Welcome to the Durable Learning Seminar Series

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Meet our Learning Science Team

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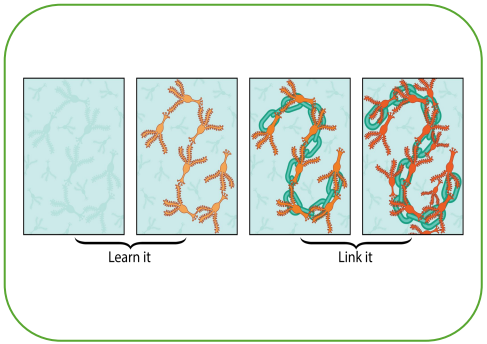
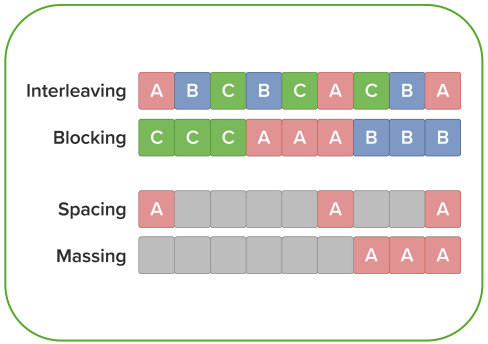
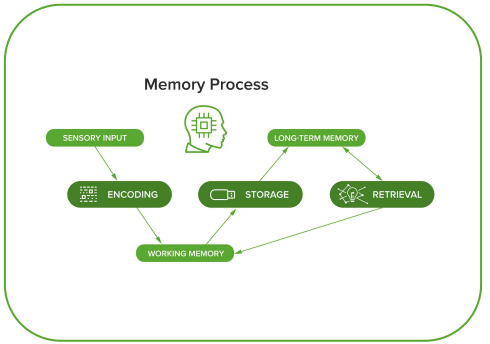
Meredith Ratliff

Seminar Topics and Applications of Learning Science

Cognitive Science & Neuroscience → **Instructional Design & Learning Strategies** → **Durable Learning**







Lecturio

Metacognition: Do You Really Know What You Think You Know?

March 09, 2022
Online Seminar

Seminar Learning Outcomes

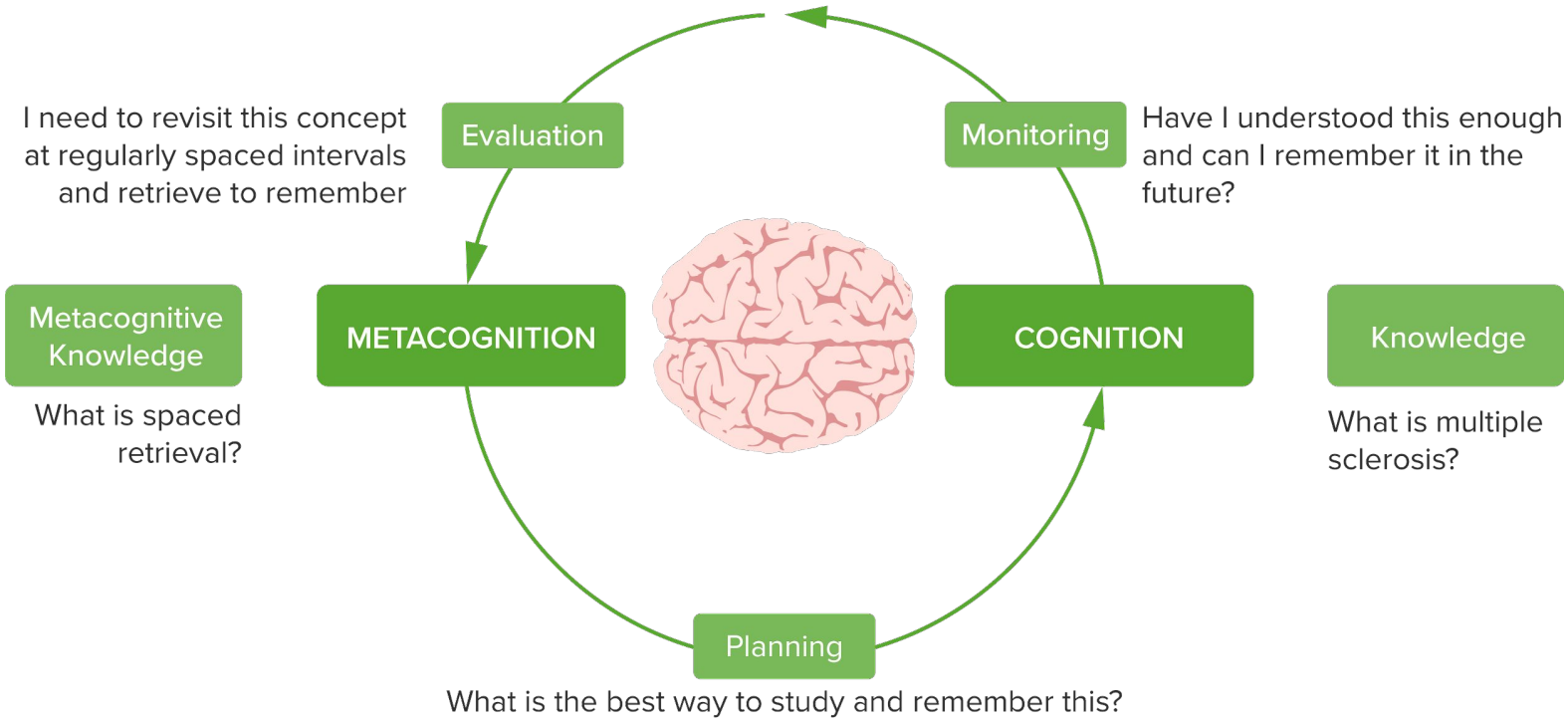
1. Participants will be able to **define** metacognition and its various elements including metacognitive knowledge and regulation.
2. Participants will be able to **recognize** the role and possibilities that metacognition has in promoting durable learning in medical education.
3. Participants will be able to **relate** their existing teaching practices to metacognitive principles.
4. Participants will be able to better **integrate** technology into the delivery and monitoring of metacognition-promoting educational techniques**.**

What is Metacognition

The term “metacognition” refers to thinking about cognition(1), or to the knowledge, monitoring, and evaluation of one’s thinking

1. Flavell, John. Metacognition and Cognitive Monitoring: A New Area of Cognitive-Developmental Inquiry. American Psychologist. 1979 Oct;34(10):906–11.

Elements of Metacognition



POLL

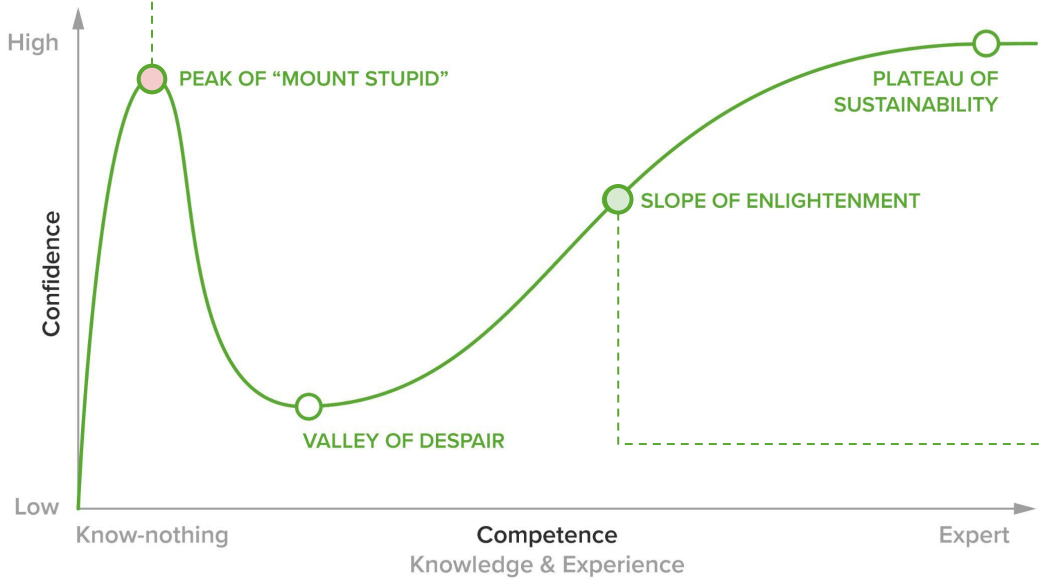
Do you teach your students about the importance of metacognition?

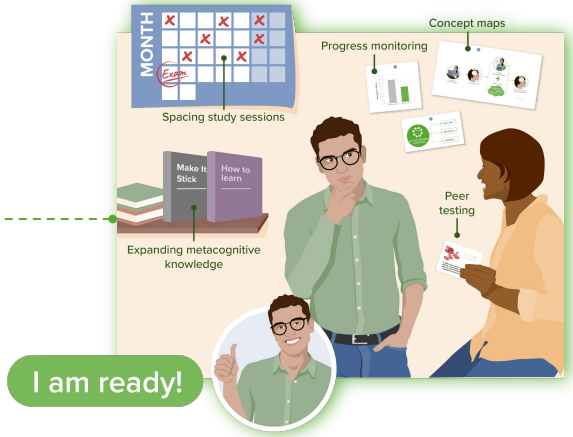
Answer the question in the poll.

The Metacognition Conundrum

The Dunning-Kruger Effect

They both think that they are ready, but the question stands: do they really know what they think they know?





Graphic based on and translated from Sciencia58, CC0, via Wikimedia Commons

Evidence for Metacognition

- Students with better **metacognition** are focused on **mastery learning**, have **higher motivation,** and **better performance**. [1]
- Explicit instruction on **metacognition** and **metacognitive skills** positively affects critical thinking skills and diagnostic accuracy. [2]
- May prove to be **conducive to reducing diagnostic errors** and **improving patient safety**. [2]

1. Artino ARJ, Dong T, DeZee KJ, Gilliland WR, Waechter DM, Cruess D, et al. Achievement Goal Structures and Self-Regulated Learning: Relationships and Changes in Medical School. Acad Med [Internet]. 2012 Oct [cited 2022 Feb 10];87(10):1375–81. Available from: link
2. Royce CS, Hayes MM, Schwartzstein RM. Teaching Critical Thinking: A Case for Instruction in Cognitive Biases to Reduce Diagnostic Errors and Improve Patient Safety. Acad Med J Assoc Am Med Coll. 2019 Feb;94(2):187–94.

Metacognition from a Neuroscientific Perspective

- Frontal cortex important in metacognitive process, separate from memory process (1,2)
- Poor planning and weak study techniques affect learning at a neurobiological level (3-5):
  - Sleep deprivation hinders neuroplasticity and consolidation
  - Excessive stress can affect neurochemical process crucial for thought process
- Transient storage capabilities of short-term memory can lead to the illusion of learning

1. Fleming SM, Frith CD. The Cognitive Neuroscience of Metacognition [Internet]. Springer; 2014 [cited 2022 Feb 23]. Available from: link
2. Fleming SM, Dolan RJ. The neural basis of metacognitive ability. Philos Trans R Soc B Biol Sci. 2012 May 19;367(1594):1338–49.
3. Sleep, Learning, and Memory | Healthy Sleep [Internet]. [cited 2022 Feb 23]. Available from: link
4. Aston-Jones G, Cohen JD. An integrative theory of locus coeruleus-norepinephrine function: adaptive gain and optimal performance. Annu Rev Neurosci. 2005;28:403–50.
5. Luksys G, Gerstner W, Sandi C. Stress, genotype and norepinephrine in the prediction of mouse behavior using reinforcement learning. Nat Neurosci. 2009 Sep;12(9):1180–6.

James Folkestad, PhD

Professor and University Distinguished Teaching Scholar

Colorado State University, School of Education, Center for the Analytics of Learning and Teaching

U-Behavior

How do we support metacognition and durable learning?

Our Chat Platform Today: Padlet

- Please **scan the QR code** with your phone, or **click the link in the chat** to open Padlet in your browser.
- If you have a second screen, please open the Padlet tab there.

Specific Objectives

1. Participants will be able to **understand** how U-Behavior connects to Metacognition for durable learning
2. Participants will be able to **understand** the U-Behavior teaching and learning method
3. Participants will be able to **identify** how existing findings support the U-Behavior method

Metacognition for Durable Learning

What is Metacognition

- The awareness of one's own thought processes/patterns and how they impact your durable learning
- Taking control and changing your learning processes and patterns to impact durable learning

What is Durable Learning

“Acquiring knowledge and skills and having them readily available from memory so you can make sense of future problems and opportunities.” [1]

1. Brown PC. Make it stick: the science of successful learning. Cambridge, Massachusetts: The Belknap Press of Harvard University Press; 2014.

To Learn, what do we need to be aware of?

QUESTION

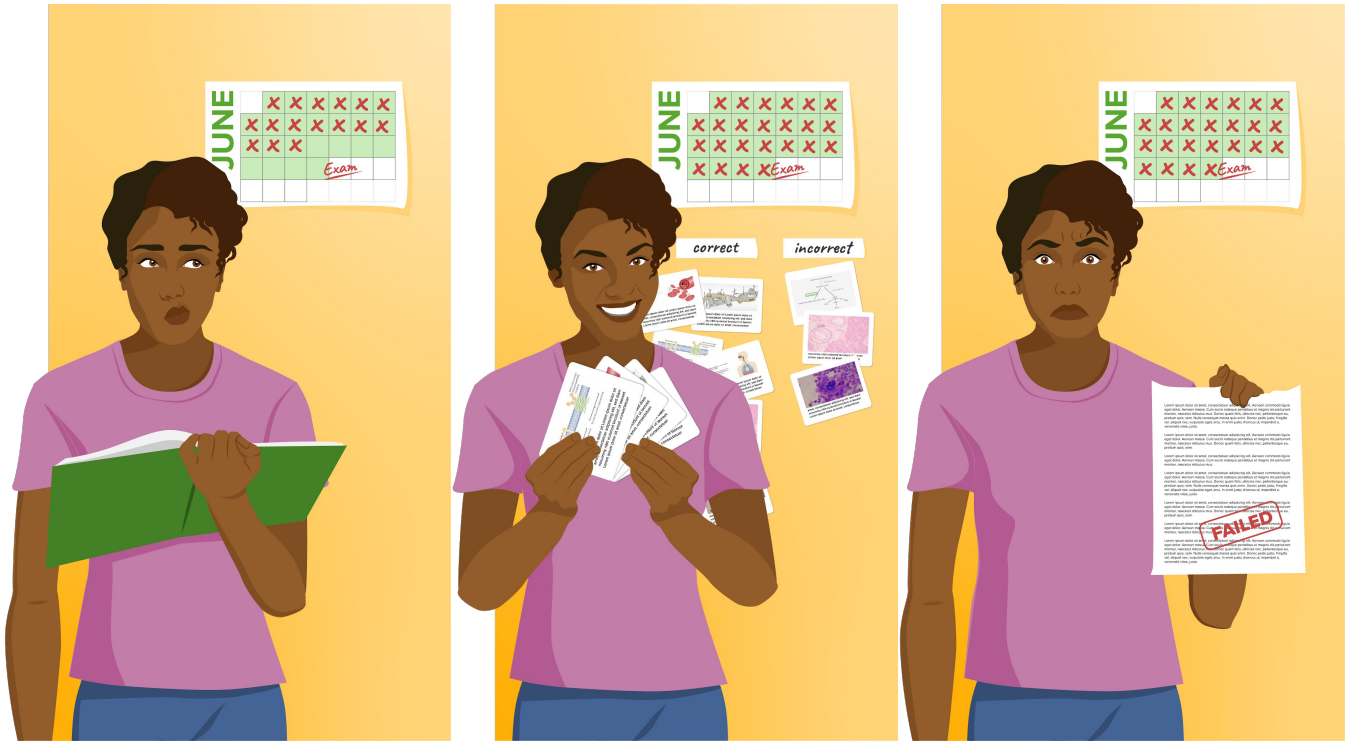
Answer: Be aware of the “How” and “When”

- We should be aware of **how and when** we engage in thinking when we are trying to learn something
- **Empirical studies** provide extensive evidence that they improve upon learning. How can we do it?
  - Being aware of **How:**
    - Testing ourselves (retrieving information from our memory)
    - Mixing up content (interleaving of content)
  - Being aware of **When:** Practice schedule (spacing our testing and mixing over time)

What are Students Doing?

QUESTION

The Answer: Non-evidence based practices



They use practices that do not align with what we know about the science of learning

What are the Instructors Doing?

QUESTION

Question 1 0.5 pts

Species can be broken down even further. What are different groupings within species called in dogs?

- Genus
- Breeds
- Phylum
- strains
- races

Evidence?

What do instructors do to support durable learning?

What the Data Says

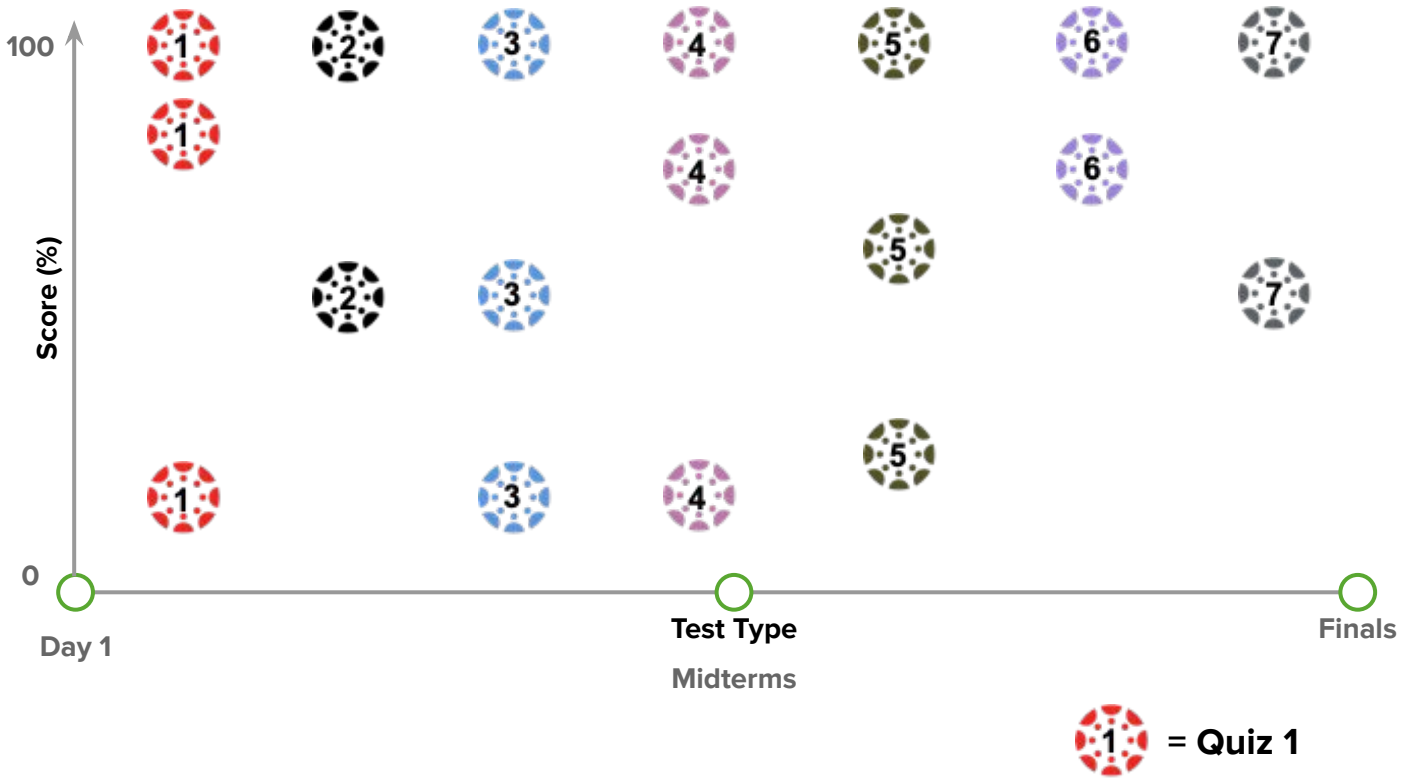
Let us explore through a series of basic questions

Question

1

What happens when students are given practice quizzes?

What happens with Low-Stakes Quizzing



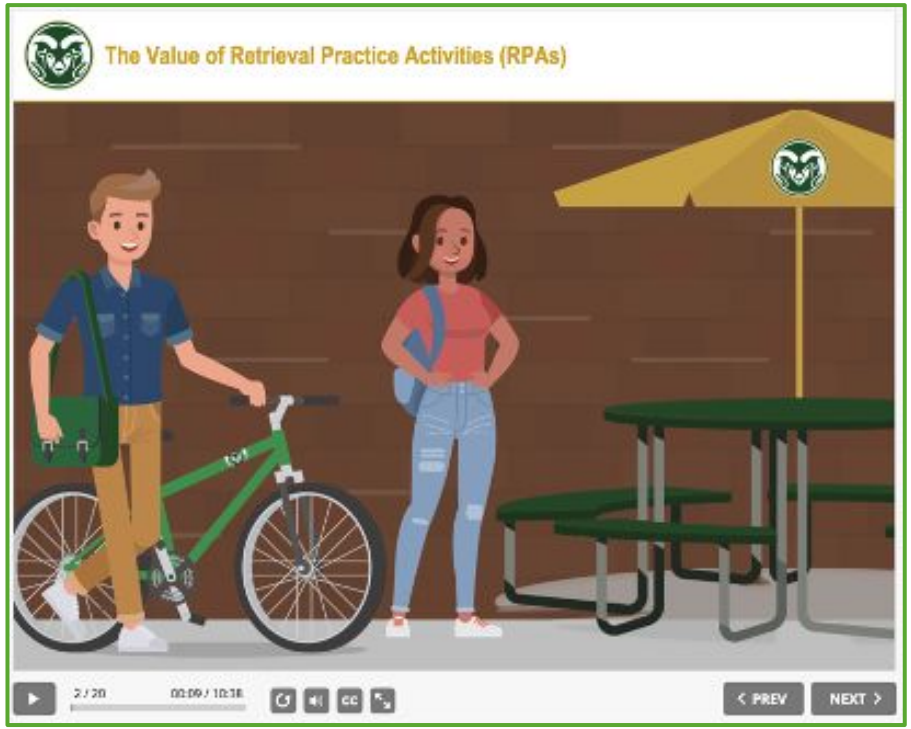
Question

2

What can we do to change the behavior of students?

Focus of this seminar:
Metacognition for Learning

The U-Behavior Method



Definition

Reflection questions about their practice behavior

The U-Behavior Method: Table Based Rubric

Practice Level	Behavior Score 1	Behavior Score 2	Percentage of Points	Points
1 Low Practice Behavior	< 40% of RPAs*	N/A	20%	
2 Moderate Practice Behavior	≥ 40% and < 70% of RPAs	N/A	50%	
3 Effective Practice Behavior	≥ 70% of RPAs	< 40% RPAs	80%	
4 Highly Effective Practice Behavior	≥ 70% of RPAs	≥ 40% of RPAs	100%	
0 Guessing or Gaming Behavior	N/A	N/A	0%	0

*) RPAs: Retrieval Practice Activities

What do you think was the result of this method?

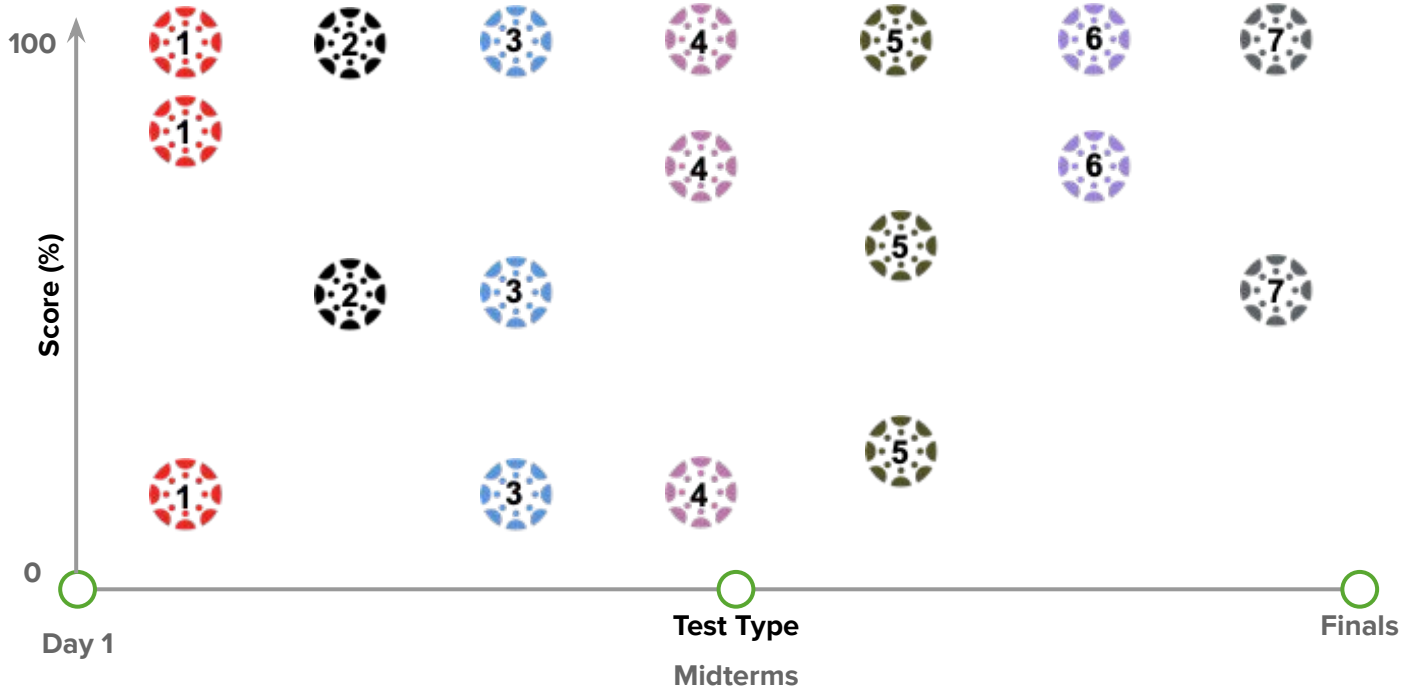
QUESTION

Experimental Method [1]

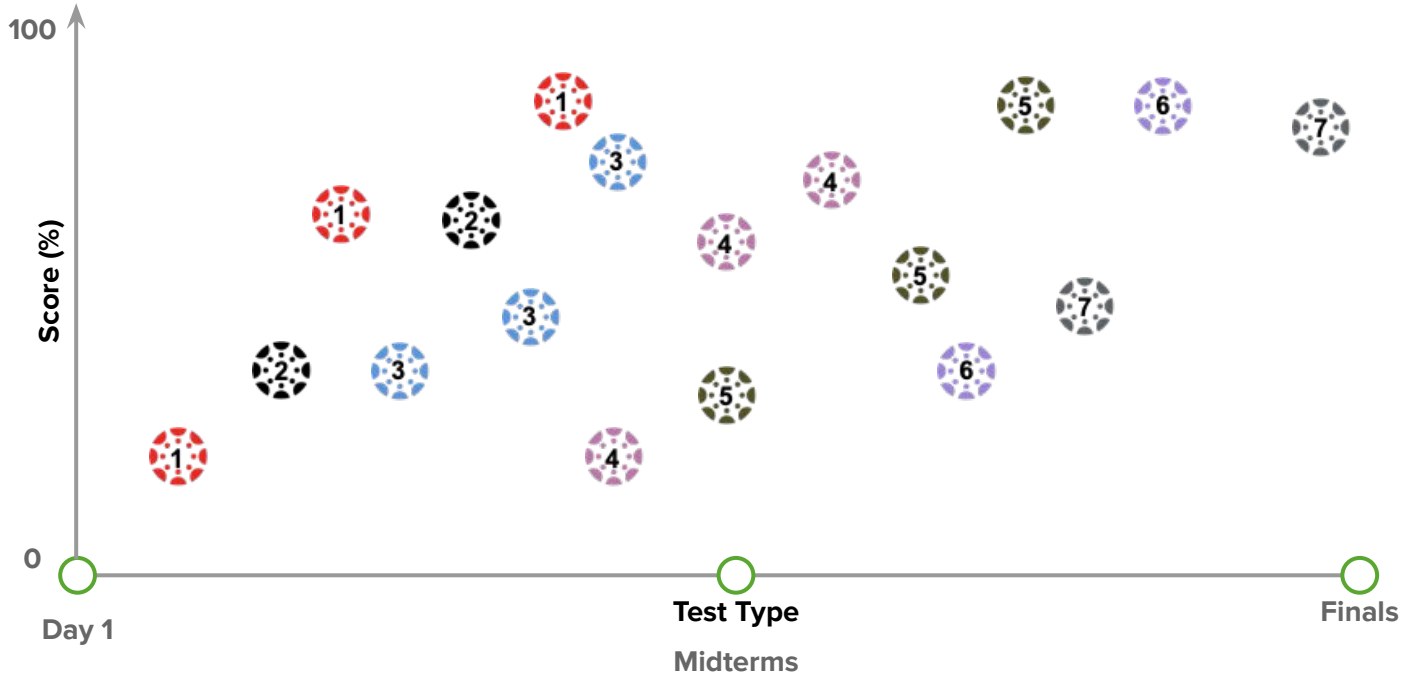
- Location: Large STEM Classrooms
- Course Name: Introduction to Microbiology (N=217)
  - Condition 1: Low-Stake Quizzing
  - Condition 2: U-Behavior Practice Method

1. McKenna, K., Pouska, B., Moraes, M. C., & Folkestad, J. E. (2019). Visual-form learning analytics: A tool for critical reflection and feedback. *Contemporary Educational Technology*, *10*(3), 214-228.

Condition 1: Low-Stakes Quizzing



Condition 2: U-Behavior Practice Method



What about performance (durable learning?)

QUESTION

?

Retention Test Performance
(Measure of Durable Learning)

Descriptive – Retention Test (4-5 Weeks)

Group	N	Min	Max	Mean	Std. Deviation
Highly Effective Behavior	16	45.0	87.0	65.0	12.1
Less than optimal behaviors	78	21.6	81.1	57.0	13.4

T-Test – Retention Test (4-5 Weeks)

Total	t	df	Sig. (2-tailed)	Mean diff	Std. Error
Equal Variance assumed	2.18	92	**.032**	7.89	3.61

Effect Size: 0.65 - Cohen's d (1 letter grade higher)

What Can We Conclude

- Behaviors impact durable learning. The question is how? and when?
- Pedagogy impacts behavior
- We need to design interventions with this at the forefront
- We need ways to witness actual behaviors

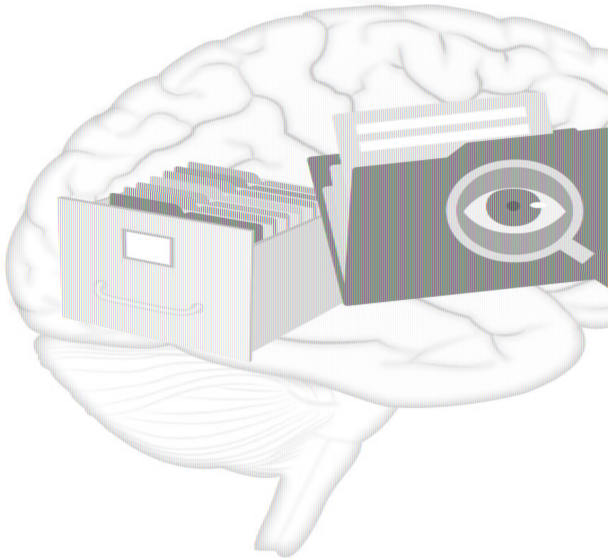
Breakout Sessions

Breakout Sessions: Instructions for Participants

- This room is for you to share and discuss how to foster metacognition in your classroom and the challenges you have encountered.
- The discussion will focus on **2 topics:**
  - **(1)** How you monitor and evaluate your students' learning in your classroom?
  - **(2)** How might you use metacognitive principles in your course design?
- Please keep your response to **under 1–2 minutes** so that your fellow educators can participate too, the time being limited. Also please add your comments and questions to the Padlet
- Try to stick to the question and avoid changing the topic.
- We will return to the main room in **10 minutes**.
- Use Zoom's "raise hand" feature when you would like to share an idea or question.
- Use the chat to share your thoughts if you would prefer not to speak.
- Don't be shy—your colleagues are interested in your experiences and thoughts!

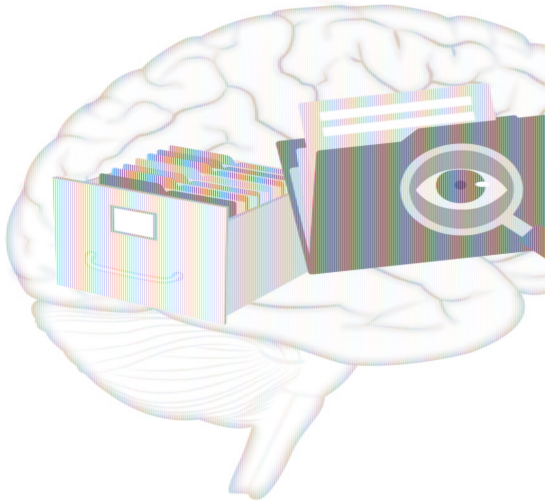
Discussion Group Question 1

Do you use course data to monitor and evaluate your students' behavior in learning? If yes, please share how



Discussion Group Question 2

Based on what you have learned, how could you make metacognition part of your course design?



Breakout Sessions: Instructions for Participants

Head to your respective rooms, and we will reflect when we return from the discussion groups.

Sharing Outcomes and Takeaway Messages

- Metacognitive skills are crucial to effective learning
- These skills are not intuitive or widely practiced and should be taught, monitored, and encouraged
- Technology can play a crucial role in facilitating the implementation and monitoring of metacognitive skills

Important Post-Event Information

- **Follow-Up:** We will share the metacognition handout along with our follow-up survey, which we encourage you to complete.
- **Certificates:** An attendance certificate for the seminar can be requested on the survey form.
- **Summary Document:** A summary document of key metacognition strategies, including implementation tips and key points from the breakout sessions, will be sent to all participants next week.

Are You Interested in Our Future Events?

Save the date for our upcoming

Durable Learning Seminar

Instructional Design: *how best to optimize the learning process*

May 11, 2022, 9:00 PDT | 12:00 EDT | 18:00 CEST

Are you interested in contributing to learning science?

Join our Learning Science team's research endeavors!

Contact us: learning-science@lecturio.com

Lecturio's Implementation of Metacognition

Join our **regional demonstration sessions** to learn how you can use Lecturio to foster **metacognitive abilities** in your teaching.

To participate, please choose a breakout room for one of the following **regional sessions**:

- ➔ USA, Canada, and Caribbean
- ➔ Europe and Middle East
- ➔ Latin America
- ➔ Asia, NZ, Australia
- ➔ Africa

If you are having trouble joining your preferred room, please let us know in the chat and we will transfer you to the correct session.

Contact us

Learning Science Team
learning-science@lecturio.com