



FLORIDA STATE
UNIVERSITY

Teaching Students How to Learn

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Activity

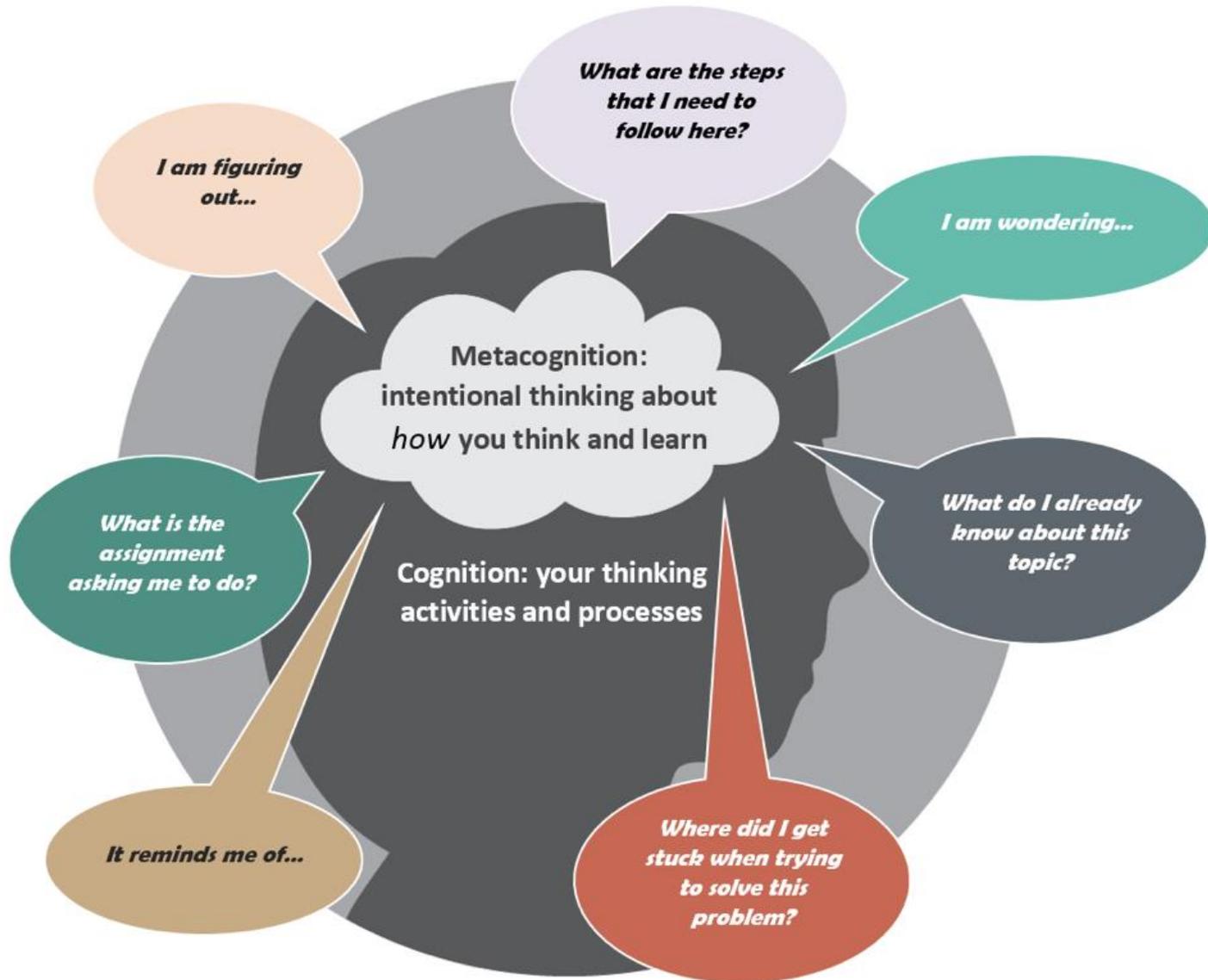
At your table, discuss the quote from the book “Make It Stick.” How have these illusions of knowing plagued your own learning or your students’ learning?



“We are *poor judges* of when we are learning well and when we’re not. When the going is harder and slower and it doesn’t feel productive, we are drawn to strategies that feel more fruitful, unaware that the gains from these strategies are often temporary.”



“Rereading text and massed practice of a skill or new knowledge are by far the preferred study strategies of learners of all stripes, but they’re also among the least productive... Rereading and massed practice give rise to feelings of fluency that are taken to be signs of mastery, but for true mastery or durability these strategies are largely a waste of time.”





make it stick



The Science of Successful Learning

Peter C. Brown
Henry L. Roediger III
Mark A. McDaniel

Brown, P. C., Roediger, H. L., & McDaniel, M. A. (2014). *Make it stick*. Harvard University Press.



Objectives

After this workshop, you will be able to:

- Design activities and mini-lessons that can be used to help your students become more effective learners
- Apply learning strategies to lesson planning such as retrieval, predictions, and structure building to promote deeper and more robust learning



4 Principles of Learning from Make It Stick

1. Retrieval
2. Spaced & Interleaved Practice
3. Predictions
4. Structure-Building

***“Retrieval practice* - recalling facts or concepts or events from memory - is a more effective learning strategy than review by rereading... Retrieval strengthens the memory and interrupts forgetting.”**



Retrieval Practice

- Use retrieval practice as a learning strategy, not an assessment tool
- Use it frequently and space it out
- Mix-up your question types: fact-based, conceptual, higher order
- Provide feedback right away
- Focus on getting information “out” rather than “in” - retrieval is challenging!



Exit Ticket

1. What are the abiotic stressors of living in the intertidal? Give one example of how an organism could cope with that stress.
2. The rocky intertidal is a habitat with strong zonation patterns, describe one example of a zonation pattern and explain what mechanisms maintain the zonation.
3. Describe what a keystone species is and provide an example of how a keystone species in the rocky intertidal influences community composition & species richness



iClicker

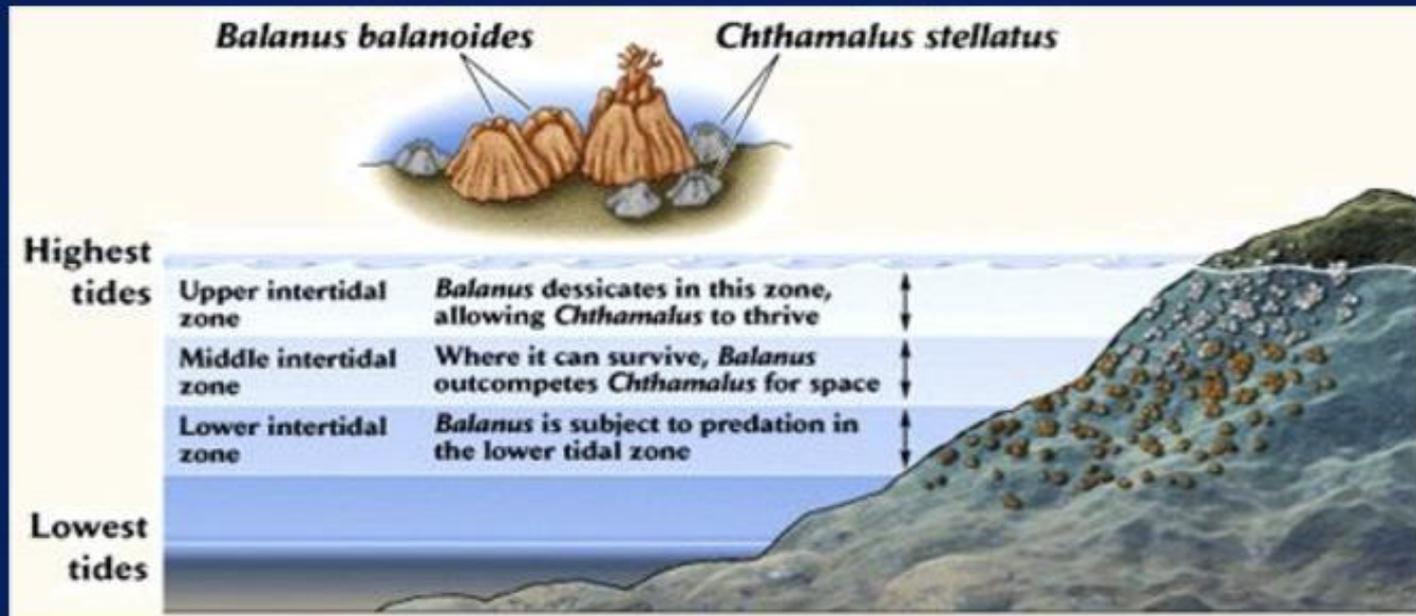
A potted geranium plant sits in a windowsill, absorbing sunlight. After I put this plant in a dark closet for a few days (but keeping it watered as needed), will it weigh more or less (discounting the weight of the water) than before I put it in the closet?

- A. It will weigh less because it is still respiring.**
- B. It will weigh less because no photosynthesis is occurring.**
- C. It will weigh the same since no biomass is produced.**
- D. It will weigh more because it still has access to water and soil nutrients.**

D'Avanzo, C., et al. "Diagnostic Question Clusters to Improve Student Reasoning and Understanding in General Biology Courses: Faculty Development Component." *Proceedings of the CABS II conference*. Available online at: <http://bioliteracy.net/manuscripts08.pdf>. 2008.



What example from class does this remind you of?





Design a 5-10 minute retrieval practice activity for your students.

How will you set up this activity so that students are motivated to do the retrieval rather than referring back to the book or notes?

“When you *space out practice* at a task and get a little rusty between sessions, or you interleave the practice of two or more subjects, retrieval is harder and feels less productive, but the effort produces longer lasting learning and enables more versatile application of it in later settings.”



Spaced Practice

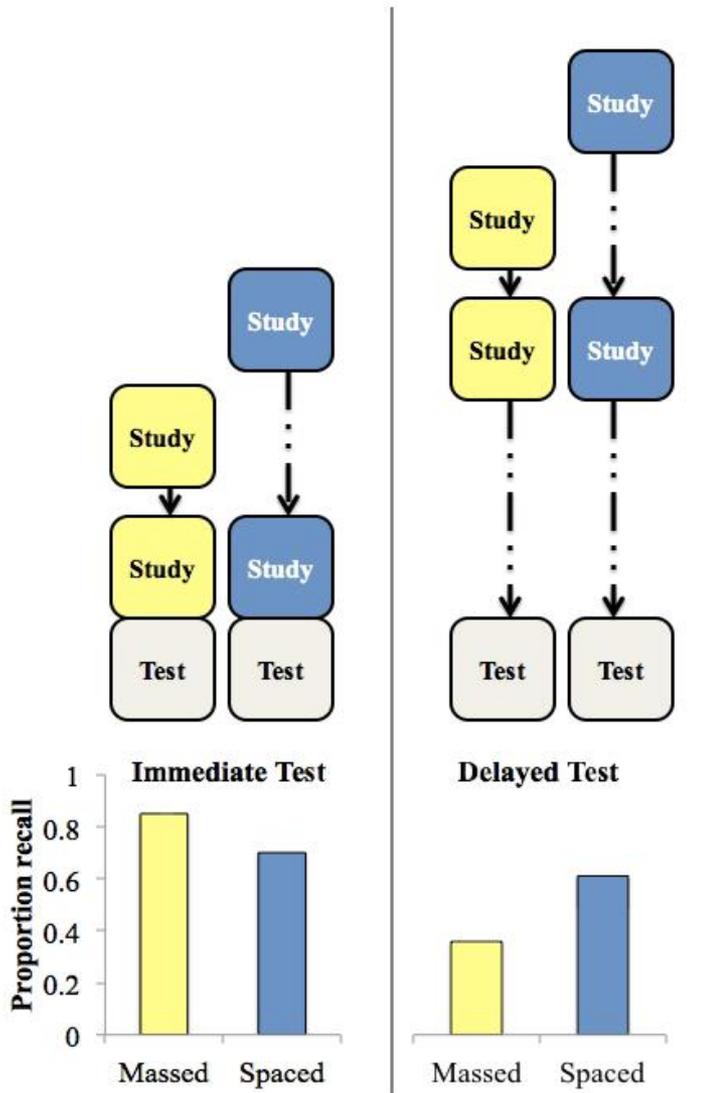


Figure 1. The typical design of a spacing experiment and hypothetical results showing the typical effects of spaced and massed practice: Massing study may lead to better performance in the short-term, but spaced study yields better long-term retention.



Spaced Practice

(subject to change)

to be read earlier in the course, but should be read

for the class.

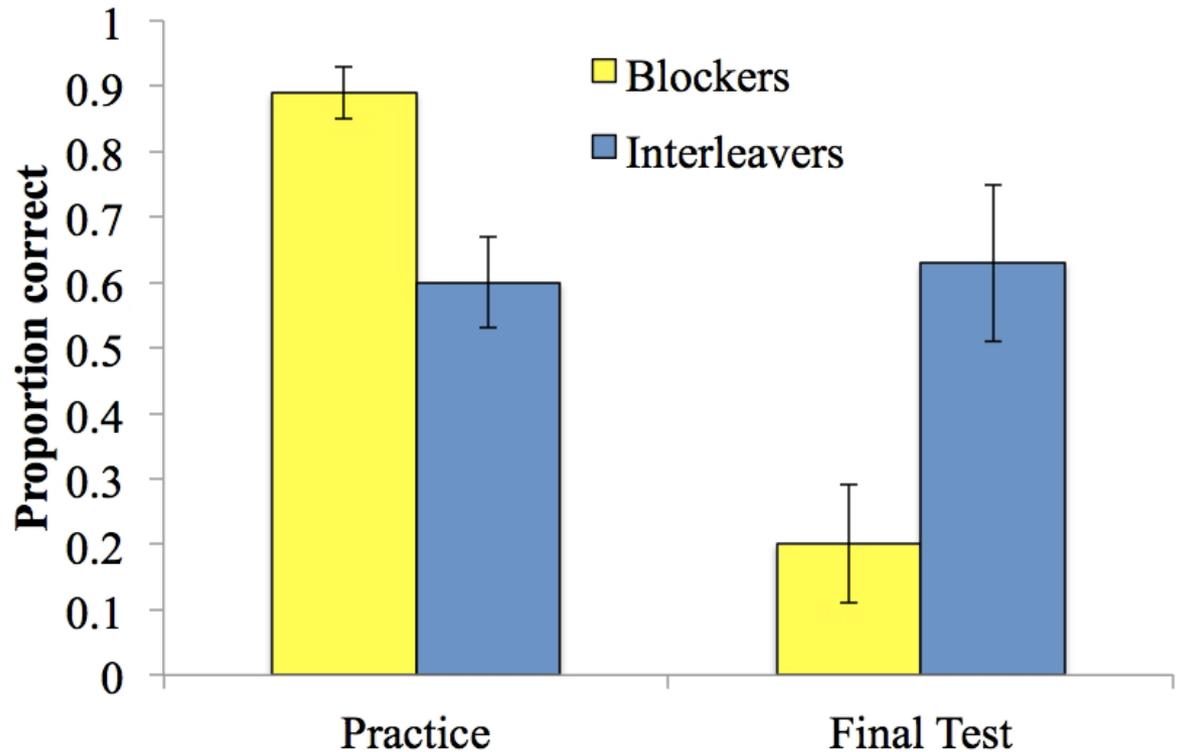
Date	Topic	Reading
Monday, May 9	Plant Cells and Basic Characteristics of Plants	Page
Wednesday, May 11	Plant Anatomy & Reproduction	Cha
Friday, May 13	Pollination & Seed Dispersal Unit Assignment Posted	Chap
Monday, May 16	Evolutionary History of Plants	Cha Chap Chapte Chapter
Wednesday, May 18	Nutrient Cycling (photosynthesis)	Review Cha
Friday, May 20	Nutrient Cycling (Carbon Cycle) & Global Warming Unit Assignment Due	Review Chapter 2 (p. 4)
Monday, May 23	Agriculture	Review Chapter 7 (p. 45-50) Chapter 8 (p. 51-58)
Wednesday, May 25	GMOs & Agriculture Discussion Economic Value of Plants Optional Review Session (12:15-1:15)	Chapter 9 (p. 59-70)
Friday, May 27	Final Exam	

At the end of the nutrient cycling lecture, students could pick to write about plant cells or plant anatomy



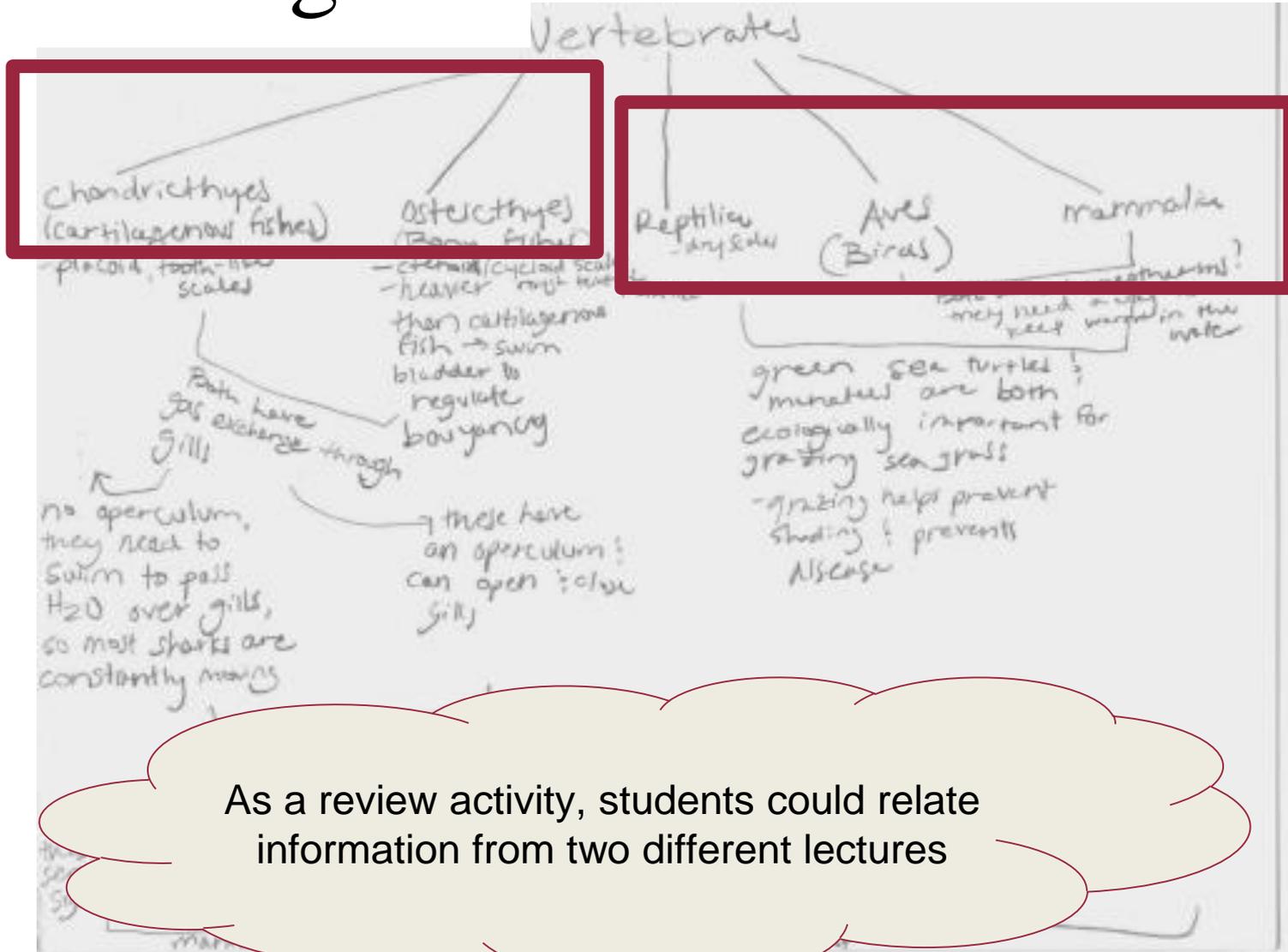
Interleaved Practice

Figure 2. The accuracy in solving math problems at the end of practice or on a delayed criterion test by participants who learned and practiced volume formulas blocked by type of solid or intermixed (from Rohrer and Taylor, 2007). Error bars represent one standard error of the mean.





Interleaving



As a review activity, students could relate information from two different lectures



How could you incorporate spaced practice into your classroom?

Design an activity for a review session where students could practice interleaving.



Pie & Coffee

Break



“Trying to solve a problem *before being taught the solution* leads to better learning, even when errors are made in the attempt.”



Making Predictions

Looking for
a solution

Retrieve
related
knowledge
from
memory

Strengthen
the route
to a gap in
learning
even before
given the
answer

Connect to
prior
knowledge
to help
think of an
answer



Making Predictions

Exercise Science Example

A new client comes to you and wants to improve her health and fitness levels. Before creating her exercise program, what information do you want to collect first?

- Health and medical history
- Risk factor identification
- Medical clearance
- Personal information
- Fitness assessment



Benefits of Making Predictions

- Pay closer attention to the question
- Emotional response
 - satisfaction when correct and frustration when not correct
- Recall past knowledge
- Recognize gaps in knowledge



Making Predictions

Pretesting

Problems,
cases, history

Polling

Attempt First

Closing
Predictions

- Keep it relevant to prior knowledge
- Provide immediate feedback
- Encourage reflection



How could you incorporate a predicting activity into your classroom?

Design an activity that you could incorporate at the beginning of your class to introduce a new topic

“When you’re adept at extracting the *underlying principles or ‘rules’* that differentiate types of problems, you’re more successful at picking the right solutions in unfamiliar situations.”



Building Structure

Mental processes people use to process new information and construct a coherent mental framework out of it

- High structure-builders vs. low structure-builders
- “Rule learners” vs. “Example-learners”

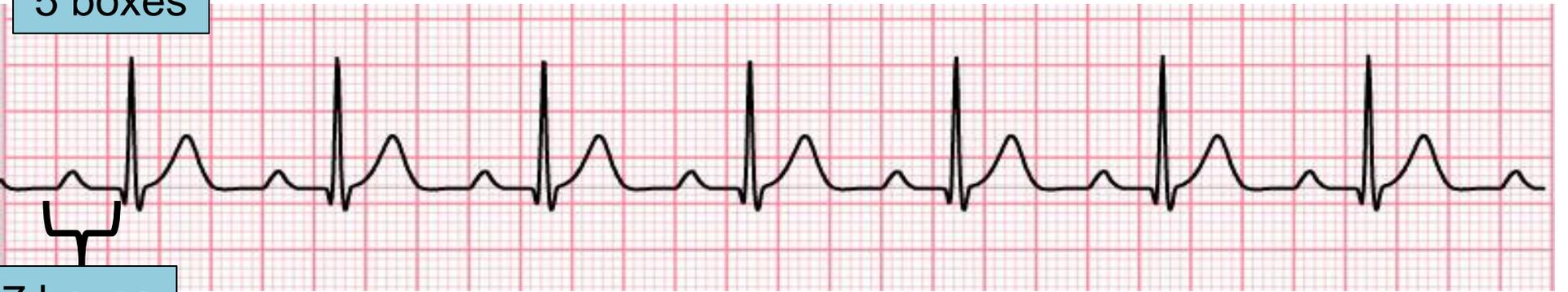
“High structure-builders and rule learners are more successful in transferring their learning to unfamiliar situations”



Example



5 boxes



7 boxes



5 boxes



Building Structure

Questions
along with
reading

Compare and
contrast
examples

Break down
ideas into
parts

Look for
patterns/make
connections

Let students
create their
own rules



Think of a way you might incorporate an activity into your classroom to help students build structure or create rules for solving a specific problem



Communicating Effective Learning Strategies

Principles for Achieving Deep Processing

1. **Elaboration:** How does this concept relate to other concepts?
2. **Distinctiveness:** How is this concept different from other concepts?
3. **Personal:** How can I relate this concept to my personal experience?
4. **Appropriate to Retrieval and Application:** How am I expected to use or apply this concept?



Strategies for Teaching Students How to Learn

- Explain to students how learning works
 - Can be uncomfortable or difficult
 - Learn better when trying to figure out the answer before being shown the solution
- Teach students how to study
- Create desirable difficulties in the classroom
- Be transparent





Resources

- Brown, P. C., Roediger, H. L., & McDaniel, M. A. (2014). *Make it stick*. Harvard University Press.
- “How to get the most out of studying” - Video Series by Stephen Chew
<https://www.youtube.com/playlist?list=PL85708E6EA236E3DB>
- RetrievalPractice.org, we recommend looking at “Resources”
<https://www.retrievalpractice.org/>
- McDaniel, M. A., Frey, R. F., Fitzpatrick, S. M., & Roediger III, H. L. (2014). *Integrating cognitive science with innovative teaching in STEM disciplines*. Washington University in St. Louis.
 - Bjork, R. A., & Yan, V. X. (2014). The increasing importance of learning how to learn.