EdCogMcMaster.ca

HOLD the Date:
July 26-27, 2018

Motivating durable learning: Focused attention and instructional design

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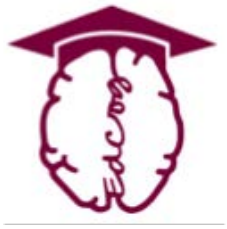
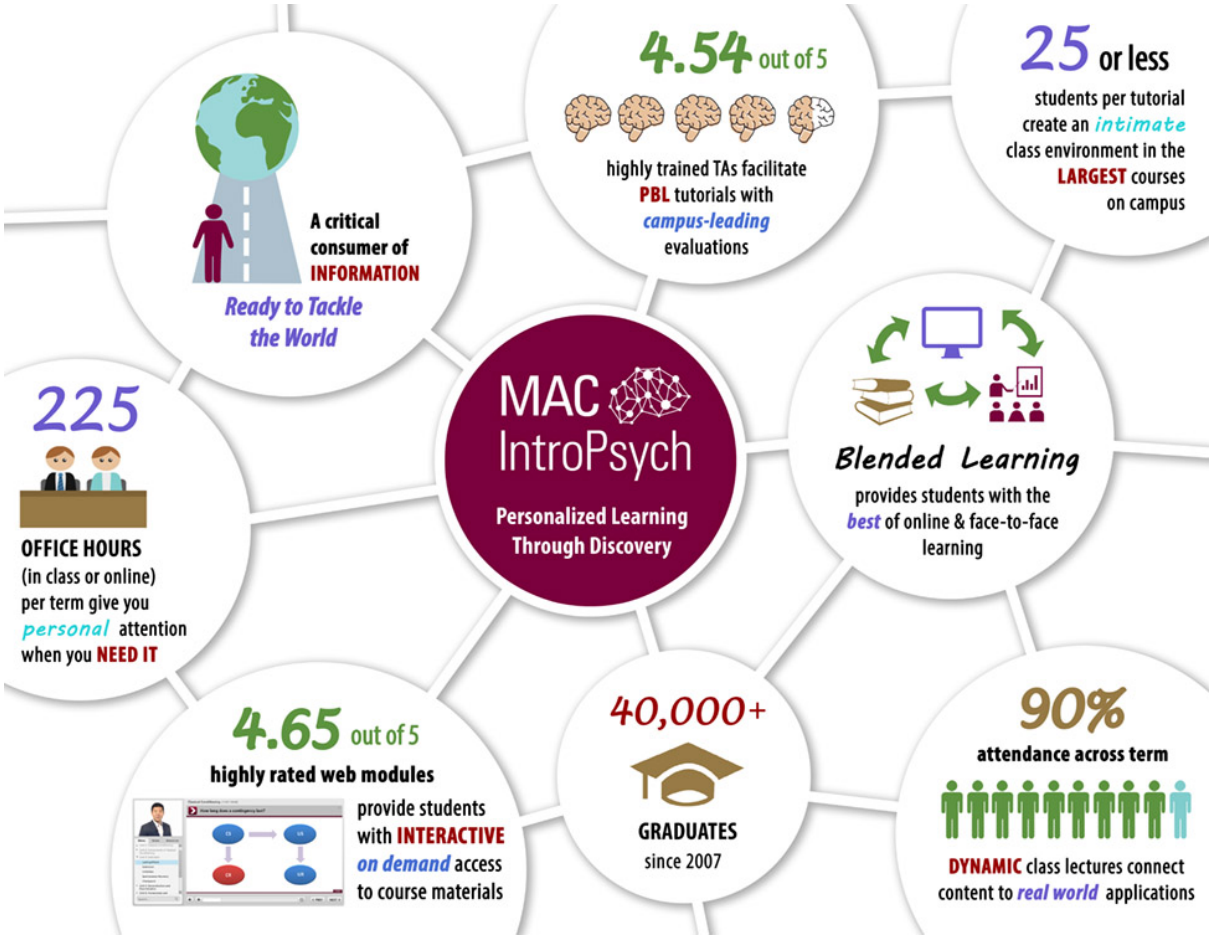
Psychology, Neuroscience & Behaviour
McMaster University



McMaster University

MAC IntroPsych.com



Does the light in the fridge go out when you close the door?

Students are expected to consume volumes of information...

...retain knowledge to apply in novel situations.

Mon 10:3

u 12:30

Mon 10:3

u 12:30

Mon 10:30

Wed 10:30

Thu 12:30

“Lectures are an effective way to teach, but a poor way to learn.”

- Stephen M. Kosslyn, Minerva University

"Any teacher that can be replaced by a machine should be!"

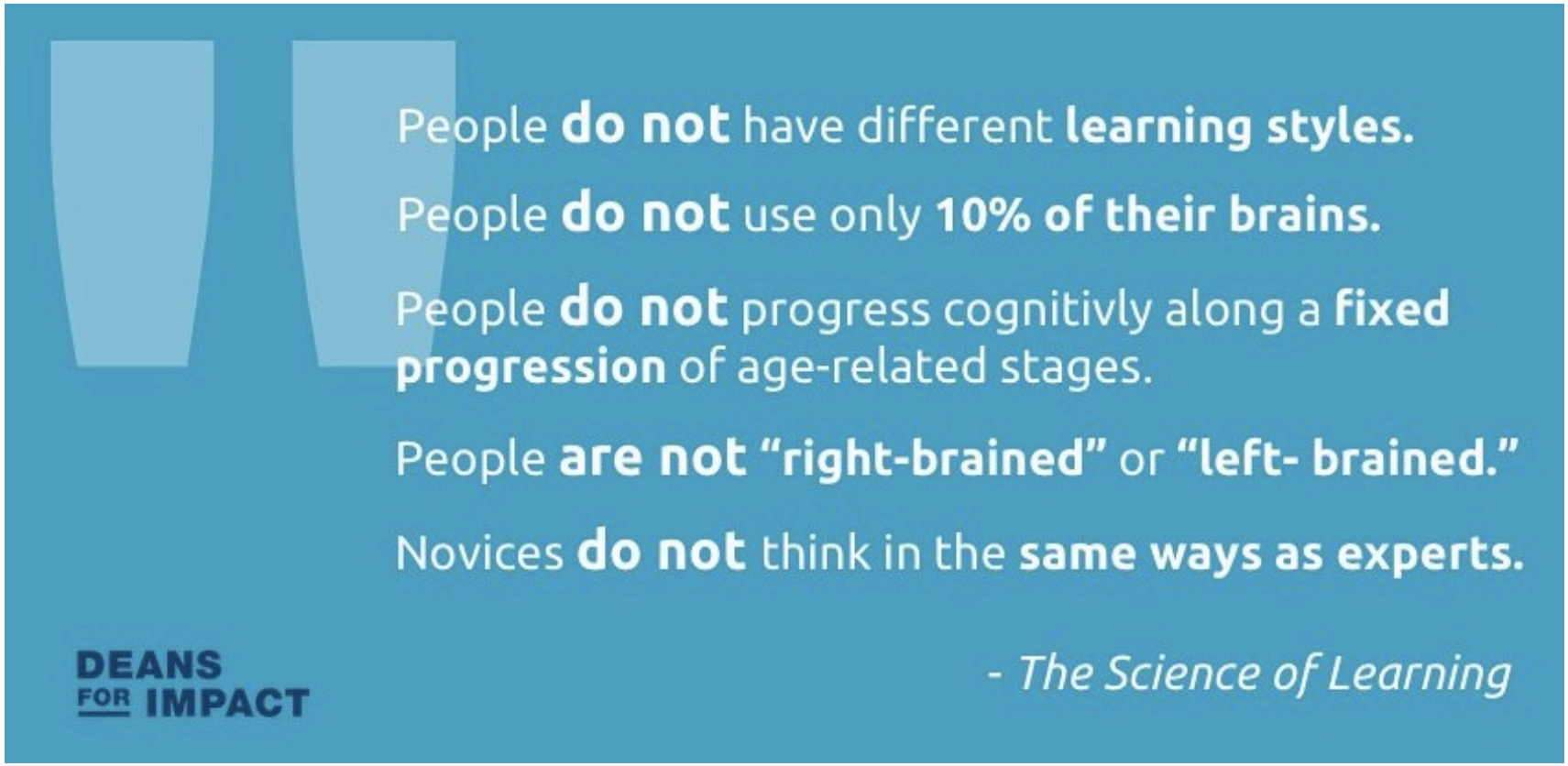
Arthur C. Clarke, "Electronic Tutors" (1980)

"…many teachers do not begin their careers with strong knowledge about strategies for learning…If teachers do not have well-developed knowledge about how to learn, it is unlikely that they will be able to lead their own students to develop knowledge about cognitive and metacognitive strategies for learning [and may] overlook the need for explicitly teaching students about cognitive and metacognitive strategies."

Askell-Williams et al., 2012, p. 414

Humans make poor metacognitive judgments on learning.

Intuitions about effective teaching influence educational practice.



Which study skills help learners?

Technique
Elaborative interrogation
Self-explanation
Summarization
Highlighting
Keyword Mnemonic
Imagery use for text learning
Rereading notes or textbook
Practice Testing
Distributed Practice
Interleaved Practice

Dunlosky et al. (2013)

Many students are being left behind by an educational system that some people believe is in crisis. Improving educational outcomes will require eff ts, but a central premise of this monograph is that one p dents to better regulate their learning through th cognitive and educational psyc se learning techniques that could help raph, we discuss 10 learning techniques in de ve utility. We selected techniques that were exp lience could be adopted by many students. Also, some techniques (e.g., highlightin ding) were selected because students report relying heavily on them, which makes especially important to examine how well they work. The tech elaborative interrogation, self-explanation, summarization, highlighting (eyword mnemonic, imagery use for text learning, rereading, prac actice, and interleaved practice. To offer recommendations about t hniques, we evaluated whether their benefits generali bles: learning conditions, student characteristics, mate conditions include aspects of the learning env hether a student studies alone or s age, ability, and level of prior ical problems to complicated es that are relevant to studer

Durable learning

Cognitive scientists have studied memory & attention in the lab for a long time.

Teachers have been teaching for a very, very long time.

Key factors for durable learning.

1. Learning begins with effortful & focused attention.

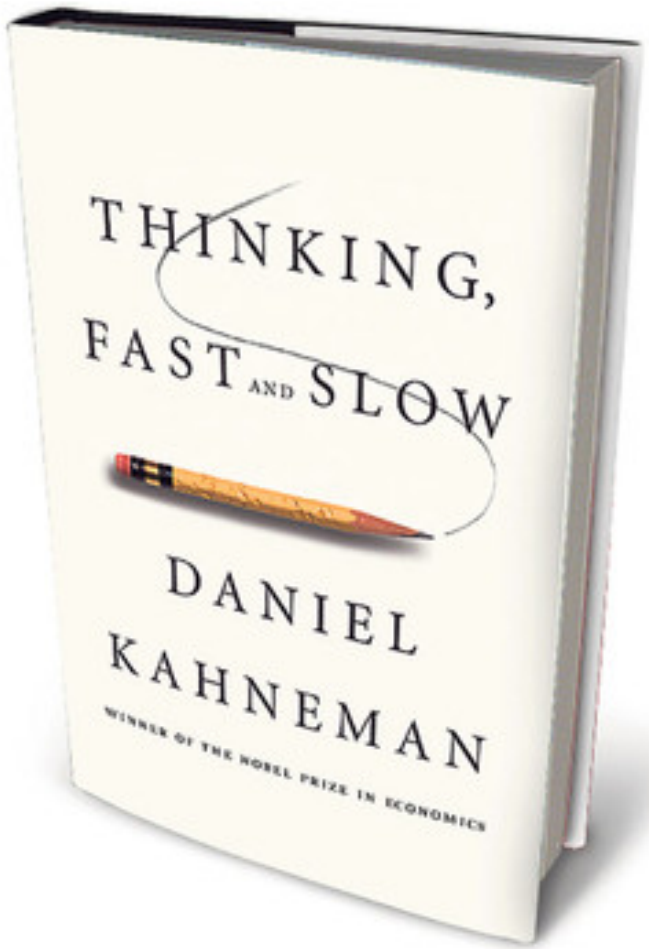
2. Instructional Design directly sets the stage for learning.

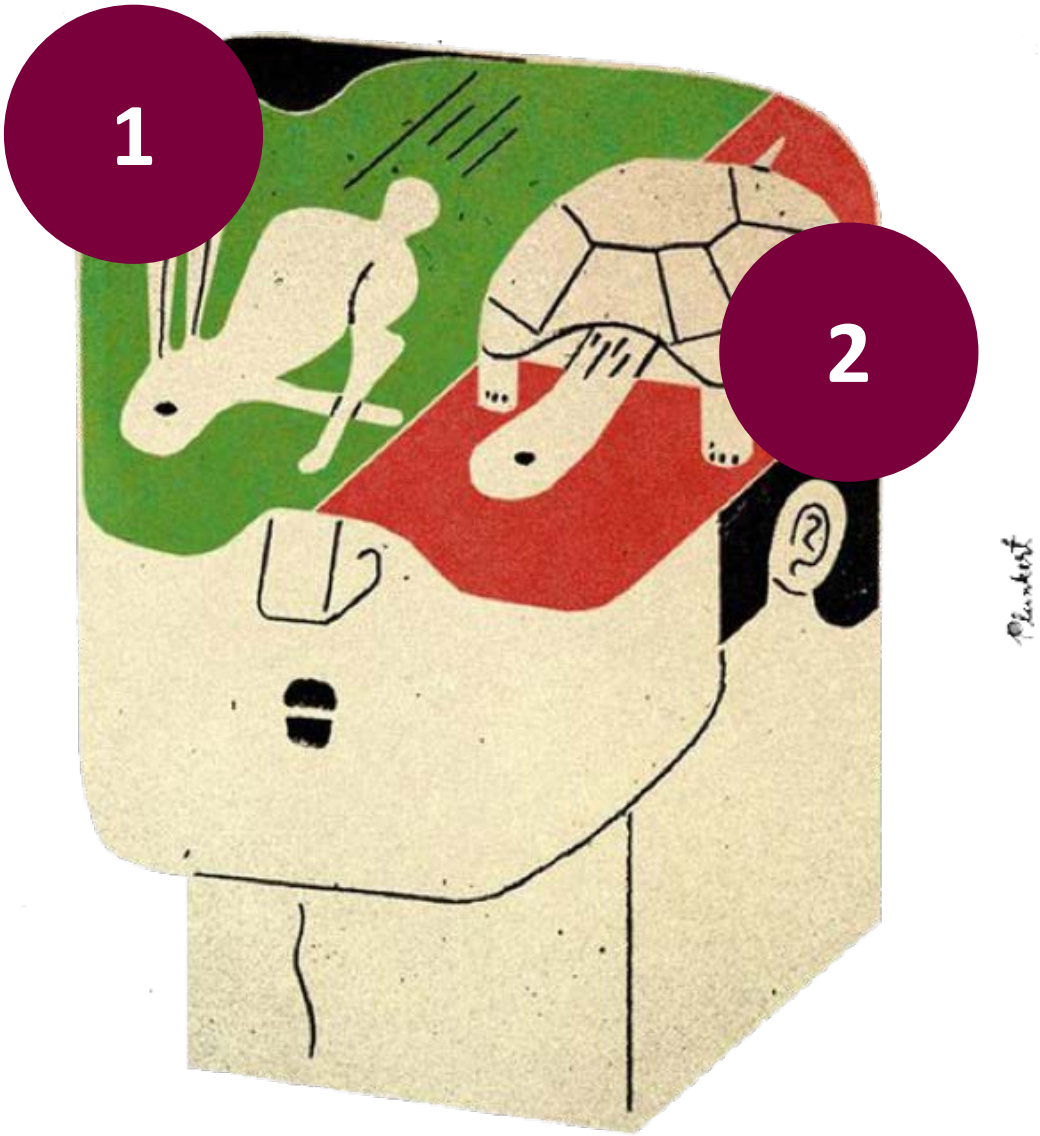
3. Effective study habits strengthen long-term retention.

1

Learning begins with effortful & focused attention.

Thinking, fast and slow.





Effortful? Are you thinking fast or slow?

A bat and a ball together cost $1.10
The bat cost $1 more than the ball.

How much does each item cost?

Effortful? Are you thinking fast or slow?

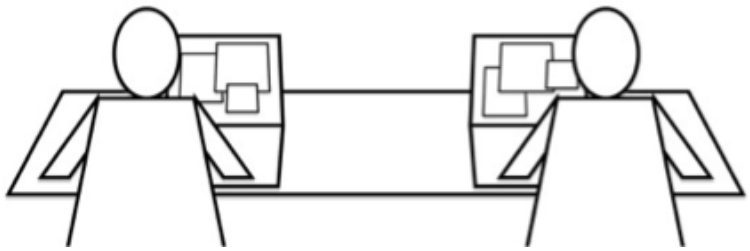
A BMW and a Tesla together cost $160,000.
The BMW cost $100,000 more than the Tesla.

How much does each car cost?

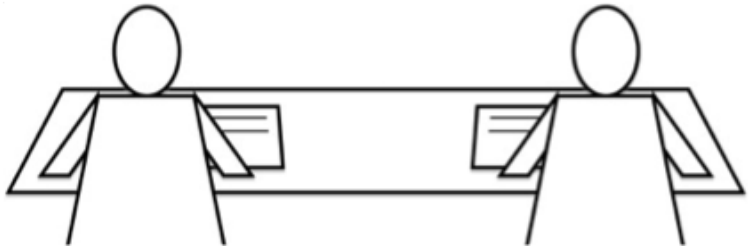
Focused? Learning while multi-tasking…

Divided attention leads to reduced gains in learning for self and peers.

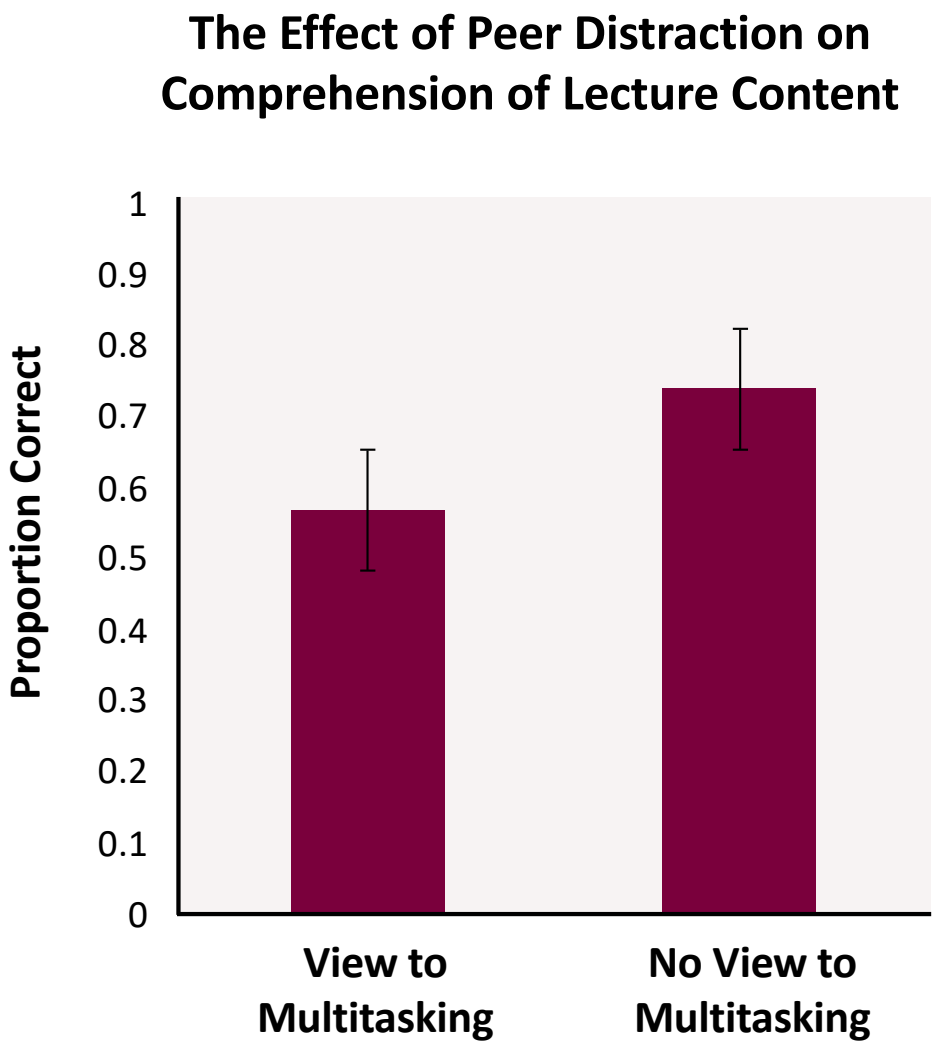
In view of a multitasking peer



VS



Not in view of a multitasking peer



Sana et al. (2013)

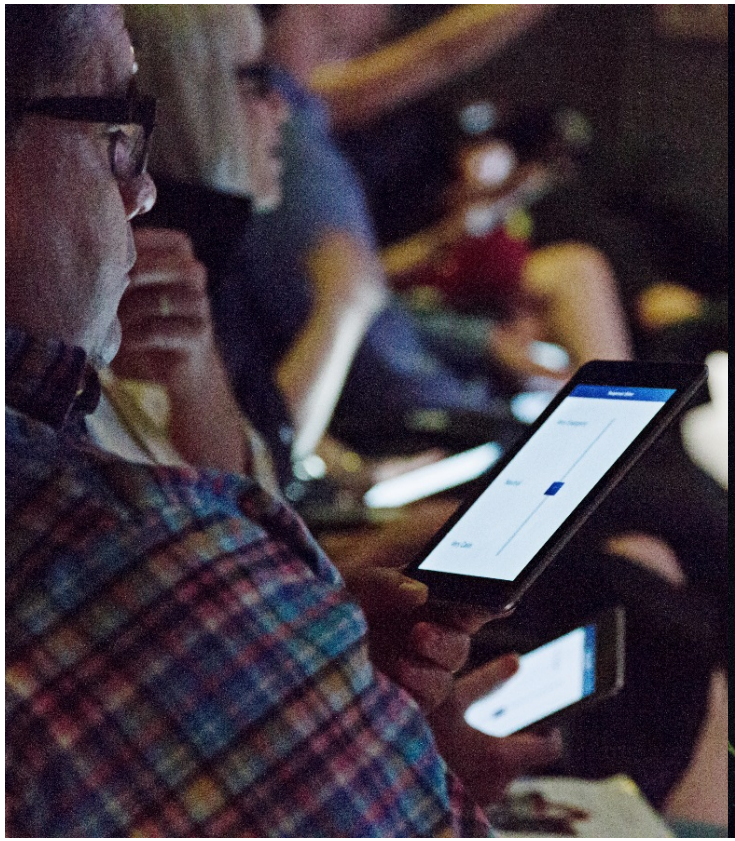
How can interventions increase attention during learning?

Dr. Barb Fenesi

Amy Pachai, PhD Candidate

NEURO FITLAB
Healthy for Life

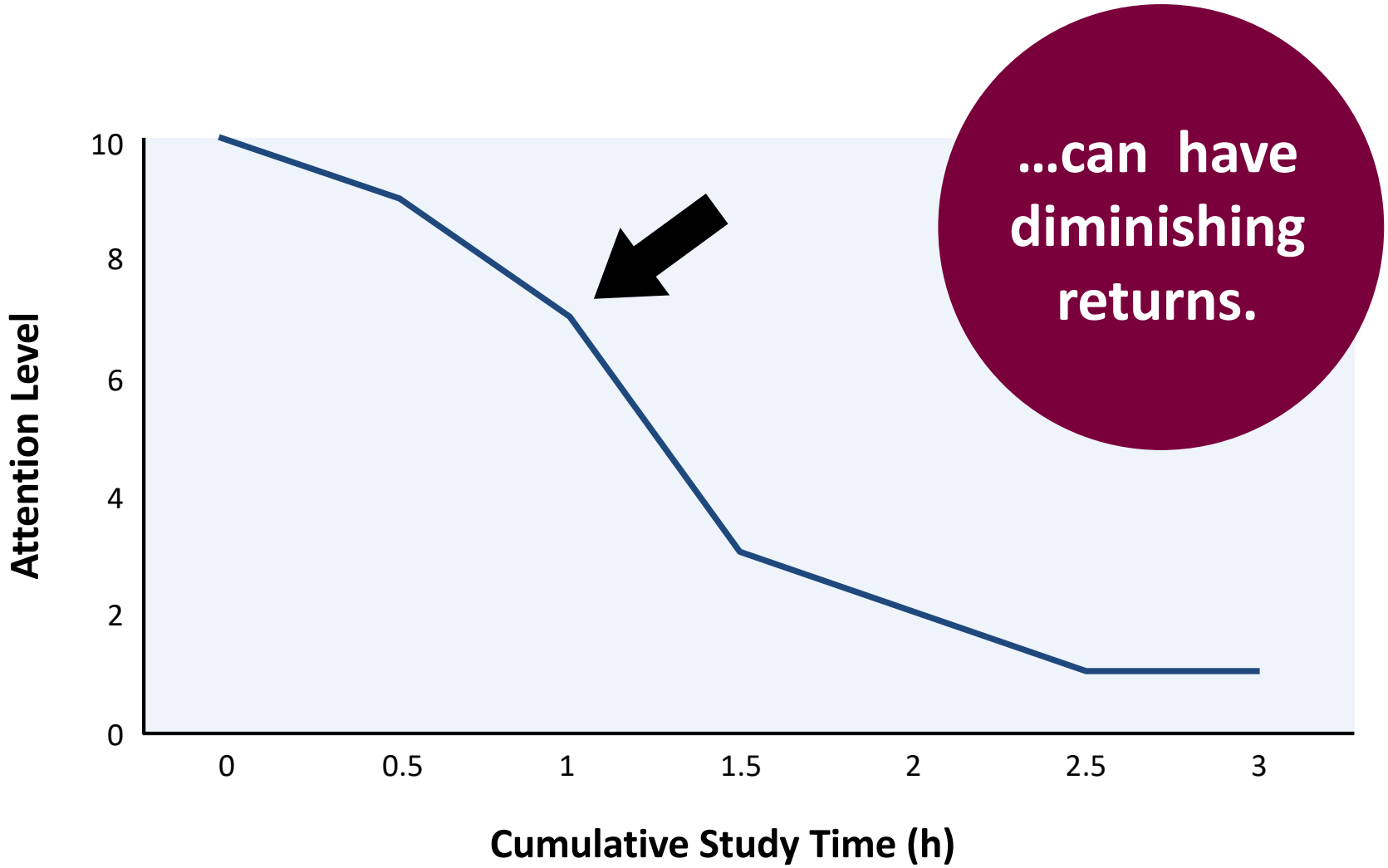
On-task attention assessed using mind-wandering probes.



McMaster University

LIVELab

Studying for sustained periods…

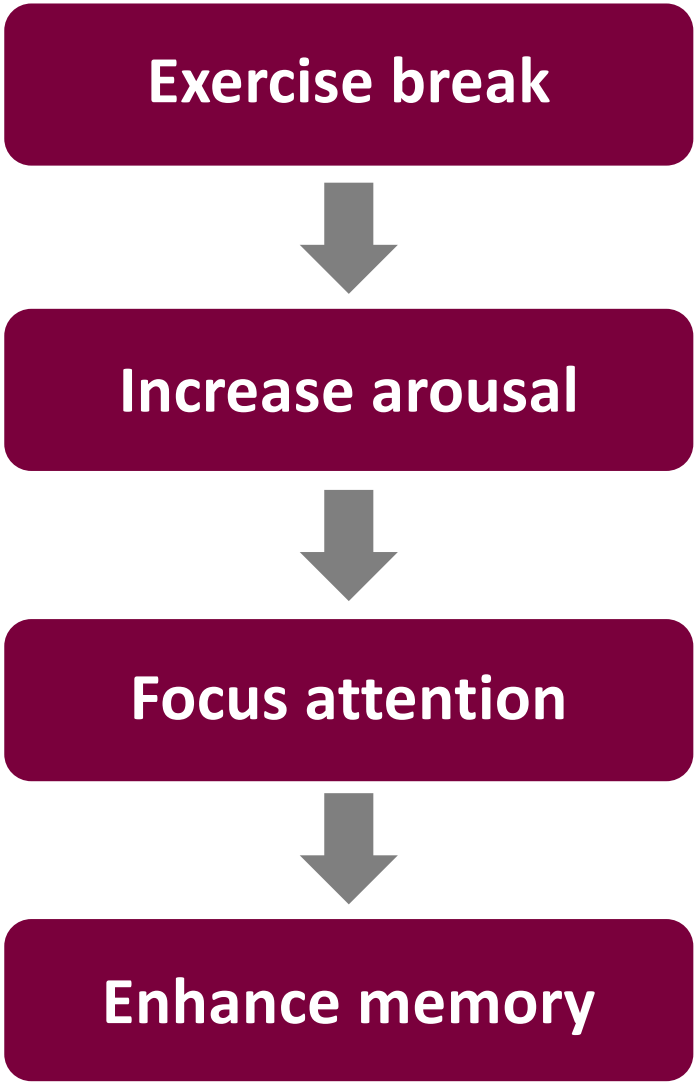


3h Night Class

1. We can have a couple breaks and go to the end….OR

2. We can push through and leave early.

Do breaks increase on-task attention during extended study?



Control

- No breaks

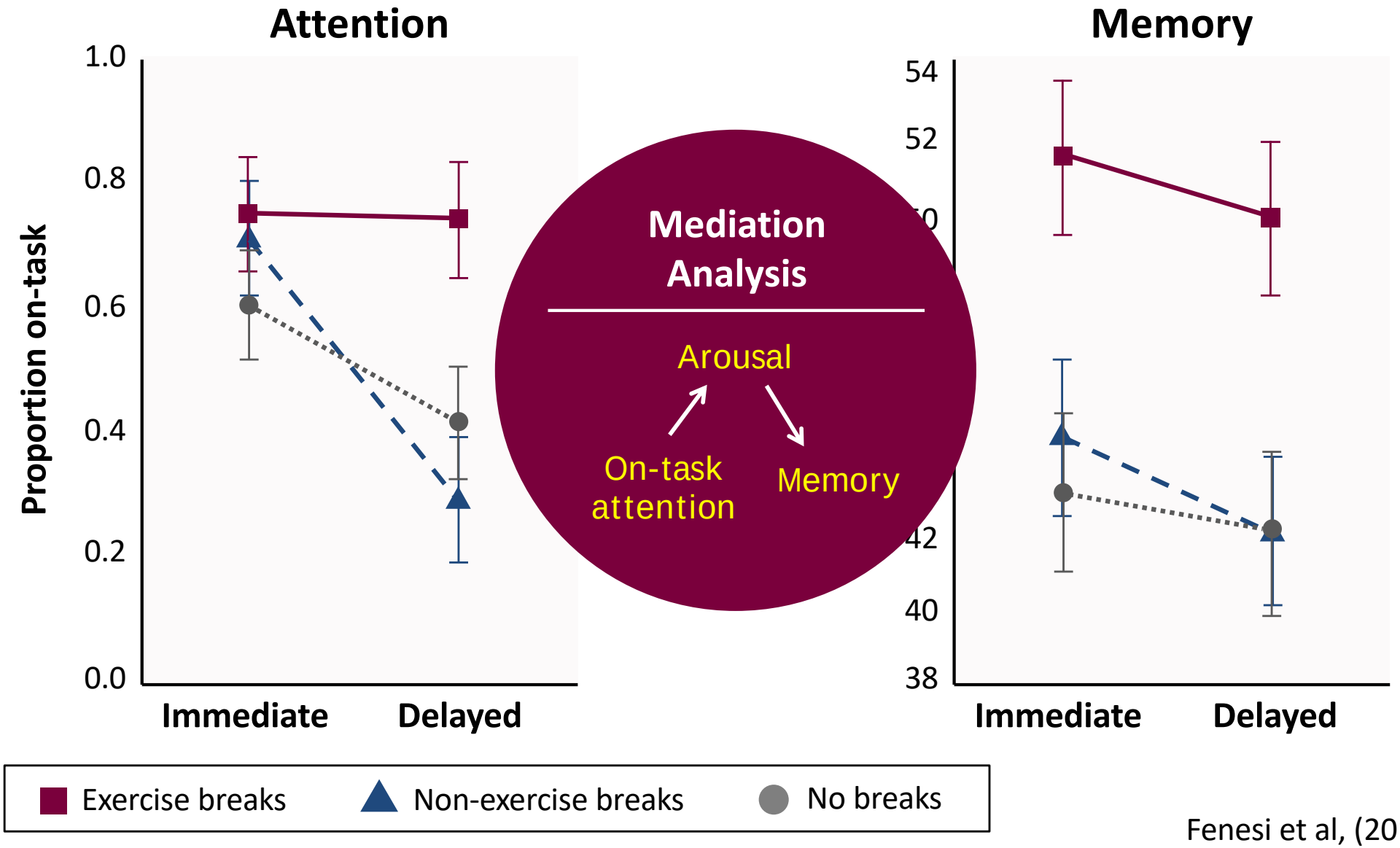
Non-exercise

- 3 x 5min
- game

Exercise

- 3 x 5min
- HIIT

Exercise breaks increased on-task attention and improved memory.



Fenesi et al, (2018)

How does exercise reduce mind wandering for optimal learning?

- Determine minimal effective doses of exercise interleaved with study.
- Understand interaction of arousal and key cognitive processes (working memory, processing speed, executive control).
- Field test of physical activity intervention in Rousseau Elementary school (Fall 2017).

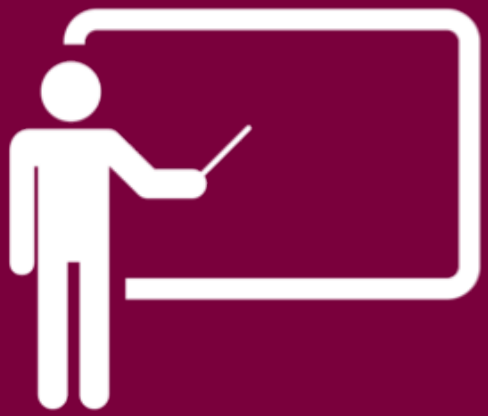
1. Learning begins with effortful & focused attention.

a. Maintaining effortful and focused attention increases in difficulty with time on task.

b. Reduce attention lapses with activities to engage learner (quiz questions, active learning).

c. When long learning sessions are required, integrate restorative breaks.

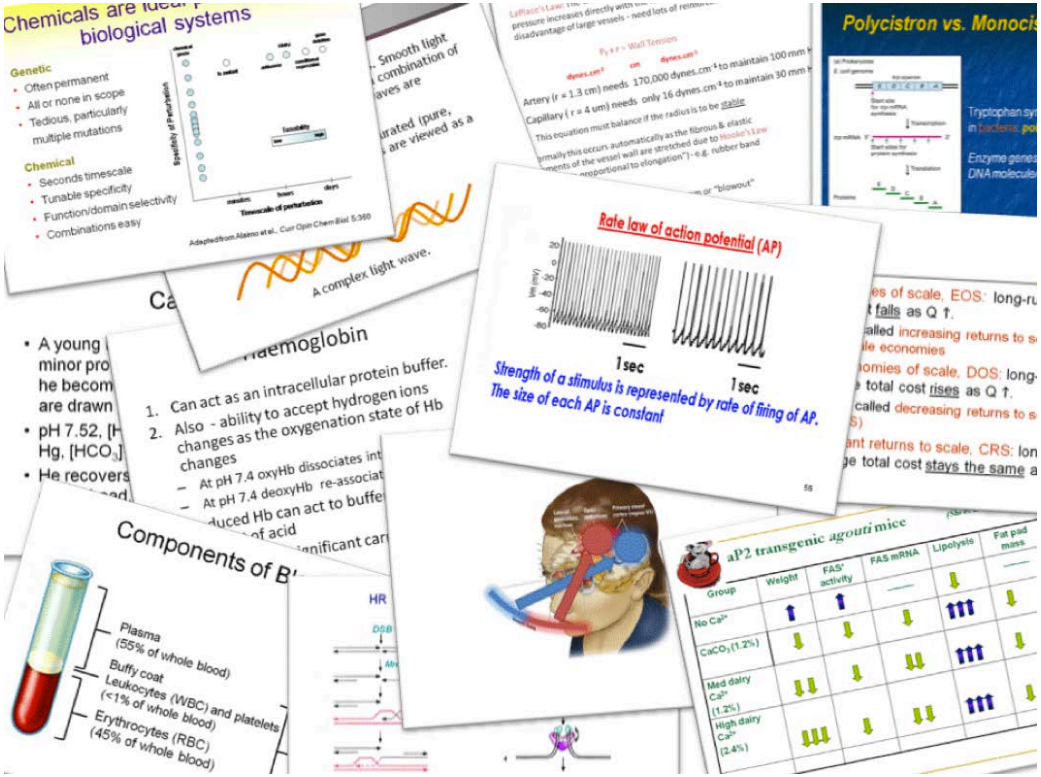
2



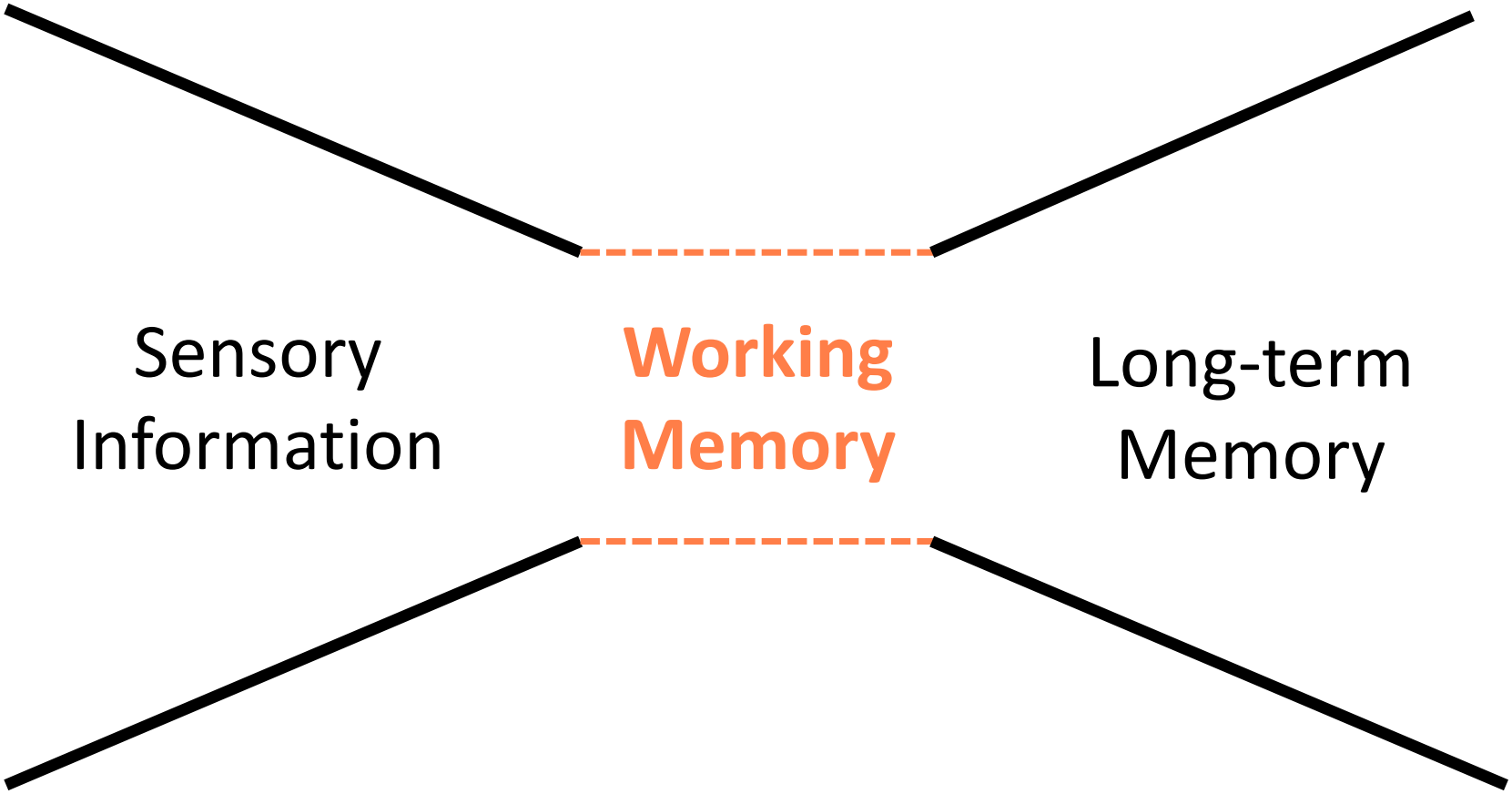
Instructional Design directly sets the stage for learning.

Evidence-based approaches to multimedia design lead to durable learning.

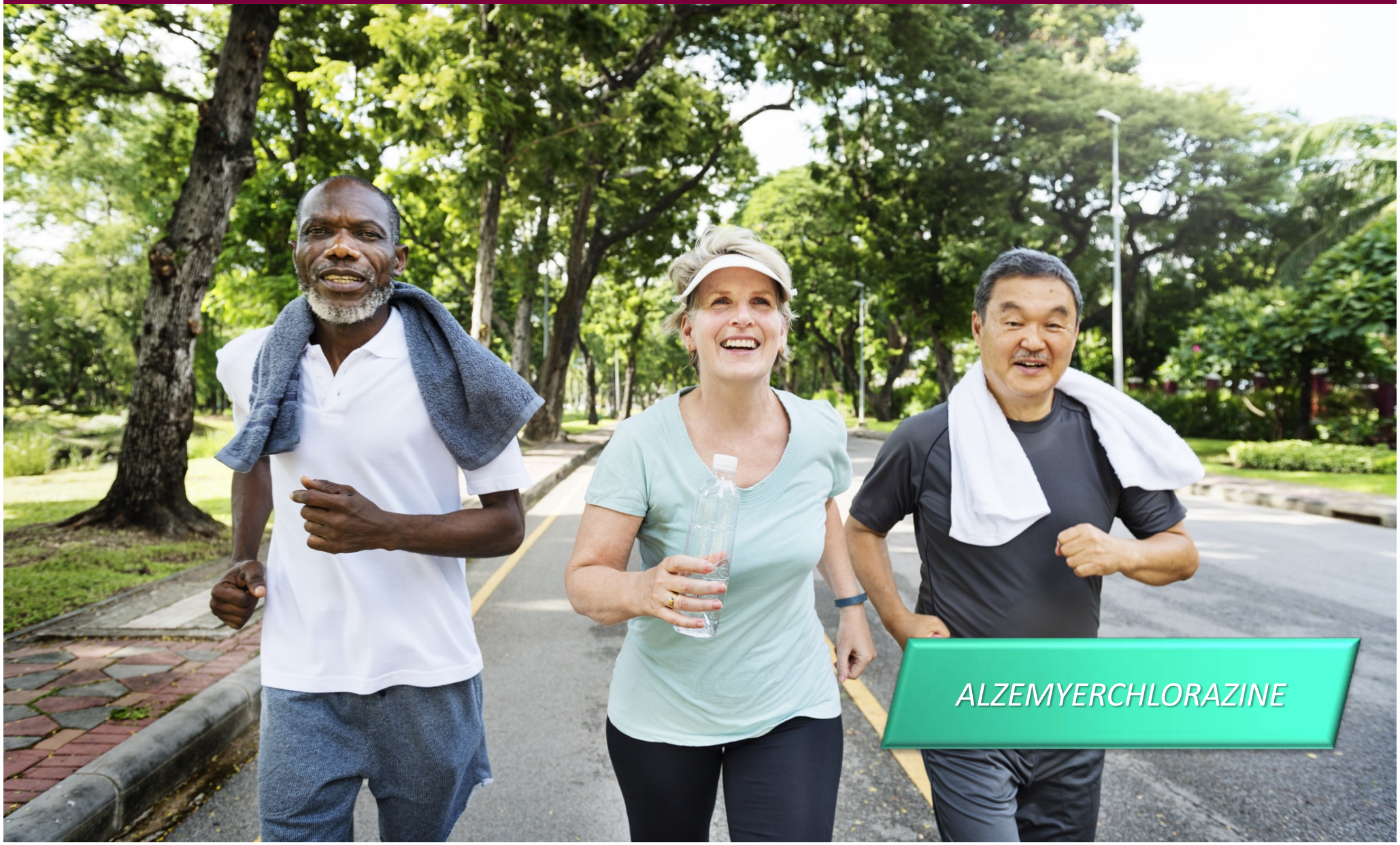
Dr. Barb Fenesi

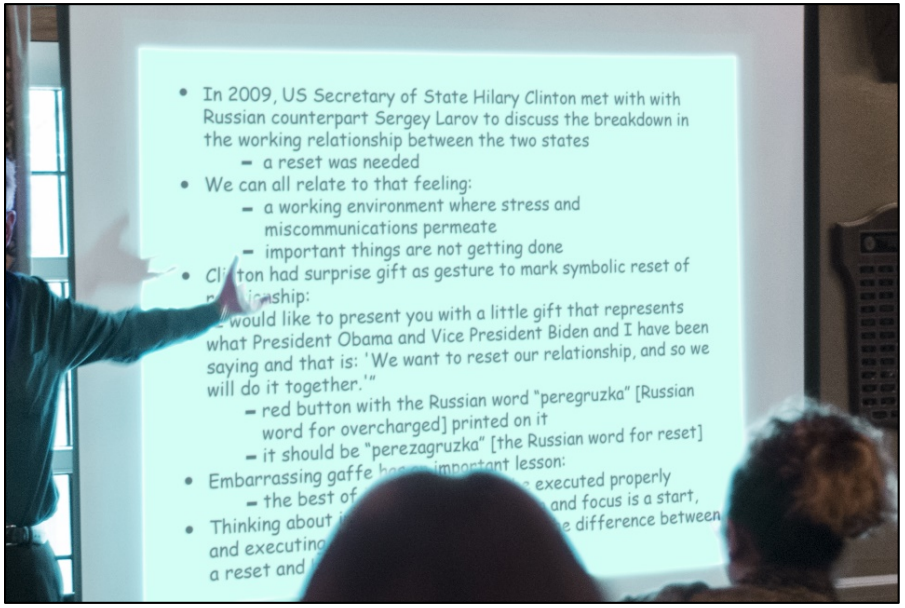


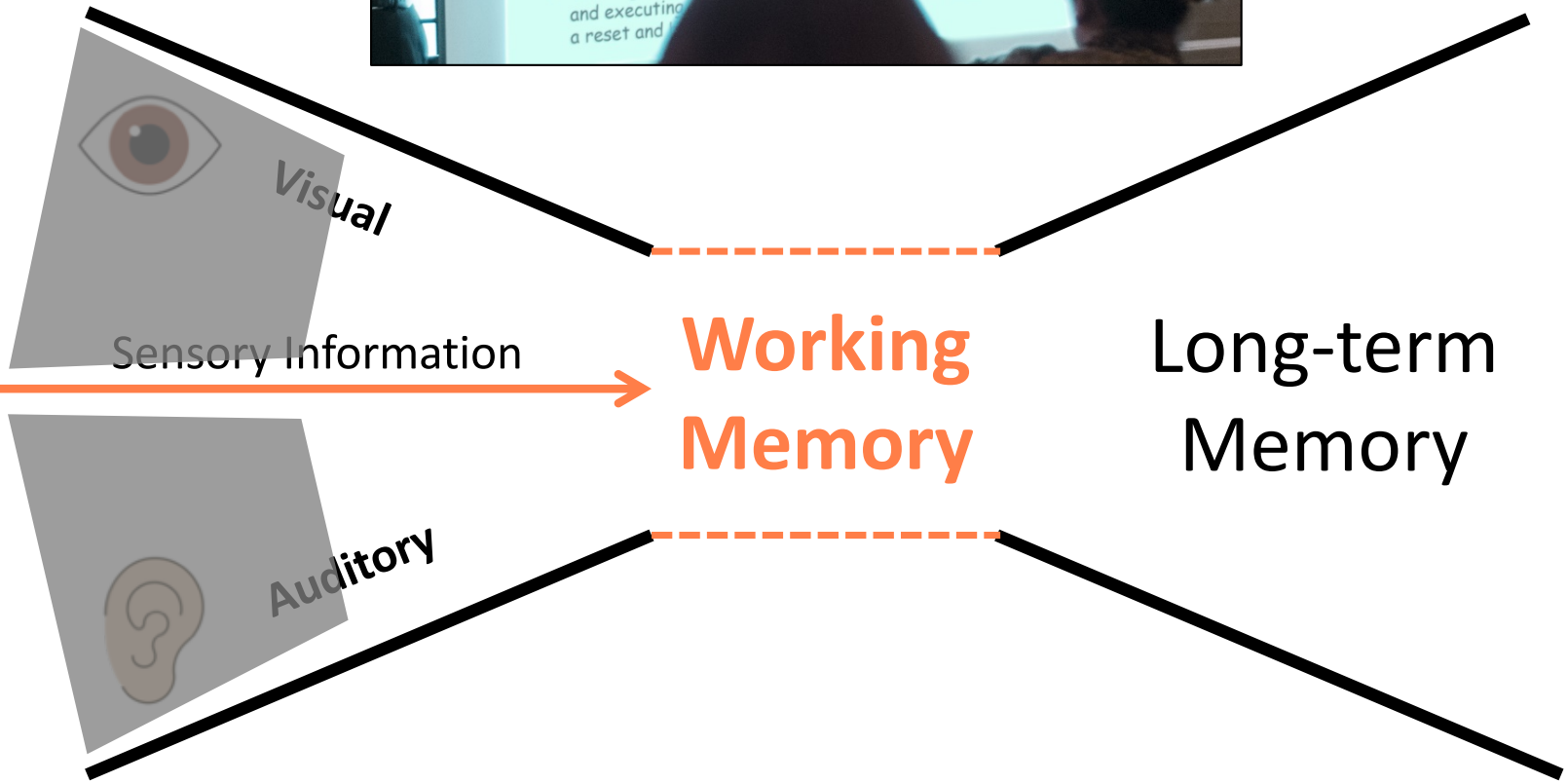
The attention span of your audience is limited at a cognitive level.



Are you making presentations to be remembered or forgotten?




In 2009, US Secretary of State Hilary Clinton met with with Russian counterpart Sergey Larov to discuss the breakdown in the working relationship between the two states
– a reset was needed
We can all relate to that feeling:
– a working environment where stress and miscommunications permeate
– important things are not getting done
would like to present you with a little gift that represents what President Obama and Vice President Biden and I have been saying and that is: 'We want to reset our relationship, and so we will do it together.'"
– red button with the Russian word "peregruzka" [Russian word for overcharged] printed on it
– it should be "perezagruzka" [the Russian word for reset]
executed properly
and focus is a start,
difference between

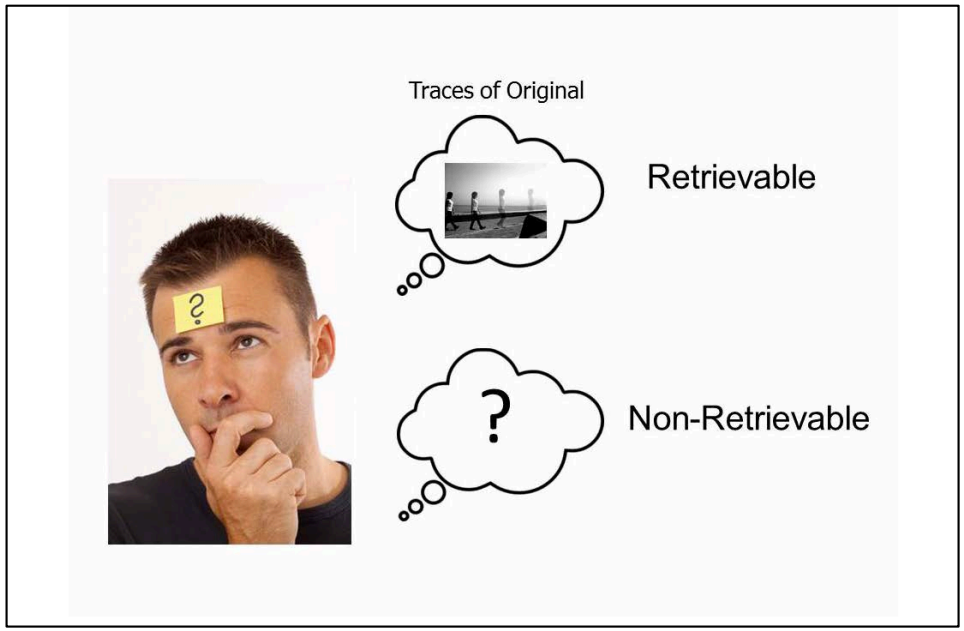

Visual
Sensory Information
Auditory
Working Memory
Long-term Memory

Limited attention resources can lead learners to miss key information.

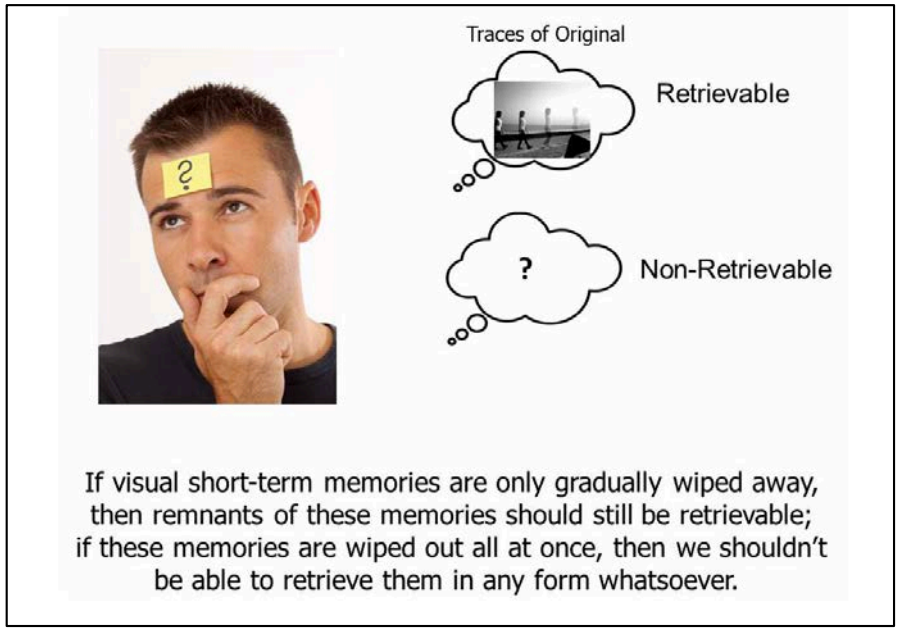
Learning to dispassionately transcribe what was dictated in the lecture hall.

Split-Attention reduces durable learning.

Complementary

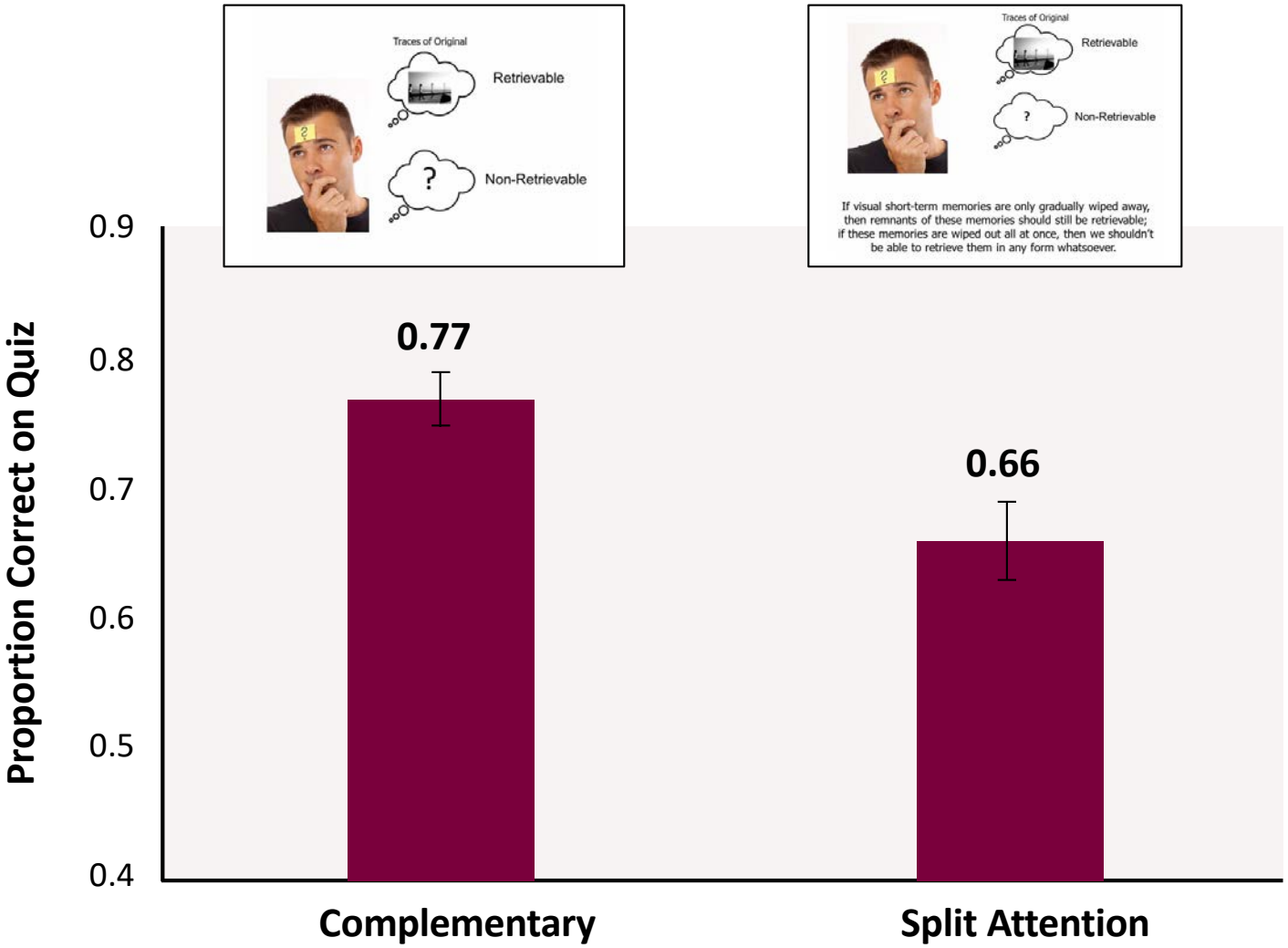


Split-Attention



Fenesi et al (2018)

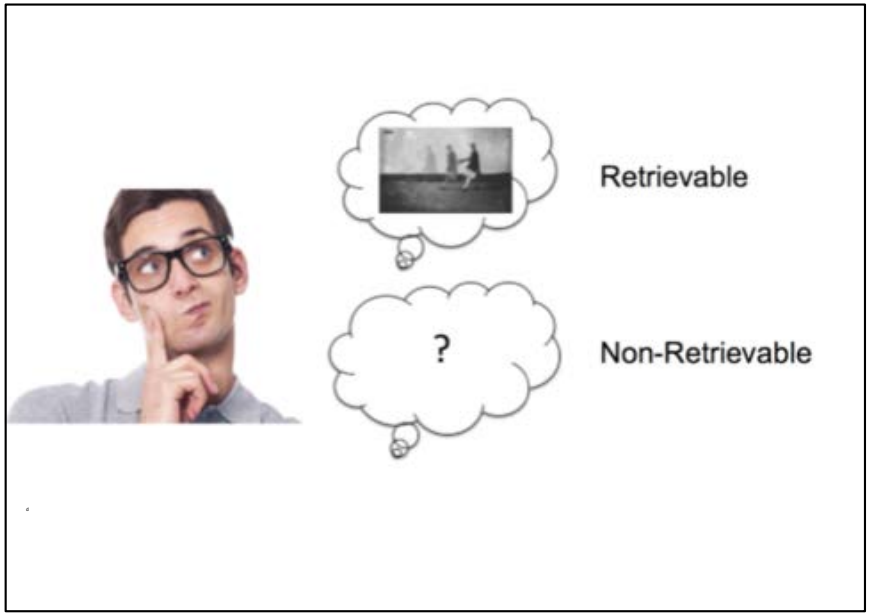
Split-attention reduces learning.



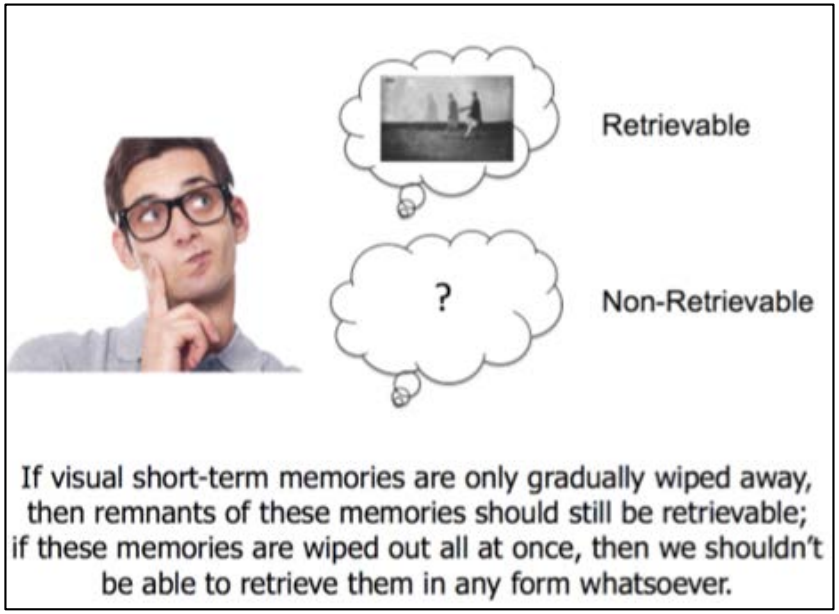
Fenesi et al (2018)

How does presentation of visual information influence learning?

Complementary



Split-Attention



Fenesi et al. (2014, 2015)
Fenesi & Kim (2015)
Fenesi et al. (in press)
Sana & Fenesi (accepted)

High Working Memory

Retrievable

Non-Retrievable

If visual short-term memories are only gradually wiped away, then remnants of these memories should still be retrievable; if these memories are wiped out all at once, then we shouldn't be able to retrieve them in any form whatsoever.

Low Working Memory

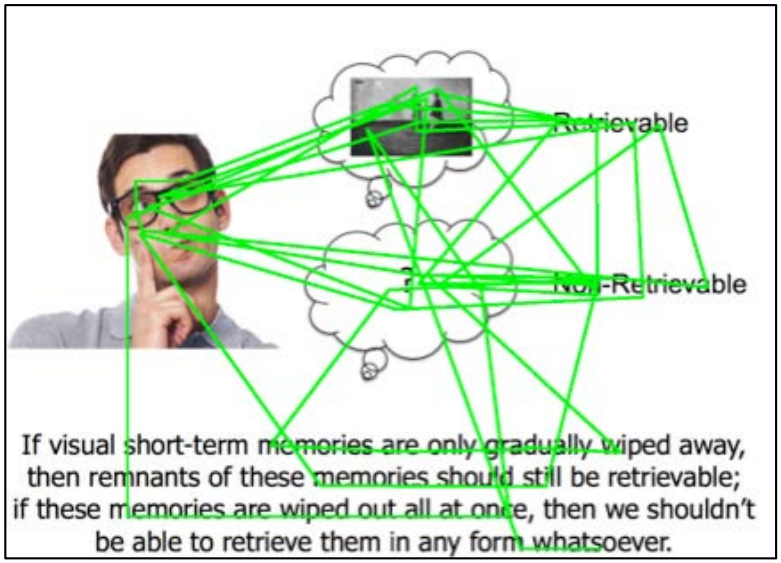
Retrievable

Non-Retrievable

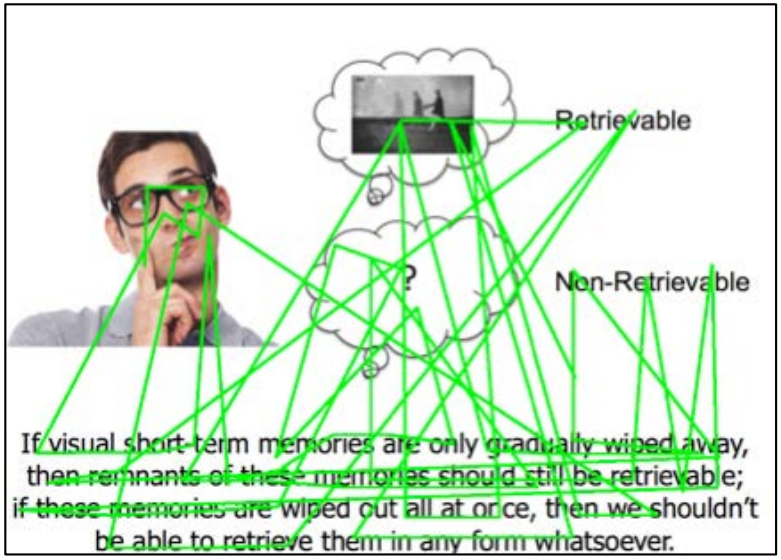
If visual short-term memories are only gradually wiped away, then remnants of these memories should still be retrievable; if these memories are wiped out all at once, then we shouldn't be able to retrieve them in any form whatsoever.

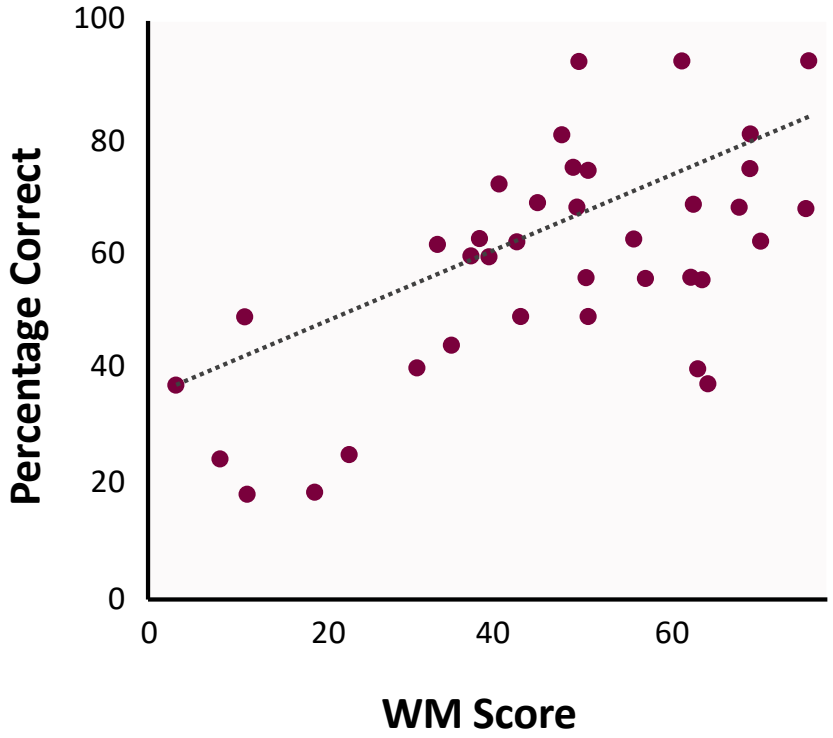
Differences in attentional control predict learning outcomes.

High WM



Low WM

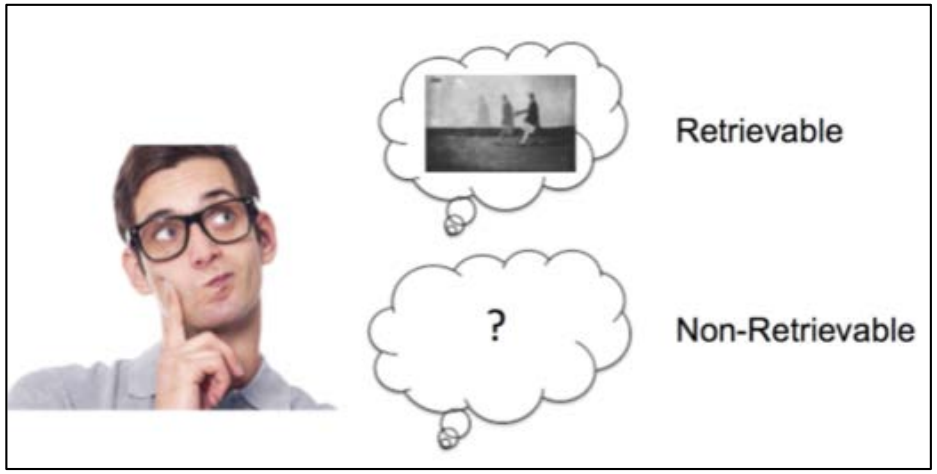




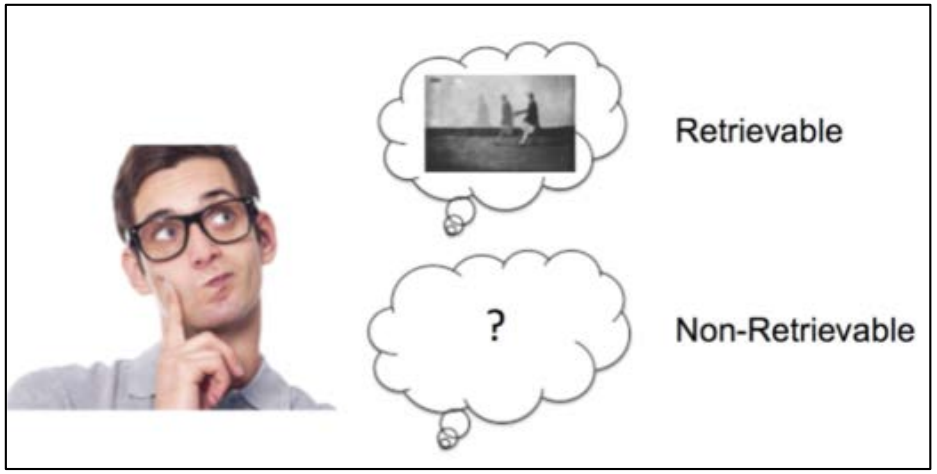
Fenesi, Kramer, Kim (2017)

Differences in attentional control predict learning outcomes.

High WM

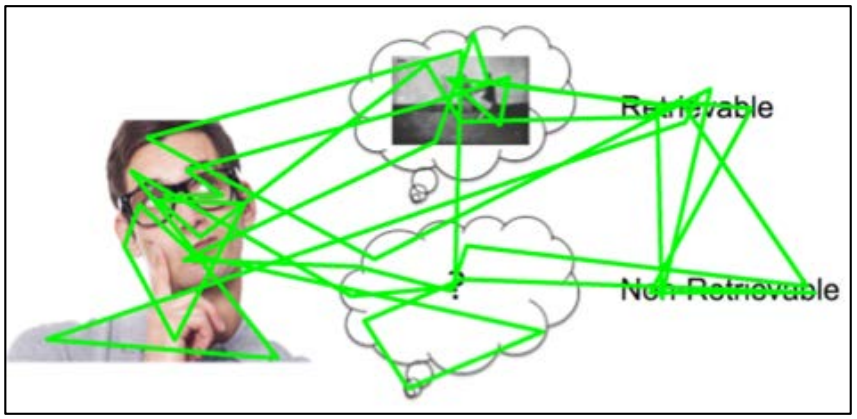


Low WM

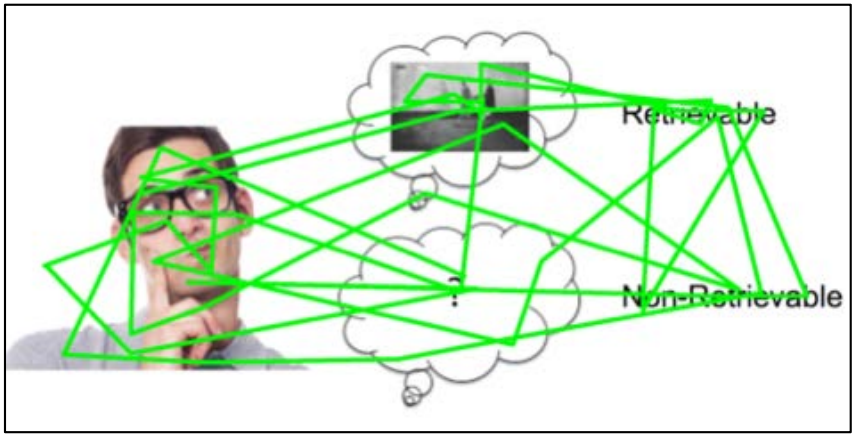


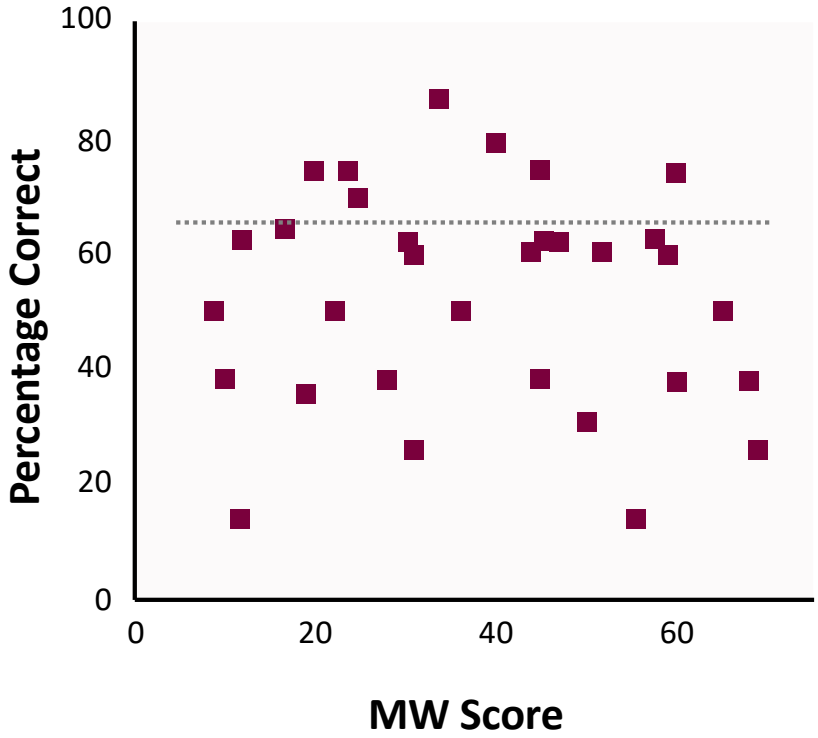
Differences in attentional control impact learning outcomes.

High WM



Low WM





Fenesi et al. (in press)

Instructors can help focus learner attention.

Controlled attention

Fenesi et al. (2015)
Sana & Fenesi (accepted)

Interventions for In-Class PowerPoint.

Dr. Catherine Overson

Multimedia Principle

"People learn better from words and pictures than from words alone."

Mayer, page 223

ORIGINAL

Obesity (cont'd)

- Those individuals who are frequently stressed and **produce lots of CRH and some cortisol**, "On-off people", tend to be **less hungry under stress**.
- Those individuals who are more likely to **produce high levels of cortisol (low CRH)** in chronic stress conditions, **tend to over eat**.
- Patterns of stress and how we respond lead to whether or not we are overweight.

MODIFIED

Obesity (cont'd)

Chronic Stress and Eating Behavior:

	Individuals who are frequently stressed and produce:	
Amount of CRH & Cortisol	High CRH & Some Cortisol (On-off people)	Low CRH & High Cortisol
Appetite	Are Less Hungry	Tend to Over Eat

Patterns of stress and how we respond are determinate factors in obesity

Example 2

ORIGINAL

Positivist Approach

- [illegible] & method of natural
  - Form & test hypotheses empirically
- Some hypotheses:
  - Law varies inversely w/ other social control
  - > stratification = more law
  - > “downward law” than “upward law”
  - > law as intimacy decreases [most law where people interact a lot w/ little intimacy]

MODIFIED

Positivist Approach

- Donald Black: perspective & method of natural ***sciences***
  - ➢ Form & test hypotheses empirically

- Some hypotheses:
  1. Law varies inversely with other social control
  2. > stratification = more law
  3. > "downward law" than "upward law"
  4. > law as intimacy decreases
     - ✓ most law where people interact a lot with little intimacy

Immediate Learning

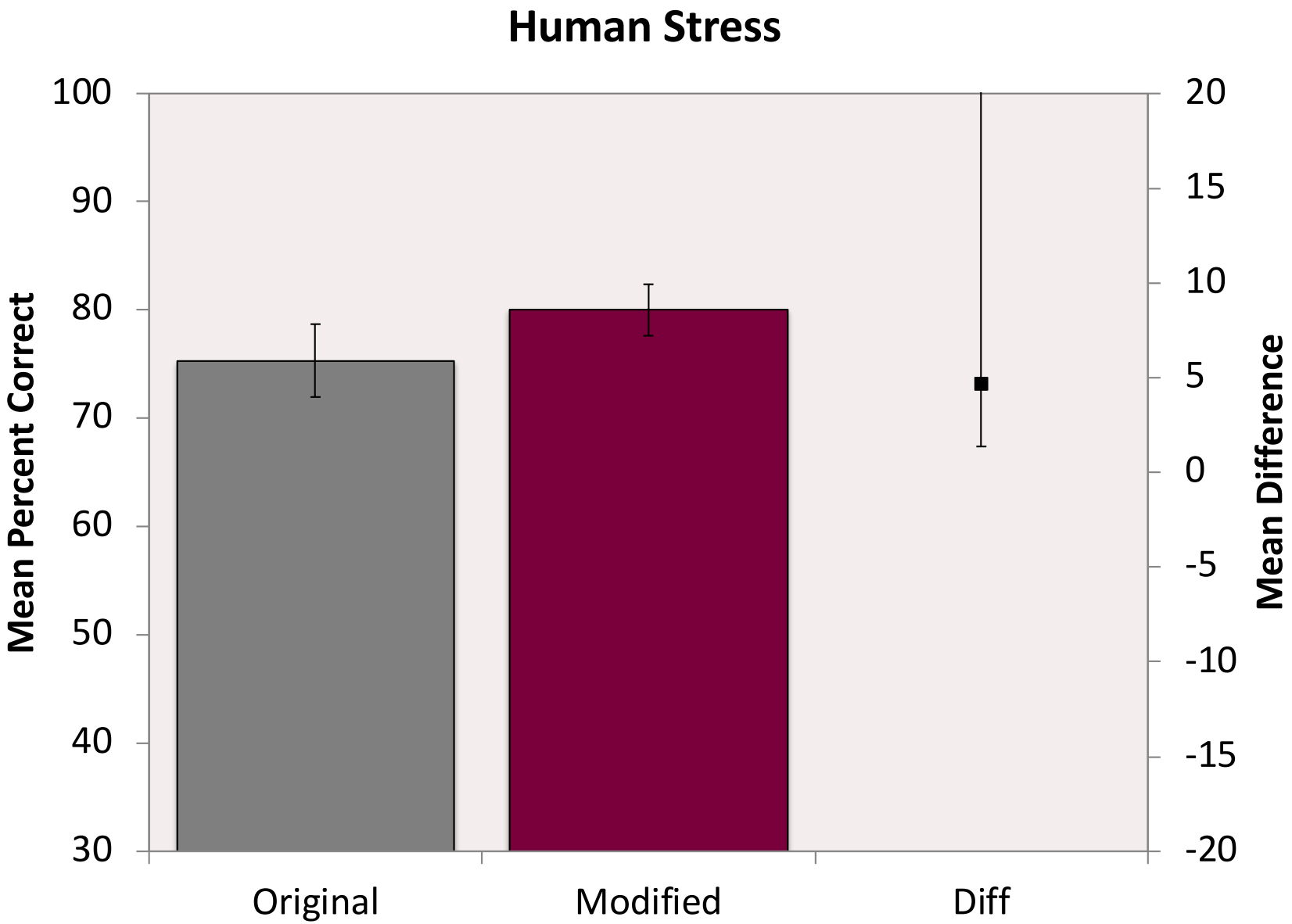
Mean % correct responses to

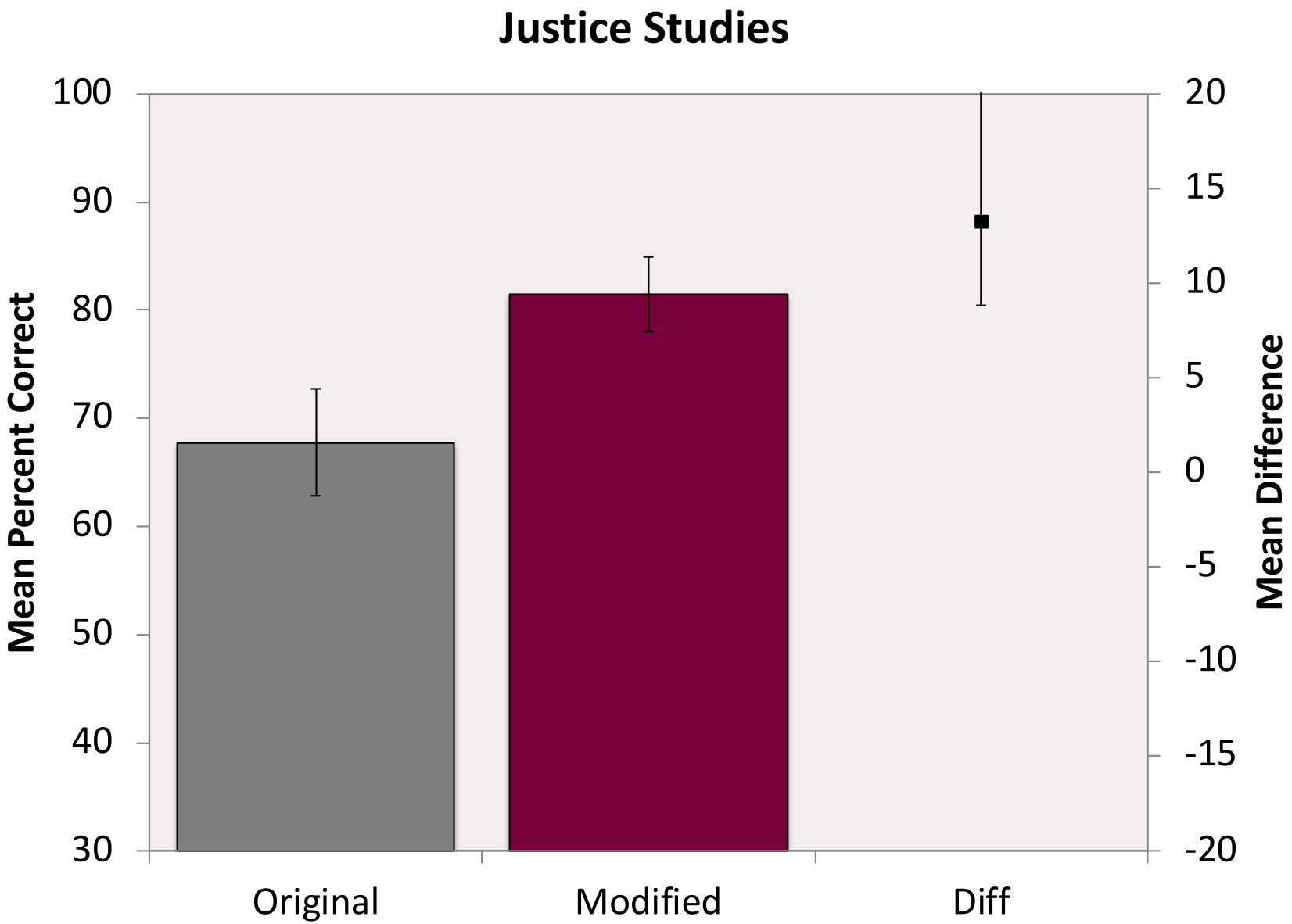
Questions Asked @ End of Class

during which

Modified vs Original

PowerPoint slides were presented


Human Stress
Mean Percent Correct
100
90
80
70
60
50
40
30
20
15
10
5
0
-5
-10
-15
-20
Mean Difference
Original
Modified
Diff


Justice Studies
Mean Percent Correct
100
90
80
70
60
50
40
30
20
15
10
5
0
-5
-10
-15
-20
Mean Difference
Original
Modified
Diff

Long-Term Retention

Mean % correct responses to

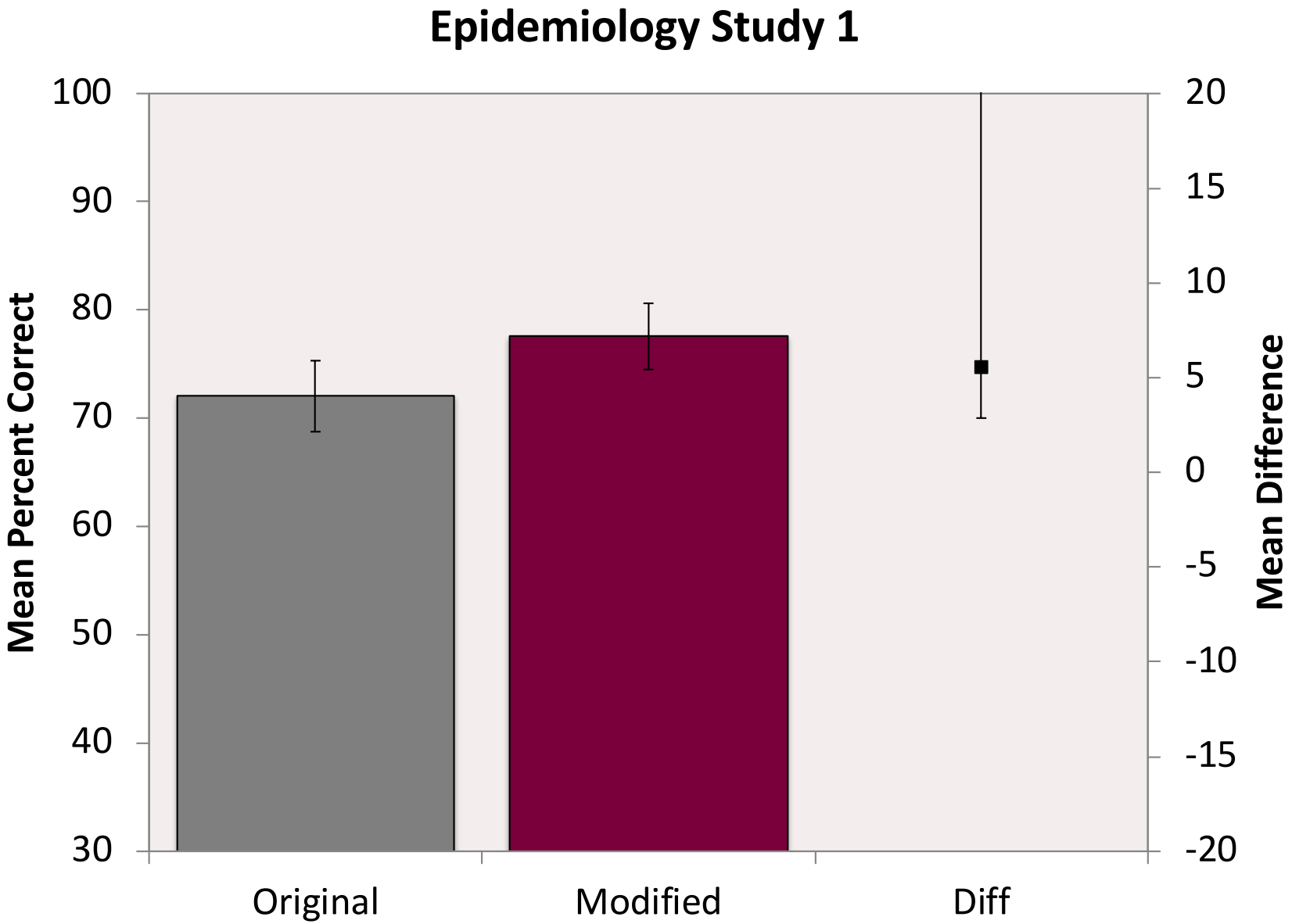
Midterm Exam Questions

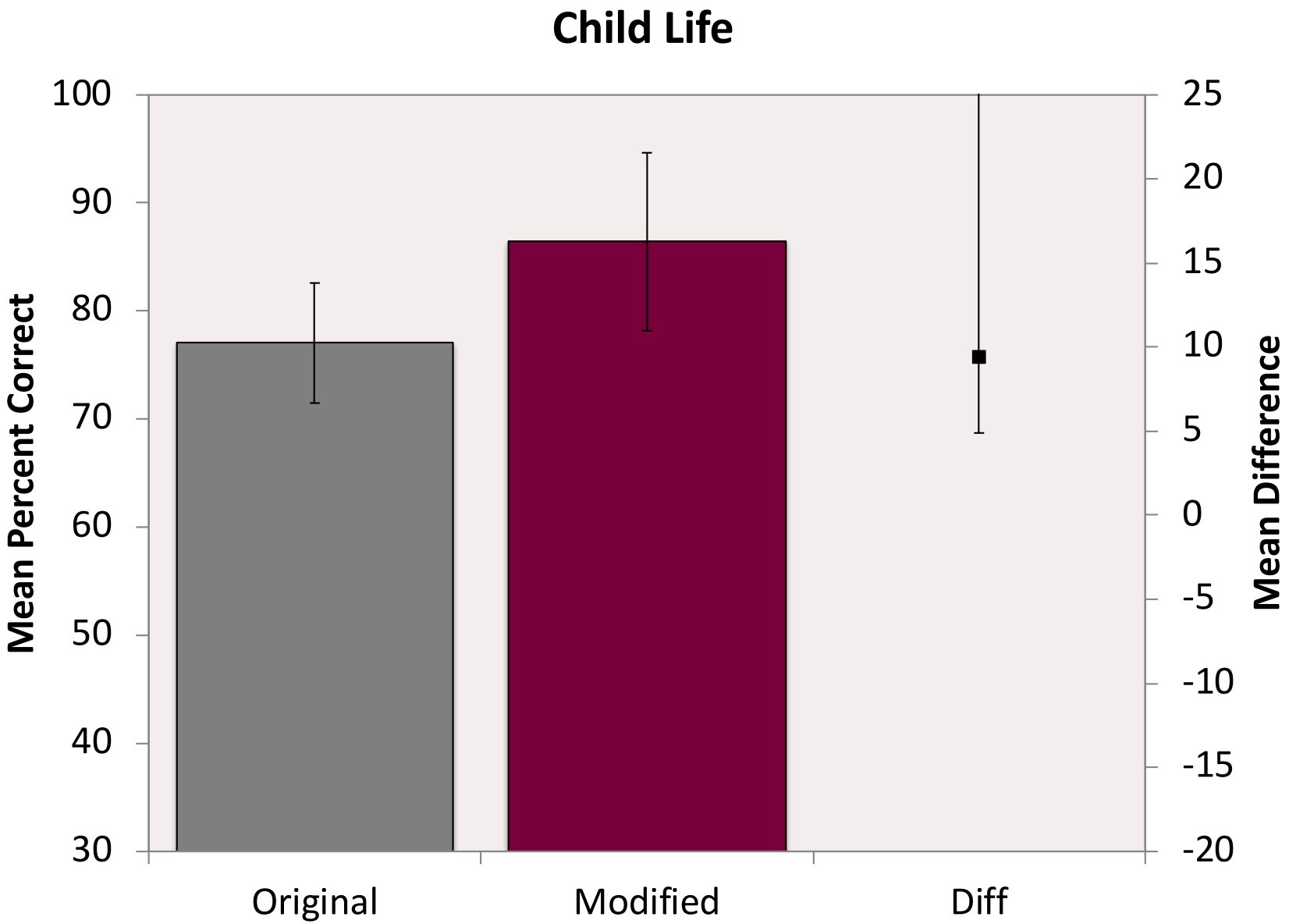
based on information in

Modified *PowerPoint slides*

vs

Original PowerPoint slides

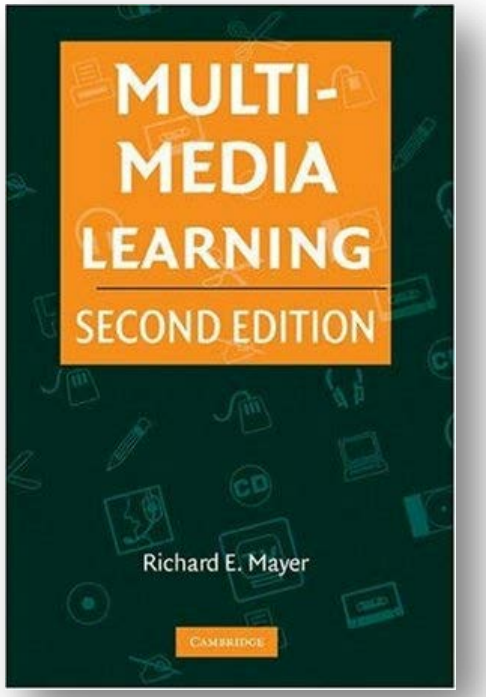

Epidemiology Study 1
Mean Percent Correct
100
90
80
70
60
50
40
30
20
15
10
5
0
-5
-10
-15
-20
Mean Difference
Original
Modified
Diff


Child Life
Mean Percent Correct
100
90
80
70
60
50
40
30
25
20
15
10
5
0
-5
-10
-15
-20
Mean Difference
Original
Modified
Diff

2. Instructional Design directly sets the stage for learning.

a. Established multimedia design principles show medium to large effect sizes in the lab.

b. Classroom intervention studies demonstrate robust gains in an authentic learning environment.



3

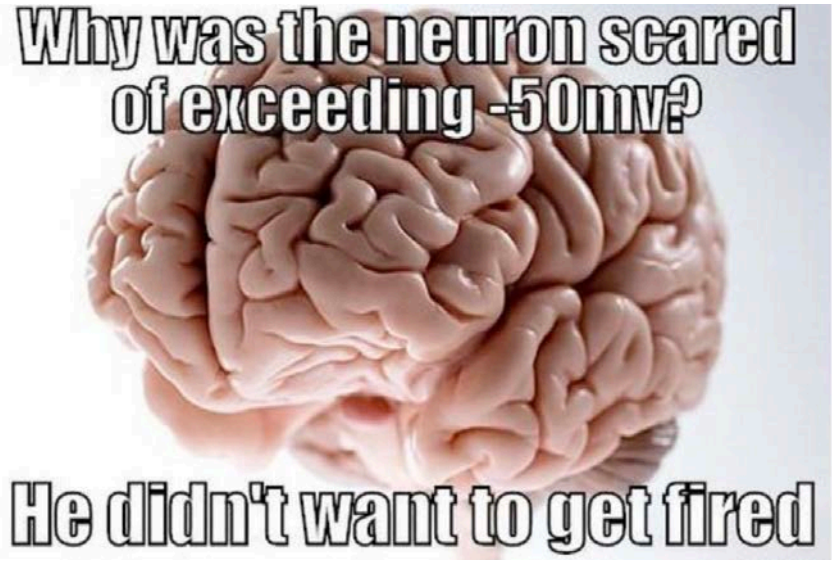
Effective study habits can strengthen long-term retention.

Which study skills help learners?

Technique	Utility
Elaborative interrogation	Moderate
Self-explanation	Moderate
Summarization	Low
Highlighting	Low
Keyword Mnemonic	Low
Imagery use for text learning	Low
Rereading notes or textbook	Low
Practice Testing	High
Distributed Practice	High
Interleaved Practice	Moderate

Dunlosky et al., (2013)

#MacIntroPsych #Memes2Review



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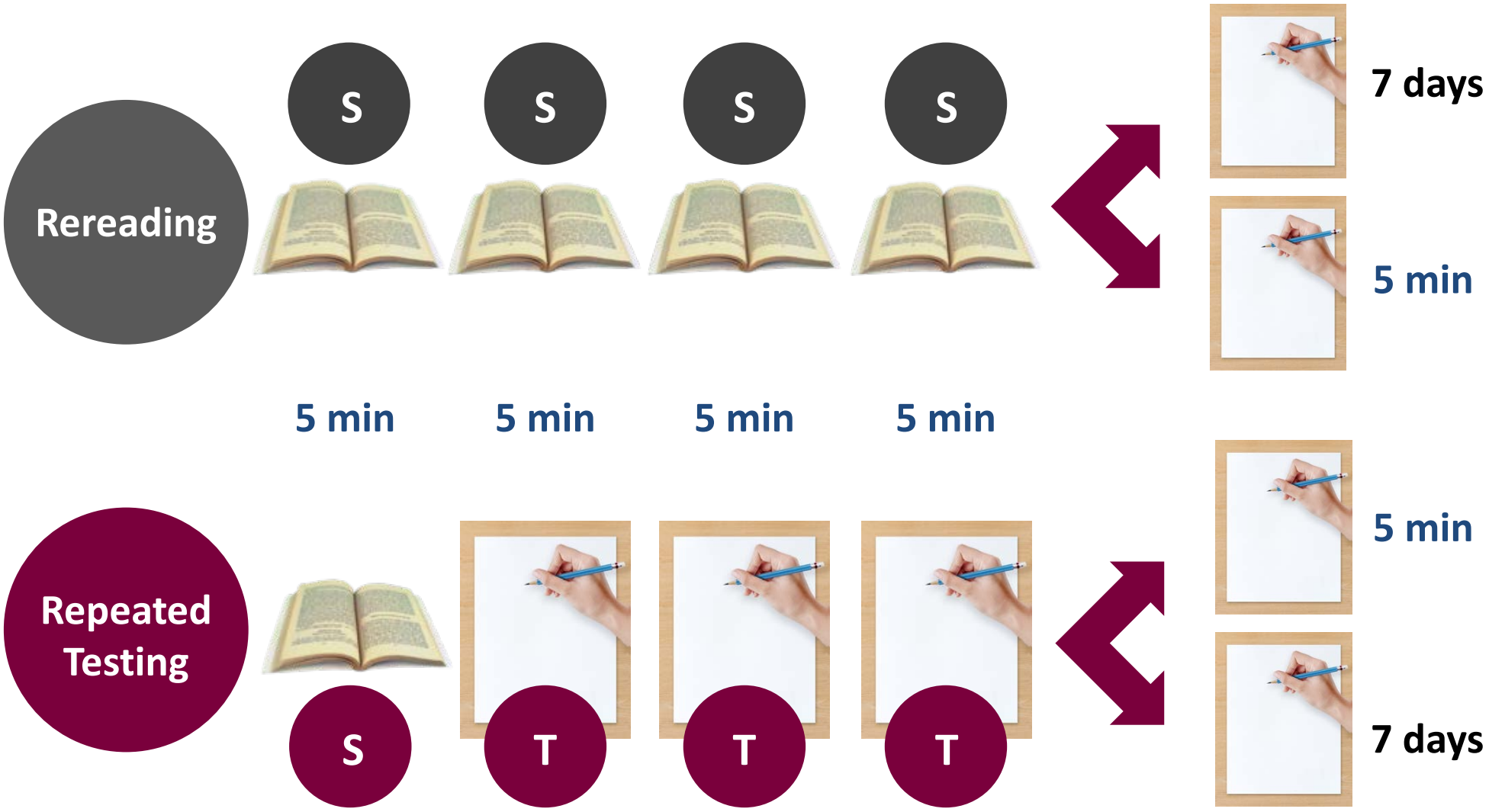
Imagery use for text learning	Low
Rereading notes or textbook	Low
Practice Testing	High
Distributed Practice	High
Interleaved Practice	Moderate

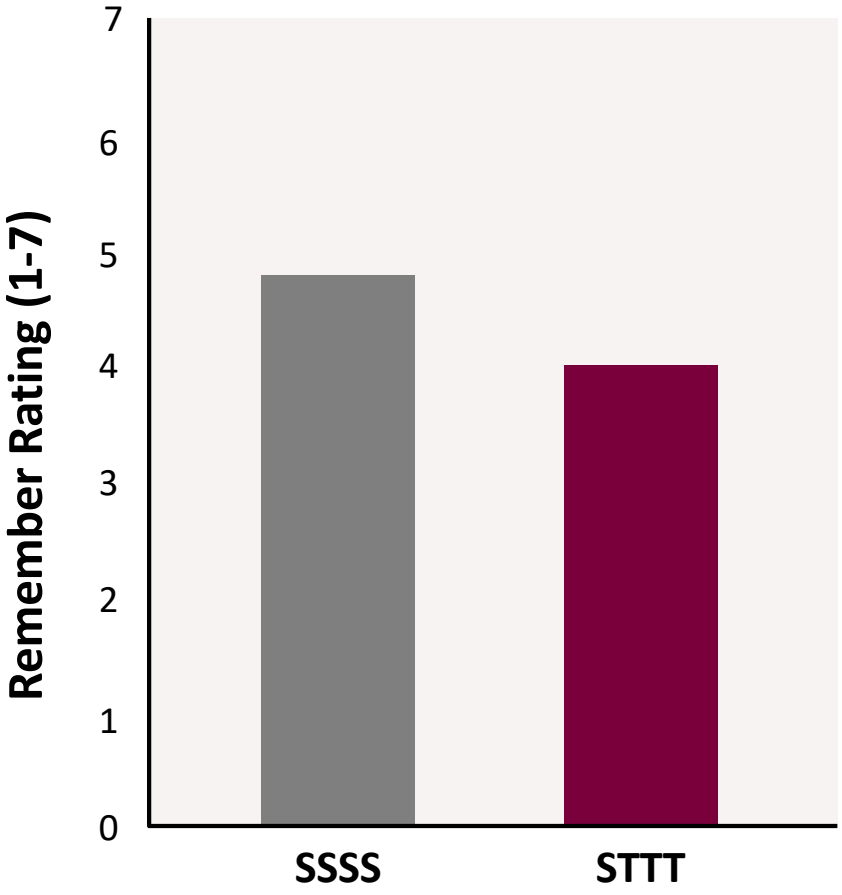
Dunlosky et al., (2013)

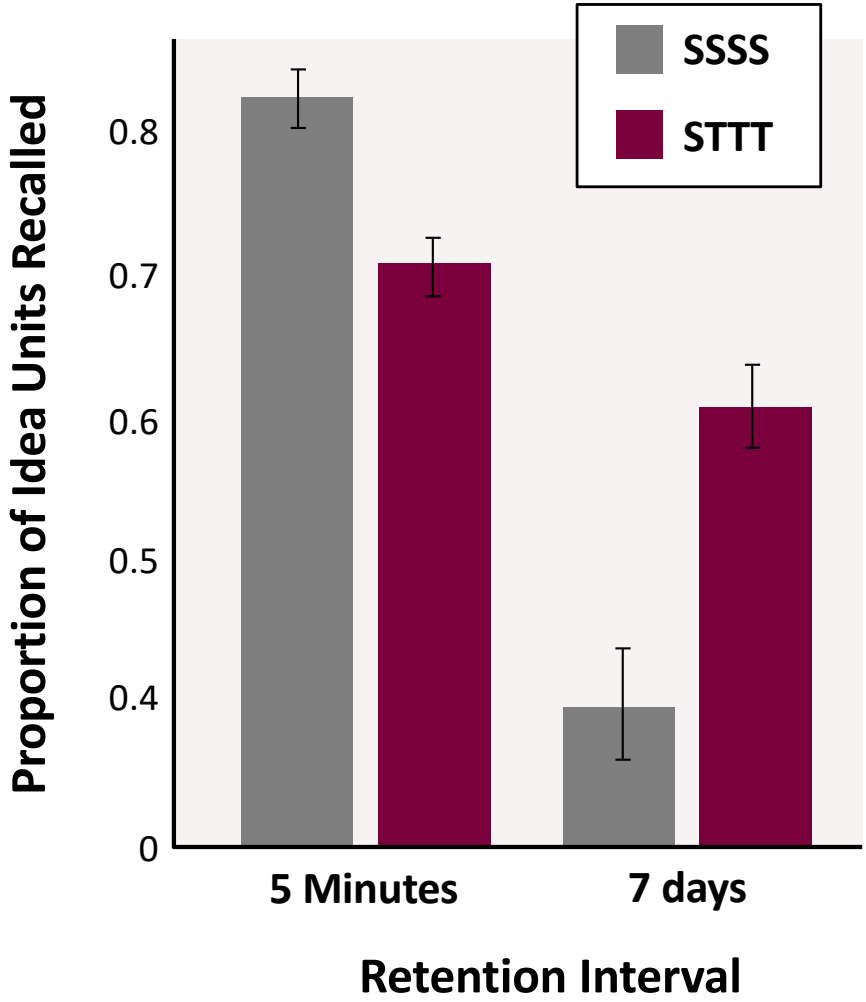
Retrieval Practice leads to durable learning.



Roediger & Karpicke (2006)

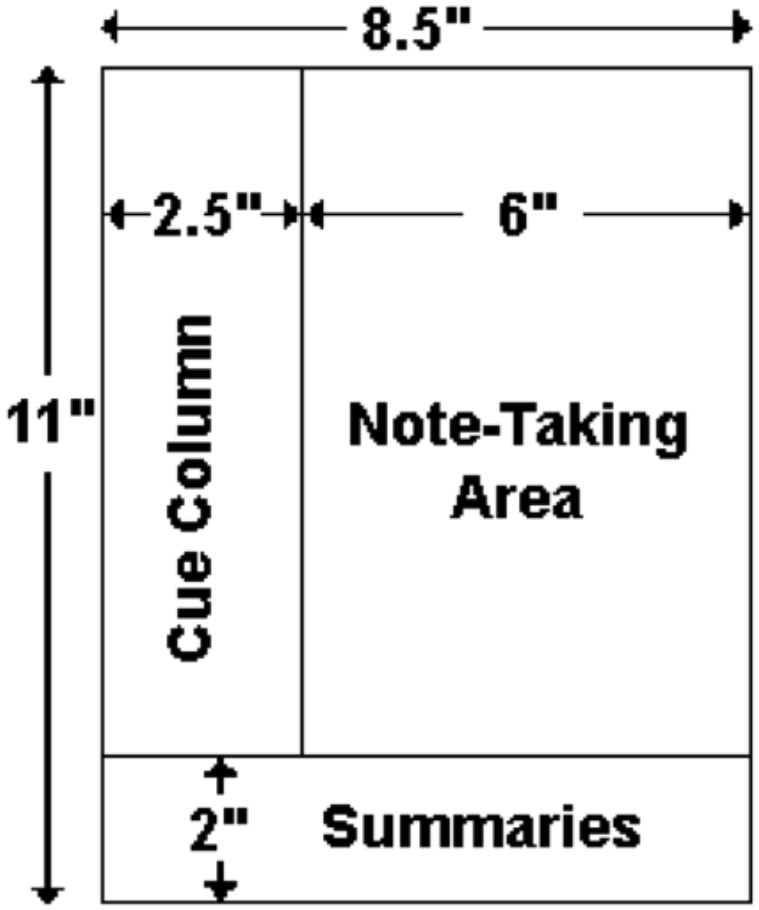
Learners judge repeated studying to be better than practice testing...

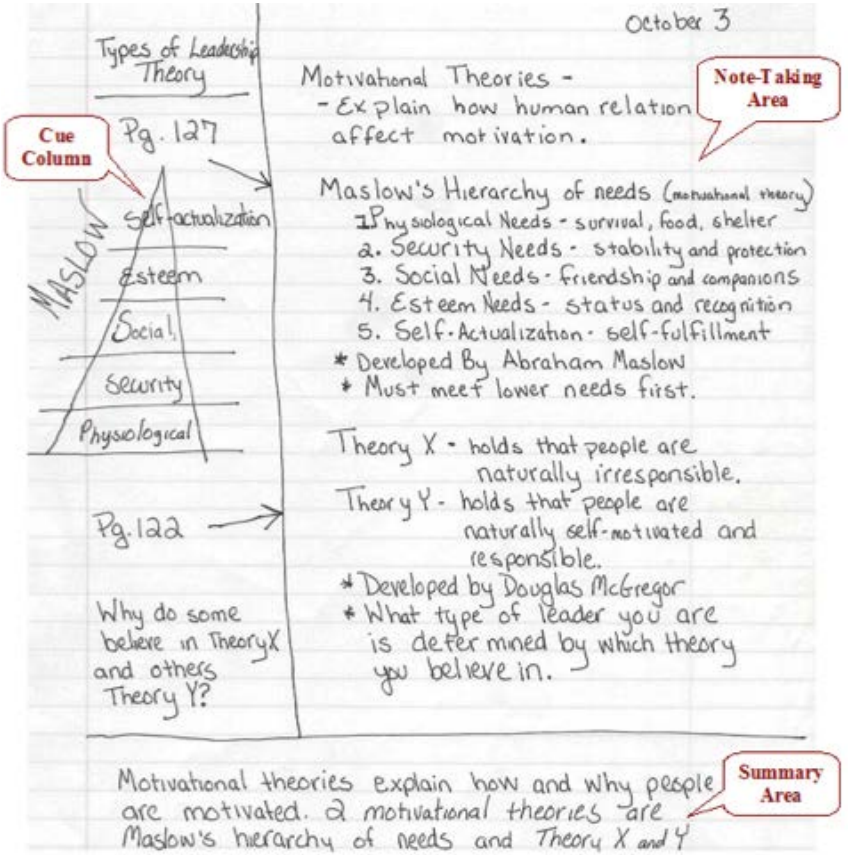




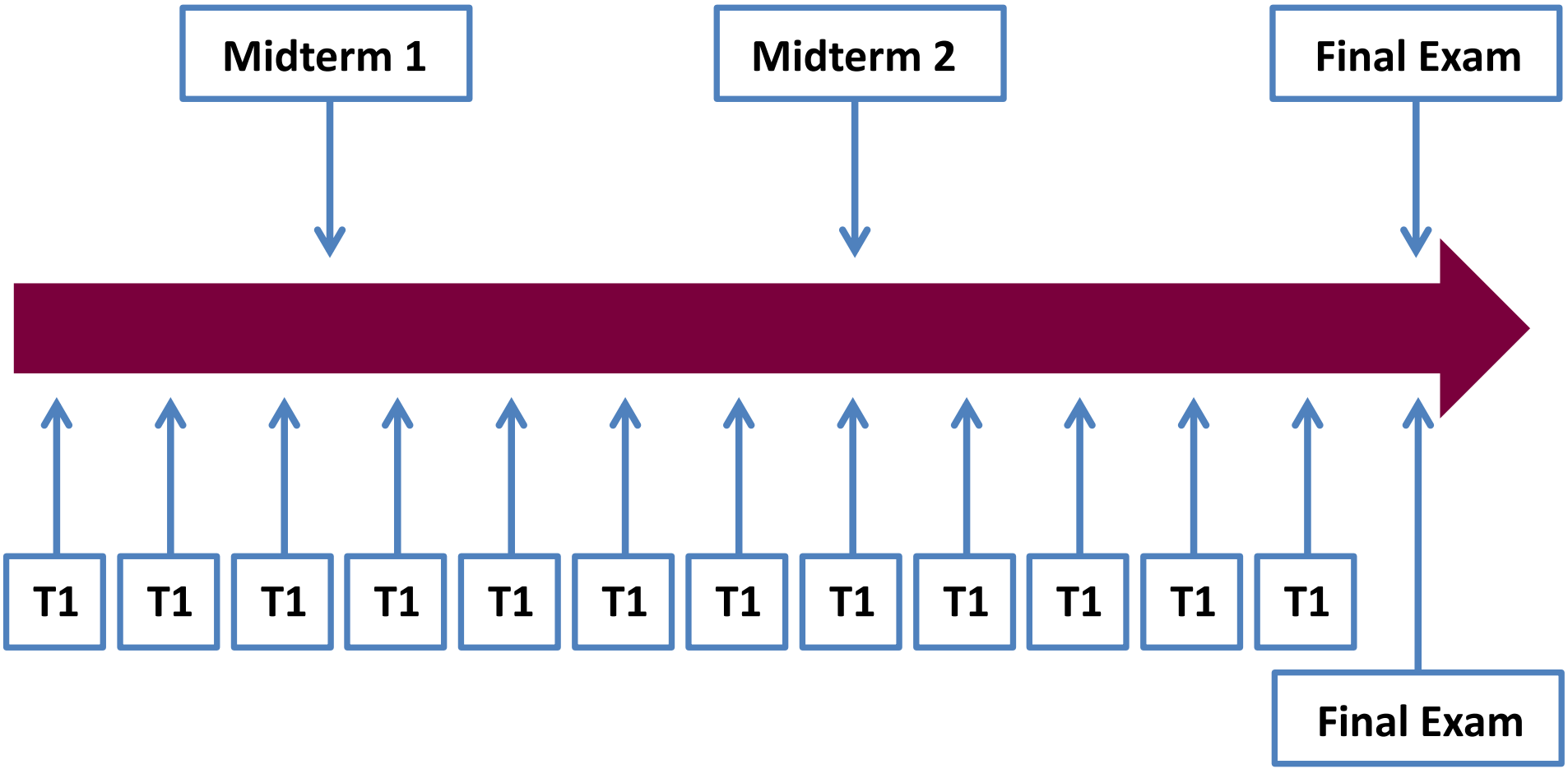
…but practice testing leads to more durable learning.

Apply: Learners can make retrieval practice a habit of note-taking.





Apply: Implement frequent testing with feedback to promote long-term learning.



You may have chosen to write the weekly quizzes in groups. Which of the following best describes your involvement in the group?

A. I wrote my quizzes on my own.

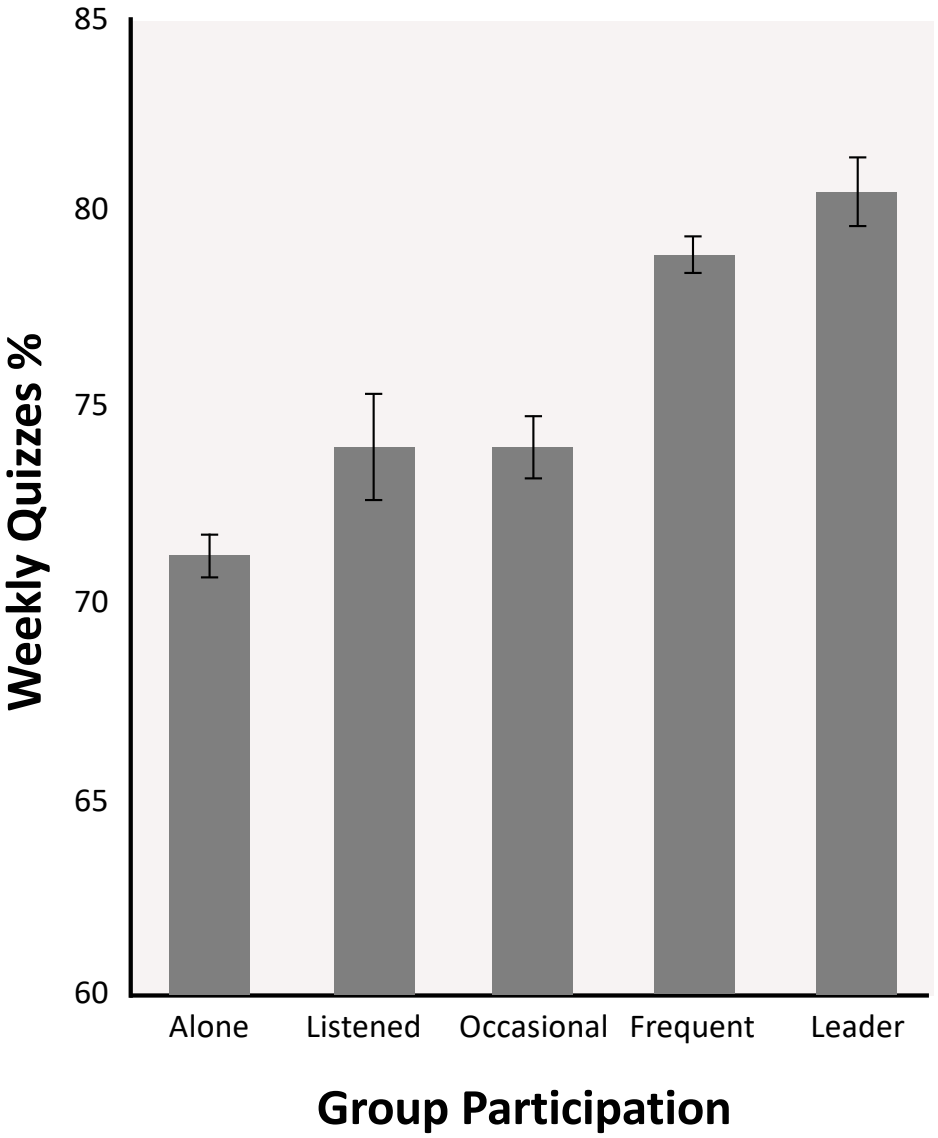
B. I actively listened and absorbed the discussion.

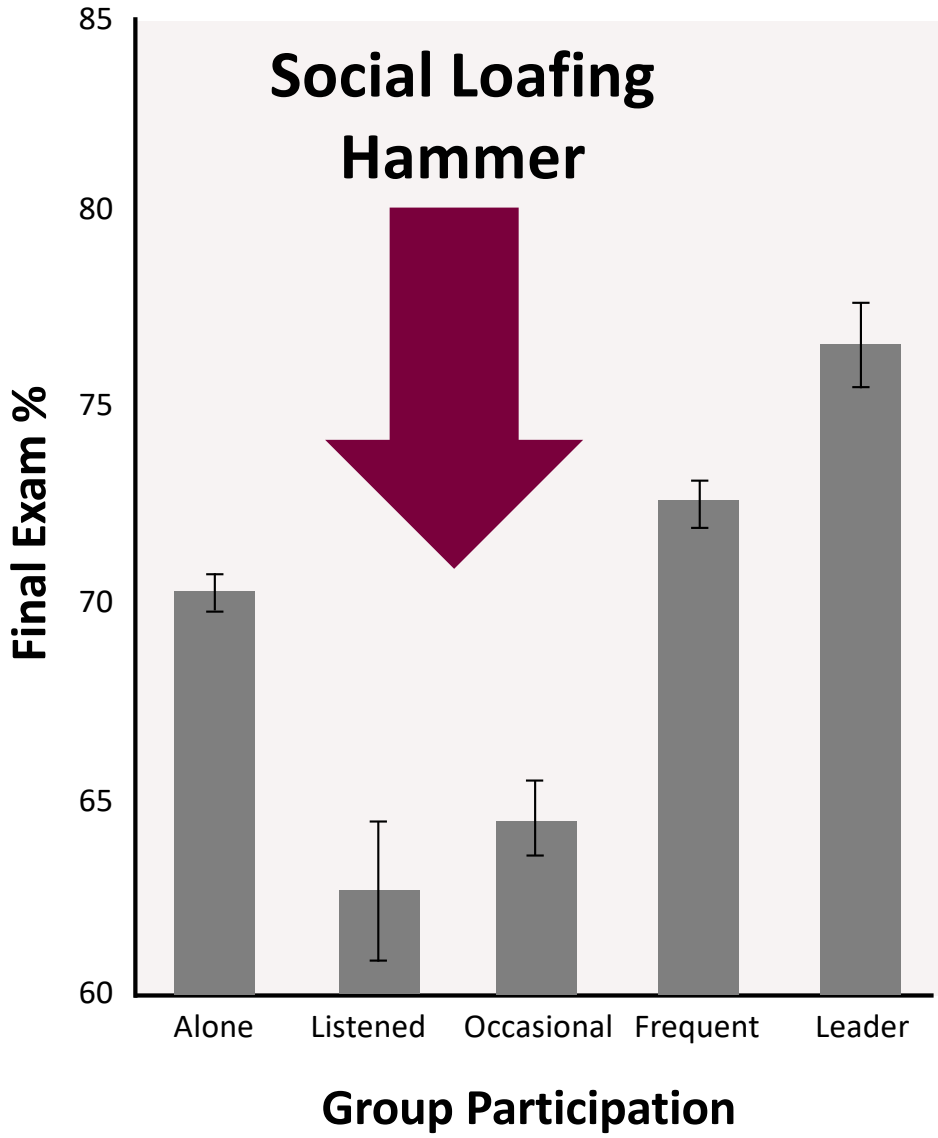
C. I actively listened to the discussion and occasionally provided input.

D. I frequently contributed to the discussion.

E. I led the discussion for most questions.

Active vs. passive role in collaborative testing group impacts durable learning.





Which study skills help learners?

Technique	Utility
Elaborative interrogation	Moderate
Self-explanation	Moderate
Summarization	Low
Highlighting	Low
Keyword Mnemonic	Low
Imagery use for text learning	Low
Rereading notes or textbook	Low
Practice Testing	High
Distributed Practice	High
Interleaved Practice	Moderate

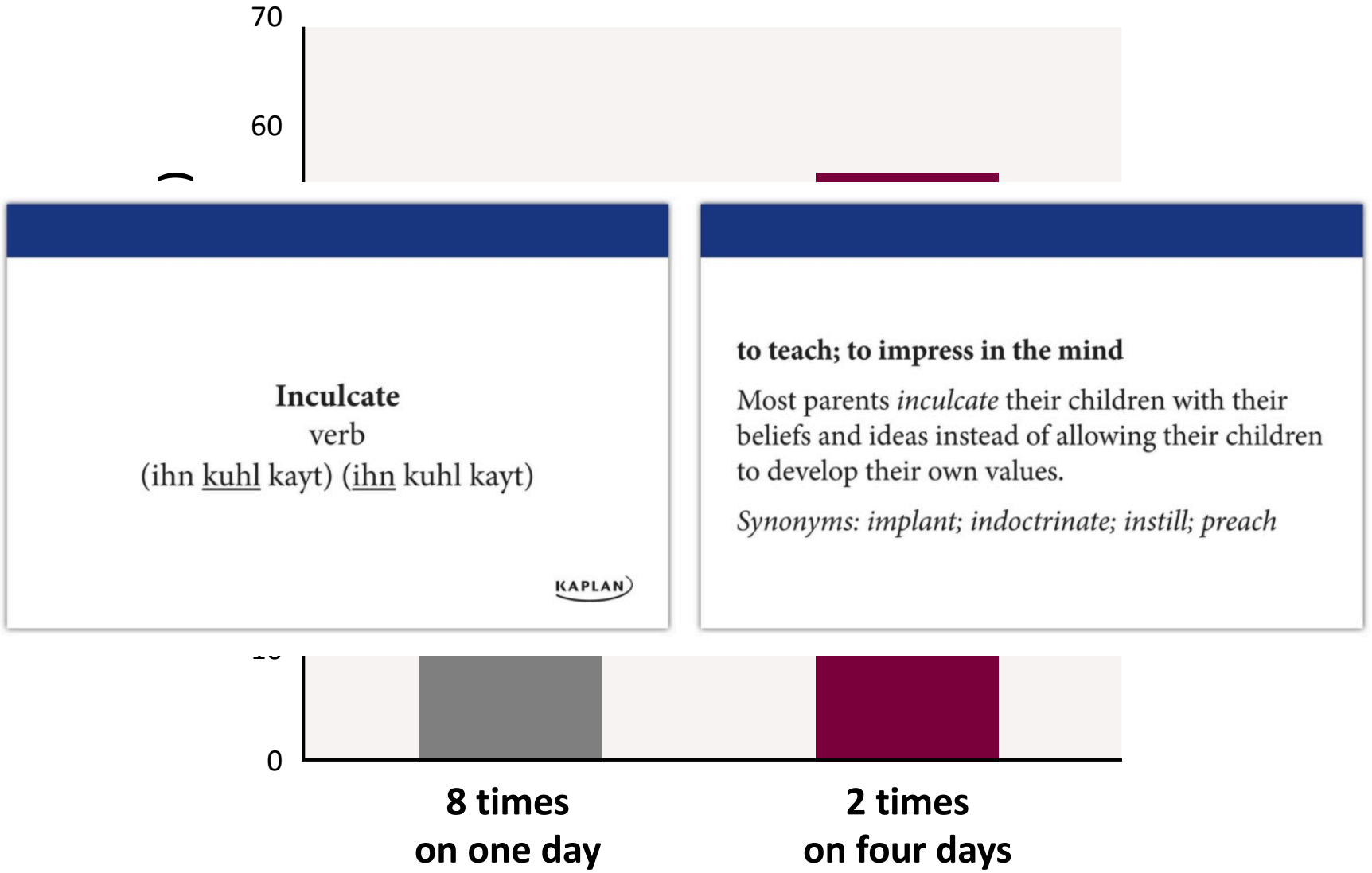
Dunlosky et al., (2013)

Distributed or massing practice sessions.

Distributed Practice

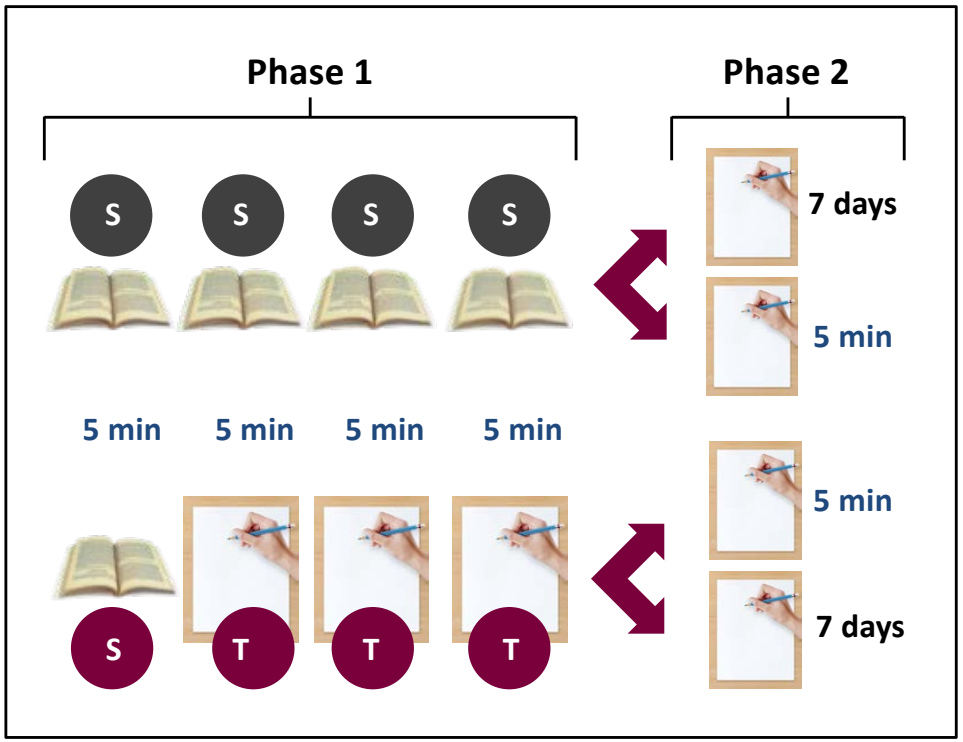
Massing (Cramming)

Spacing study across days is better than cramming for the same study time.



Kornell (2009)

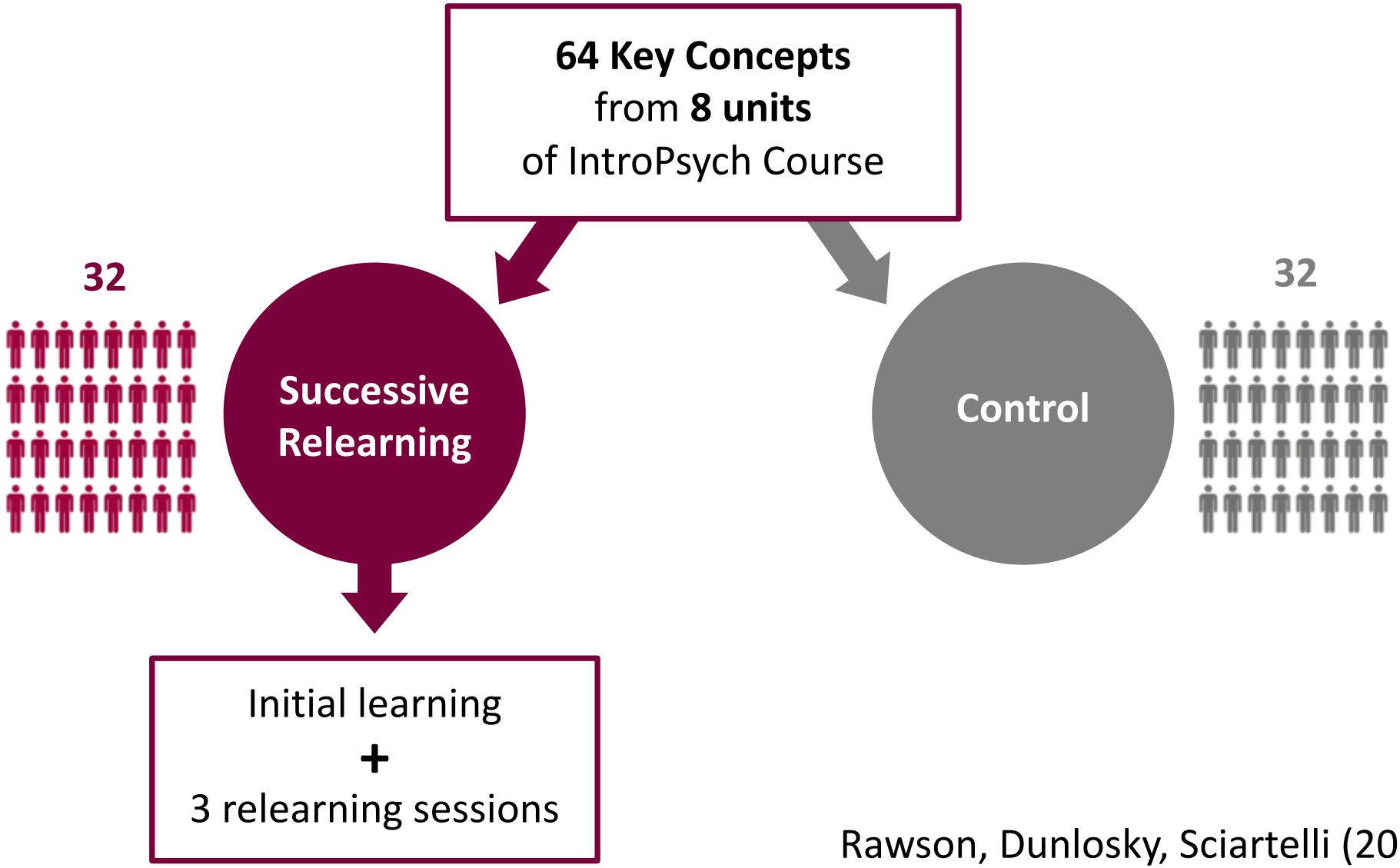
Successive Relearning



Successive Relearning

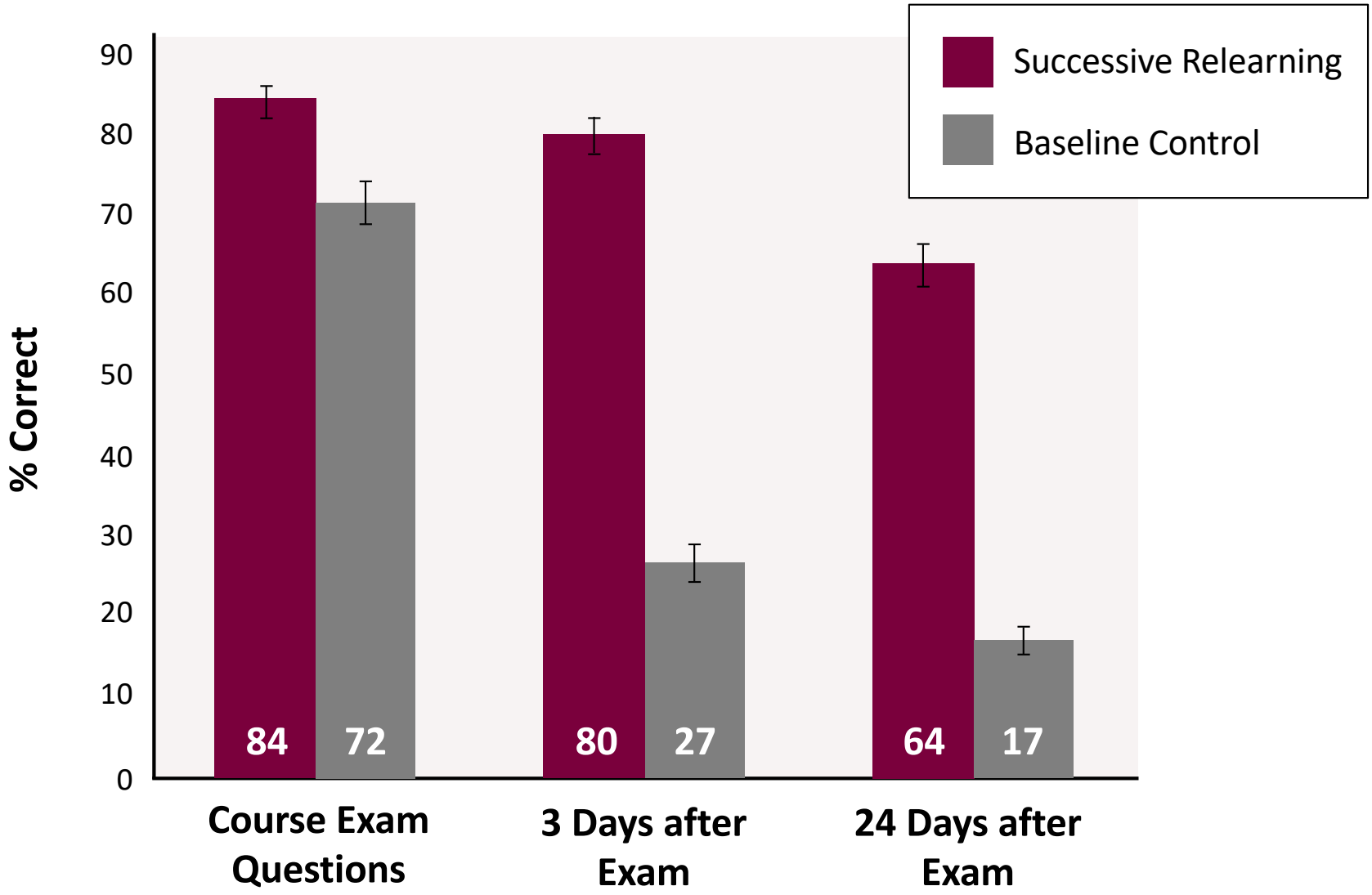
Session 1	Learn content to specific criterion (practice retrieval plus restudy until correct)
Session 2	Relearn the same material
Session 3	Relearn the same material
Session 4	Relearn the same material

Successive relearning in a class study.



Rawson, Dunlosky, Sciartelli (2013)

Successive relearning leads to durable learning gains in the classroom.



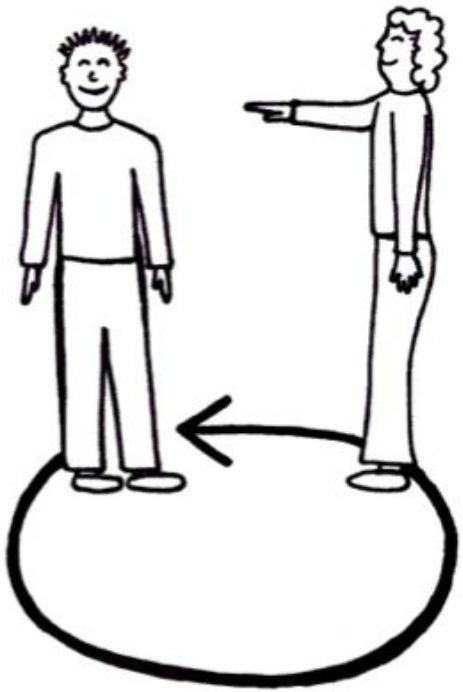
3. Effective study habits can strengthen long-term retention.

a. Poor metacognitive judgments lead students to select ineffective strategies for durable learning.

b. Retrieval Practice + Spacing = successive relearning with large effect sizes in the lab and real learning gains in the classroom.

What habits lead to a healthy lifestyle?

Activity: Put into practice active scheduling for the upcoming QuizTerm.



1. Estimate how much time you can devote to this task.
2. Schedule in 3-4 space study sessions into your calendar.
3. Set a start time for your QuizTerm.
4. Repeat above steps for your other major tasks due this week.
5. Spend 15 min every Sunday, and 5 min everyday, planning and reviewing your schedule.

Training yourself to study is just a matter of applying instrumental conditioning.

S^D

R

S^R

YouTube

Key factors for durable learning.

1. Learning begins with effortful & focused attention.

2. Instructional Design directly sets the stage for learning.

3. Effective study habits strengthen long-term retention.

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HOLD the Date:
July 26-27, 2018

"Any teacher that can be replaced by a machine should be!"

Arthur C. Clarke, "Electronic Tutors" (1980)

"Nothing can replace a good human teacher, but much of the drudgery of education -- the routine and the rote -- could be taken over by electronic devices."

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