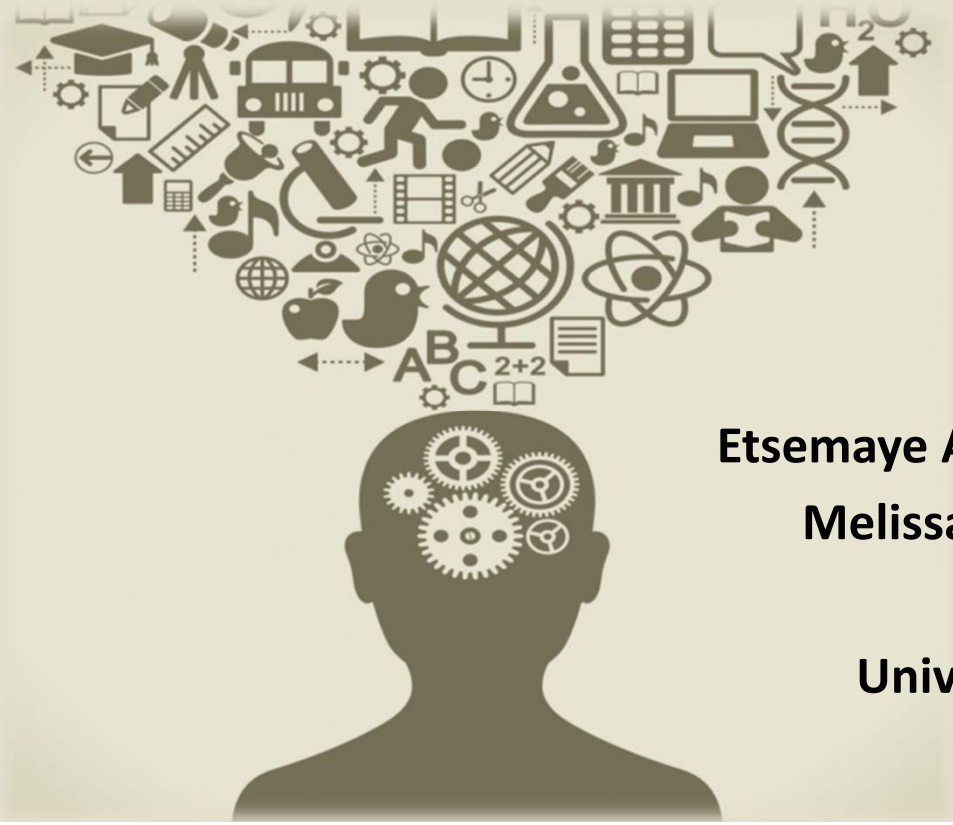
Making It Stick:

Applying the Science of Learning to Everyday Teaching during Morning Report, in the Clinic/on the Wards, and for the Struggling Learner



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October 21st, 2017

Your intern asks you what type of CT scan to order. You…

a. Ask her to look it up

b. Ask her to tell you what type of imaging she thinks she should order

c. Tell her your approach so she can learn from your example

You want to review prior teaching with your team at the end of the week. Do you…

a. Make a quick review sheet so everyone can have a copy to review when they have time

b. Quiz your team on the topics/learning points your team discussed

c. Ask everyone on the team to reflect and list 3 things they learned this week

You want to teach your team about supraventricular tachycardias. Do you…

a. Show multiple EKGs demonstrating atrial fibrillation until you're certain your learner has it down before moving on

b. Mix up EKGs showing various SVTs and review the notable findings as they come up

You want to teach your residents bedside echocardiography. Do you…

a. Set aside an afternoon to go patient to patient and review different views and pathologies

b. Perform bedside echocardiography on one patient during rounds on Monday, Wednesday, and Friday

Objectives

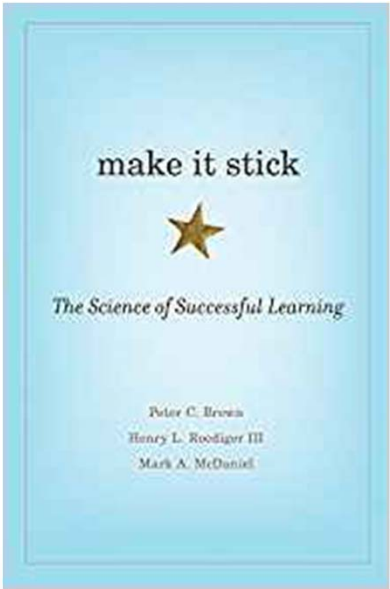
- Describe the basics of how the brain encodes, consolidates, and retrieves learned information
- Understand reasoning behind evidence-based teaching strategies such as promoting retrieval, spacing, interleaving, and self explanation
- Identify practical applications of these strategies to improve every day teaching during morning report, in the clinic/on the wards, and for the struggling learner

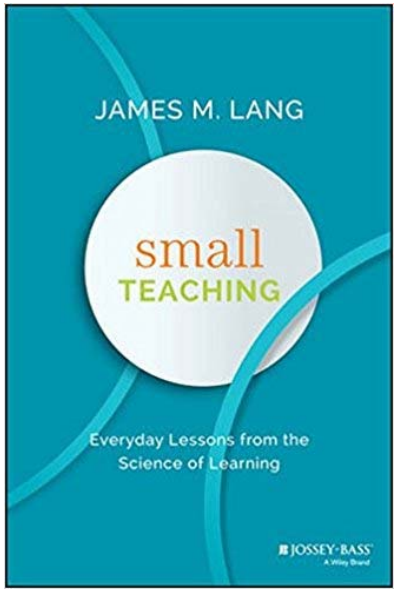
Outline

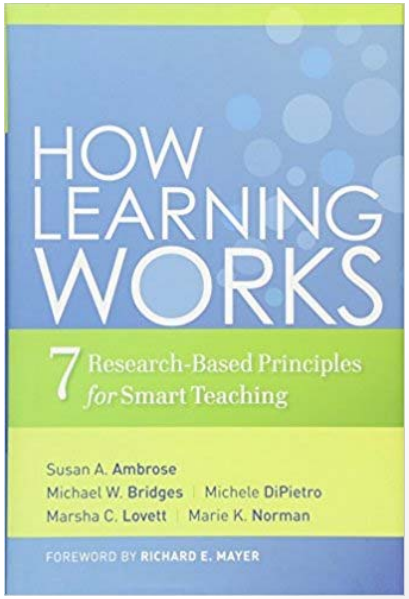
- Introduction to learning theory
- Promoting retrieval
- Spacing
- Interleaving
- Self-explanation
- Take home points

Suggested Reading

- **Make it Stick:** Peter Brown, et al
- **Small Teaching:** James M. Lang
- **How Learning Works:** Susan Ambrose, et al





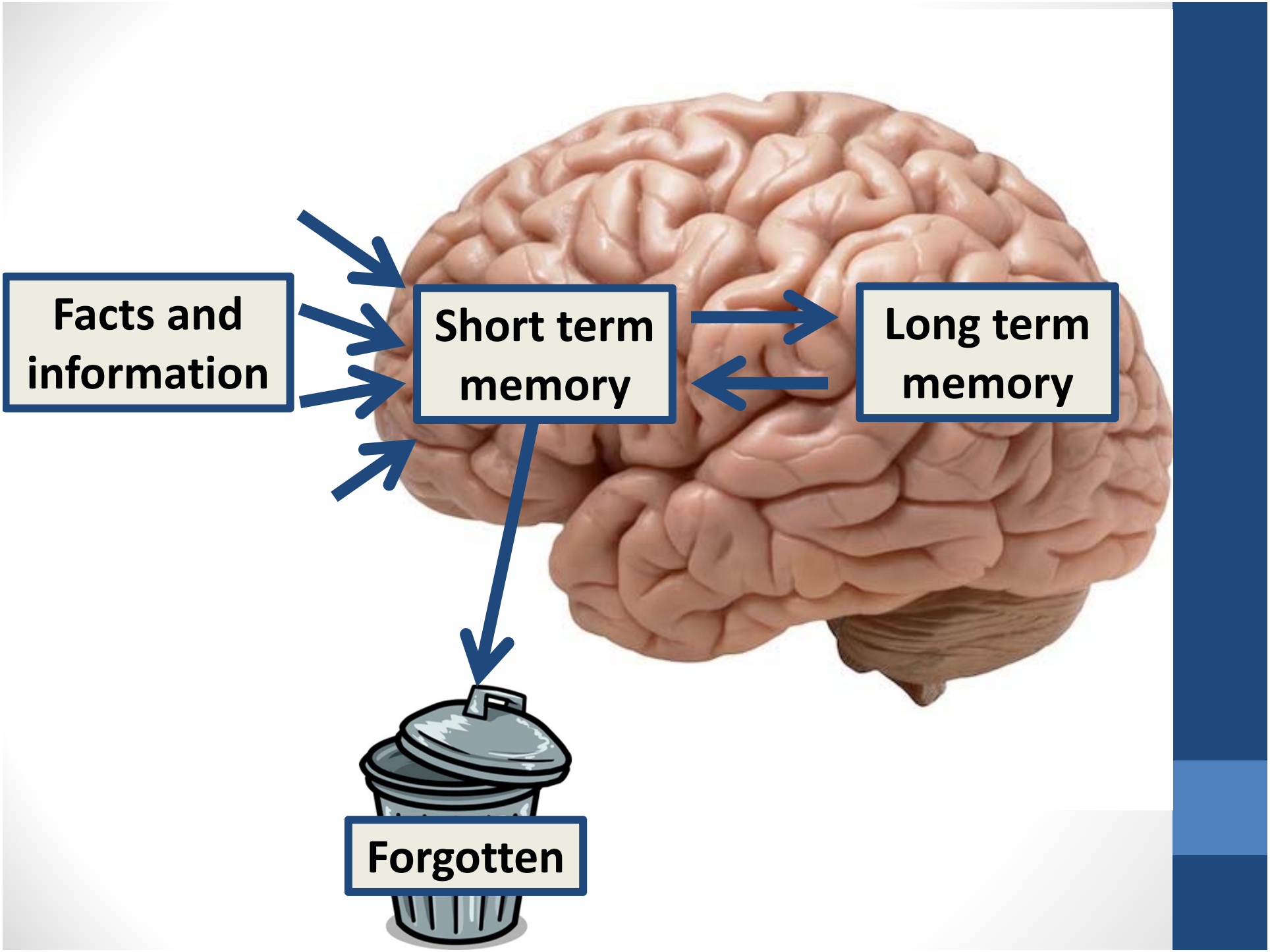


Truths about learning

1. **To be useful, learning requires memory**. What we have learned needs to be there later when we need it.

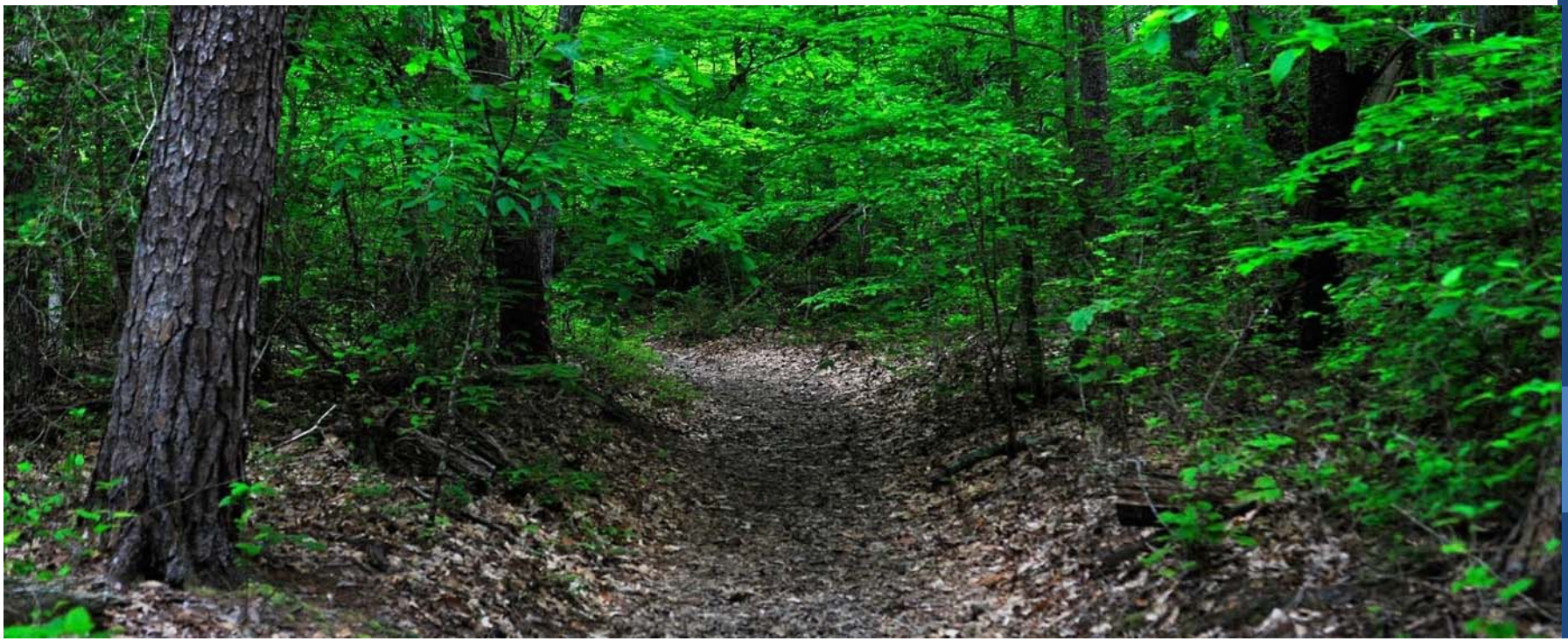
2. **Learning is an acquired skill**. The most effective strategies are often counterintuitive.

3. **Learning is deeper and more durable when it is *effortful*.**


Facts and information
Short term memory
Long term memory
Forgotten

Truths about learning

4. Paths in the brain that are **worn deeper** and **used repetitively over time** are easier to follow the next time.



Truths about learning

5. **We are poor judges of when we are learning well.**

6. **Re-reading and massed practice** (rapid-fire repetition of something you're trying to learn) give rise to a false sense of fluency and mastery but **lead to learning that is often shallow and not durable**.

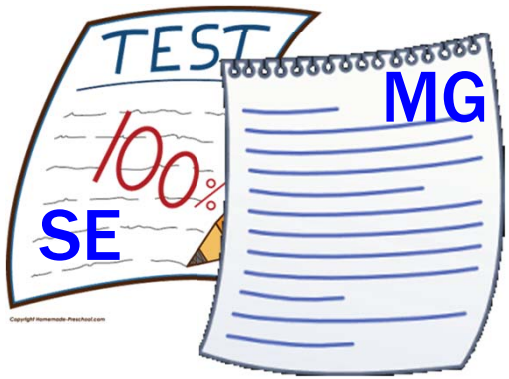
Four evidence-supported learning strategies

1. **Promoting Retrieval**
2. **Spacing**
3. **Interleaving**
4. **Self-explanation**

TESTING VS STUDY

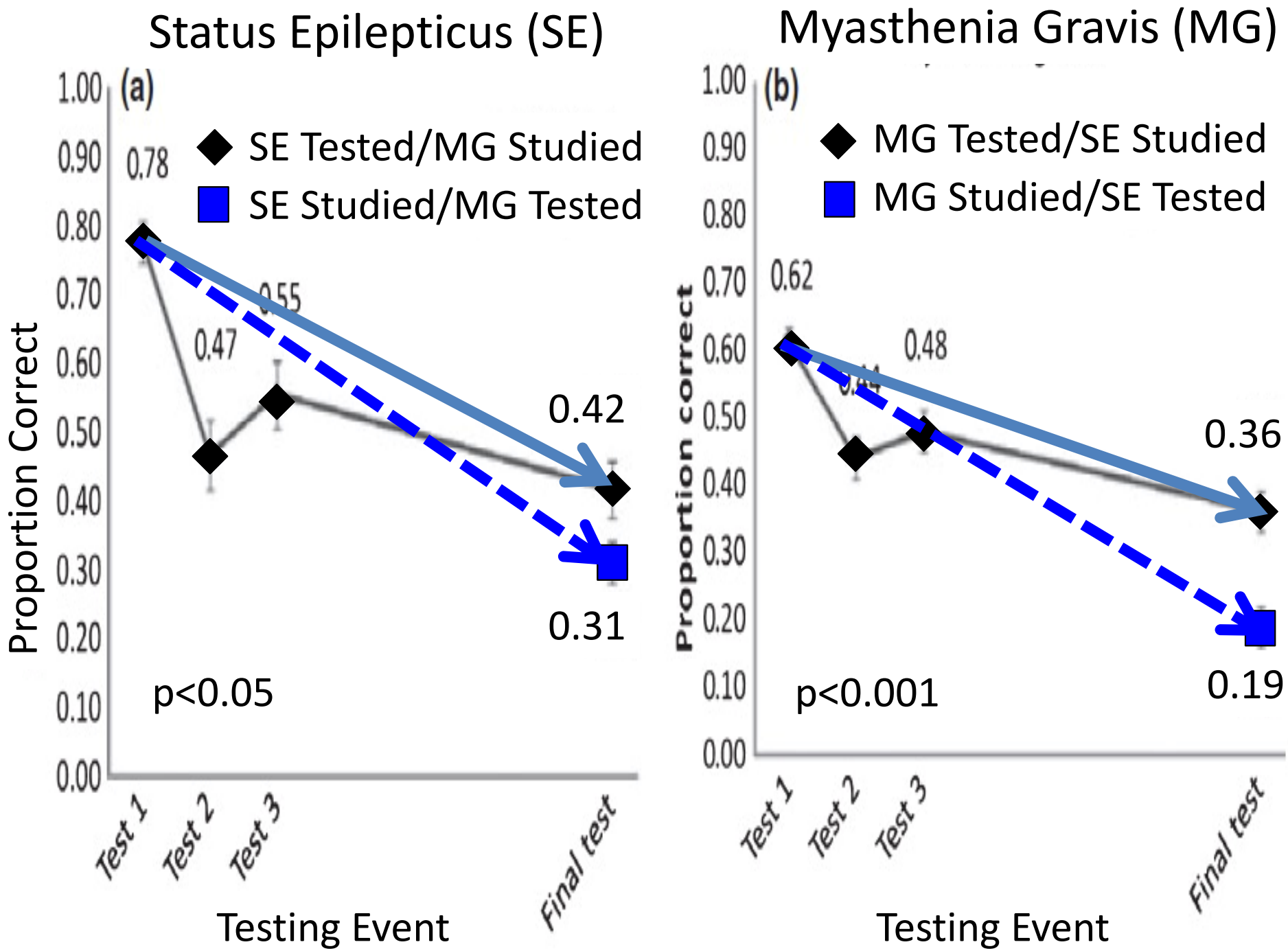
40 Pediatric & Emergency Medicine residents

1-hour teaching on status epilepticus (SE) and myasthenia gravis (MG)



At 0, 2 and 4 weeks

Larsen et al.. Med Educ. 2009; 43: 1174-1181.


Status Epilepticus (SE)
(a)
SE Tested/MG Studied
SE Studied/MG Tested
Proportion Correct
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.78
0.47
0.55
0.42
0.31
p<0.05
Test 1
Test 2
Test 3
Final test
Testing Event
Myasthenia Gravis (MG)
(b)
MG Tested/SE Studied
MG Studied/SE Tested
Proportion correct
0.62
0.48
0.36
0.19
p<0.001
Test 1
Test 2
Test 3
Final test
Testing Event

PROMOTING RETRIEVAL

Repeated testing promotes better retention of learning

PROMOTING RETRIEVAL

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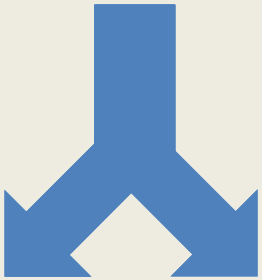
How can we apply this?

- During morning report
- On the wards/in clinic
- For the struggling learner

Four evidence-supported learning strategies

1. Promoting Retrieval
2. **Spacing**
3. Interleaving
4. Self-explanation

38 junior surgical residents learning microvascular anastomosis



Spaced Instruction (weekly x4)

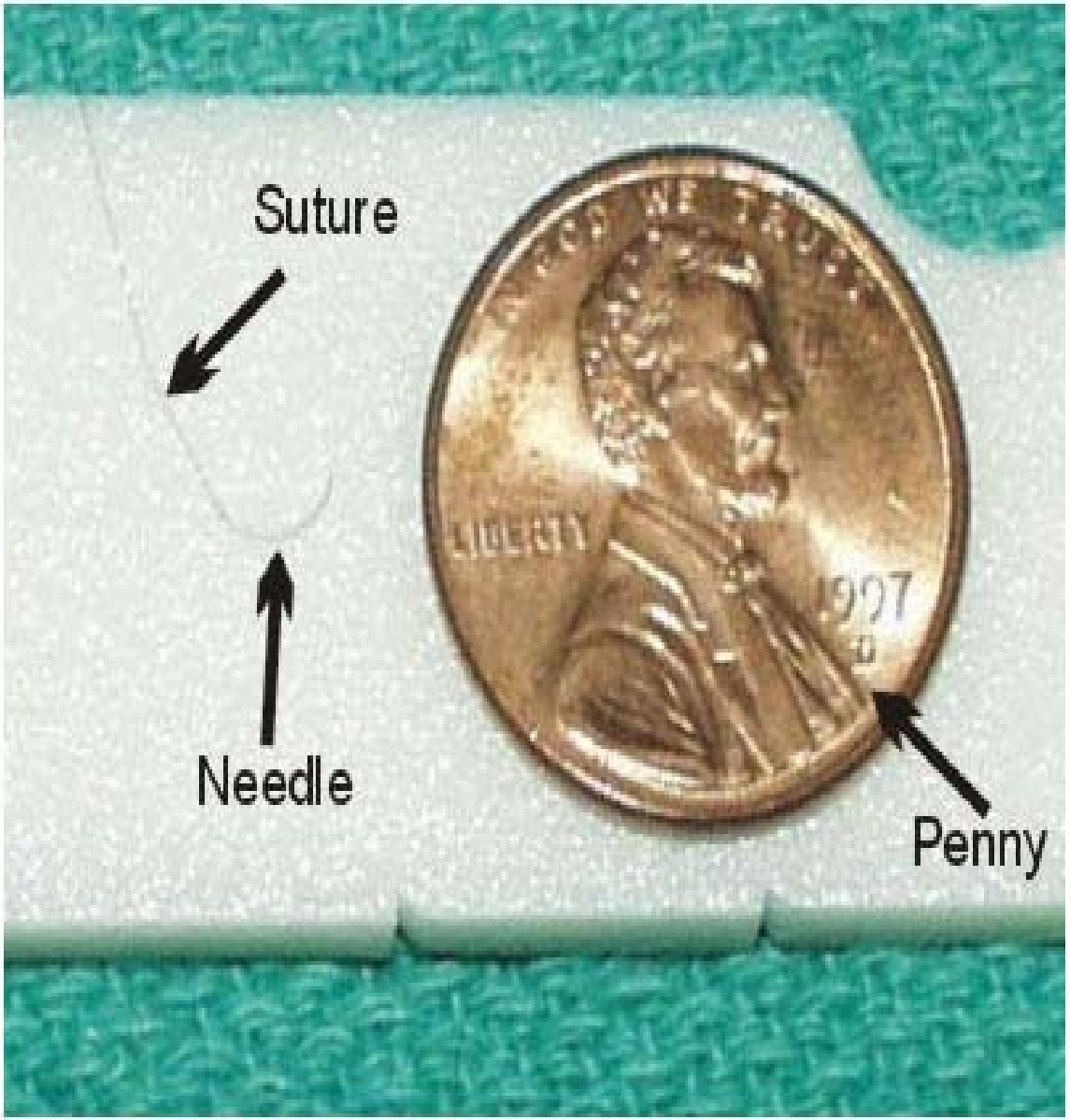
Massed Instruction (1 day)

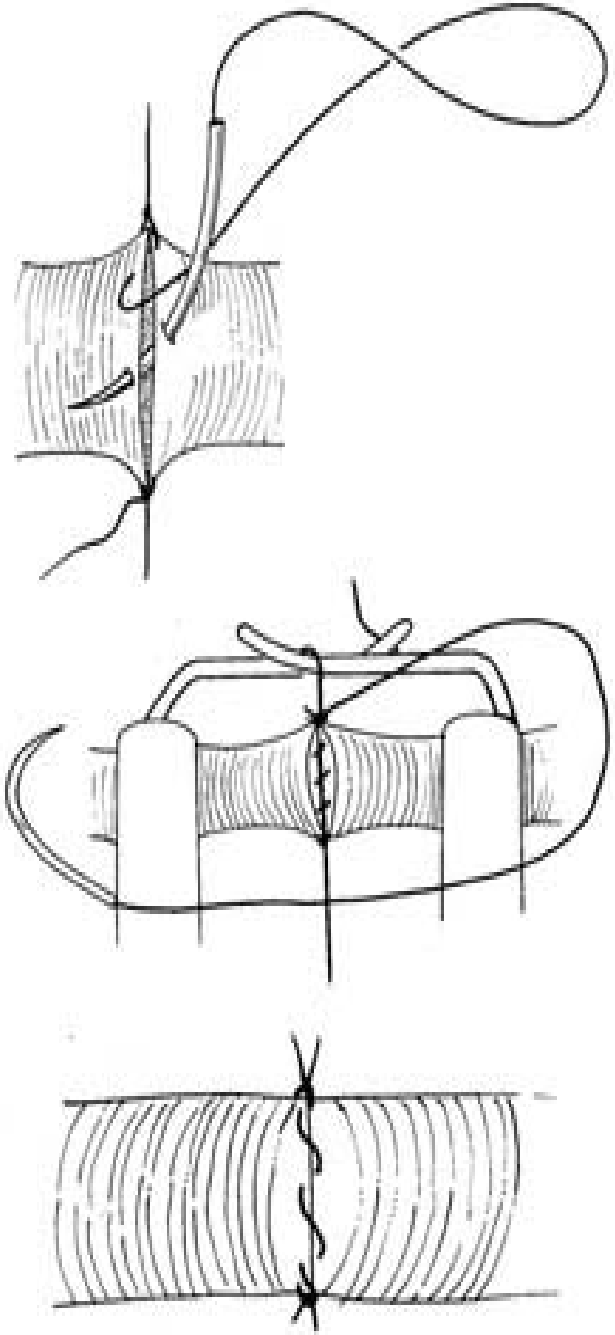
Performance assessed:

1. Pre-training
2. Immediately post-training
3. 1 month post-training

Moulton et al. Annals of Surgery. 2006; 244(3): 400-409.

SPACED TEACHING IN MICRO SPACES


Suture
Needle
Penny
LIBERTY
1997



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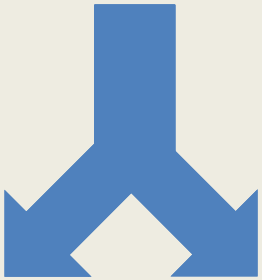

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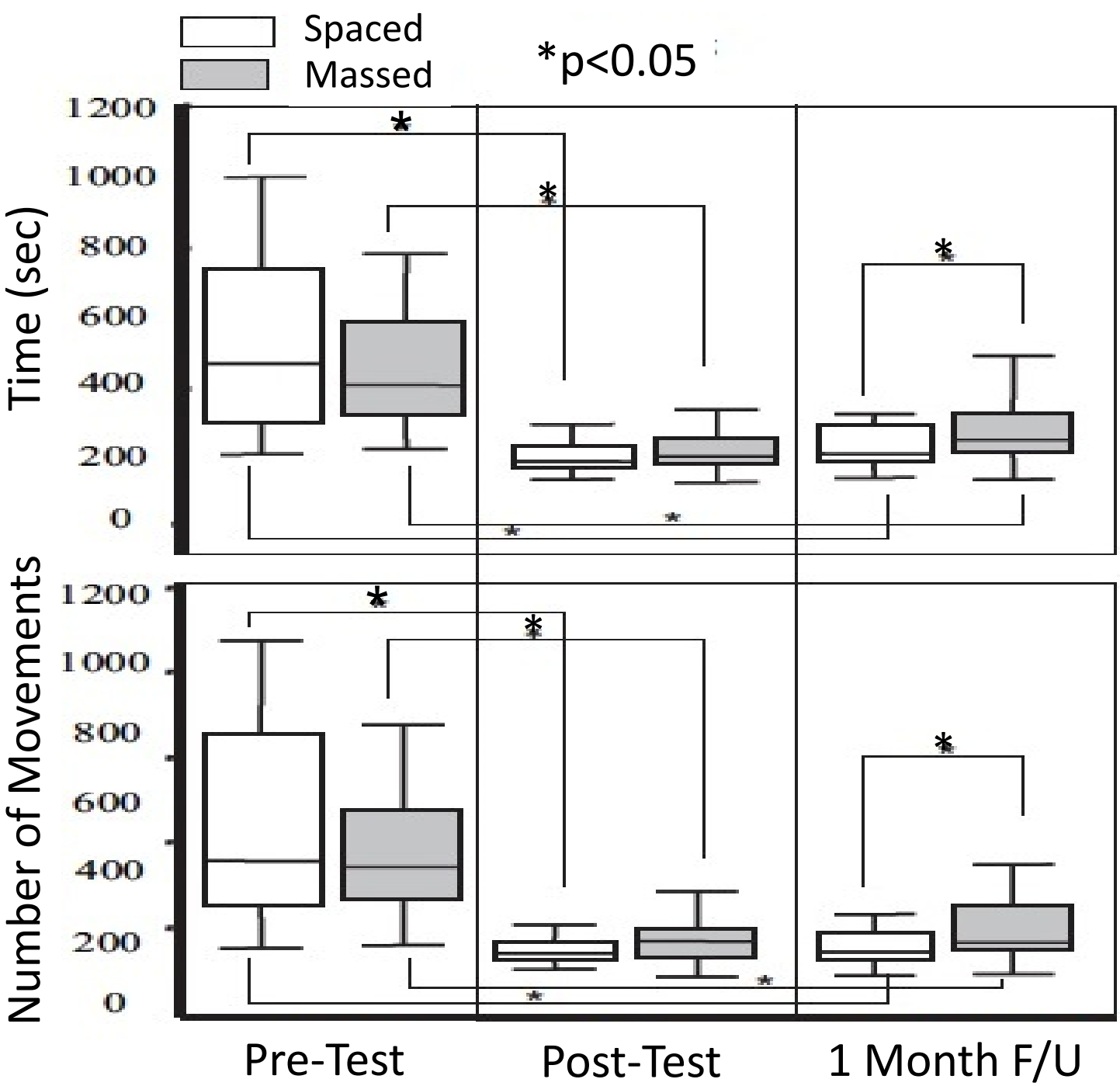


SPACED VS. MASSED TEACHING

SPACING:

Learning is more resilient when it is spread out over time.

SPACING

Learning is more resilient when it is spread out over time

How can we apply this?

- During morning report
- On the wards/in clinic
- For the struggling learner

Four evidence-supported learning strategies

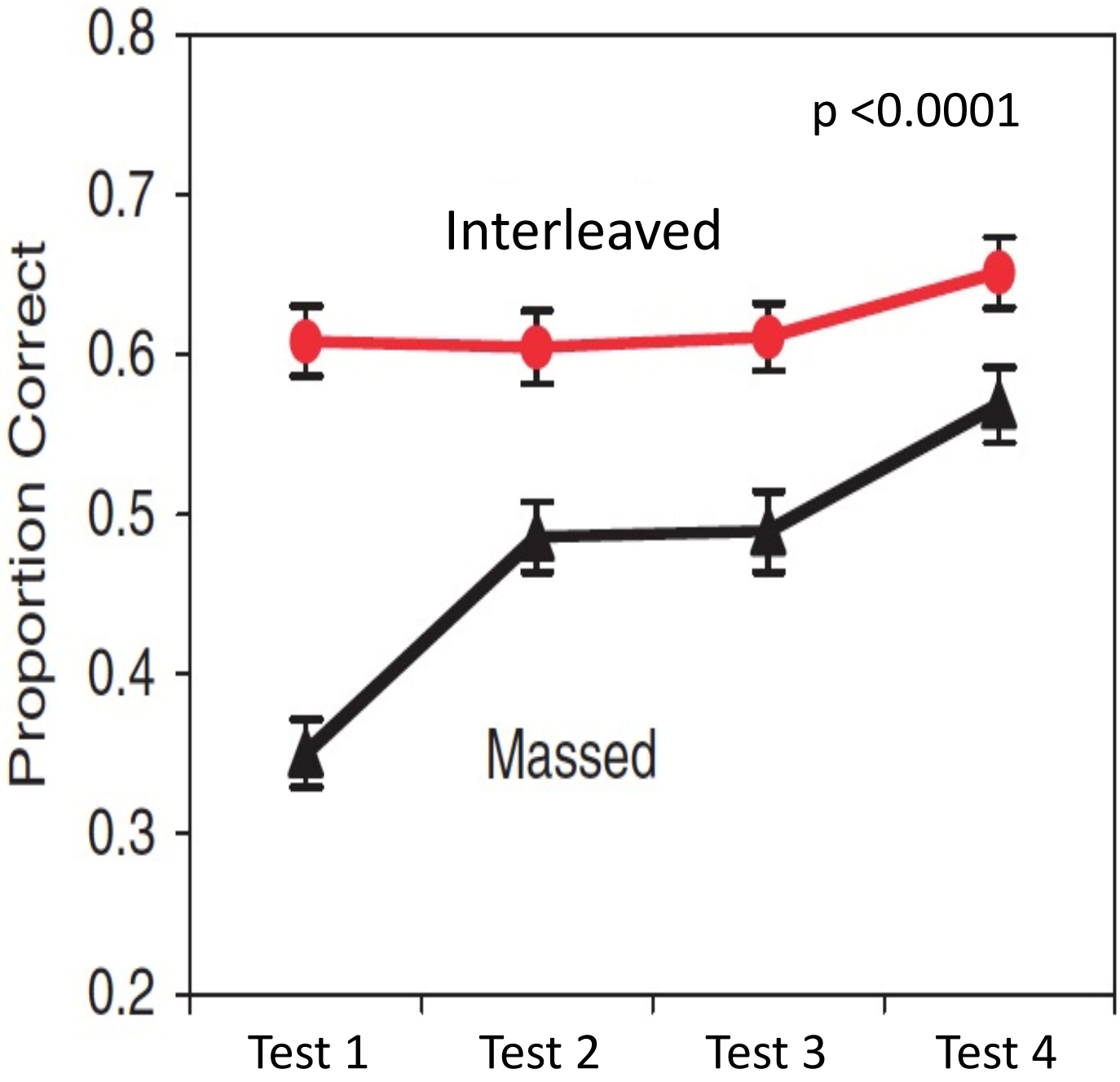
1. Promoting Retrieval
2. Spacing
3. **Interleaving**
4. Self-explanation

THE ART OF LEARNING

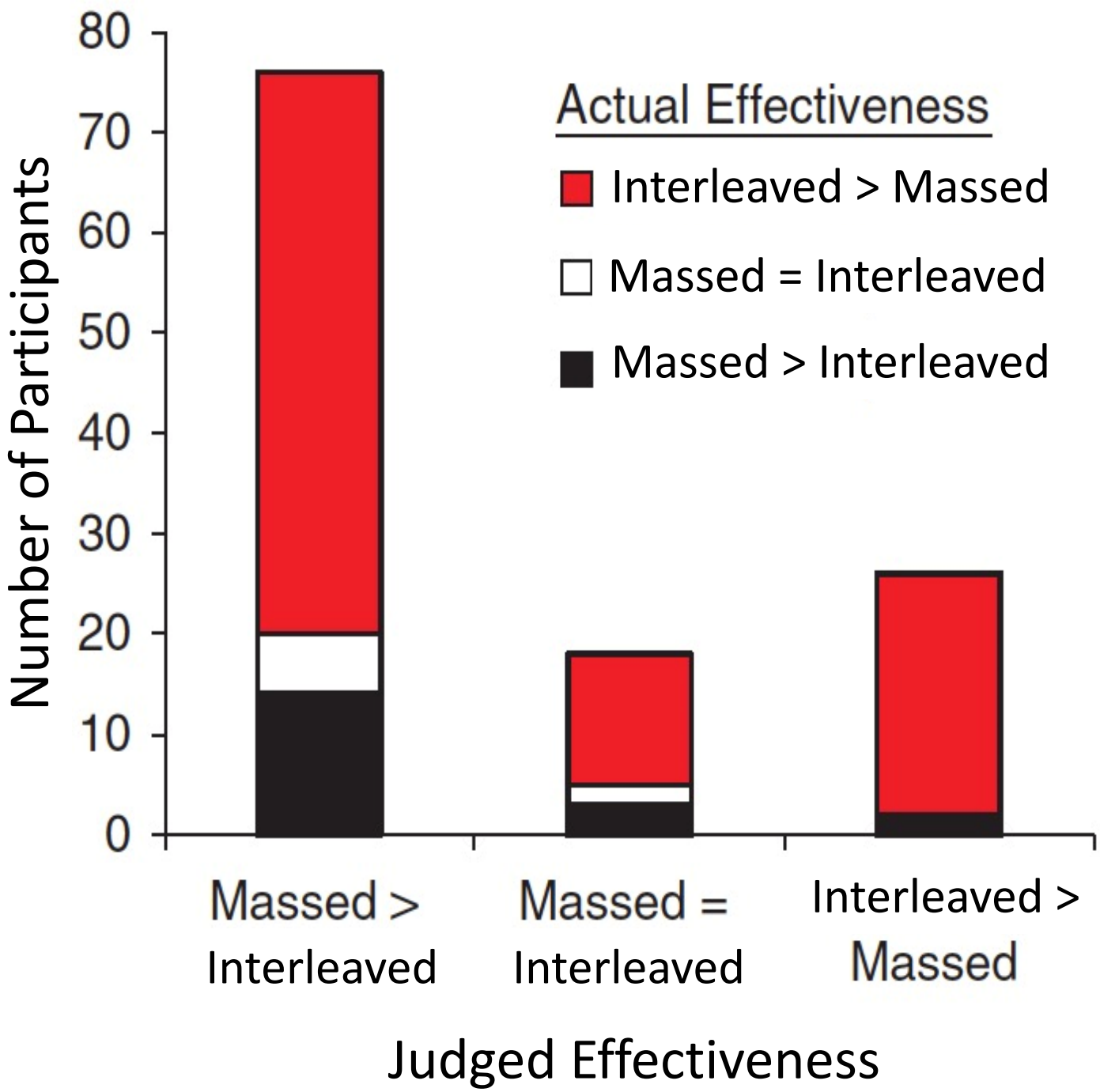
72 UCLA
Undergraduate Students

Learn to recognize the work
of 12 different artists

Kornell et al. Psych Science. 2008; 19(6):585-592.


0.8
0.7
0.6
0.5
0.4
0.3
0.2
Proportion Correct
p <0.0001
Interleaved
Massed
Test 1
Test 2
Test 3
Test 4

THE RESULTS



WE CAN BE POOR JUDGES OF HOW WE LEARN

INTERLEAVING

Learning that is varied and shuffled tends to be more flexible and adaptable

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Four evidence-supported learning strategies

1. Promoting Retrieval
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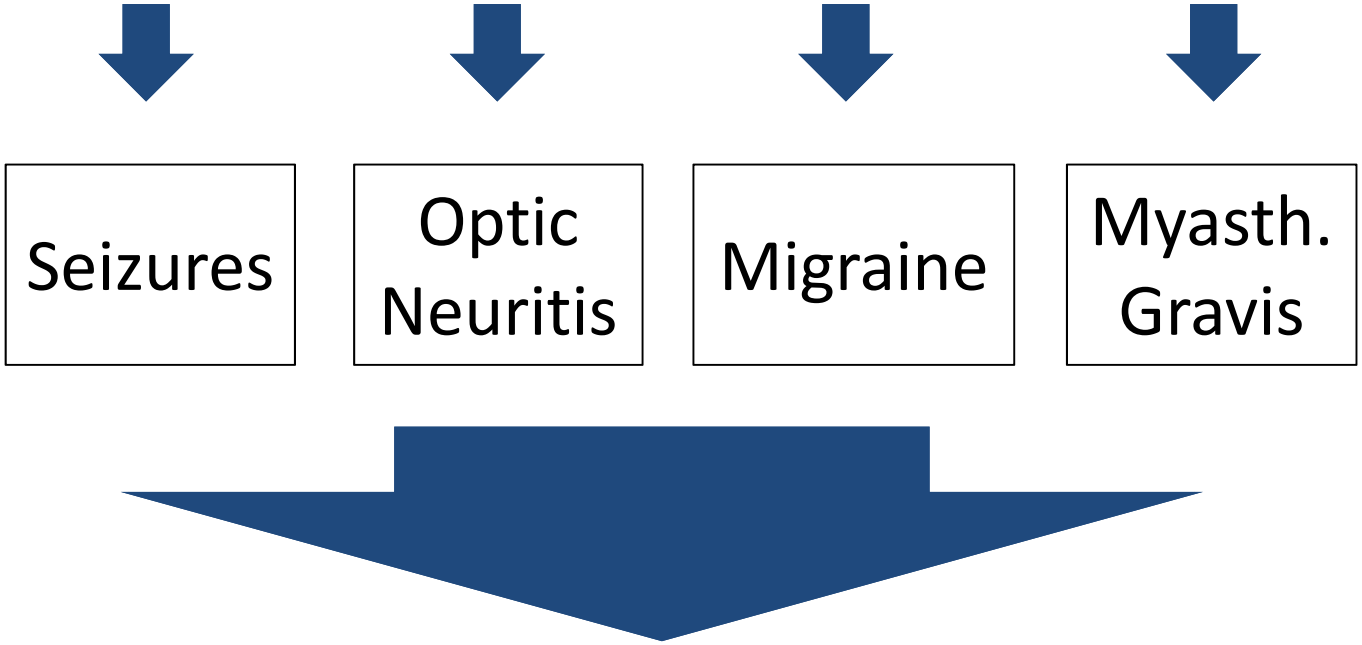
3. Interleaving
4. **Self-explanation**

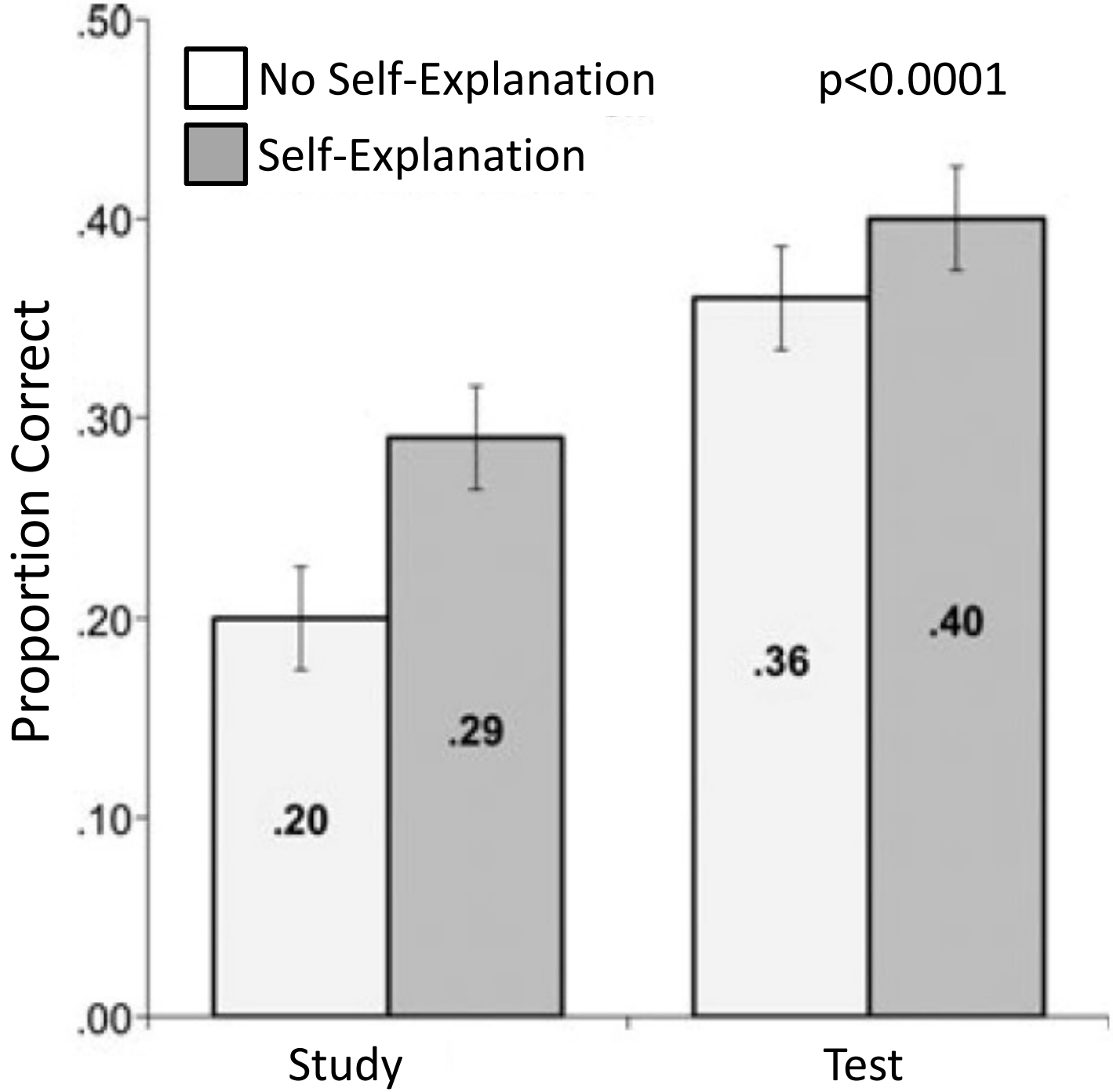
49 MS1s recruited
for two 2-hour sessions covering 4 topics:



- Short-answer Test
- Short-answer Test + Self-explanations
- Study Sheet
- Study Sheet + Self-explanations

SEIZE YOUR LEARNING

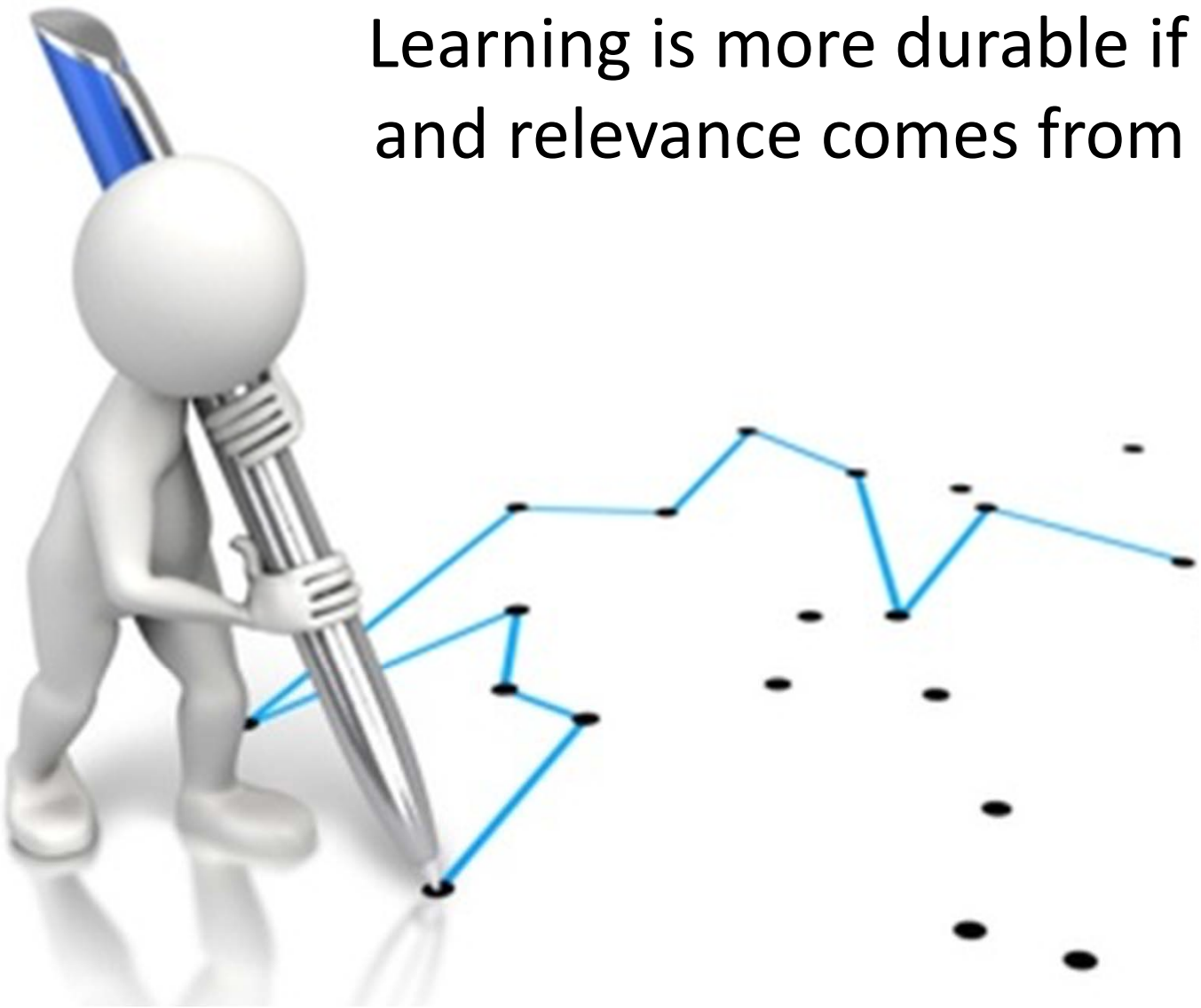
Larsen et al. Med Educ. 2013; 47: 674-682.



6 MONTH FOLLOW UP TEST

SELF-EXPLANATION

Learning is more durable if its meaning and relevance comes from the learner.



SELF-EXPLANATION

Learning is more durable if its meaning and relevance comes from the learner

How can we apply this?

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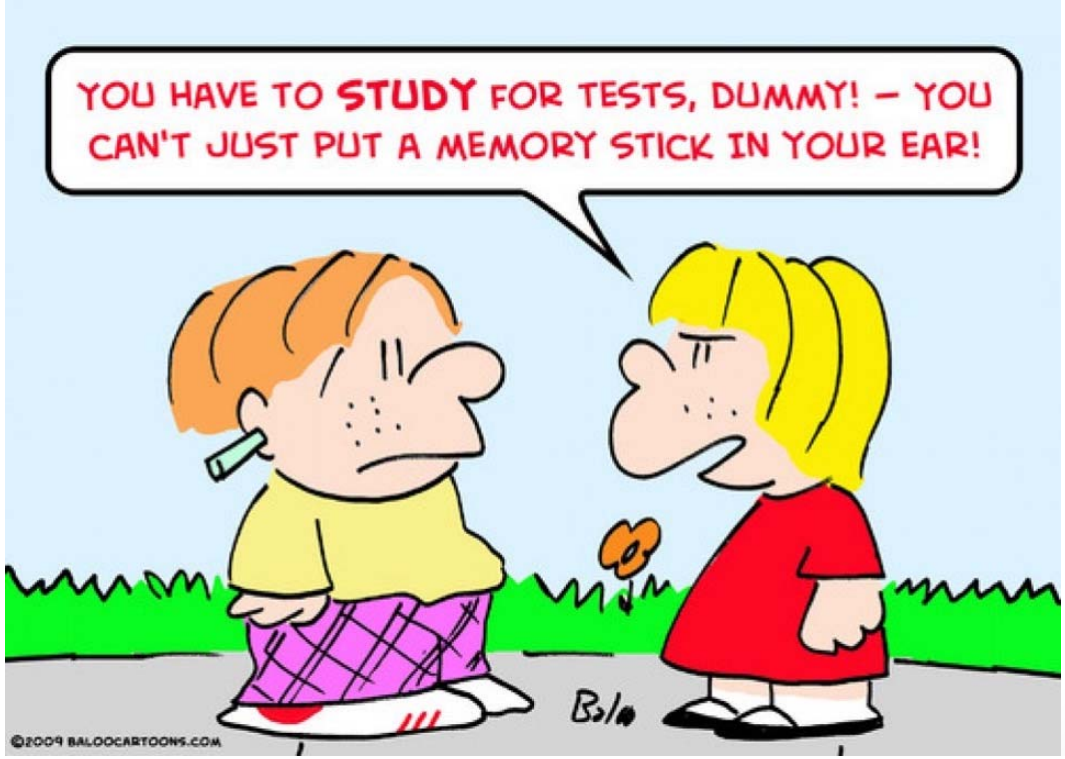
Take Home Points

- Learning that is **effortful** is more **durable**
- Work to introduce **desirable difficulties** into your teaching



Take Home Points

Promoting retrieval: Repeated testing promotes better retention of learning

Examples:

MORNING REPORT	CLINIC/WARDS	STRUGGLING LEARNER
• "Flashback Friday"	• Finish pre-clinic conference with a 3 question quiz • "Pimping"	• Coach them to do MKSAP questions

Take Home Points

Spacing: Learning is more resilient when it is spread out over time

Examples:

MORNING REPORT	CLINIC/WARDS	STRUGGLING LEARNER
• Send email with take home points later in day • Tie in learning from prior cases	• Discuss management of diabetes over 4 weekly sessions • Go over one chest X-ray every day	• Coach them to reflect on their learning at the end of each week

Take Home Points

Interleaving: Learning that is varied and shuffled tends to be more flexible & adaptable

Examples:

MORNING REPORT	CLINIC/WARDS	STRUGGLING LEARNER
• Focus on key learning points regarding multiple aspects of the case	• Focus on multiple small learning points for each patient	• Coach them to mix up their MKSAP quizzing

Take Home Points

Self Explanation: Learning is more durable if its meaning comes from the learner

Examples:

MORNING REPORT	CLINIC/WARDS	STRUGGLING LEARNER
• Make residents backup their reasoning with pathophysiology	• Ask for reasoning behind treatment plan • Ask learners to explain consultant recs	• Coach them to put their money down and think outload

Your intern asks you what type of CT scan to order. You…

a. Ask her to look it up

b. Ask her to tell you what type of imaging she thinks she should order

c. Tell her your approach so she can learn from your example

You want to review prior teaching with your team at the end of the week. Do you…

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Sources

1. Brown, Peter, et al. Make it Stick: The Science of Sucessful Learning. The Belknap Press of Harvard University Press. 2014.
2. Deng et al. Student-directed retrieval practice is a predictor of medical licensing examination performance. Perspect Med Educ. 2015;4:308-313.
3. Kornell et al. Learning Concepts and Categories: Is Spacing the "Enemy of Induction"? Psych Science. 2008; 19(6):585-592.
4. Lang, James M. Small Teaching: Everyday Lessons from the Science of Learning. Jossey-Bass. 2016.
5. Larsen et al. Repeated testing improves long-term retention relative to repeated study: a randomised controlled trial. Med Educ. 2009; 43: 1174-1181.
6. Larsen et al. Comparative effects of test-enhanced learning and self-explanation on long-term retention. Med Educ. 2013; 47: 674-682.
7. Moulton et al. Teaching Surgical Skills: What Kind of Practice Makes Perfect? A Randomized, Controlled Trial. Annals of Surgery. 2006; 244(3): 400-409.
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Questions/Comments?

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