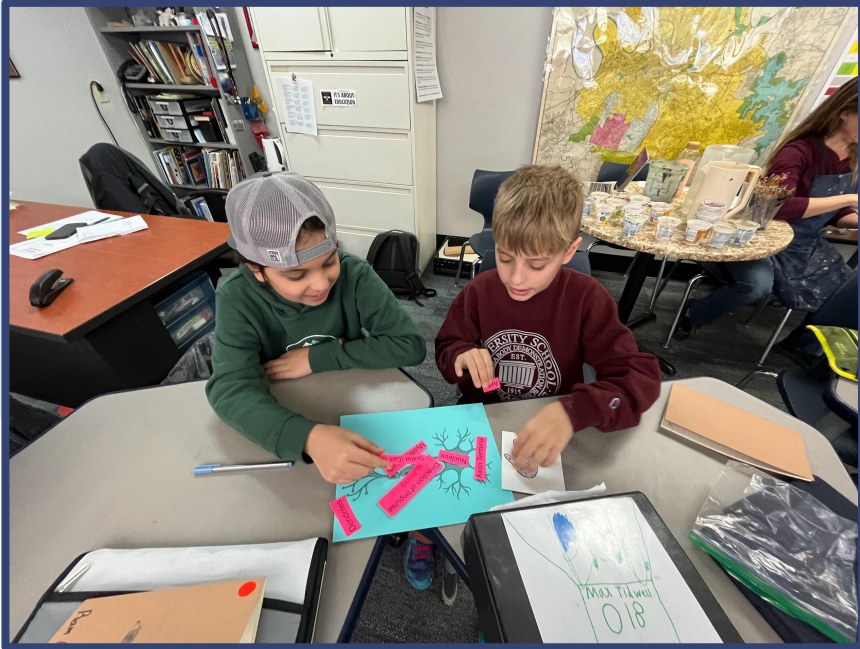
## **LESSON 4:** Neuron anatomy, sleep, and personal agency

- ME-J to revisit myelination and retrieval
- Layers of neuron anatomy practice
- Neural networks and the early settlement of our nation
- Personal agency in neuron health: sleep and dendritic spines
- Art for understanding

Learning in layers: my thoughts, our thoughts, revised thoughts!



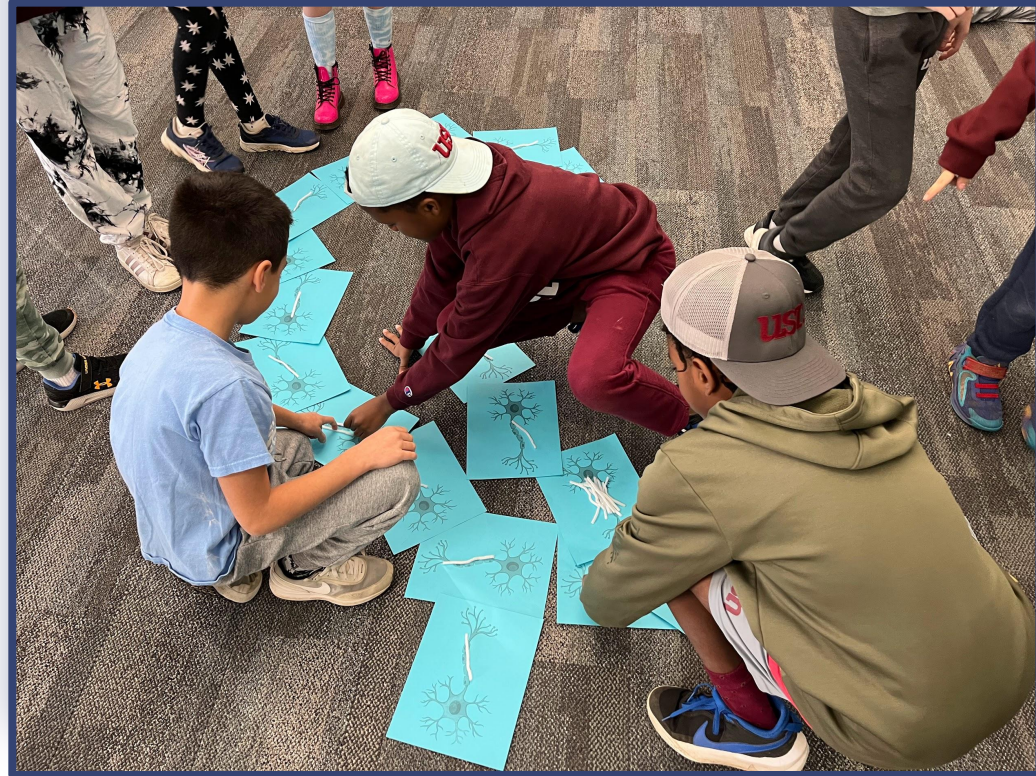
Strain your brain to retrieve!  
Interrupt the forgetting!

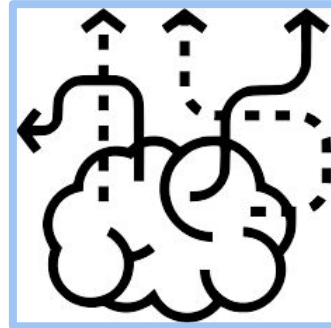
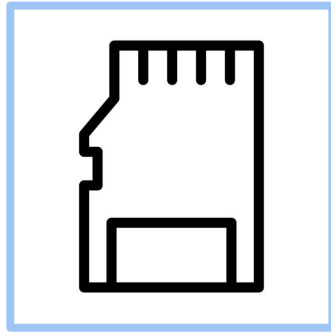
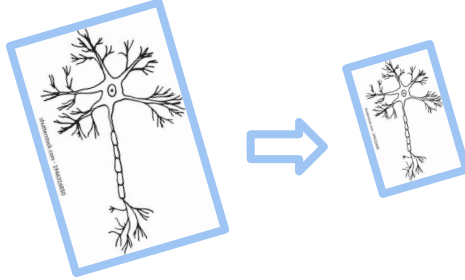


## Myelination and the early settlement of our country



Revamping on the spot!  
Looking for the “LOPPS” in our  
own teaching and learning!





Transferring our understanding of neuron anatomy...



Growing dendrites  
and axon terminals!

Growing axons!





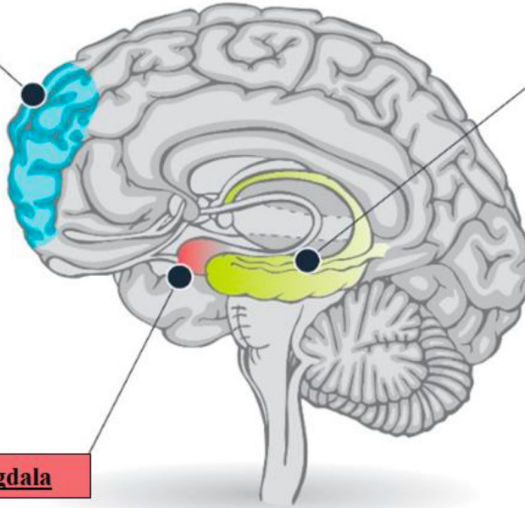
## LESSON 5: The learning parts of the brain

- ME-J to revisit neuron anatomy and sleep
- Amygdala, hippocampus, and prefrontal cortex
  - Basic facts, hand model, and personal agency
  - Connect with classroom learning, including *Phineas Gage*
- Art for understanding

# The Learning Brain

## Prefrontal Cortex

- Abstract thinking
- Problem solving
- Planning
- Emotional regulation



## Hippocampus

- Memory consolidation
- Navigation and spatial memory
- Learning

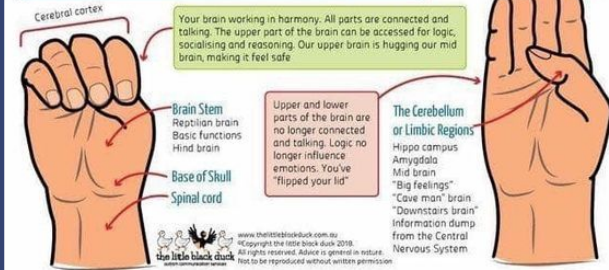
## Amygdala

- Decision making
- Emotional memories
- Regulates behavior
- Initiates fear response

## The Hand Model of the Brain

### What happens when we "flip our lid"?

When our brain is working efficiently both the upper and mid brain are communicating effectively. Information comes in and is processed logically. Sometimes too much information is coming in for the Upper brain to process and it disconnects. We "flip our lid" and can no longer access the functions provided by the upper brain.



## PHINEAS GAGE

A Gruesome but True Story About Brain Science



by JOHN FLEISCHMAN



Echoing the learning layers in our art





# True or False?



## NEUROMYTH BUSTERS

Cards from the Center for  
Transformative Teaching & Learning



<https://schoolstore.saes.org/shop-ctl/face-the-mbe-facts-a-neuro-mythbuster-activity-card-set>

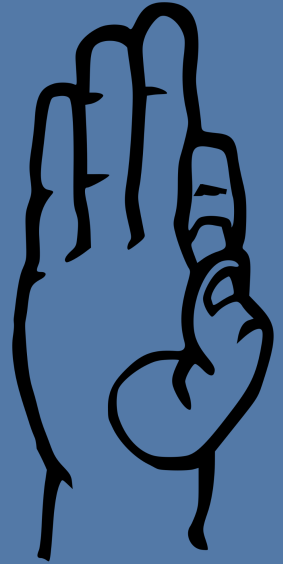
# NEUROMYTH BUSTERS!



Self testing is a great way to prepare for a test, so teachers should actively coach this skill.

TRUE

FALSE



# NEUROMYTH BUSTERS!



**TRUE**



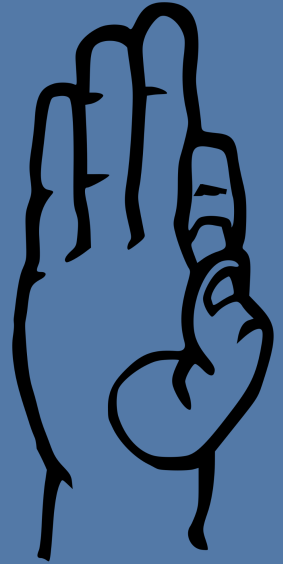
# NEUROMYTH BUSTERS!



Avoid having students  
memorize information -  
this is an outdated  
instructional strategy.

TRUE

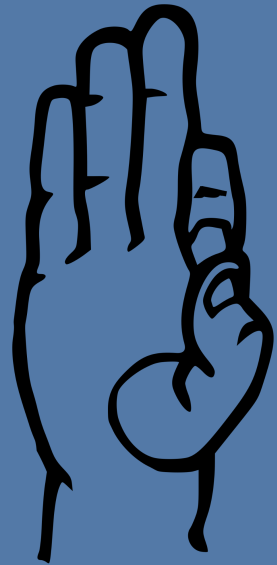
FALSE



# NEUROMYTH BUSTERS!



**FALSE**



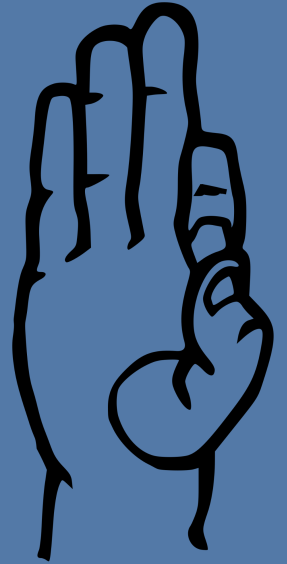
# NEUROMYTH BUSTERS!



Reading the text on a slide while presenting it helps students learn because they are getting the information in two modalities.

TRUE

FALSE

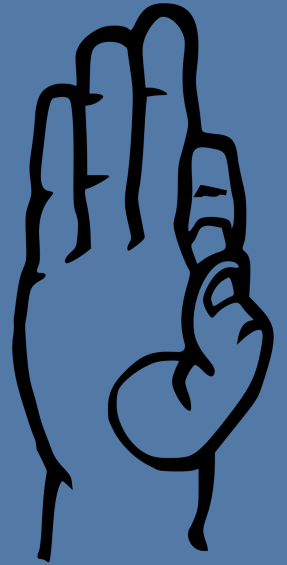




# NEUROMYTH BUSTERS!



**FALSE**



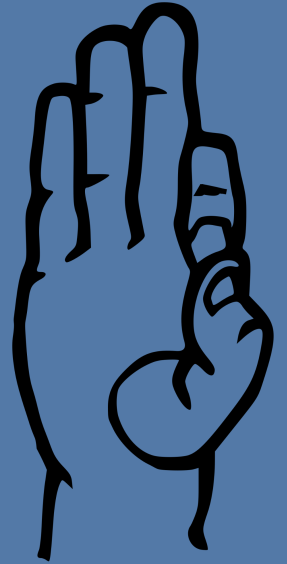
# NEUROMYTH BUSTERS!



Lecturing is an  
outdated form of  
teaching.

TRUE

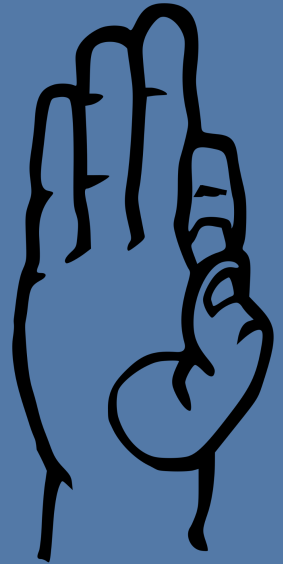
FALSE



# NEUROMYTH BUSTERS!



**FALSE**



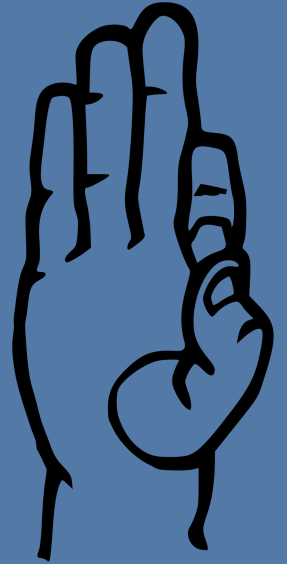
# NEUROMYTH BUSTERS!



Teachers are responsible for managing the cognitive load of their students.

TRUE

FALSE



# NEUROMYTH BUSTERS!



**TRUE**



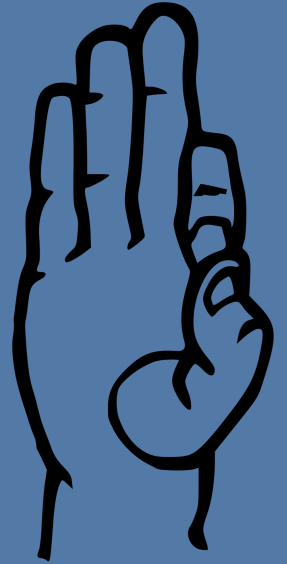
# NEUROMYTH BUSTERS!



Some people are kinesthetic learners, some are auditory learners, and some of visual learners.

TRUE

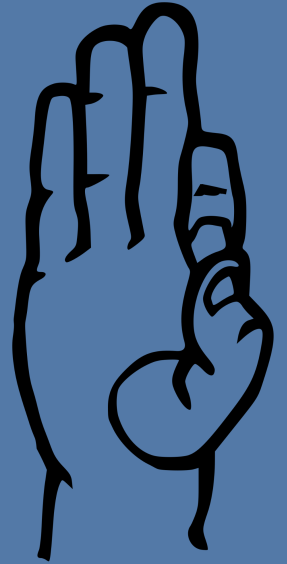
FALSE



# NEUROMYTH BUSTERS!



**FALSE**



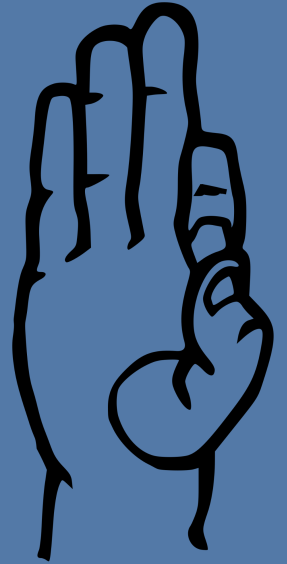
# NEUROMYTH BUSTERS!



Our active working  
memory can only hold  
4-5 items for about 20  
seconds.

TRUE

FALSE





# NEUROMYTH BUSTERS!



**TRUE**



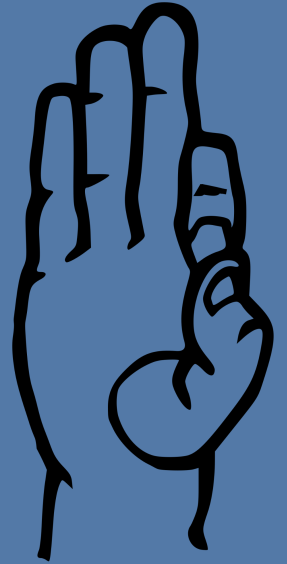
# NEUROMYTH BUSTERS!



Students' brains are constantly rewiring in reaction to their environment. This means that every teacher is a brain changer, whether they believe it or not.

**TRUE**

**FALSE**



# NEUROMYTH BUSTERS!



**TRUE**



# NEURO

BRAIN SCIENCE AND THE  
FUTURE OF EDUCATION

# TEACH

GLENN WHITMAN AND IAN KELLEHER

Do we need 2B observed for obj flk?  
choice first/last sleep effort limbics network  
not transferring

## THE TOP TWELVE RESEARCH-INFORMED STRATEGIES EVERY TEACHER SHOULD BE DOING WITH EVERY STUDENT

1. Class periods should be designed with an understanding that what students will recall most is what takes place in the first part of the class and what students will recall second most will take place in the closing minutes of class.<sup>1</sup>
2. Students should be given more frequent, formative, low-stakes assessments of learning.<sup>2</sup>
3. Students need more opportunities to reflect, think meta-cognitively, on their learning and performance.<sup>3</sup>
4. Students need to know that the pervasive way they choose to study is actually hurting their ability to learn for the long term and that self-testing is much more effective than reading one's notes.<sup>4</sup>
5. Students, parents, teachers, and school leaders need to understand that sleep is critical to memory consolidation. Without sufficient sleep we create a system that perpetuates the illusion of learning.<sup>5</sup>
6. Students need to know that effort matters most, and that they have the ability to rewire their brain to make themselves better learners and higher-achieving students (the concept of "neuroplasticity").<sup>6</sup>
7. Students need more, but well judged, opportunities for choice in their learning, which enhances engagement and intrinsic motivation.<sup>7</sup>
8. Students need to love their limbic system and recognize the impact stress, fear, and fatigue have on the higher-order thinking and memory parts of their brain.<sup>8</sup>
9. Students need opportunities to transfer their knowledge through the visual and performing arts.<sup>9</sup> Yes!

show st's notes - what is best way 2 use to help LT? T Balzer

# 12 Research-Informed Strategies We Should Use with ALL Students

Adapted from *Neuroteach*, by Whitman and Kelleher

aka

**Aunt Bea Can Eat French Fries  
Like My Mom Plays the Queen of Spades**



Make time for students to transfer new knowledge through the **ARTs**

Students need basic **BRAIN** anatomy & info

Offer informed **CHOICE** with your instruction to increase interest and motivation

Students need to know that **EFFORT** is the secret to rewiring the brain

Offer **FREQUENT FORMATIVE, LOW/NO-STAKES ASSESSMENTS**

The **FIRST** and **LAST** parts of class are prime instructional time...make them count!

Help students love and tend to their **LIMBIC** systems to help with learning

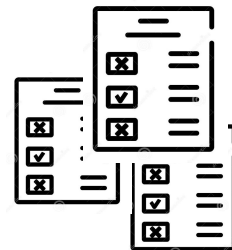
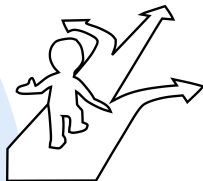
Teach and assess using **MULTIPLE MODALITIES** based on content and time of day  
(not “learning styles”)

Teach, model, and practice reflection to develop **META-COGNITION**

Students need time for **PLAY**


Self-**QUIZZING** is the most efficient and effective study strategy

**SLEEP** is essential for memory consolidation





**Strategy Checklist:** Where am I utilizing the 12 strategies? Where can I enhance my instruction?

 \_\_\_\_\_

 \_\_\_\_\_


 \_\_\_\_\_

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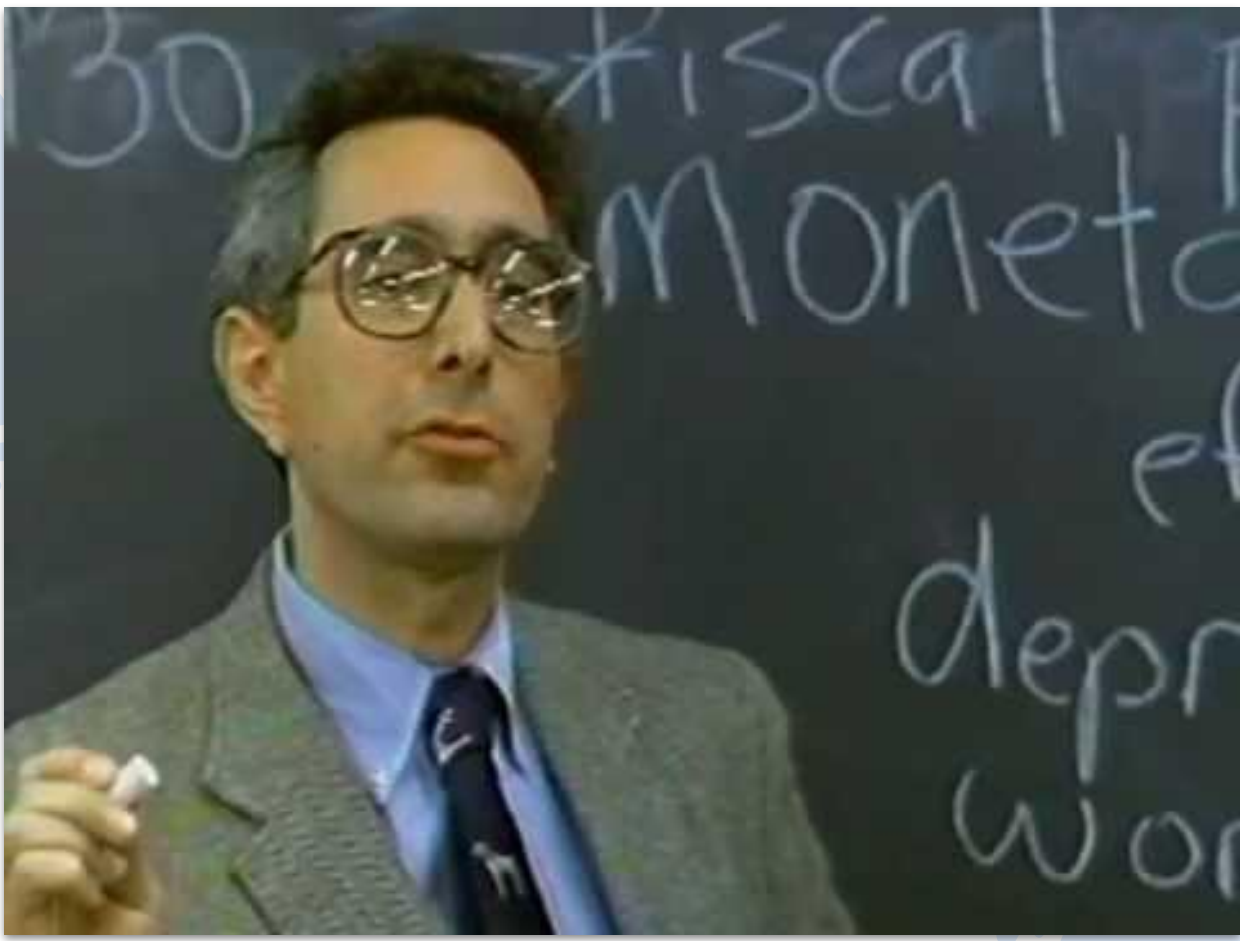
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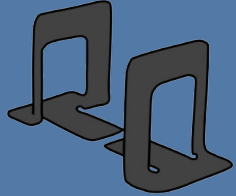
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# MBE Shifts

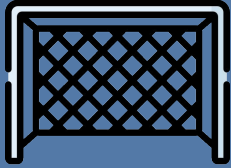
Anyone,  
anyone?



# Small Shifts



Primacy Recency Effect



Clear Learning Goals



Student Reflections

Name: Batty Date: \_\_\_\_\_ Travel: \_\_\_\_\_

Learning Log: Prince Henry Reading Assessment 2022

On the table below, use the guiding questions to record your thoughts on the progress you feel you are making and areas where you need to focus on more.

Learning Target	Student Reflection
I can identify key ideas within the text and record them as visual notes.	Did your <b>visual notes</b> capture key moments in the text that appeared on the assessment? How was the process of creating the notes helpful in making the learning stick?  My visual notes captured some key moments in the text of the assessment and the process of creating notes made the learning stick because I illustrated pictures while annotating the text which let me use my senses and pay attention so the information moves to my short term and then I retrieve the information by taking notes to the side. I also made a picture notecard.
I can use <u>margin notes</u> as a way to leave tracks of my thinking in the text.	How was marking the text with M.O.A. helpful? In what ways are you seeing <b>progress/growth</b> in your annotation skills? What do you find the most <b>challenging</b> with recording margin notes?  M.O.A. Was helpful because it helped me remember key spots in the text. My annotation skills have progressed because I write text on the side of the paper more. The challenging part about annotating was seeing what was important and what was interesting.

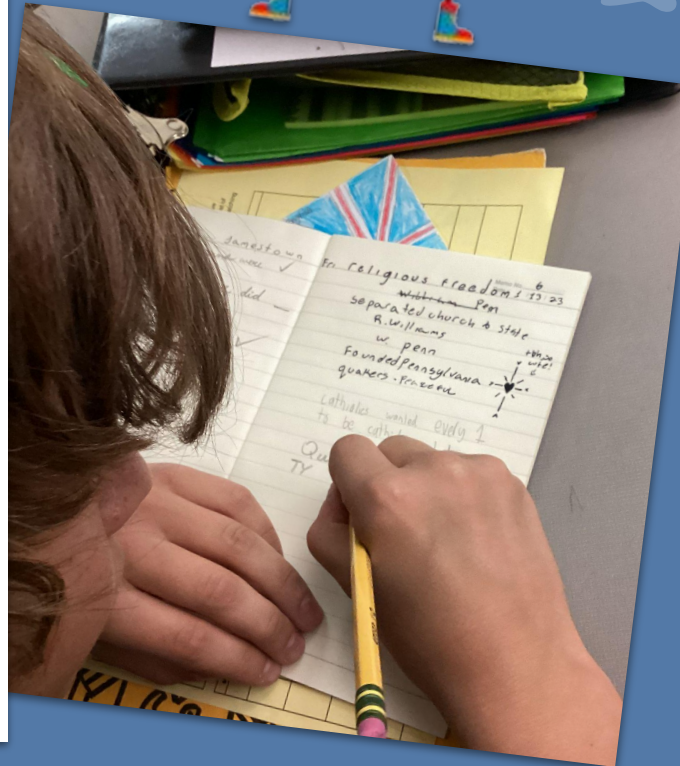
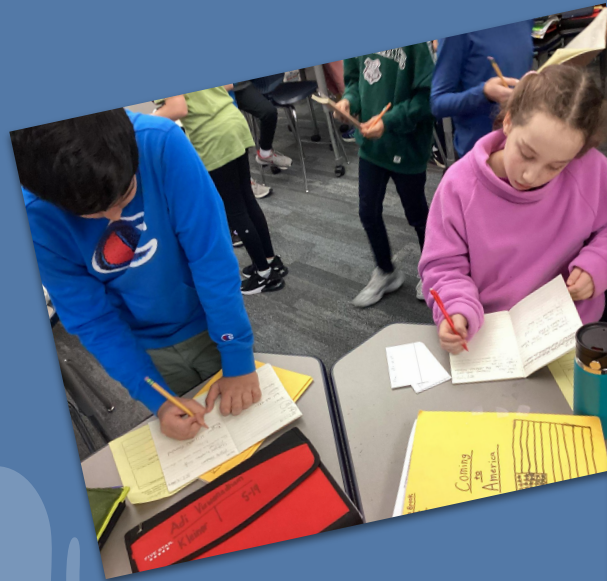
**Self-Evaluation:** Record a 1, 2 or 3 to evaluate your performance under the "student" column.  
1 = I'm not there YET.      2 = I'm on my way.      3 = I've got it.











Student      Teacher

Assessment Sections

Matching Section: People and Places

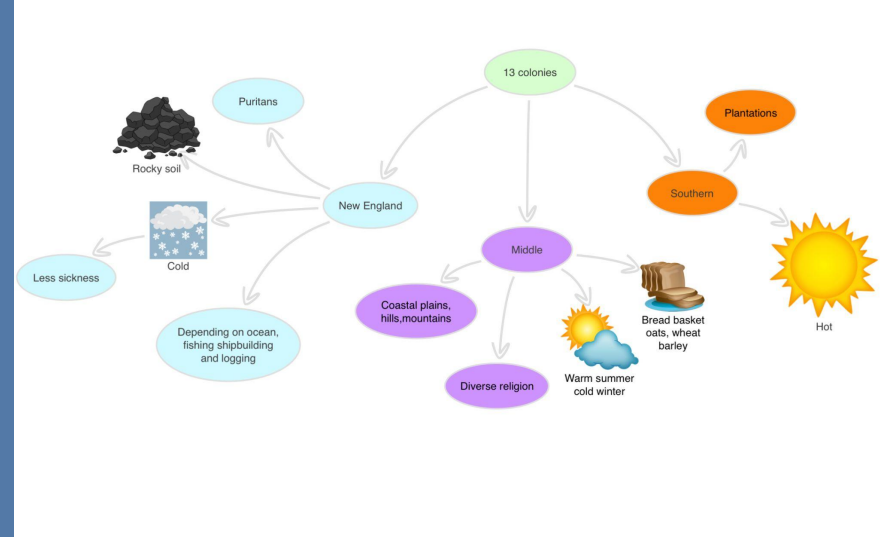
# Practice & Retrieval with the "M.E. Journal"



Retrieval Practice Choice Board	
 <p><b>Brain Dump</b></p> <ol style="list-style-type: none"> <li>1) Close books, remove all notes.</li> <li>2) Write out everything you can remember (consider organizing thoughts in a mindmap) about a topic under timed conditions.</li> <li>3) Use your notes to make any corrections or additions in another color pen.</li> </ol>	 <p><b>Think Two Things - Pair - Share</b></p> <ol style="list-style-type: none"> <li>1) Write down two things you learned.</li> <li>2) Turn &amp; teach a partner about these things.</li> <li>3) Add the new learning shared with you to your paper in another color.</li> <li>4) Be ready to share with the class.</li> </ol>
 <p><b>Retrieval Flash Cards</b></p> <ol style="list-style-type: none"> <li>1) <b>Retrieve:</b> Either say the answer out loud or write down the answer BEFORE turning the card over.</li> <li>2) <b>Reorder:</b> Shuffle and flip the cards to retrieve in a different order.</li> <li>3) <b>Repeat:</b> Keep the cards in the "to know" in deck until they have been successfully retrieved THREE times.</li> </ol>	 <p><b>One Minute Summary</b></p> <ol style="list-style-type: none"> <li>1) Summarize, using your own words, in one sentence or in a 6-word story, what you understood from the reading/ topic.</li> </ol> <p><b>One Minute Muddiest Point</b></p> <ol style="list-style-type: none"> <li>2) Write down what you are confused about.</li> </ol>
 <p><b>Retrieve Taking</b></p> <ol style="list-style-type: none"> <li>1) Listen &amp; participate in class but don't take notes (yet!)</li> <li>2) Take closed-book notes and write down important topics to remember.</li> </ol>	 <p><b>Practice Quiz</b></p> <ol style="list-style-type: none"> <li>1) Use your notes/text to create assessment questions.</li> <li>2) Create different types of questions (short answer, multiple choice, broad &amp; detailed content).</li> </ol>
 <p><b>Map It Out</b></p> <p>Create a table, graph or mind map to organize the information.</p>	 <p><b>Sketch It Out</b></p> <p>Create a simple drawing that represents your understanding about a topic or key ideas.</p>
 <p><b>Keywords</b></p> <p>Choose 5 important keywords about the current topic and explain why you chose them.</p>	 <p><b>Link It Up</b></p> <p>Create a list of 5 keywords from the last lesson and explain how they all link together.</p>

# Multimodalities:

Neural networks that connect many sensory systems (seeing, hearing, touching, doing, moving) increase retention and retrieval abilities.



**New England Colonies**

Colonies- Massachusetts, Connecticut, New Hampshire, Rhode Island

My - Massachusetts  
 Cat - Connecticut  
 Never - New  
 Has - Hamph  
 Rabies - Rhode Island

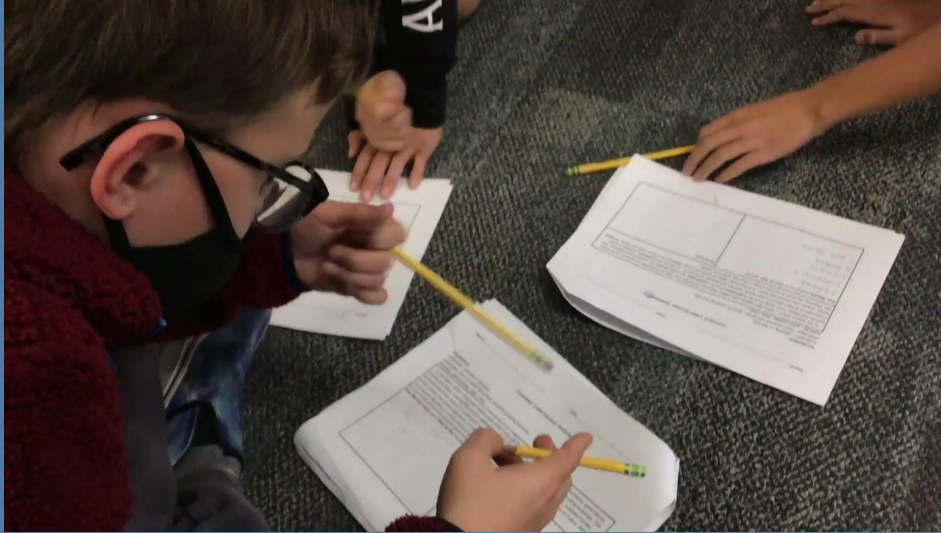
**Climate/Geography** - Colonists in the New England colonies endured bitterly cold winters and mild summers. Land was flat close to the coastline but became hilly and mountainous farther inland. Soil was generally rocky, making farming difficult. Cold winters reduced the spread of disease.

**Religion** - The New England colonies were dominated by the Puritans, reformers seeking to "purify" Christianity, who came over from England to practice religion without persecution. Puritans followed strict rules and were intolerant of other religions, eventually absorbing the separatist Pilgrims in Massachusetts by 1629. Life in New England was dominated by church, and there were severe consequences for those who failed to attend, or those who spoke out against the Puritan ways. Singing and celebrating holidays were among things prohibited in Puritan New England.

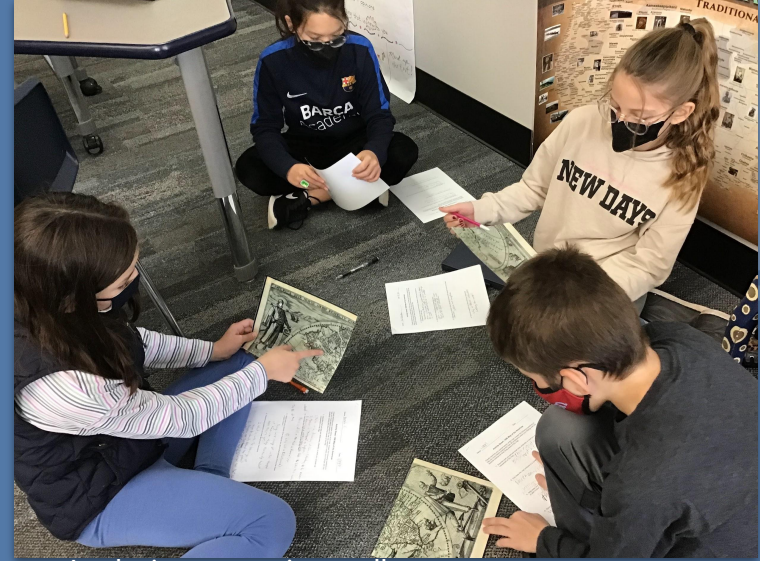
**Economy** - New England's economy was largely dependent on the ocean. Fishing (especially codfish) was most important to the New England economy, though whaling, trapping, shipbuilding, and logging were important also. Eventually, many New England shippers grew wealthy buying slaves from West Africa in return for rum, and selling the slaves to the West Indies in return for molasses. This process was called the "triangular trade."

Application Mts  
 Punishment  
 not inclusive  
 Party Poopers!

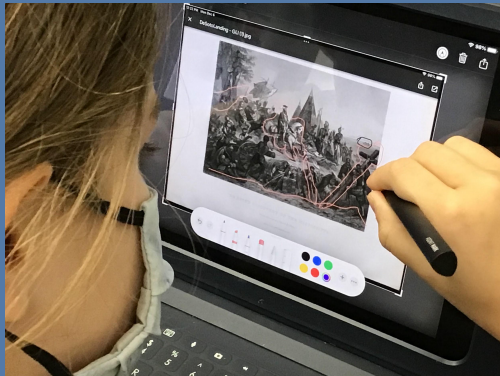
# Multimodalities with Primary Sources



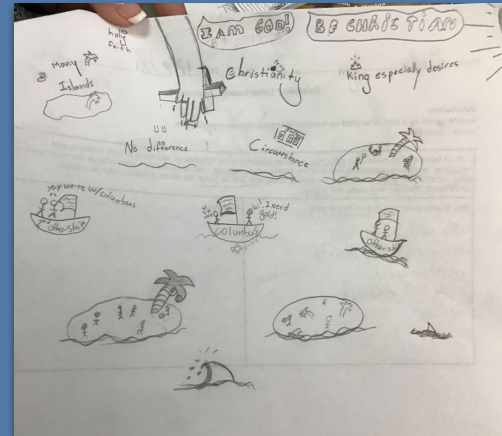
Analyzing Columbus' letter to the king & queen of Spain.



Analyzing a map in small groups.



Analyzing & annotating an image.



Visual interpretation of a text.





### Importance is Everywhere

People only look at the big things in pictures, especially historical ones. You have to look at what's important, that's not on the podium or the throne. You have to look at the smaller things that are just as important, maybe even more important. In historical pictures Native Americans are just pushed aside and seen as pawns in a chess game. They are seen as they are worth nothing. They are seen as slaves. That's why in my artwork I made the natives pop out. I whited out some Spaniards and their weapons. I also crumpled up De Soto's men. I made De Soto and his horse gold, which means power. After all of that you can see the Native Americans finally pop out in a historical picture.

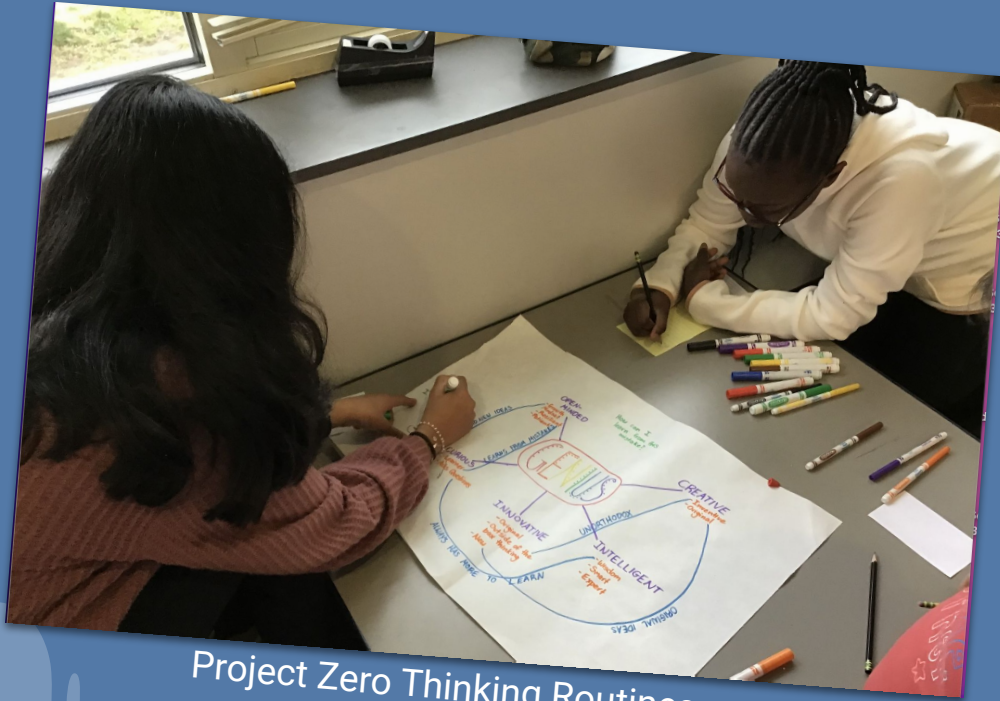


### Hidden Perspective

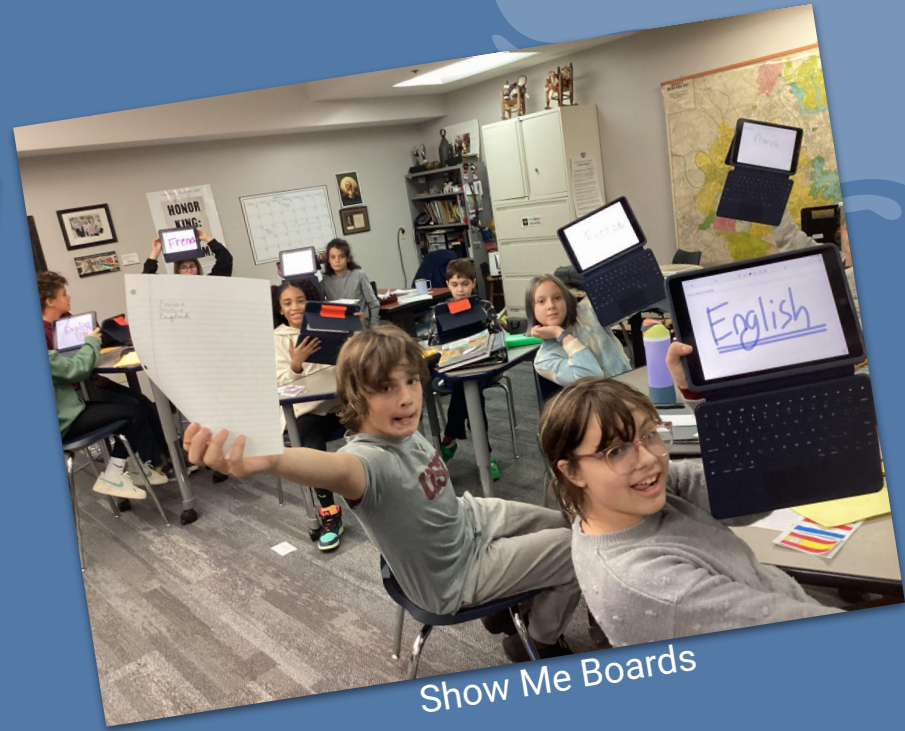
Imagine someone you've never met came & just kicked you out or hurt you & benefited from it. Well, let's go back to Hernando De Soto. I created this art to show the natives' perspective of what was happening. I cut out De Soto, the cross they were putting in, & the flags because I felt that is where they showed the most power. I ghosted De Soto's crew because I felt that they were still powerful but not the most powerful part of the image. The parts I cut out I filled the area with a letter for the queen & king. To me the letter just shows how De Soto & other explorers have benefited from lying to the queen & king saying how nice they have been welcomed & how all the natives let them take over. But in reality the natives were just scared & wanted to keep their lives. I made the natives pop out from the page to really bring attention to them because they were the ones being kicked off their land & being enslaved. Art can really bring your attention to the hidden or unrecognized parts in history, & that is what I tried to do with my piece.



# Formative Assessments



Project Zero Thinking Routines



Show Me Boards

# COLD CALLING

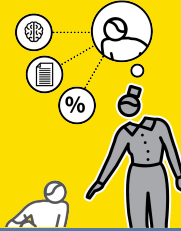
- 1
- 2
- 3
- 4
- 5



ASK THE CLASS THE QUESTION



GIVE THINKING TIME



SELECT SOMEONE TO RESPOND



RESPOND TO THE ANSWERS



SELECT ANOTHER STUDENT AND RESPOND AGAIN

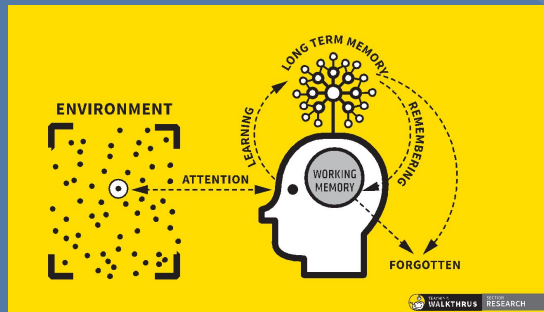


Image from [Tom Sherrington's Teachhead Blog](#)

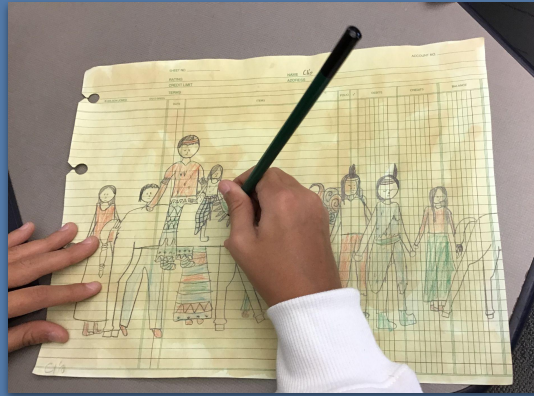
# Checking for Understanding

<b>Show Me Boards</b>	<b>Think, Pair, Share</b>	<b>Cold Calling</b>
Quick hit of seeing all student answers at once.	Explore student ideas verbally and an opportunity for students to rehearse explanation.	Explore a sample of responses in depth with everyone's mind engaged.

# Art Integration



Black Joy & Genius



Native American Ledger Art



Race Project



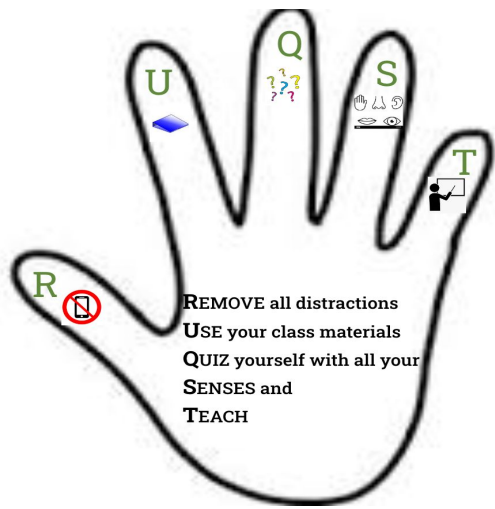
Fabric of Freedom Quilt



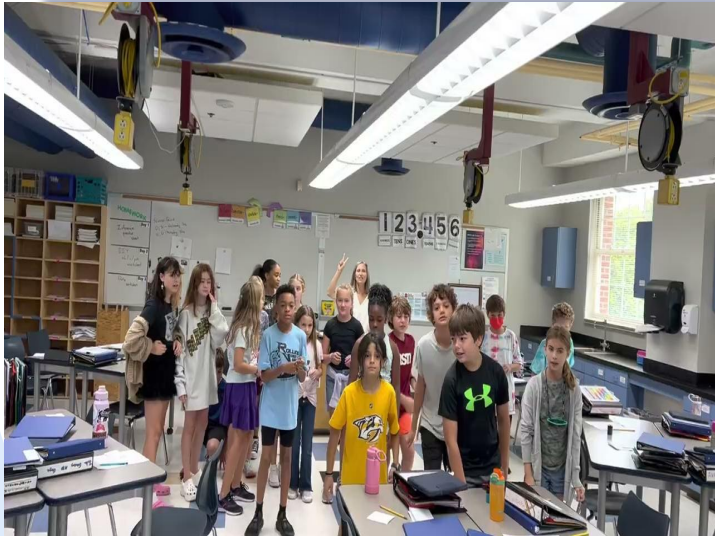
Sundown Towns

# Make Learning Meaningful with Place-Based Learning





# Student Voices: Which MBE Strategy?



A 5th grader describes the role of retrieval in the memory-making process.



5th graders work together to retrieve the pathway of a memory.



An 8th grader with dyslexia describes his move towards MBE strategies over his middle school years.



An 8th grader describes the difference in how he *feels* now that he has MBE strategies in his tool box.



# Twitterverse Recommendations



- ✓ Tom Sherrington - @teacherhead
- ✓ Walkthurs - @WALKTHRUs\_5
- ✓ Dylan Wiliam - @dylanwiliam
- ✓ Daniel Willingham - @DTWillingham
- ✓ Inner Drive - @Inner\_Drive
- ✓ Kate Jones - @KateJones\_teach
- ✓ Oliver Lovell - @olicav
- ✓ Retrieval Practice (Pooja Argawal) @RetrieveLearn
- ✓ David Goodwin - @MrGoodwin23

# Books & Resources We Currently Love....

*Transforming Your Teaching: Practical Classroom Strategies Informed by Cognitive Neuroscience*, by Kimberly Carraway

*Neuroteach*, by Whitman and Kelleher

*A Mind for Numbers: How to Excel at Math and Science (Even if You Flunked Algebra)*, by Barbara Oakley

*Learning How to Learn*, by Barbara Oakley

*Uncommonsense Teaching*, by Barbara Oakley

*Learning How to Learn* video course on [Coursera](#) for [youth](#) or for [adults](#)

*Powerful Teaching*, by Pooja Agarwal and Patrice Bain

*A Parent's Guide to Powerful Teaching*, by Patrice Bain

*Remember: The Science of Memory and the Art of Forgetting*, by Lisa Genova

*Seven and a Half Lessons about the Brain*, by Lisa Feldman-Barrett

*Teaching WalkThrus: Visual Step-by-Step Guides to Essential Teaching Techniques*, by Caviglioli and Sherrington

[Innerdrive](#)

[The Learning Scientists](#)



# Stay in touch

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*Special and immense thanks to Emily Holt for her partnership in ALL things “art”!*

# Sources

## **Images:**

<https://thenounproject.com/browse/icons/term/self-reflection/>

<https://depositphotos.com/95513932/stock-illustration-vector-black-brain-icon.html>

<https://www.dreamstime.com/outline-test-quiz-vector-icon-isolated-black-simple-line-element-illustration-user-interface-concept-editable-stroke-white-image144301204>

*Neuroteach, Whitman and Kelleher*

## **Tom Sherrington Graphics:**

<https://teacherhead.com/2021/02/07/cold-calling-the-1-strategy-for-inclusive-classrooms-remote-and-in-person/>

## **Anyone, Anyone teacher from Ferris Bueller's Day Off Clip**

<https://www.youtube.com/watch?v=uhiCFdWeQfA>

## **Slidesgo:**

Brain Surgery presentation slide template