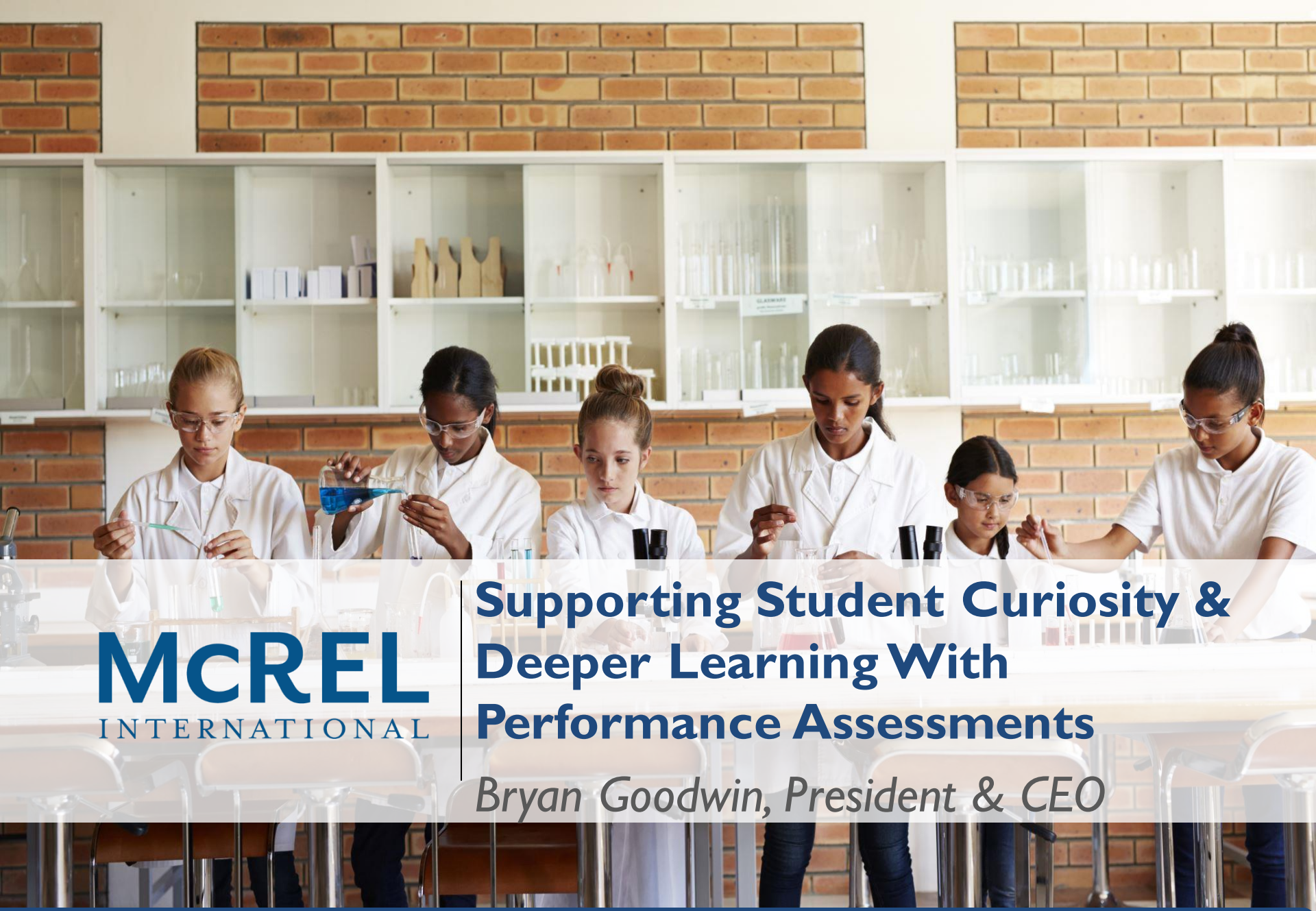

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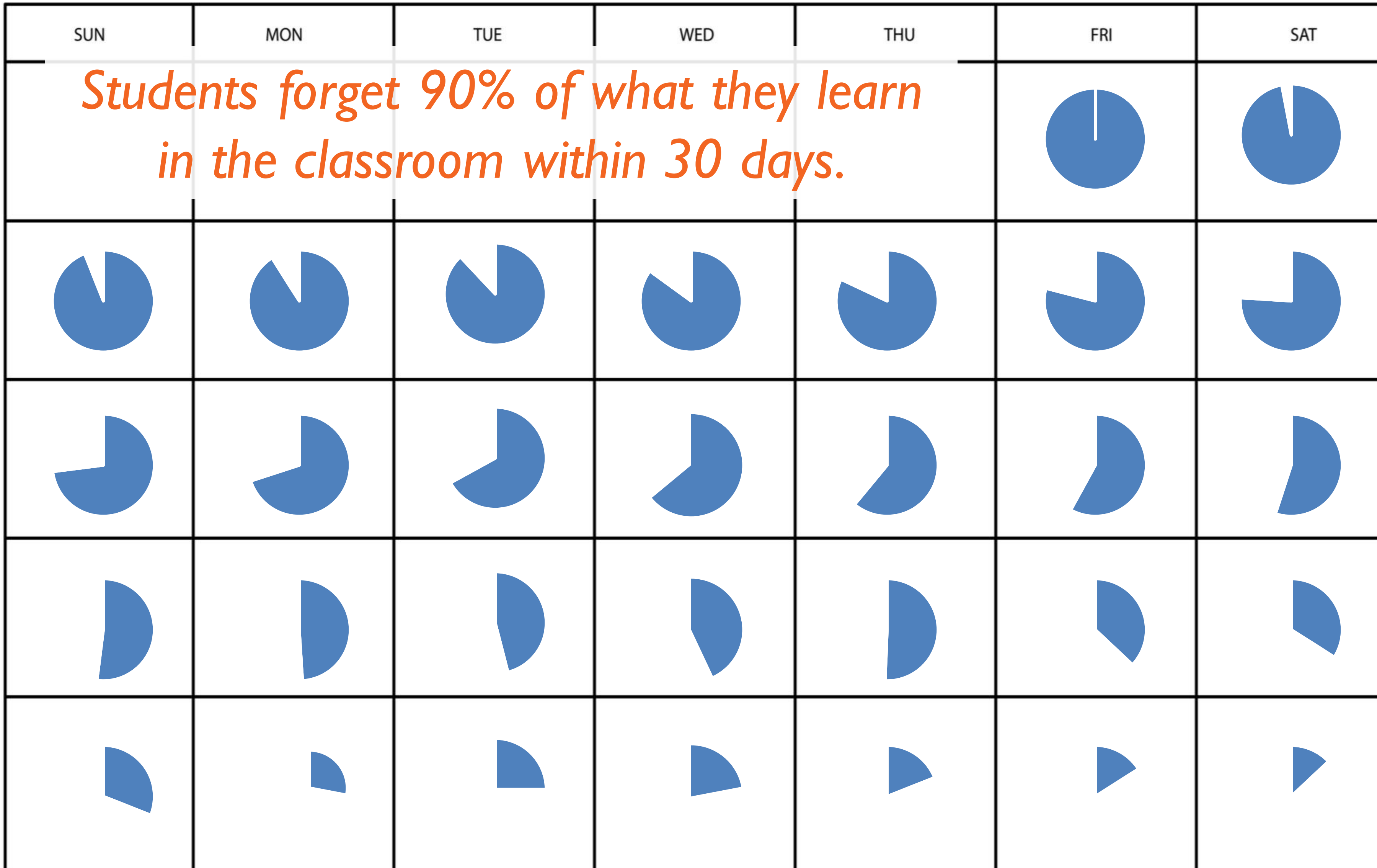
Supporting Student Curiosity & Deeper Learning With Performance Assessments

Bryan Goodwin, President & CEO

curiosity for better learning

Month



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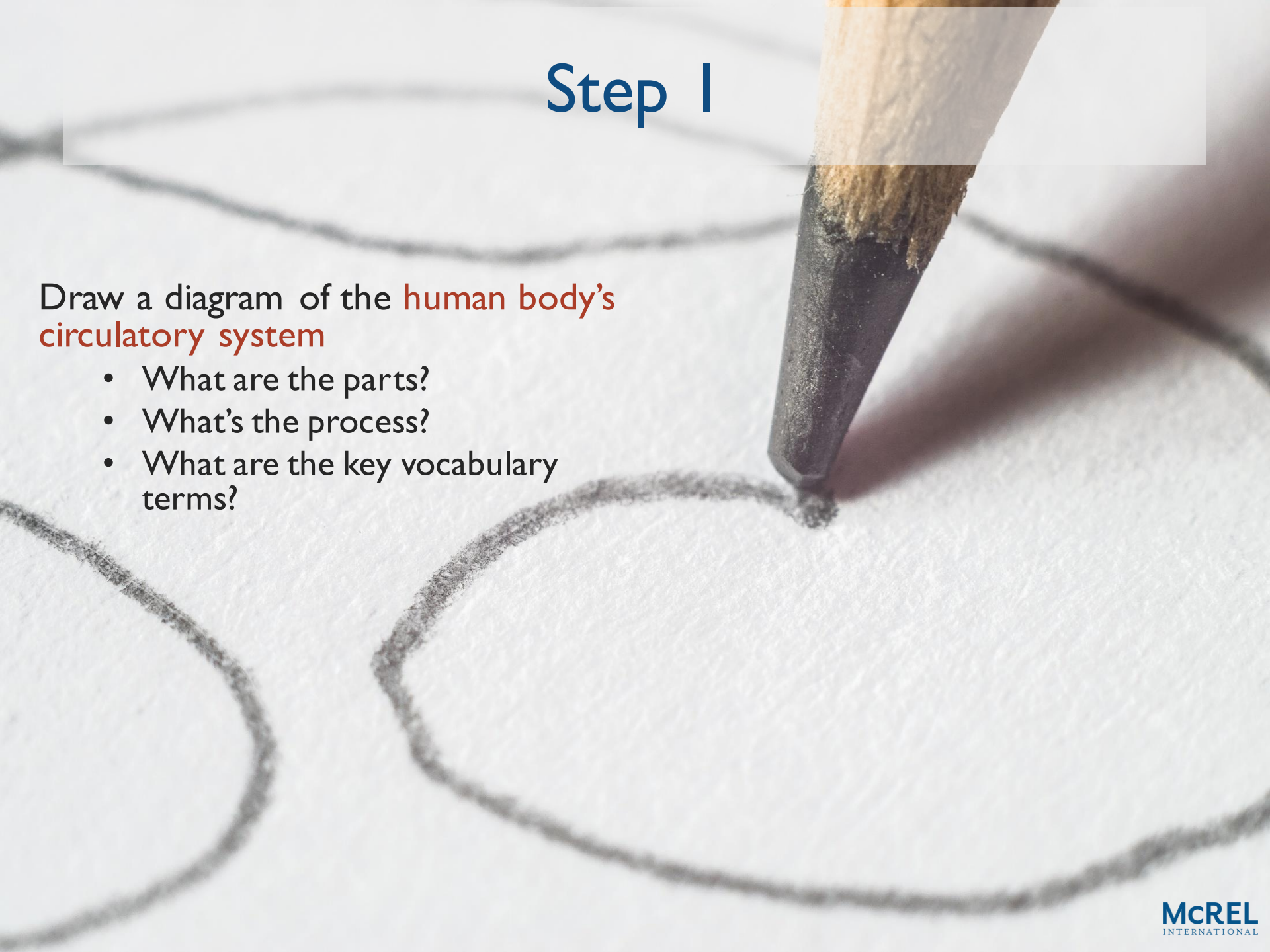
Why do you think students forget 90% of what they learn in the classroom within 30 days?

Provide Your Answer In The Chat

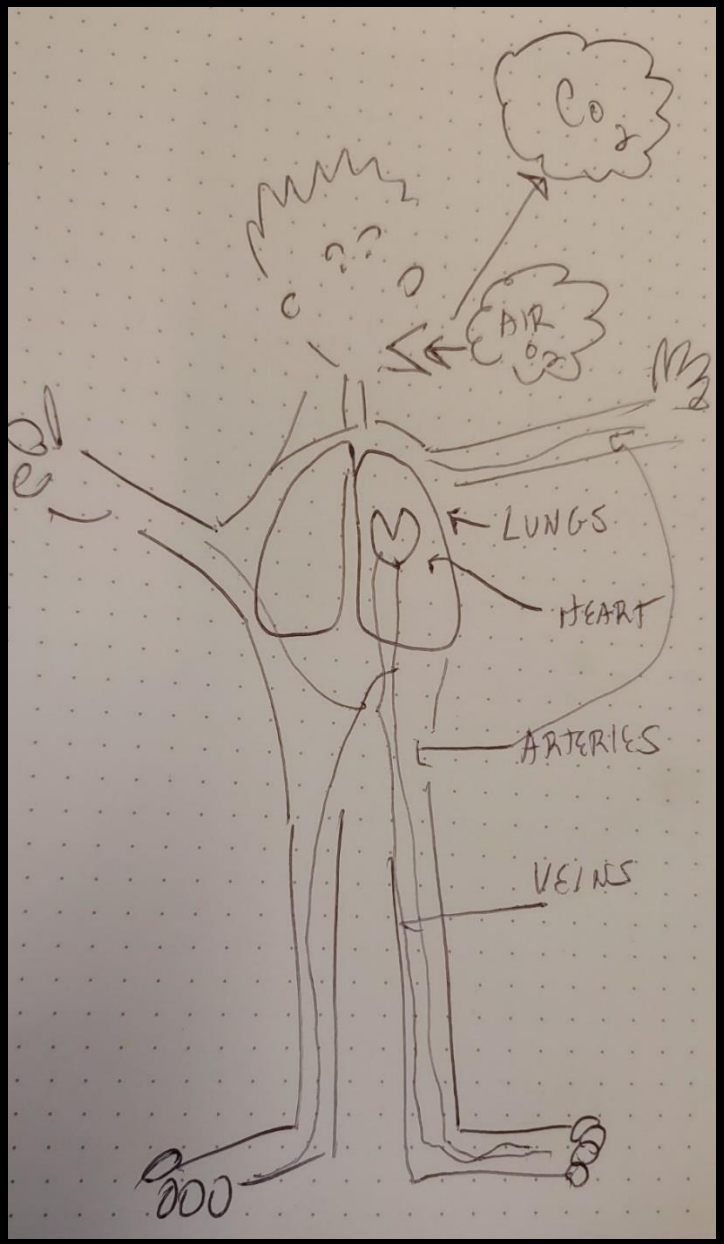
Lateral Thinking Activity

Step 1

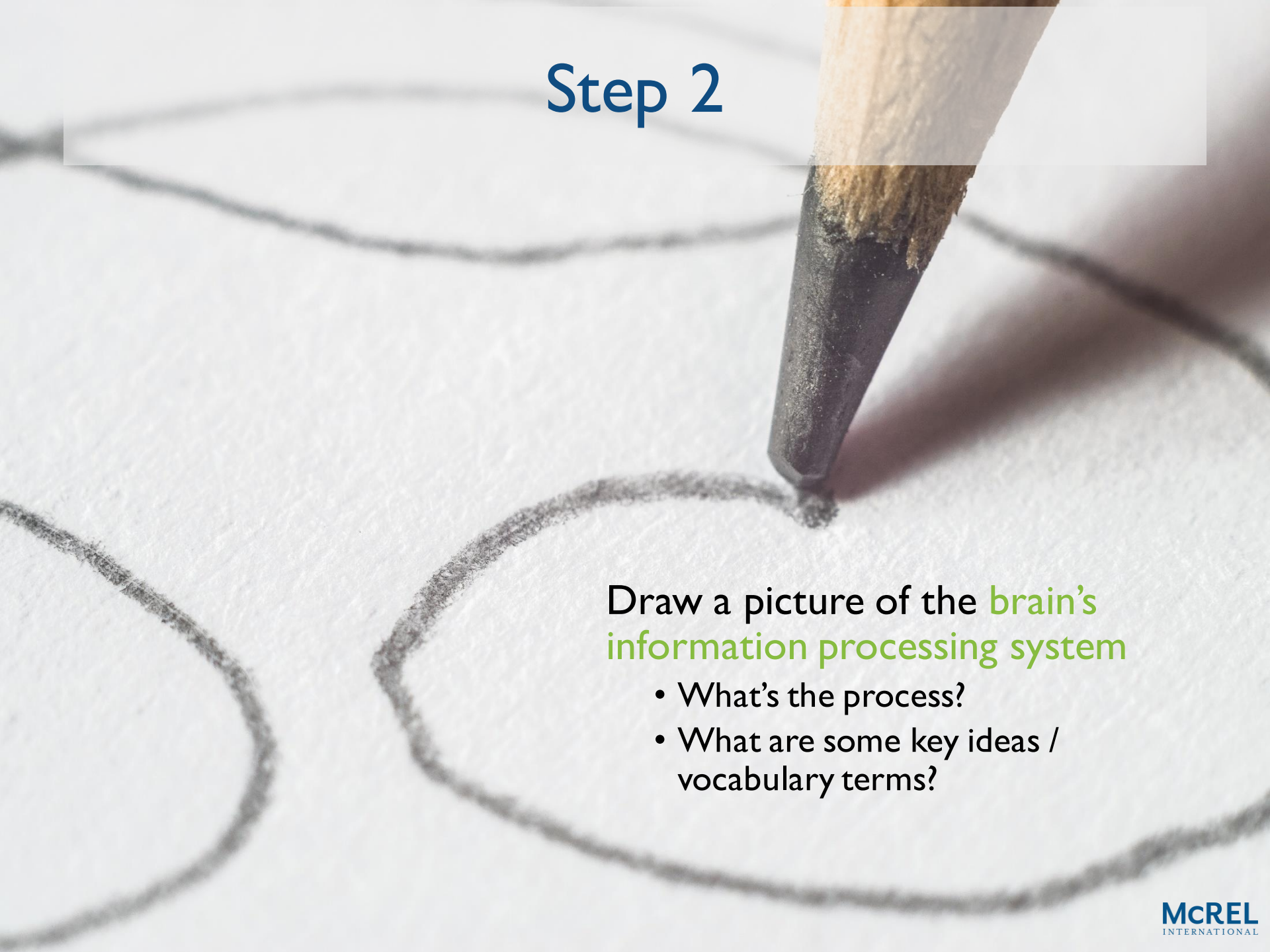


Draw a diagram of the human body's circulatory system

- What are the parts?
- What's the process?
- What are the key vocabulary terms?



Step 2



Draw a picture of the brain's information processing system

- What's the process?
- What are some key ideas / vocabulary terms?


Teaching…
It's like performing non-invasive brain surgery on 25 patients at a time.
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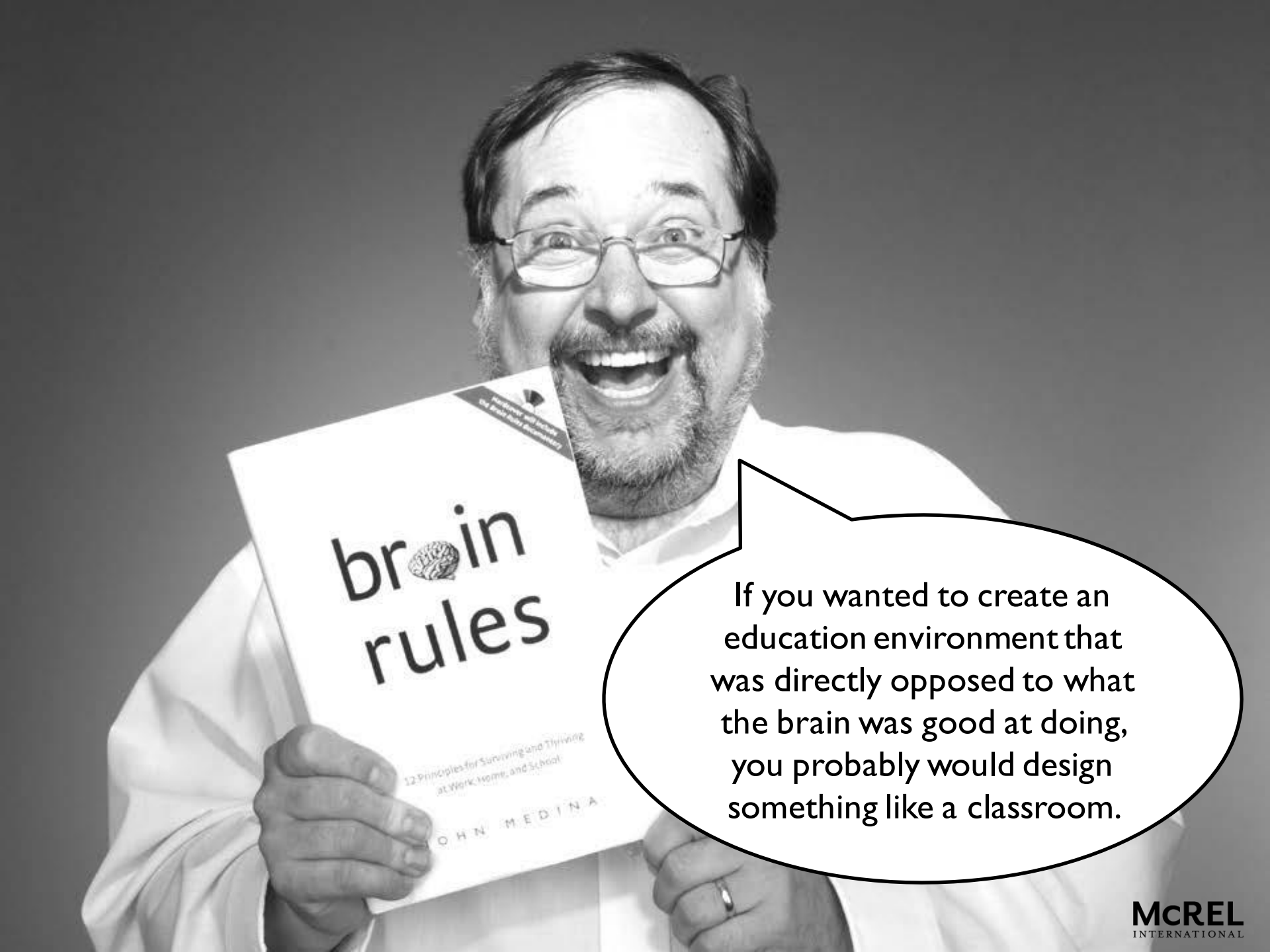

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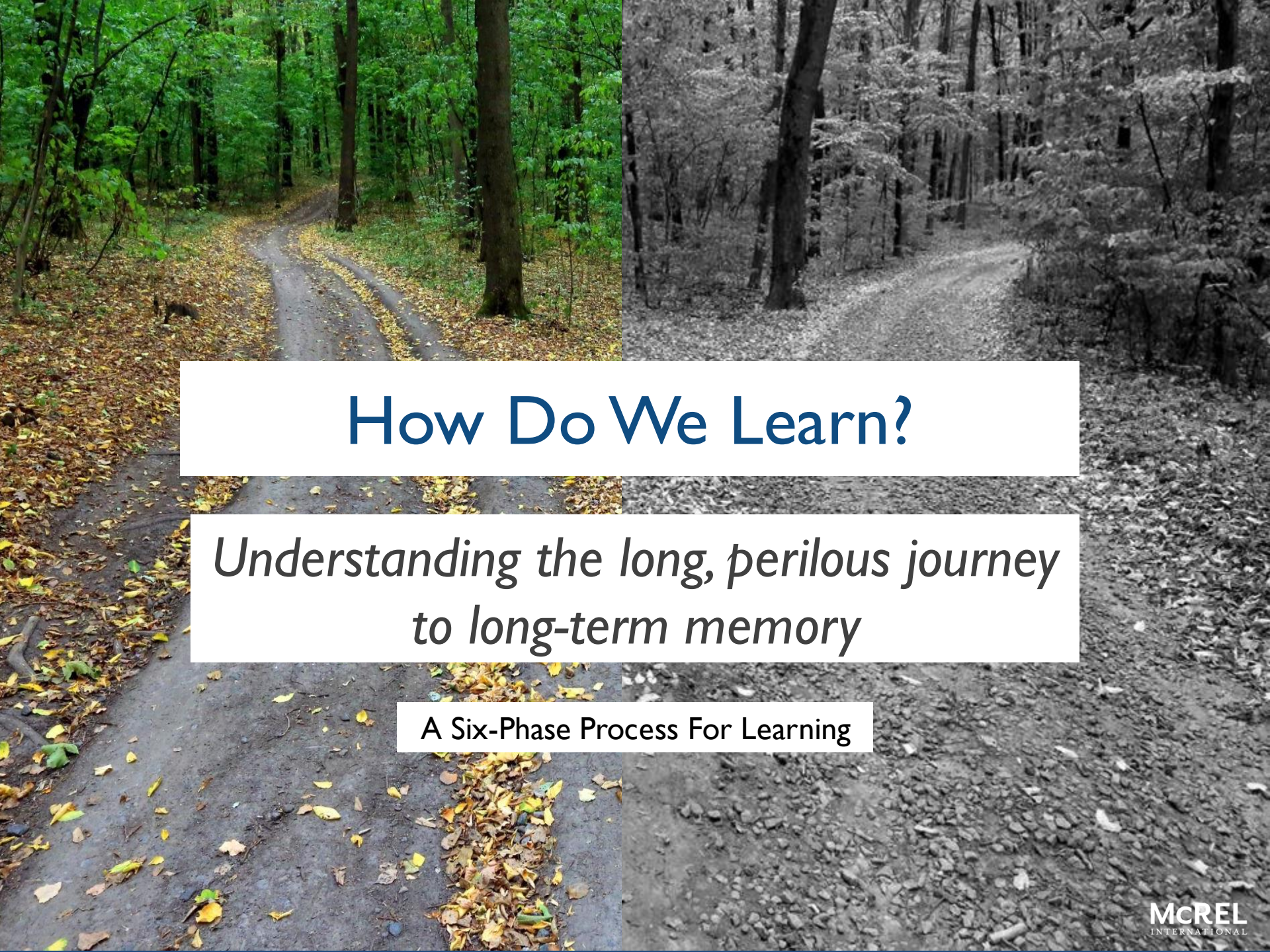
Our Guiding Questions For Today

What is the process of learning?

How can we apply what we know from the science of learning to create unforgettable learning experiences for students?



How Do We Learn?

Understanding the long, perilous journey to long-term memory

A Six-Phase Process For Learning

Where Learning Begins: Immediate Memory

30 Seconds

Our senses record 11 million bits of information per second.

How many bits can our brains absorb?

About 120 bits per second.

How do we find signal in all this noise?

Stimuli With
Emotional Valence

Where Learning Begins: Immediate Memory

30 Seconds

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About 120 bits per second.

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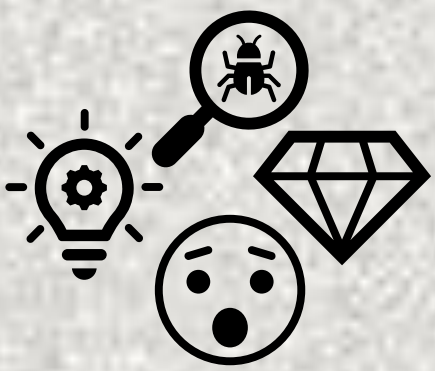
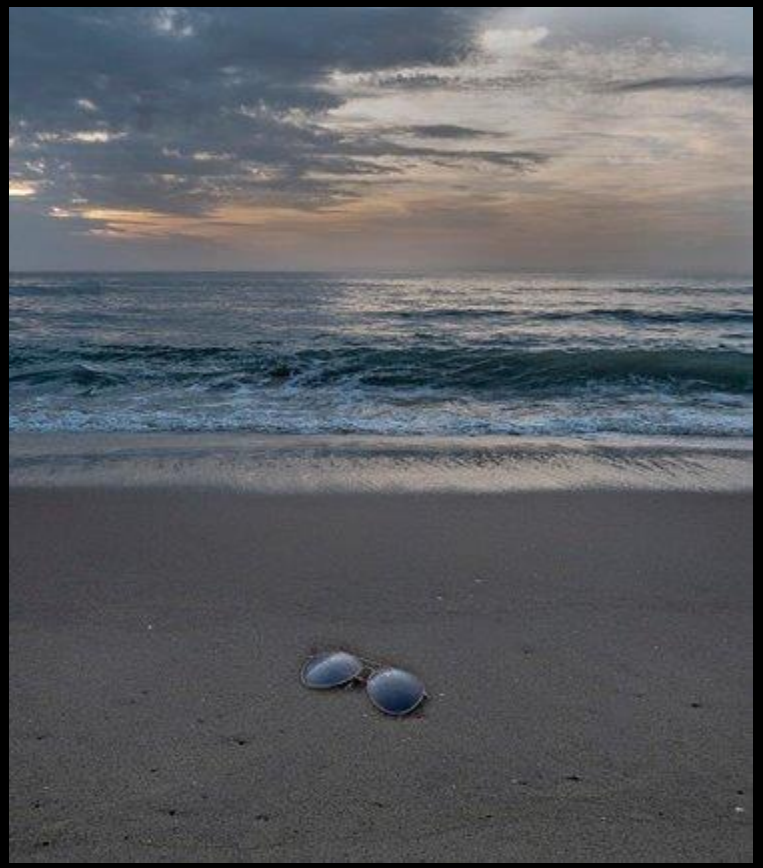


Novel or
Interesting Stimuli




What grabs your attention?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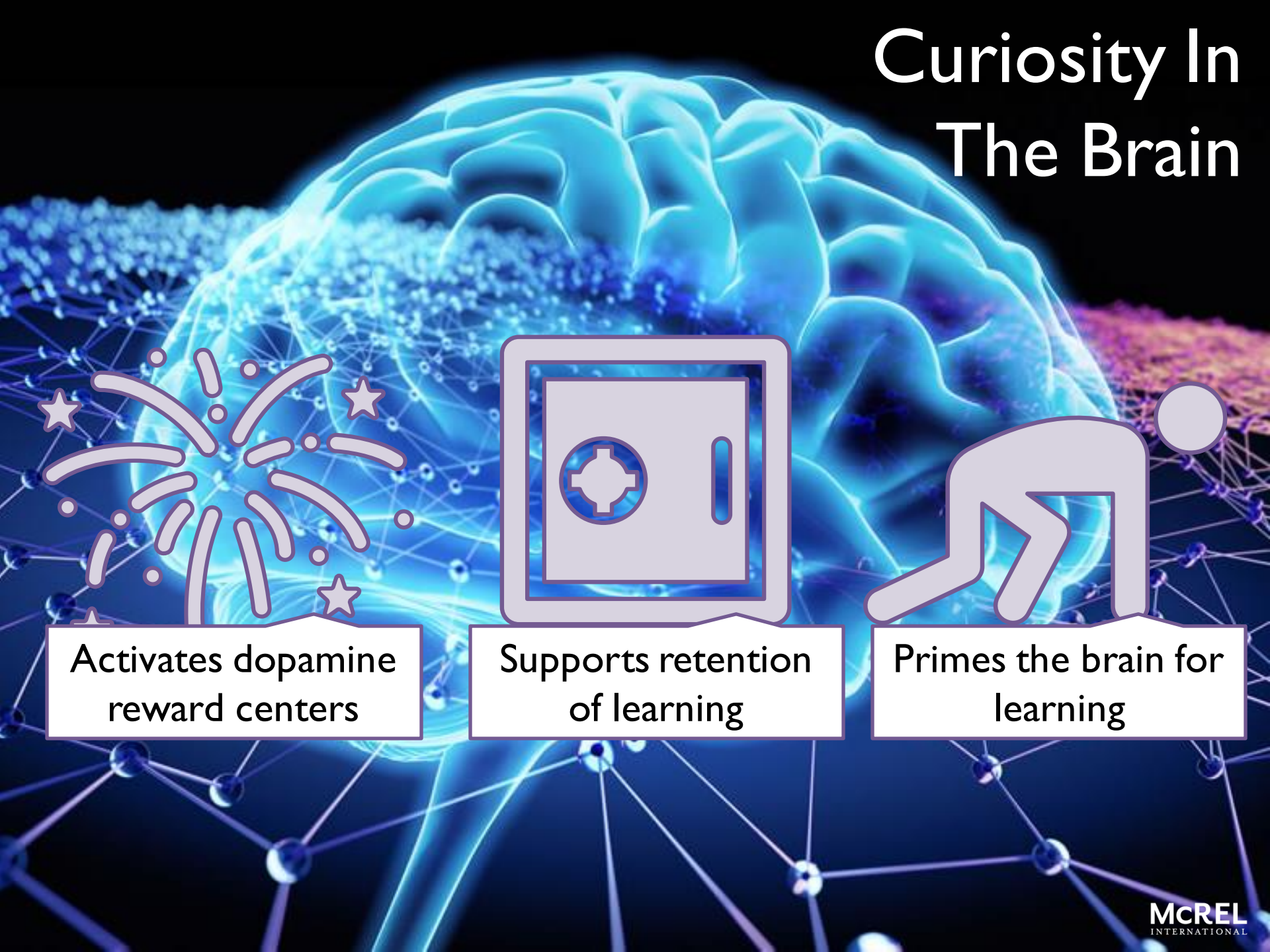
Curiosity In The Brain



Activates dopamine reward centers

Supports retention of learning

Primes the brain for learning

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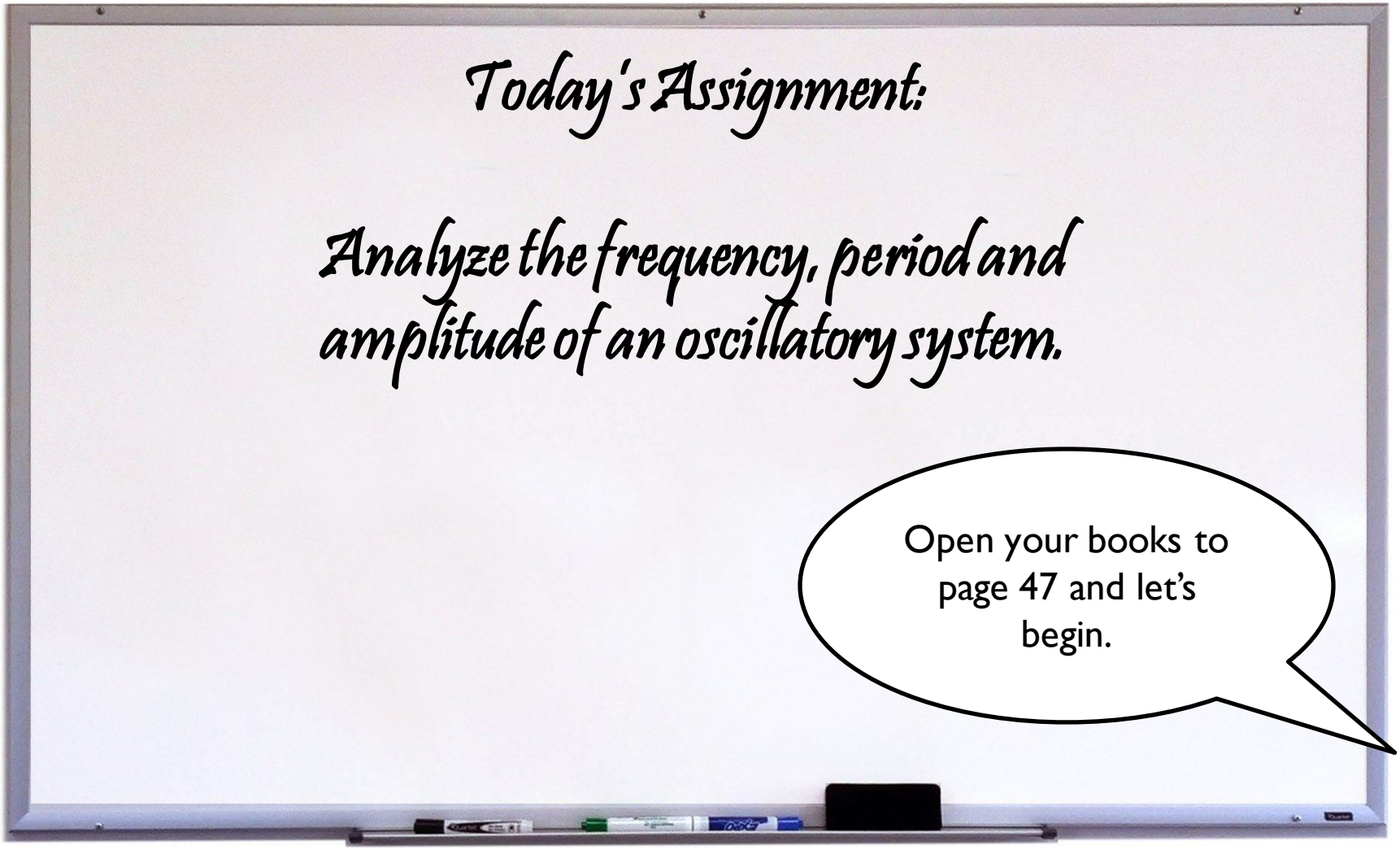

Oscillations are all around us—in our bodies, in music, business cycles, geysers, bridges, and automotive parts like springs.

In this unit, we're going to explore oscillations and how we can measure, predict, and harness them to solve real-world challenges.

Spark Learning With Curiosity

Students' Brains Are Designed To Ignore Boring Stimuli And Pay Attention To What Sparks Their Curiosity.

Brain-Based Learning Tip #1

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Become Interested

Share In Chat

What hooks your students' curiosity?

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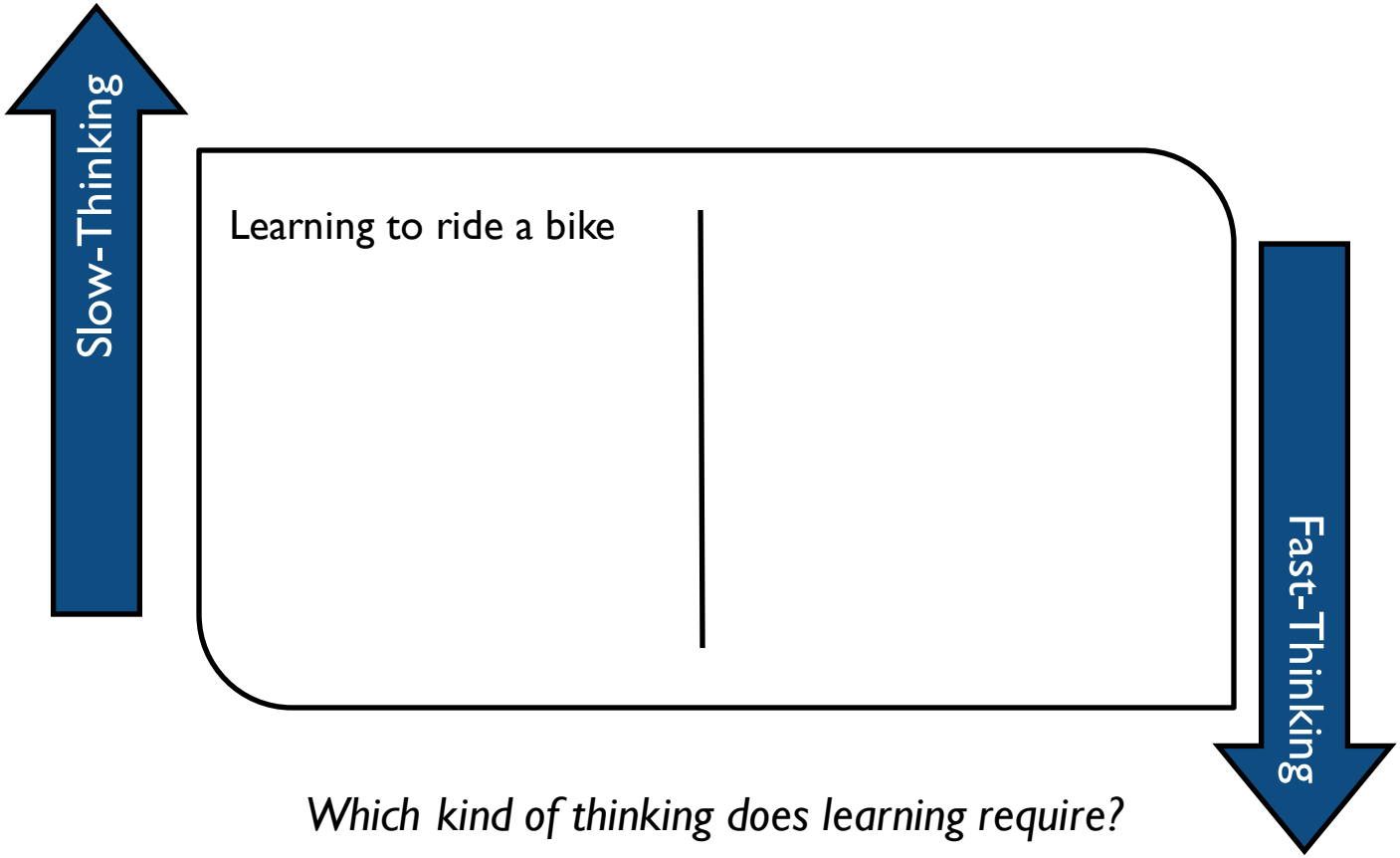
My Students Have Become Interested In Learning.

Now What?

Our Brains Have Two Operating Systems



Which kind of thinking does learning require?

Which kind of thinking do our brains prefer?

An Inescapable Truth: Our Brains Would Rather Do This …

So How Do Convince Our Brains To Put Forth Effort?

Become Interested

Commit To Learning

What's The Formula For Student Motivation?

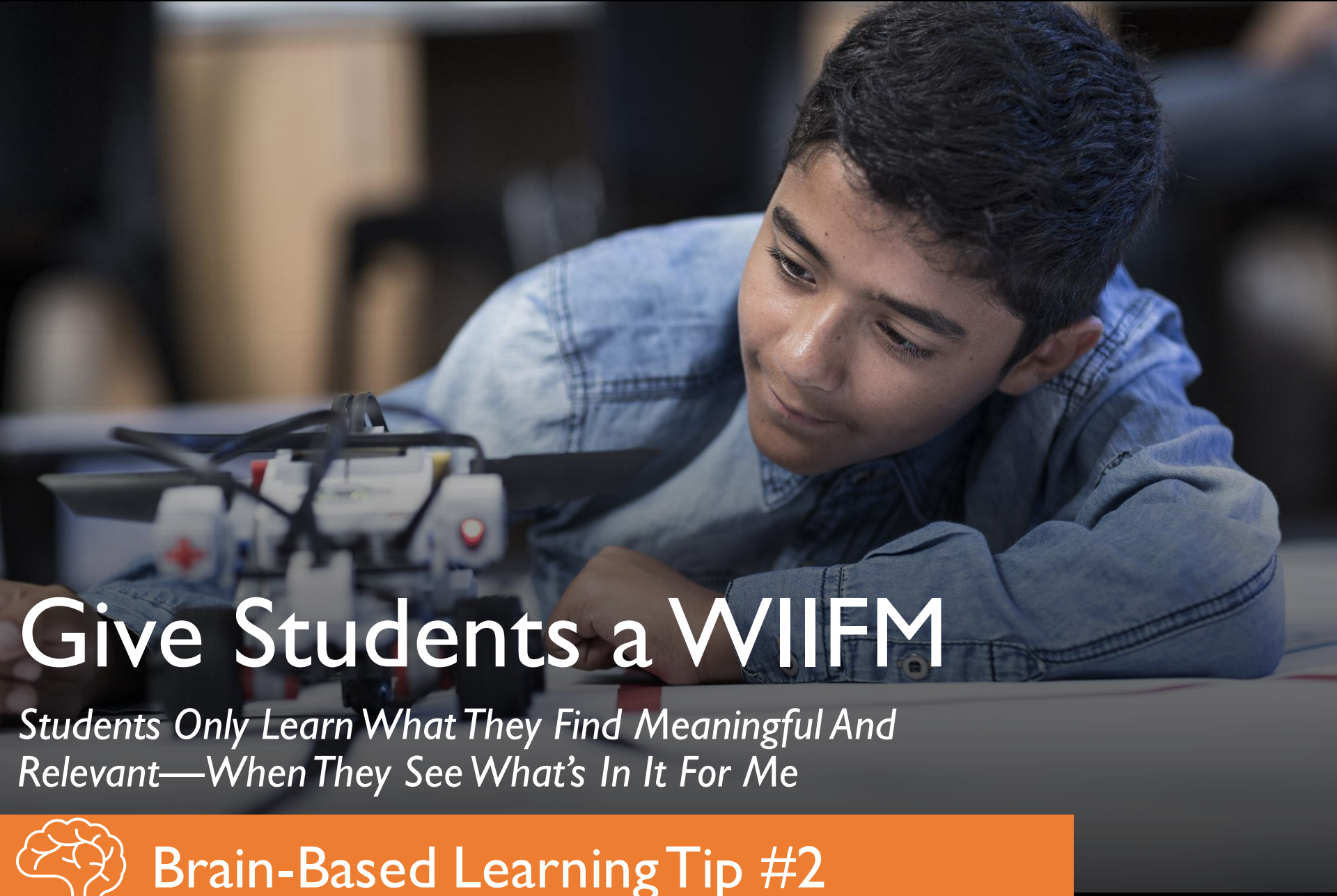
Expectancy
(can I do it?)

Value
(is it worth it?)

Motivation
To Learn

Brophy, J. (2004). *Motivating students to learn*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

2 Questions Our Brains Ask Before We Commit To Learning



Give Students a WIIFM

Students Only Learn What They Find Meaningful And Relevant—When They See What's In It For Me

Brain-Based Learning Tip #2

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Chat Discussion

When do your students most commited to learning?

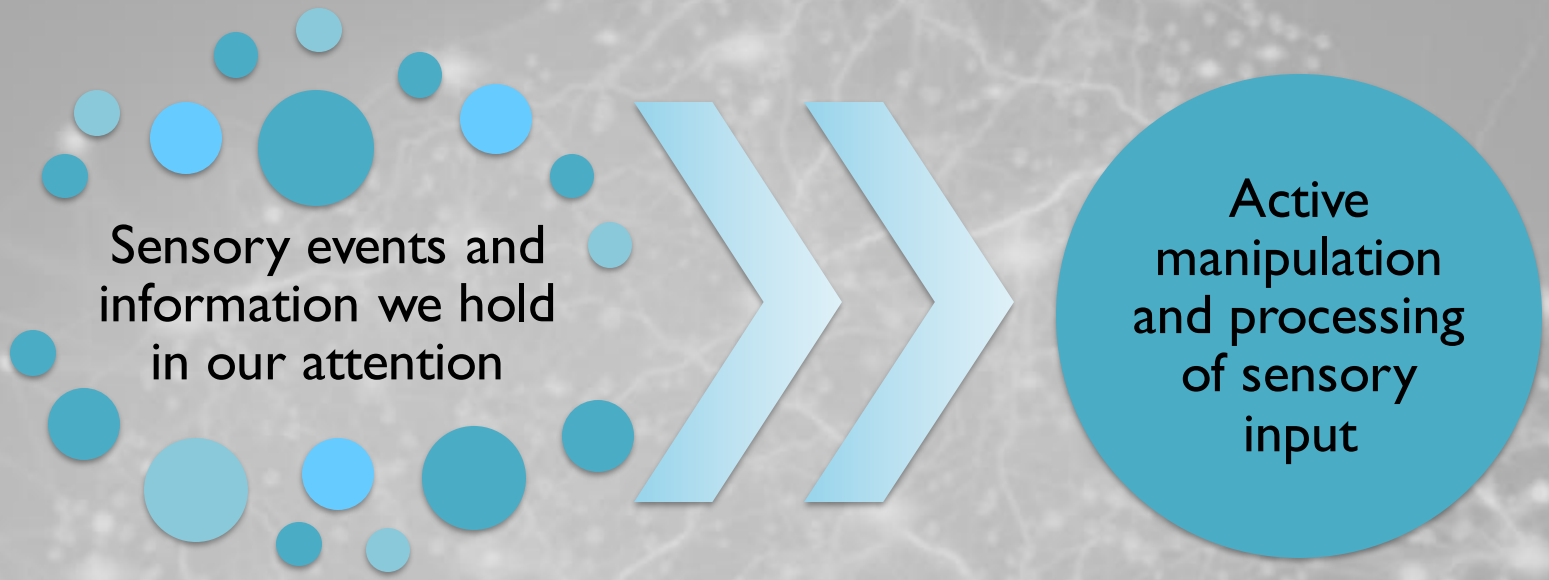
Immediate Memory

Become Interested

Commit To Learning

Short-Term Working Memory (Input)

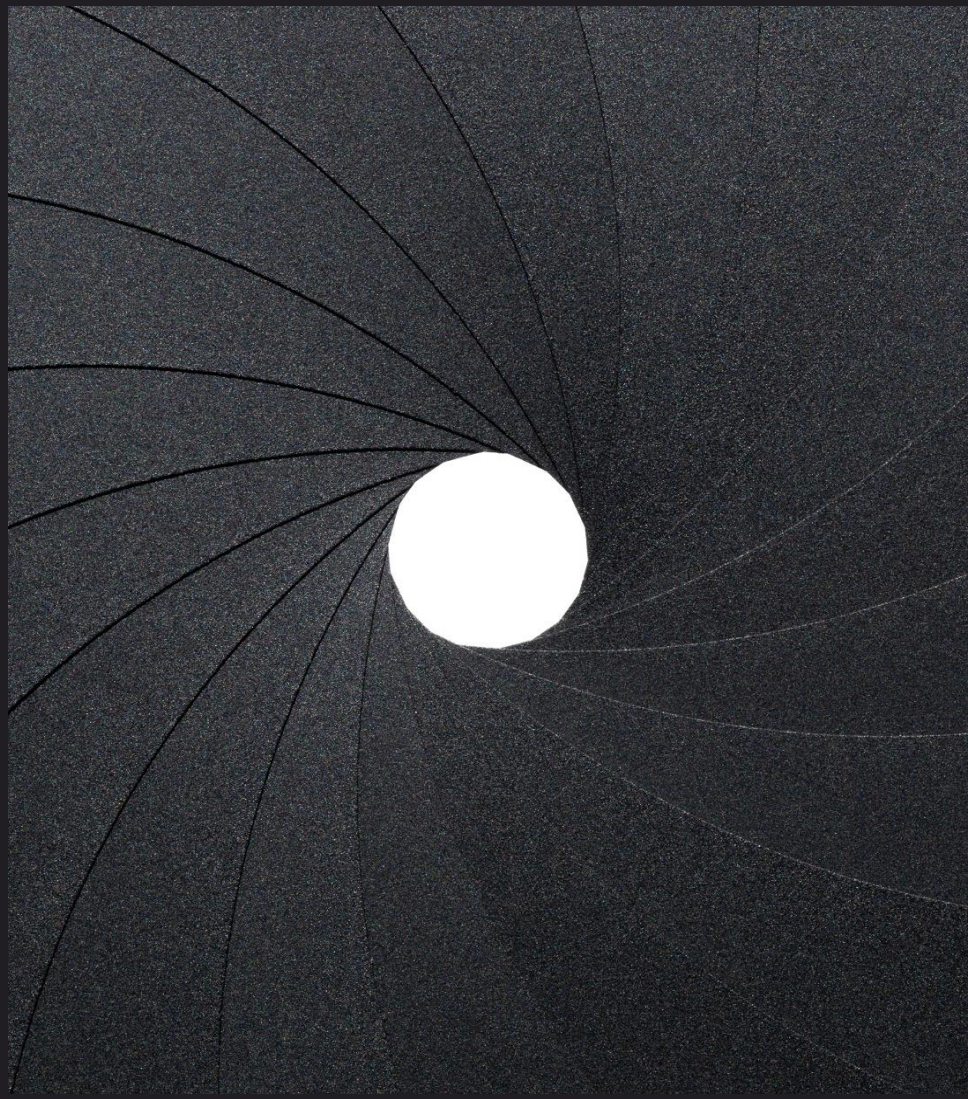
What Is Short-Term Working Memory?



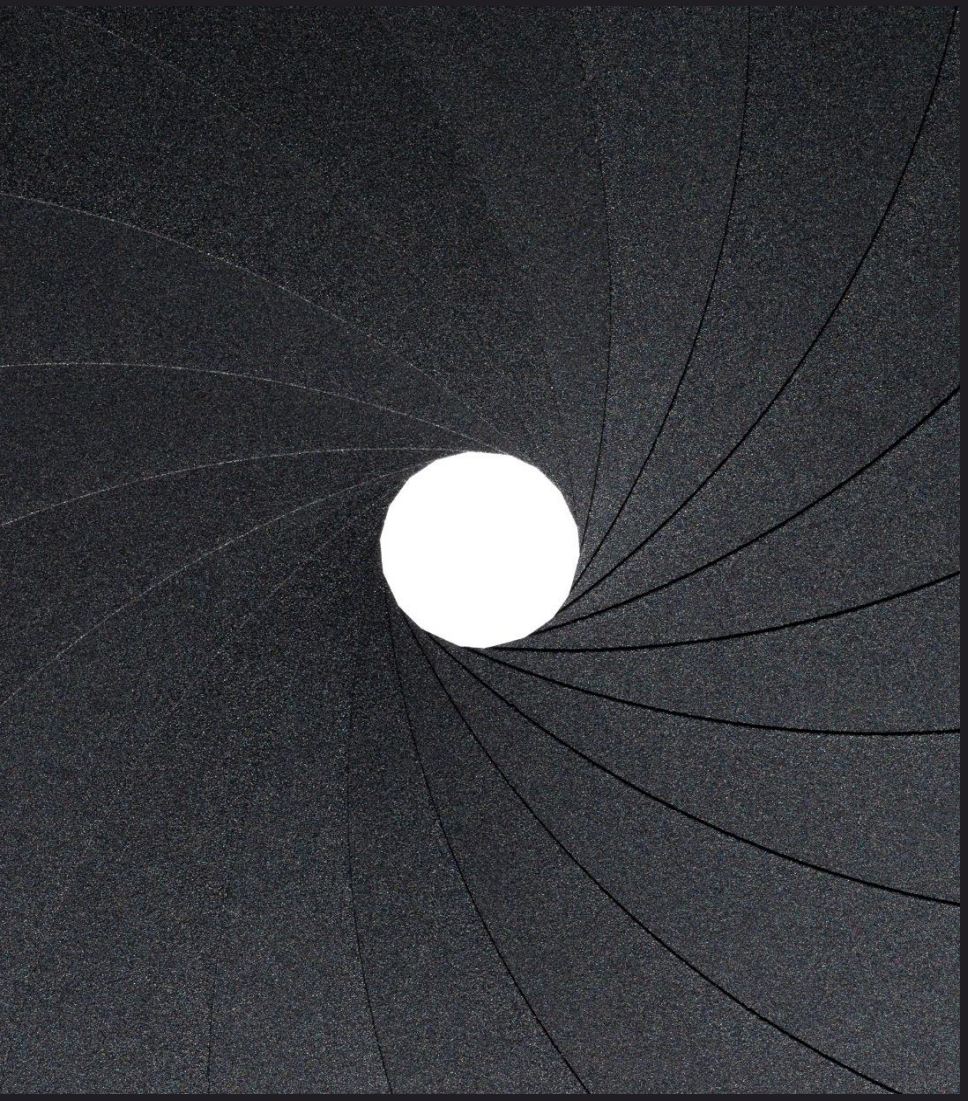
Short-Term Working Memory

Working Memory Can Focus On Just One Thing At A Time*

Our brains receive millions of bits of stimuli per second but can only handle about 60 bits of *verbal* information at once (equivalent to one person speaking to us).

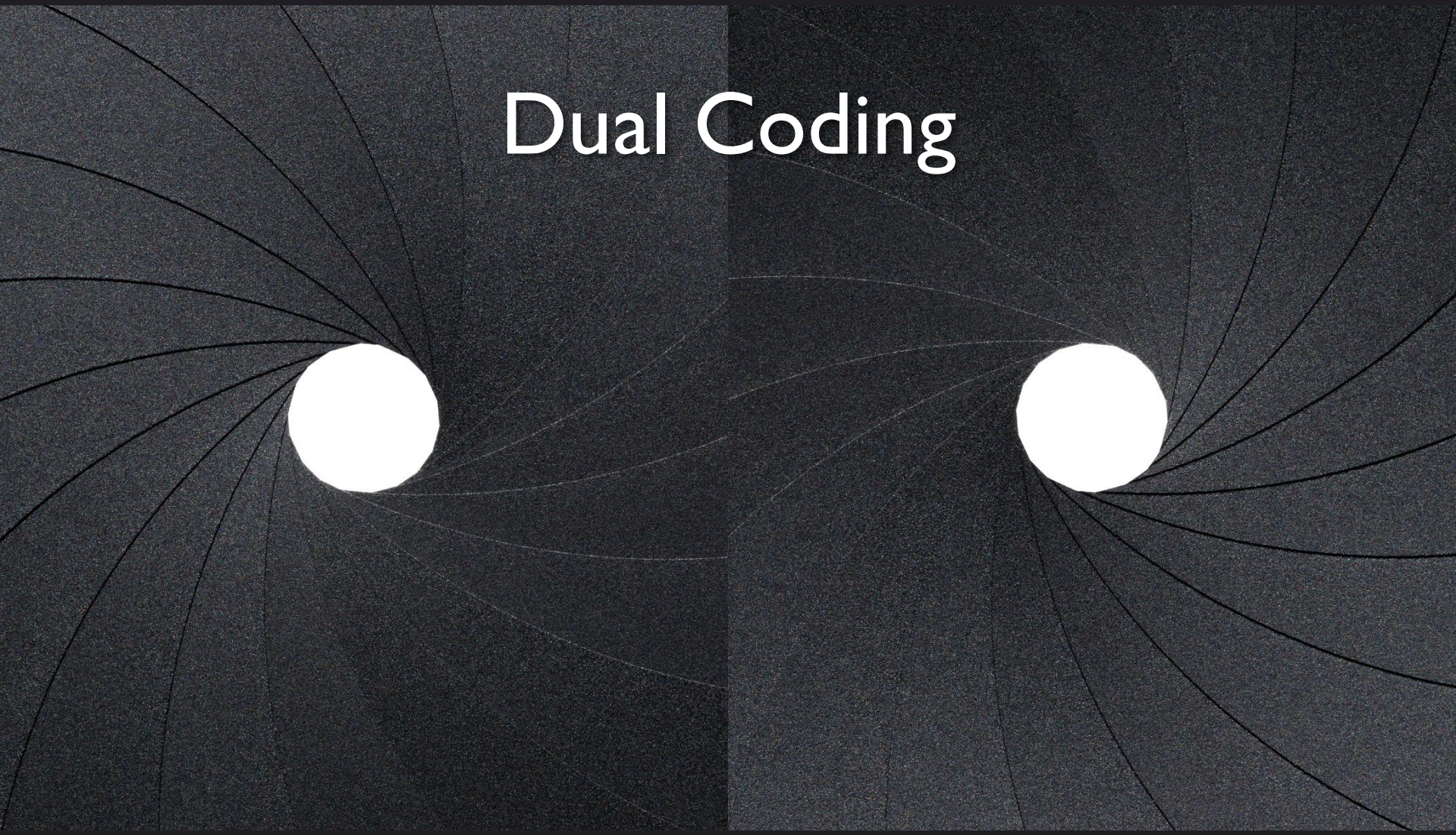


Working Memory Can Focus On Just One Thing At A Time*



We can only process about 60 bits of *visual* information at once (which is why we can only look at one thing at a time).

Our Brains Can Only Focus On One Thing At A Time*



** But we can process visual and verbal information simultaneously.*

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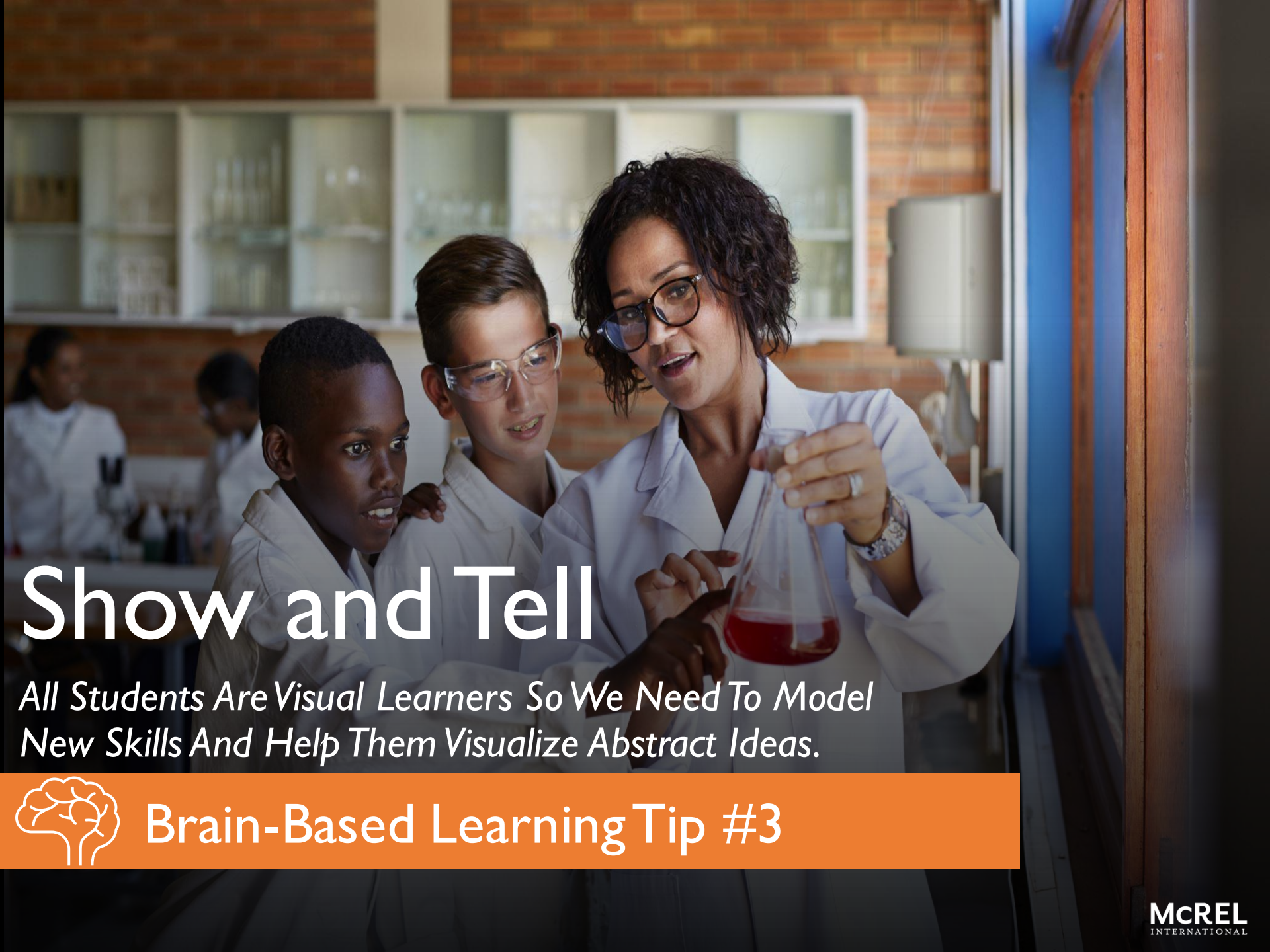

Show and Tell

All Students Are Visual Learners So We Need To Model New Skills And Help Them Visualize Abstract Ideas.

Brain-Based Learning Tip #3

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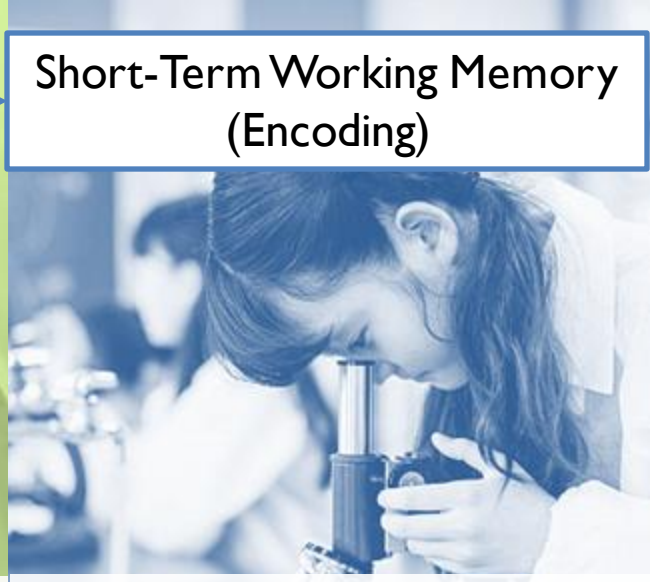
Immediate Memory

Become Interested

Commit To Learning

Short-Term Working Memory (Encoding)



Focus On New Learning

Working Memory Can Only Hold About 4 Bits Of Information At Once

Working Memory "Times Out" After 5-10 Minutes.

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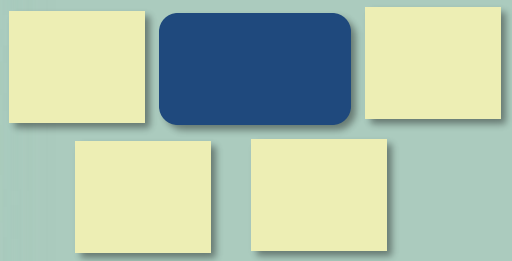
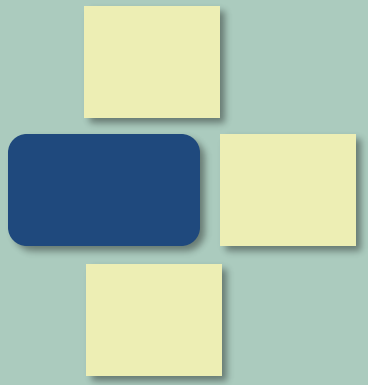
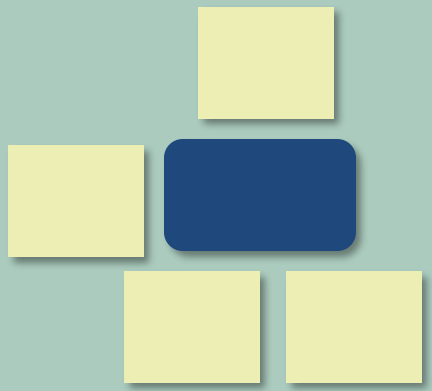
Students Only Remember What They *Think About* In Working Memory

We Learn Best When We Have Opportunities To Categorize, Connect And Cluster New Information







Chunk Learning Into Bite-Sized Segments

Give Students Time To Pause And Process Learning

Brain-Based Learning Tip #4

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Focus On New Learning

Make Sense Of Learning

Pause & Process

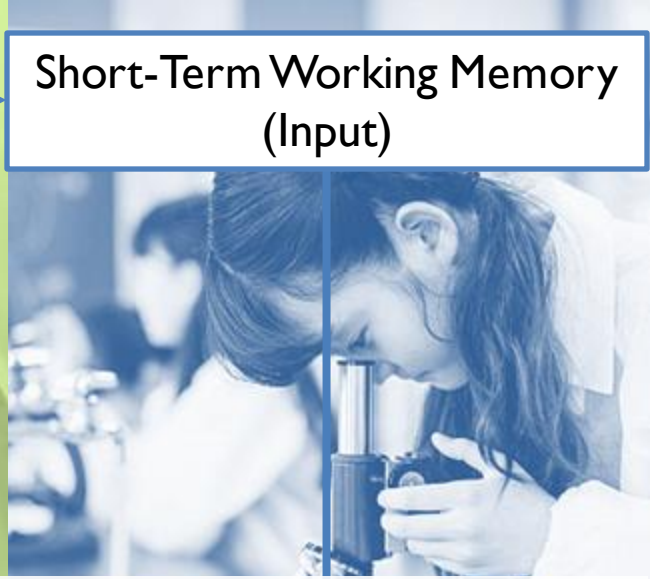
In your experience, how often do classroom learning conditions

- *Make learning visual?*
- *Provide opportunities for them to pause & process their learning?*

What differences might you see in student learning if they consistently experienced these learning conditions?

Immediate Memory

Short-Term Working Memory (Input)



Become Interested

Commit To Learning

Focus On New Learning

Short-Term Working Memory (Consolidation)

Long-Term Memory

Make Sense of Learning

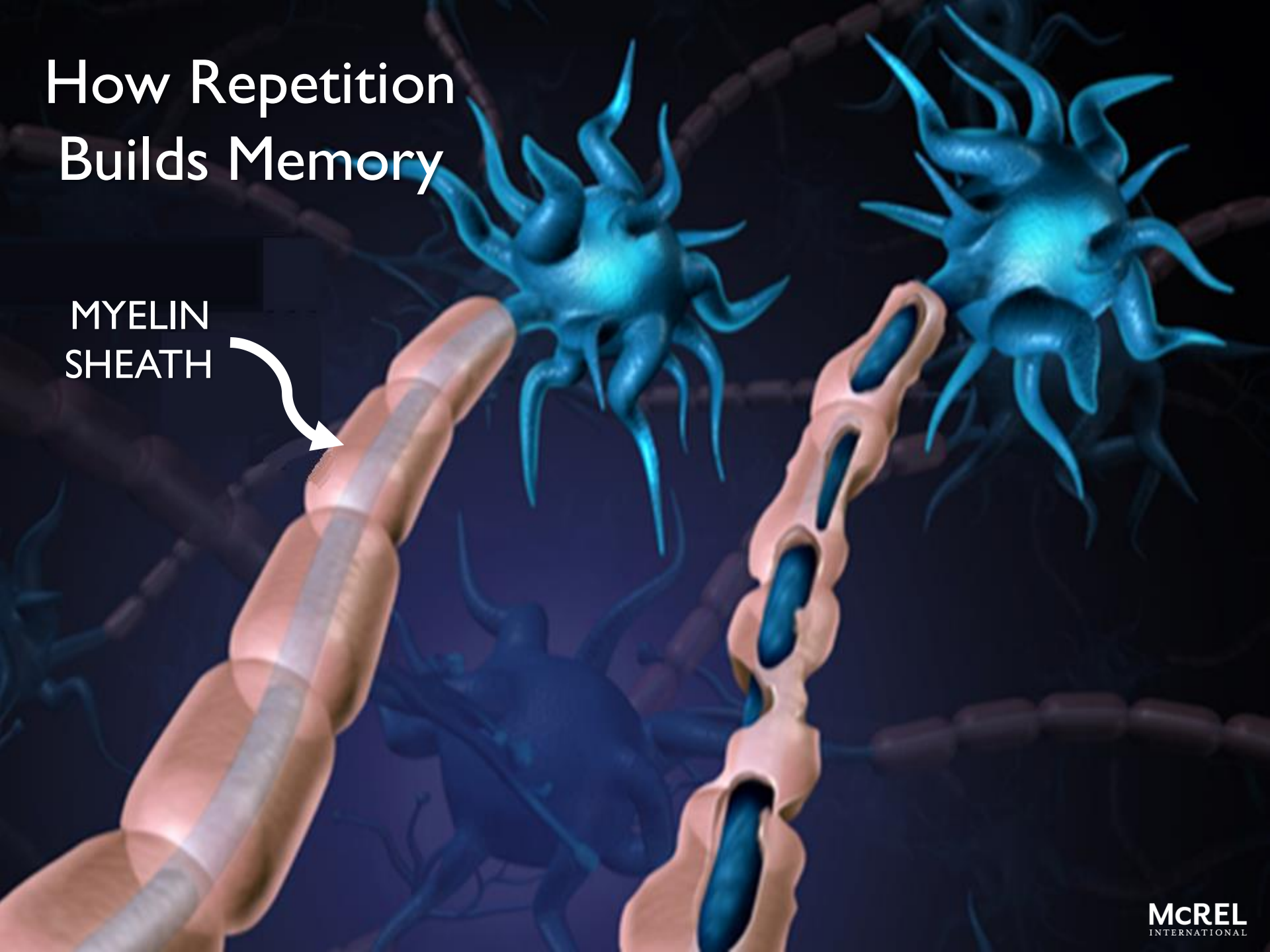
McREL INTERNATIONAL

How Does The Brain Store Memories?

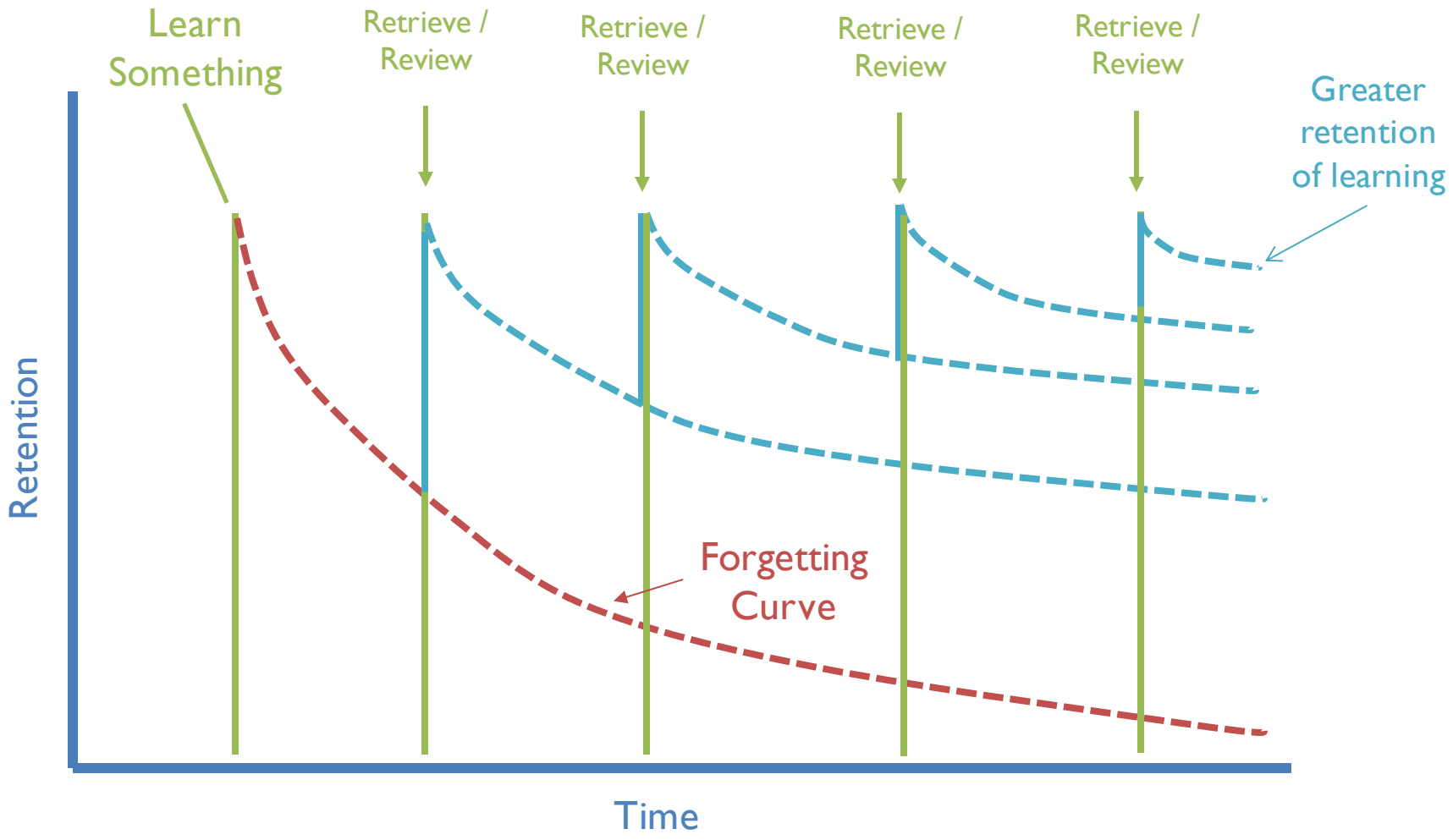
- Repeating new learning in multiple sessions spread out over days & weeks

Repeating

How Repetition Builds Memory

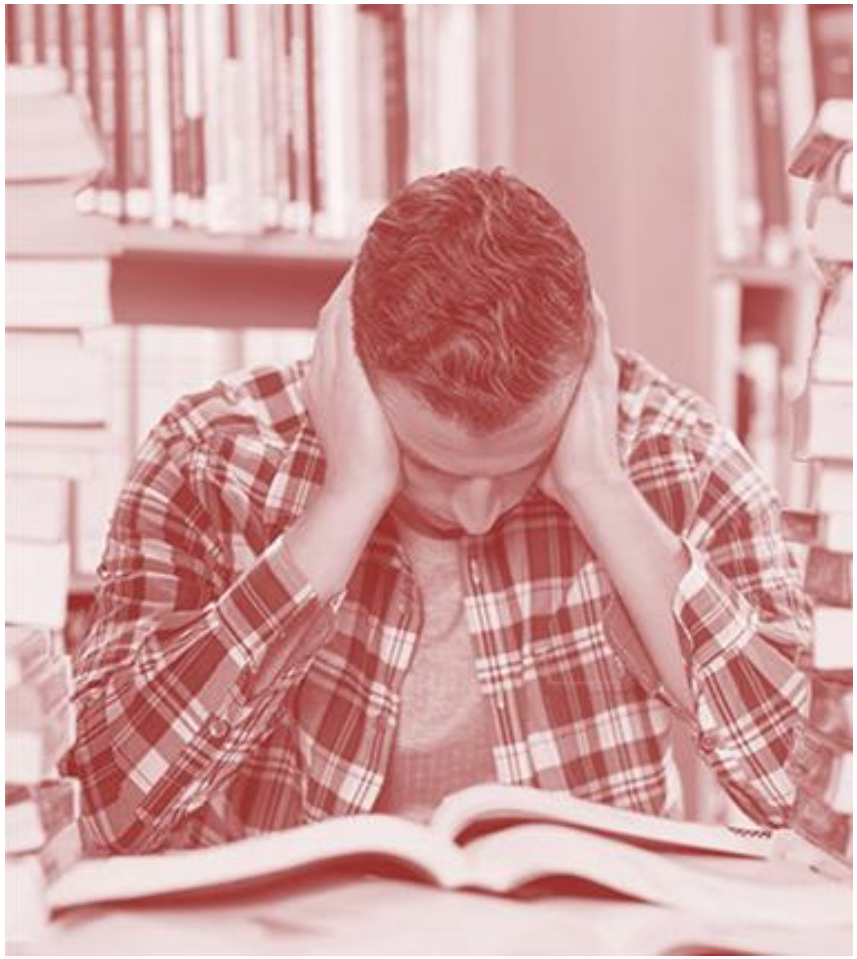


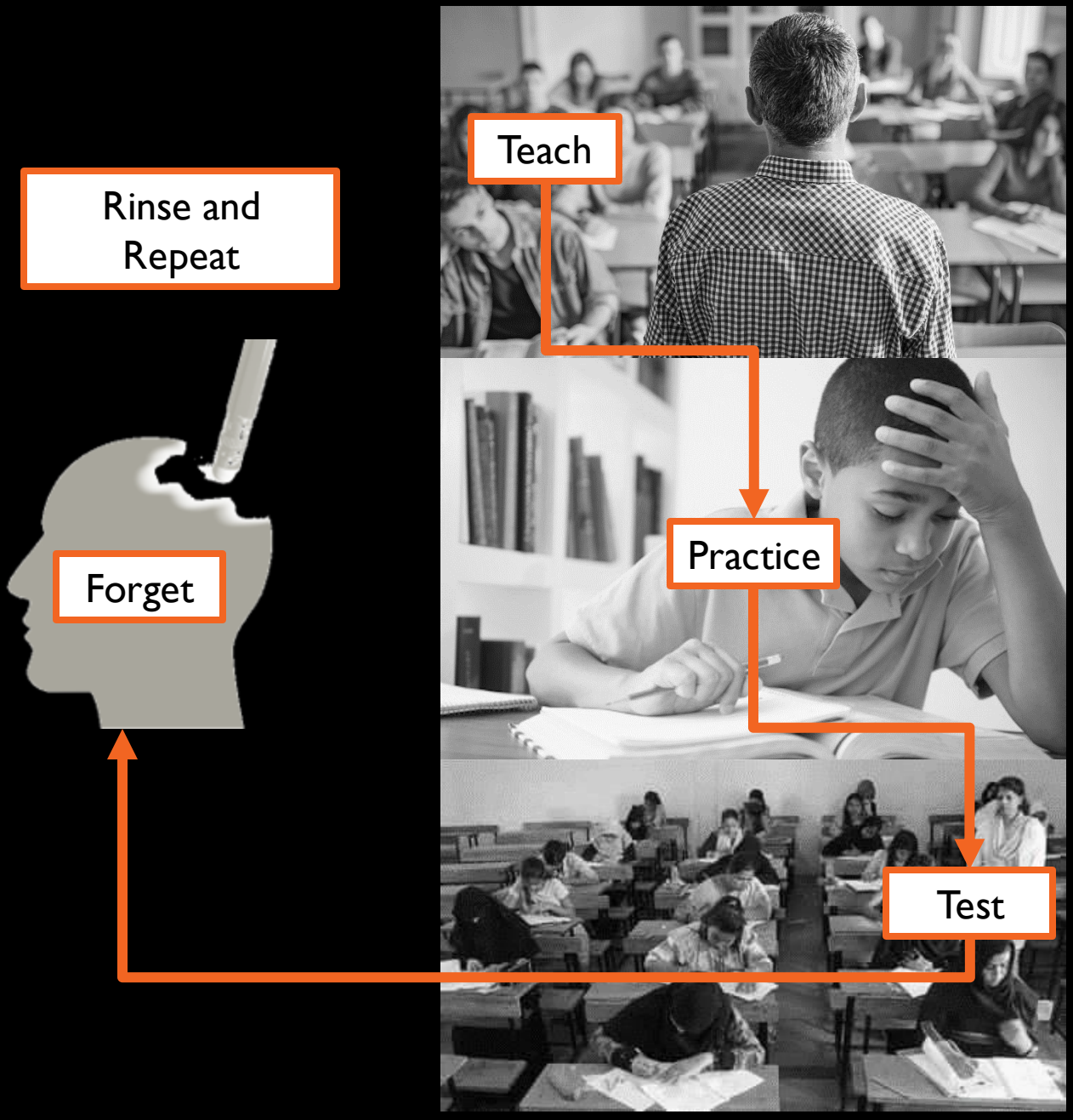
Retrieval Practice Disrupts The "Forgetting Curve"



The Trouble With Cramming

- Long-term memories form via repetition over days & weeks
- Cramming leads to "fast learning and fast forgetting"





Space Practice Opportunities

Students Only Learn What They Practice In Multiple Sessions Spread Over Time

Brain-Based Learning Tip #5

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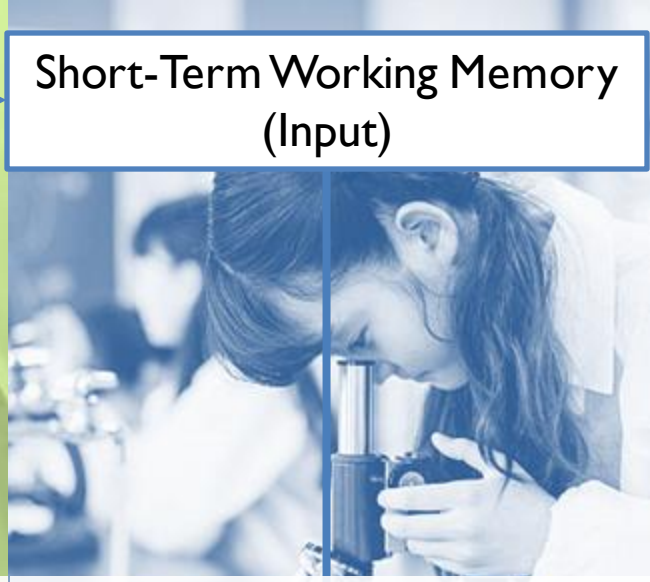
Immediate Memory

Become Interested

Commit To Learning

Short-Term Working Memory (Input)



Focus On New Learning

Short-Term Working Memory (Consolidation)

Make Sense of Learning

Practice & Reflect

Long-Term Memory

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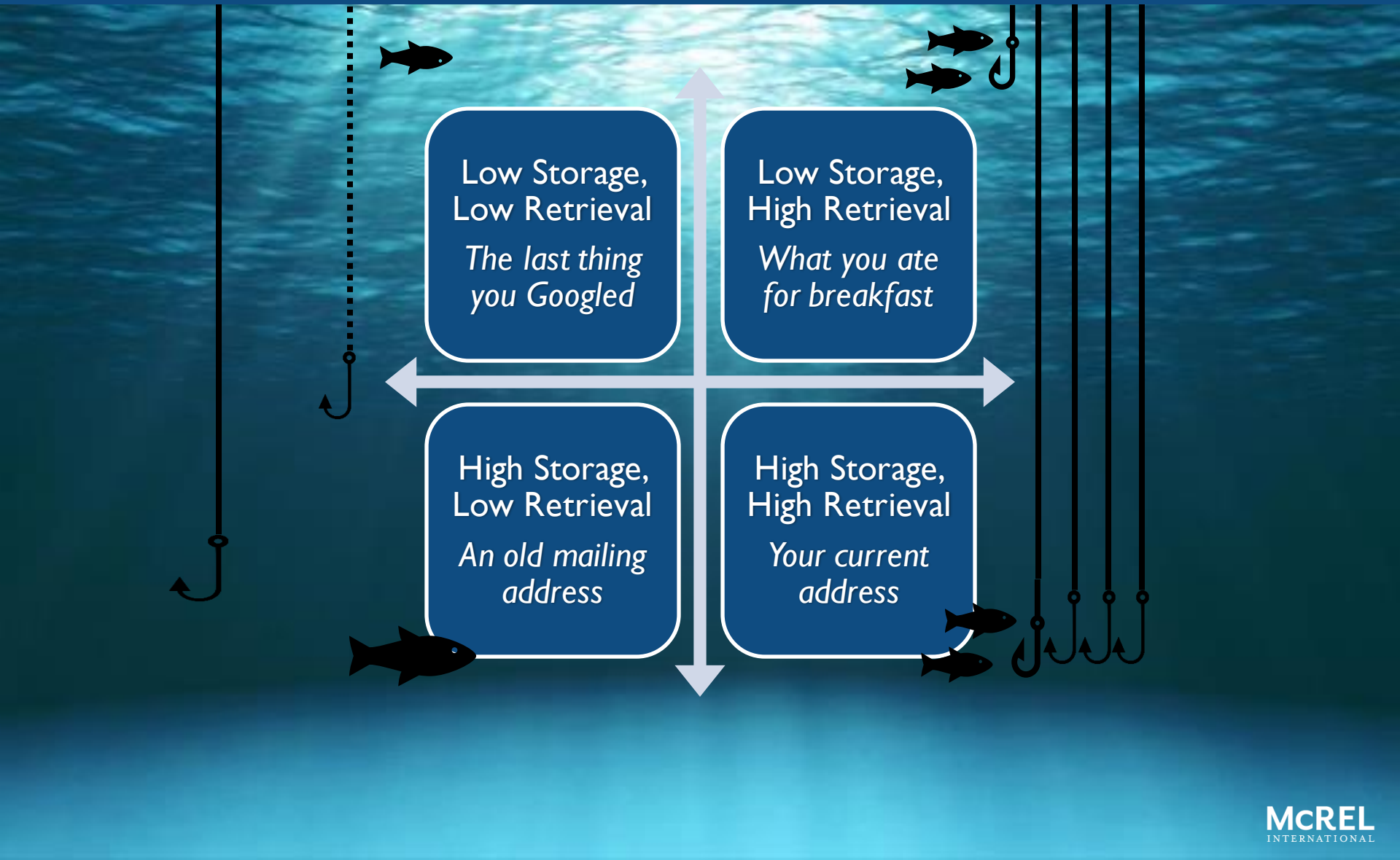
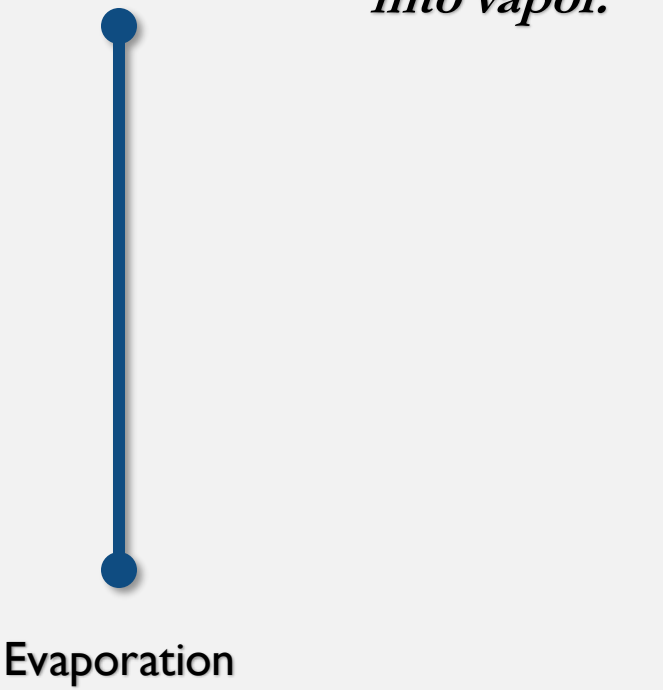
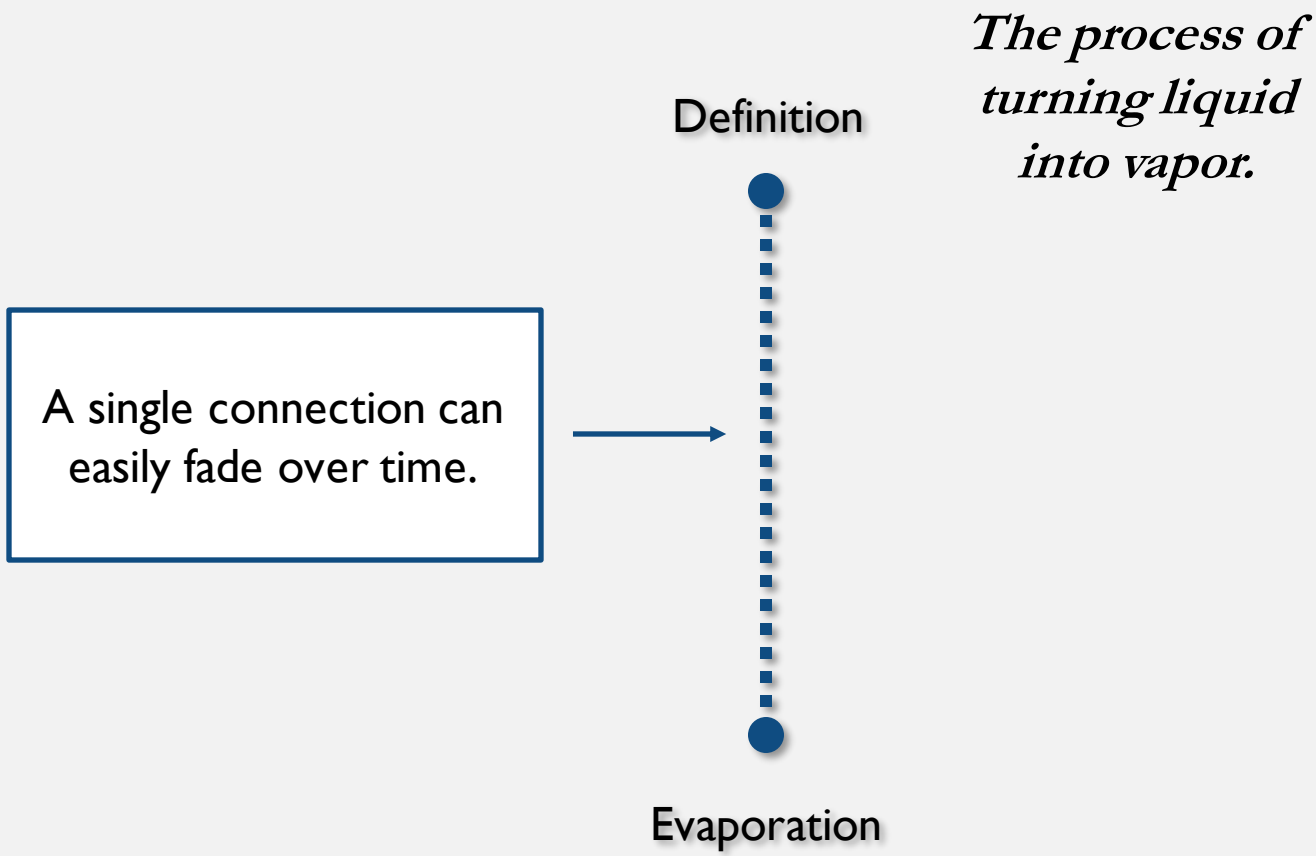
Memory Storage Is Not The Same Thing As Memory Retrieval



Often, Students Learn New Concepts In Just One Way And In One Setting



Yet A Single Connection Can Easily Fade Over Time



The More Connections We Make With New Learning The Better We Can Retrieve It

Definition

The process of turning liquid into vapor.

Image

Real-Life Example

Explaining It

Evaporation

Applying It

Knowledge Is Like Paint; It Does No Good Until It's Applied

Students' Only Remember What They Apply Through Problem-Solving, Writing, Research, And Investigating

Brain-Based Learning Tip #6

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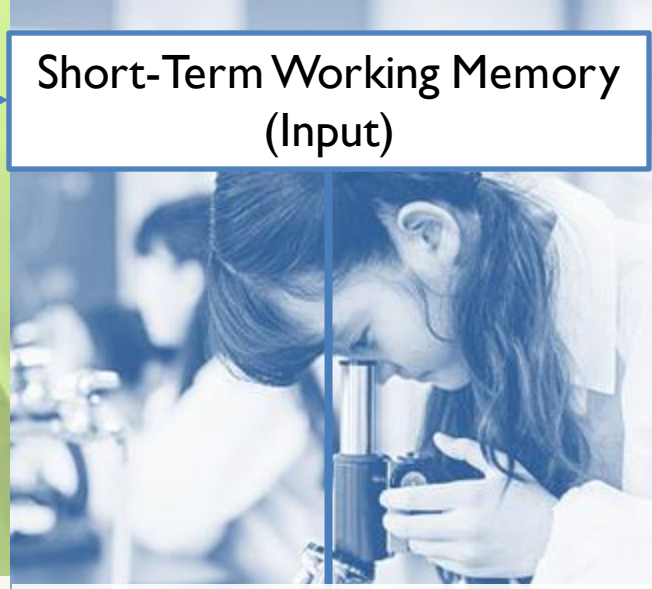
Immediate Memory

Short-Term Working Memory (Input)



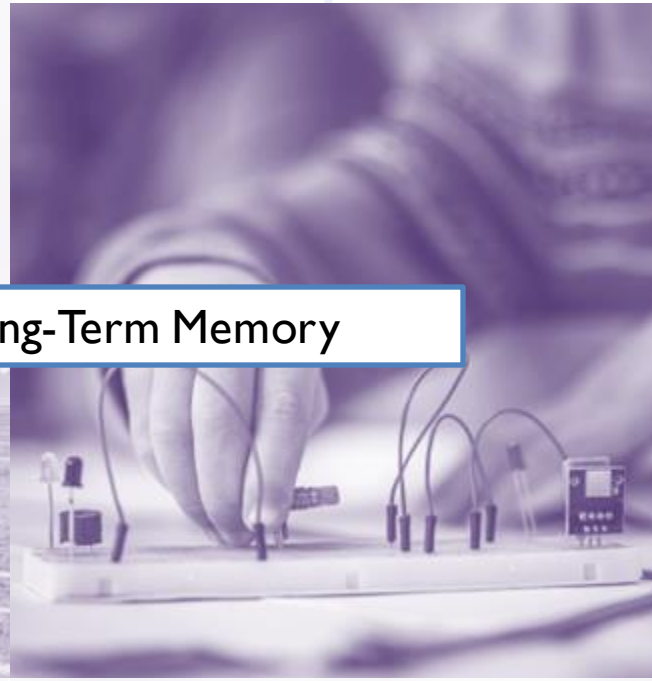
Become Interested

Commit To Learning

Focus On New Learning

Short-Term Working Memory (Consolidation)

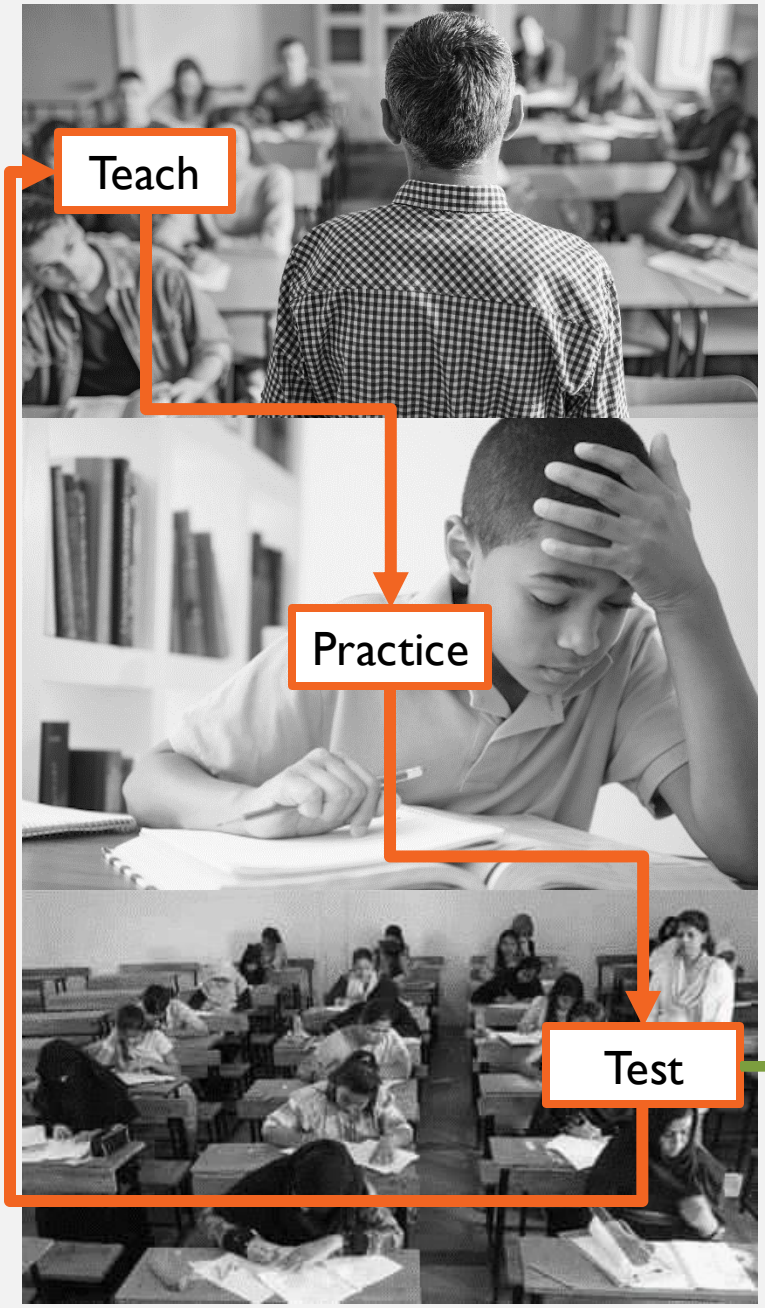
Long-Term Memory

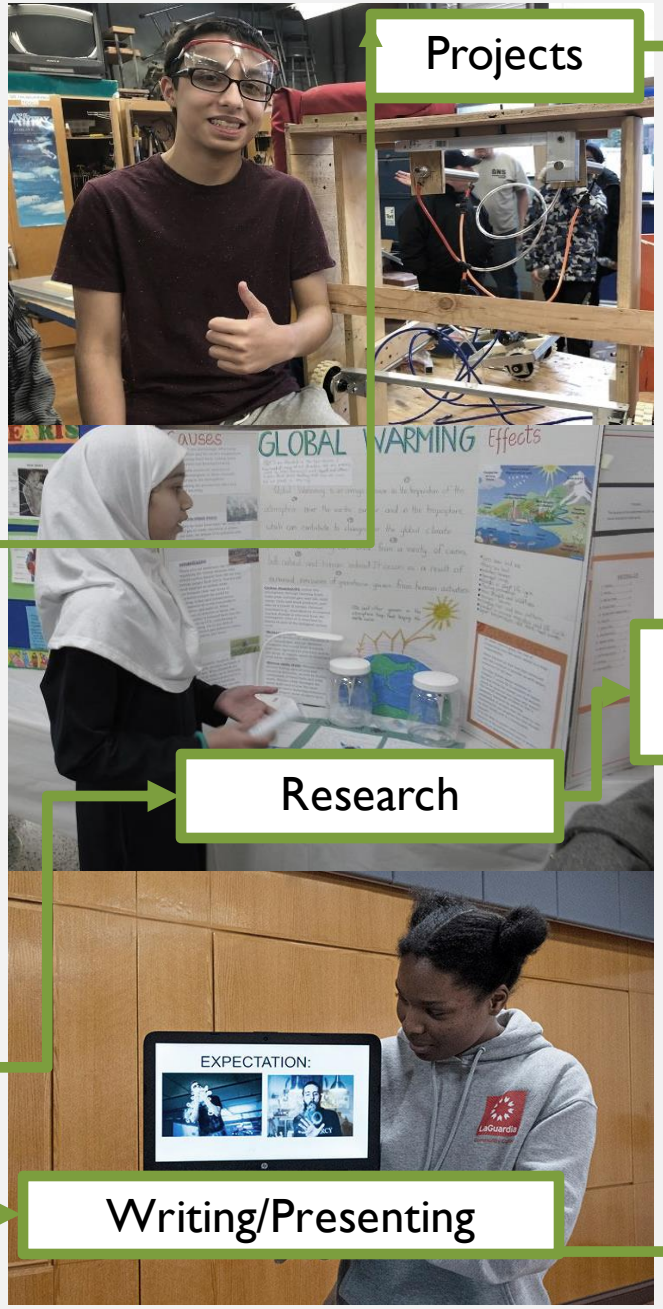


Make Sense Of Learning

Practice & Reflect

Extend & Apply





Deeper Learning

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Practice & Reflect

Extend & Apply

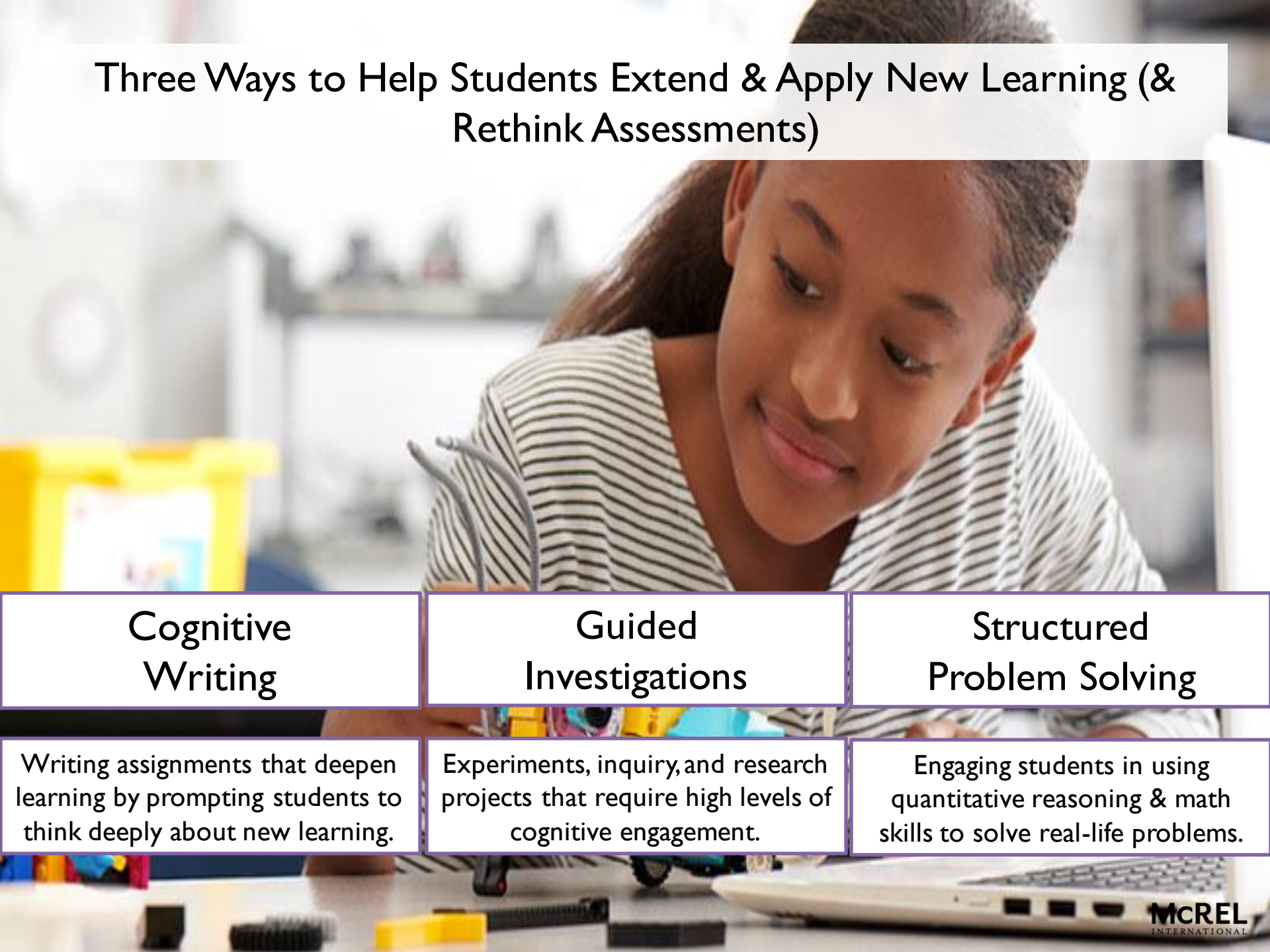
Pause & Process

In your experience, how often do students in your classrooms experience these learning conditions?

- *Practicing and re-learning new knowledge and skills in sessions intentionally spread out over days and weeks*
- *Opportunities to develop deep neural connections to learning with "minds on" activities?*

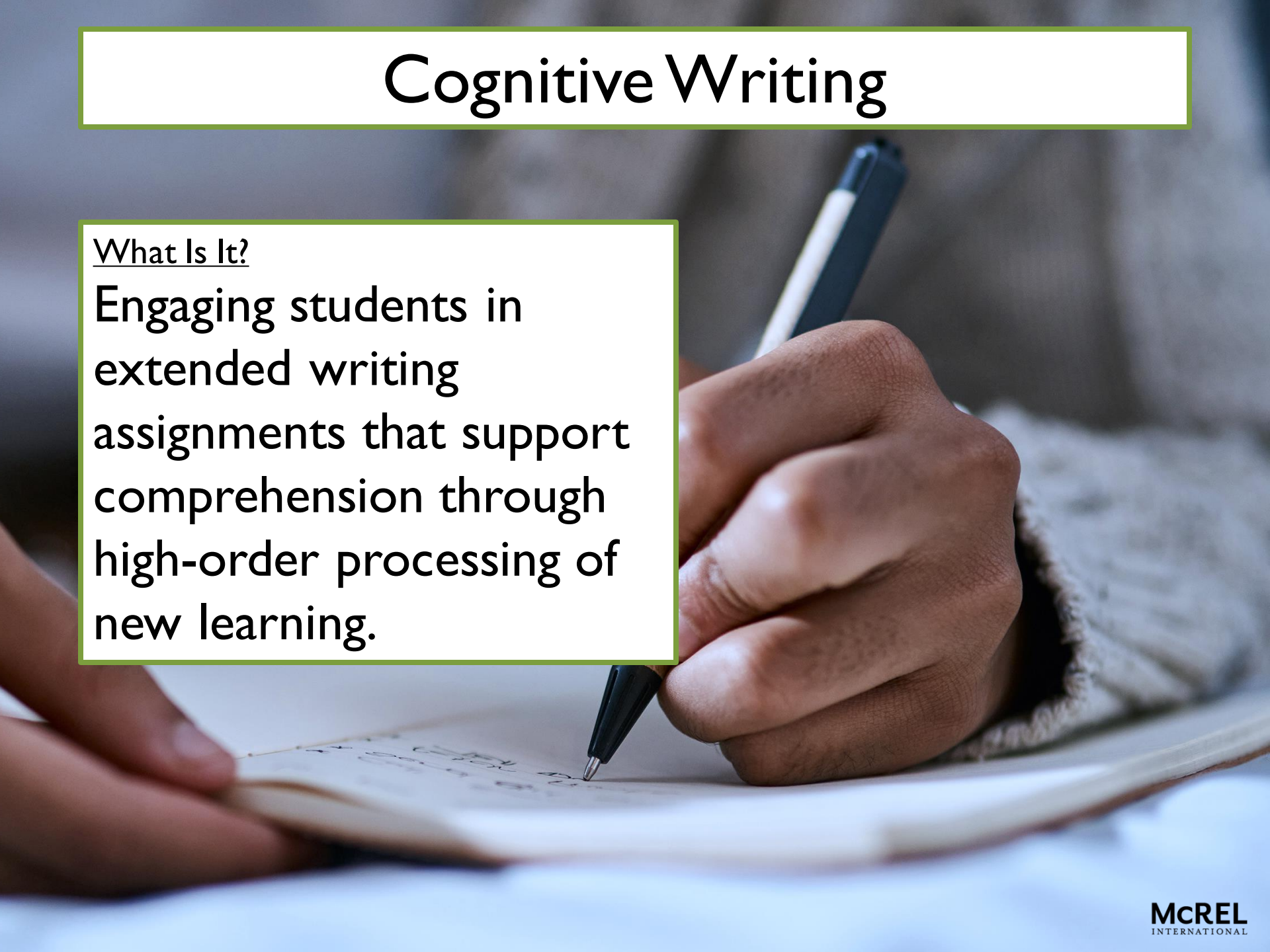
What differences might you see in student learning if they had regular exposure to these learning conditions?

Three Ways to Help Students Extend & Apply New Learning (& Rethink Assessments)



Cognitive Writing	Guided Investigations	Structured Problem Solving
Writing assignments that deepen learning by prompting students to think deeply about new learning.	Experiments, inquiry, and research projects that require high levels of cognitive engagement.	Engaging students in using quantitative reasoning & math skills to solve real-life problems.

Cognitive Writing



What Is It?

Engaging students in extended writing assignments that support comprehension through high-order processing of new learning.

Cognitive Writing

What's The Point?

- Arranging thoughts, concept & ideas into sentences and paragraphs help us arrange them in our brains.
- Writing is a powerful tool for deep learning in all subject areas as it engages students in thinking about their learning, sharpens their understanding, and helps them make multiple connections to new learning

How Should Teachers Use Cognitive Writing?

- To help students process new learning (e.g., connecting ideas, comparing and contrasting concepts, developing and defending arguments).
- To teach thinking skills associated with writing (e.g., setting goals, identifying main ideas and expressing them in one's own words, developing original ideas, revising one's own thinking).

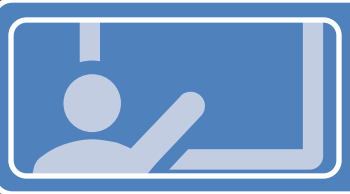
How Do Students Use Cognitive Writing?

- To engage in deep learning by aggregating disparate concepts into big ideas and mental schema that support retention and retrieval of new learning.
- To sustain curiosity and interest in learning by making personal connections to it and having opportunities to express their own ideas (finding "voice" in their learning).

Designing Cognitive Writing Assignments

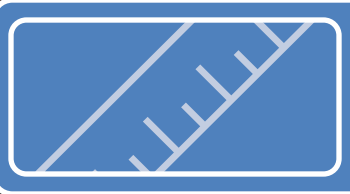
1: Identify What Students Should Think About To Deepen Their Learning

2: Design A Writing Assignment That Prompts Students To Think About Their Learning



3: Teach Thinking & Writing Skills Directly

4. Create A "Thinksheet" To Guide Writing

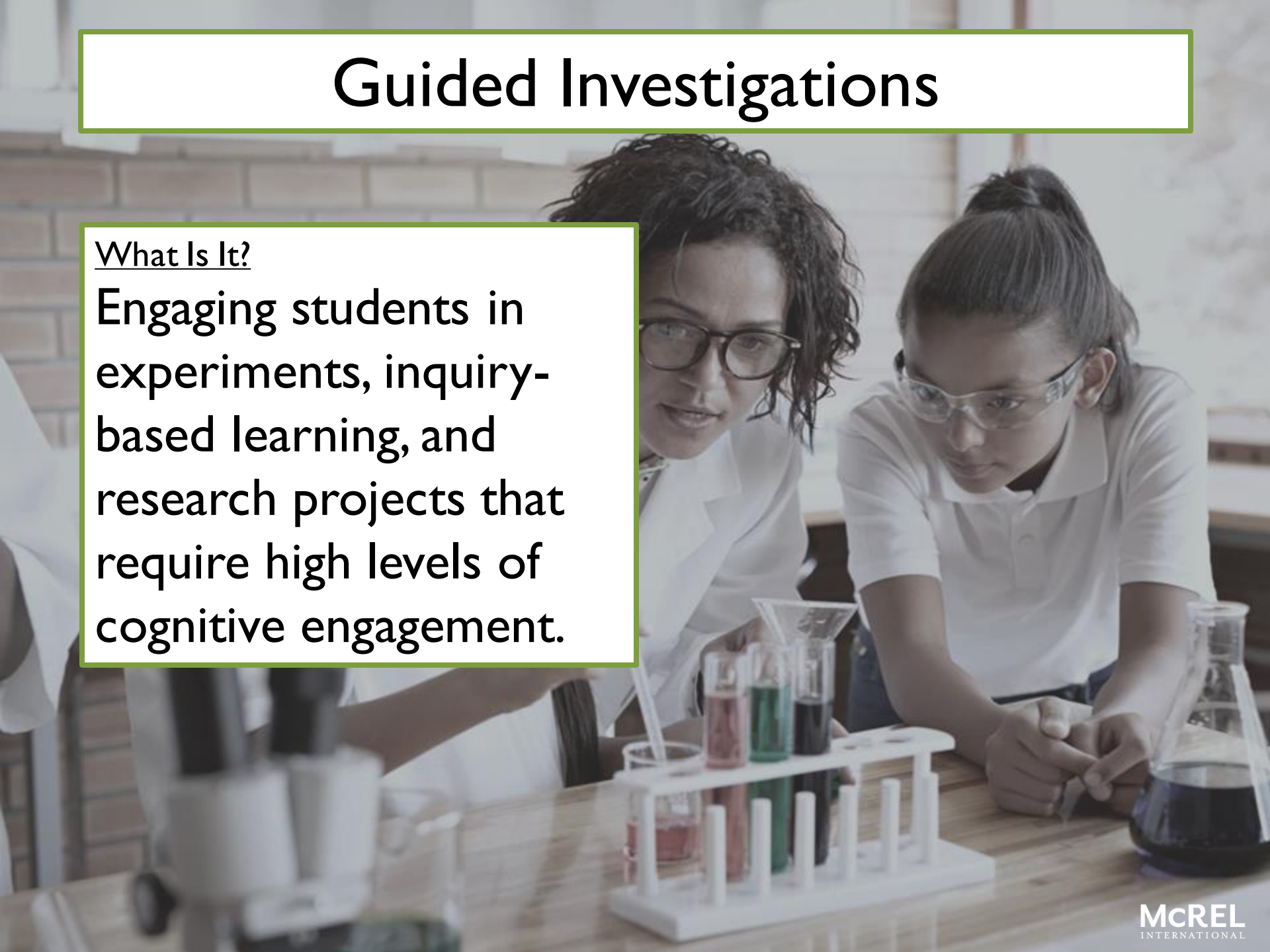


5. Provide Students With A Rubric To Help Them Self-assess Progress Toward Mastery

Examples of Cognitive Writing Assignments

Thinking Skill	Example
Comparison	What parallels exist between the Pax Romana and Pax Americana? In what ways are Walter and Mama's motivations different? Alike?
Analysis	How does the author build tension in "The Most Dangerous Game"? What genetic adaptations make sharks "nature's perfect predators"?
Evaluation	Does *Citizen Kane* deserve its reputation as a great film? Do political parties help or hinder democracy?
Synthesis	Based upon what you've learned about non-native species, should they be exterminated? Based on what you've learned about social media and its effects on mental health, should we restrict young people's access to it?

Guided Investigations



What Is It?

Engaging students in experiments, inquiry-based learning, and research projects that require high levels of cognitive engagement.

Guided Investigations

What's The Point?

- The more ways we reflect on, apply, and connect new learning to prior learning, the deeper we learn it.
- Students need hands-on and "minds on" opportunities to explore big ideas, observe real-world phenomena, analyze evidence, and report their discoveries.
- Minimally guided instruction is often detrimental for younger and lower-performing students, so teachers must balance direct instruction with independent learning.

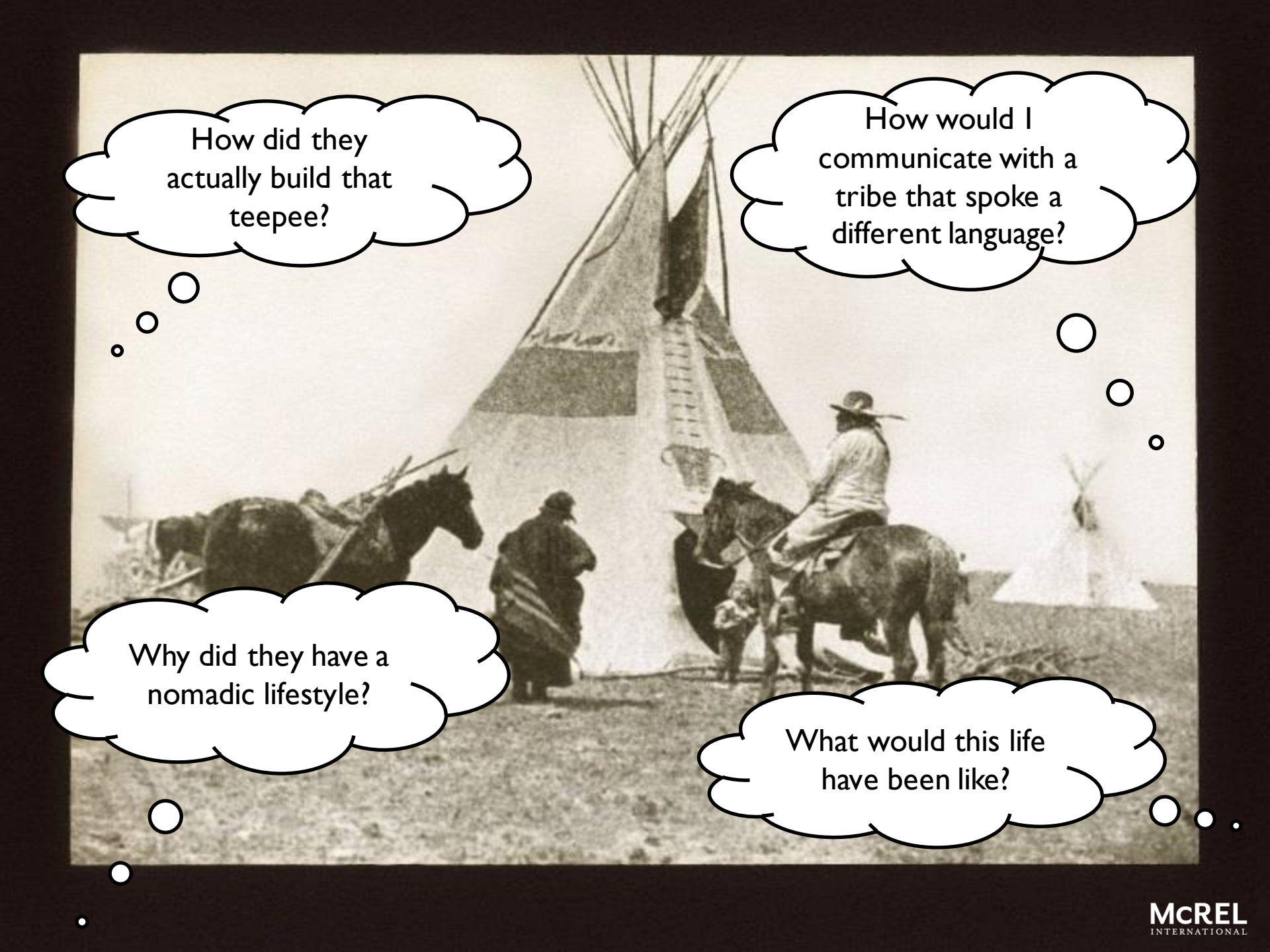
How Should Teachers Use Guided Investigations?

- To engage students in extending and applying foundational knowledge and skills acquired during classroom-based, direct instruction.
- To help students consolidate and deepen knowledge by inviting them to observe and analyze scientific and social phenomena and reflect on their learning.

How Do Students Use Guided Investigations?

- To think deeply about their learning and develop rich neural networks that support greater retention and retrieval of new learning.
- To better understand social and scientific phenomena by observing and/or investigating them, collecting and analyzing data, and developing and defending ideas with evidence.
- To deepen their personal connections to learning.

Many Activities Are Hands On, But Not "Minds On."



Designing Guided Investigations

1: Identify Essential Knowledge Students Should Think About To Deepen Their Learning

2: Identify What Essential Knowledge You'll Teach And What Students Will Discover

3. Guide The Investigation

4. Anchor Student Learning To A Performance Task That Reflects Mastery Learning

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An Example

What natural forces drive the hurricane season in the Atlantic?

Why are some hurricane seasons worse than others?

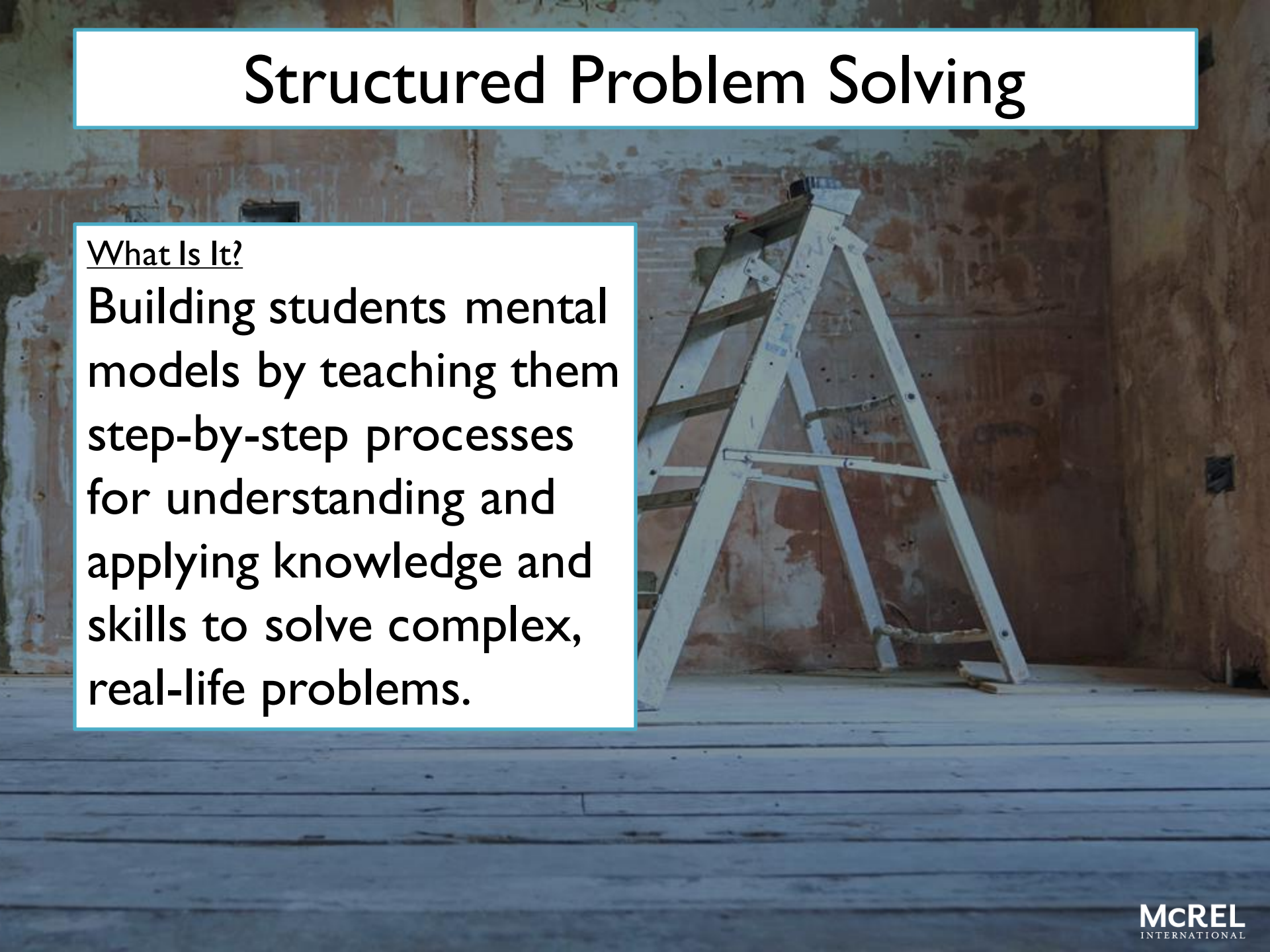
What has been the pattern of hurricane seasons over the past few decades?

How might climate change affect hurricane seasons?

Demonstrate Your Learning By

- Creating a children's book to explain hurricanes.
- Creating a documentary video to explain the science of hurricanes.
- Writing a magazine article explaining why hurricanes are likely to grow worse.

Structured Problem Solving



What Is It?

Building students mental models by teaching them step-by-step processes for understanding and applying knowledge and skills to solve complex, real-life problems.

Structured Problem Solving

What's The Point?

- Anchoring learning in real-life problems enhances student motivation and problem-solving skills.
- Students often need direct instruction to learn how to recognize problem structures of real-world problems and retrieve appropriate methods for solving them.
- Helping students develop mental schema needed to apply foundational knowledge and skills to solve real-world problems reflects the culmination of learning.

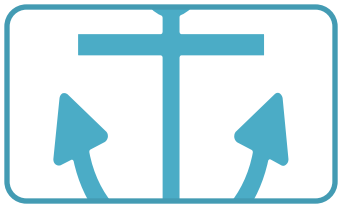
How Should Teachers Use Structured Problem Solving?

- To increase student interest by engaging them in solving meaningful, real-world problems.
- To help students embed math and quantitative skills into long-term memory by giving them opportunities for them to retrieve and apply these skills in novel situations.
- To scaffold students' ability to solve complex problems by providing them with graphic organizers and mnemonics that guide them through the process.

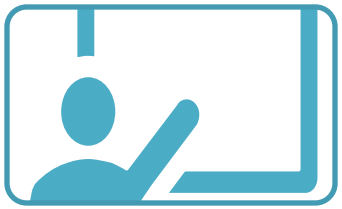
How Do Students Use Structured Problem Solving?

- To better understand how math and quantitative skills can solve real-world problems.
- To develop mental schema needed to recognize and solve complex problems.
- To develop habits of mind (productive struggle, positive self-talk) needed to solve complex problems.

Designing Structured Problem-Solving Assignments



1: Identify A Meaningful Challenge To Anchor Learning In Complex And Relatable Problems



2: Teach Students How To Recognize And Solve Complex Problems

3. Provide Students With Memory Aids For Solving Complex Problems

4. Teach Students The Meta-Cognitive Skills And Positive Self-Talk Needed To Solve Problems

A Sample Complex Problem

Your grandmother is letting you use her shed as a hangout. To make it feel more comfortable, you want to install real flooring over the plywood floor.

The floorplan is shaped like this.

How would you calculate the costs if:

- carpet is $6.45 / sq. yard
- wood is $10.00 / sq. foot
- tile is $7.50 / sq. foot

Create **three different** designs for your flooring and calculate the costs.

Individual & Group Work

- Select one of the three strategies
  - Cognitive Writing
  - Guided Investigations
  - Structured Problem Solving
- Use the handout to frame your next curricular unit around a challenging learning task
- After 15 minutes, you'll join a breakout group to share your thinking and answer these questions:
  - What will be most challenging?
  - What will be most different for students?

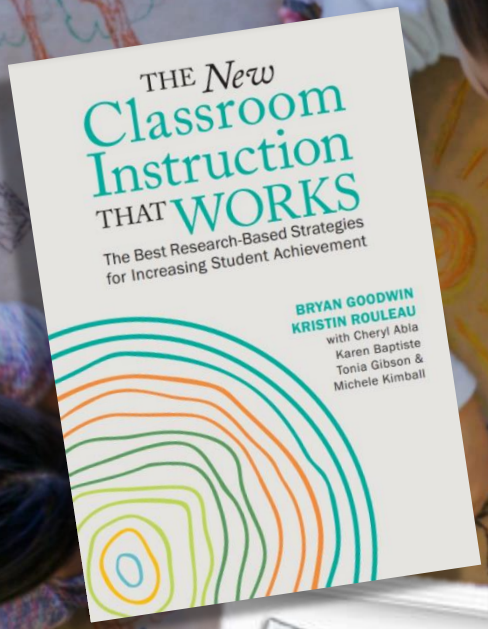
Final Thoughts

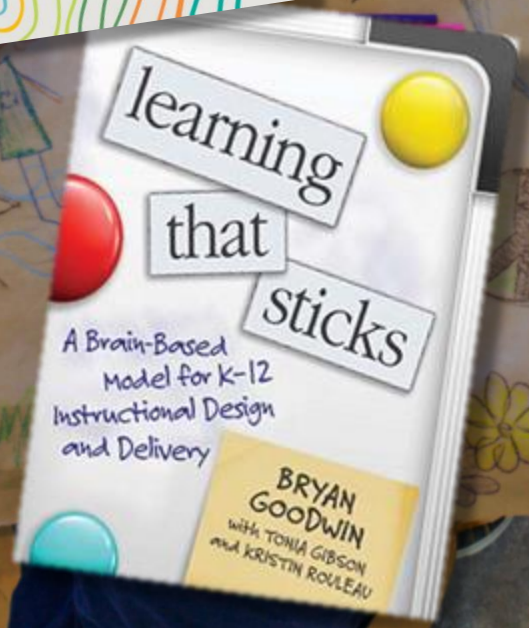
A Guided Investigation

7 Years Later

Accepted into vet school at the University of Missouri

The mind is not a vessel to be filled,
but a fire to be kindled.
~ Plutarch





Stay Curious!

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