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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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.**
Short term memory

Facts and information

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
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)

- SE Tested/MG Studied
- SE Studied/MG Tested

Myasthenia Gravis (MG)

- MG Tested/SE Studied
- MG Studied/SE Tested

Proportion Correct

- 0.42
- 0.31
- 0.19
- 0.36
- 0.19

p<0.05

p<0.001
Repeated testing promotes better retention of learning
PROMOTING RETRIEVAL
Repeated testing promotes better retention of learning

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

38 junior surgical residents learning microvascular anastomosis

Performance assessed:
1. Pre-training
2. Immediately post-training
3. 1 month post-training

1 Month F/U

Post‐Test

Massed

Pre-Test  Post-Test  1 Month F/U

Time (sec)

Number of Movements

Spaced  Massed

*p<0.05

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
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Four evidence-supported learning strategies

1. Promoting Retrieval
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72 UCLA Undergraduate Students

Learn to recognize the work of 12 different artists

The results show a significant difference between Interleaved and Massed tests, with a p-value less than 0.0001. The graph illustrates the proportion correct over tests 1 to 4, with Interleaved consistently outperforming Massed.
We can be poor judges of how we learn.
INTERLEAVING

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

Learning that is varied and shuffled is more flexible and adaptable

How can we apply this?

• During morning report
• On the wards/in clinic
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Four evidence-supported learning strategies

1. Promoting Retrieval
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4. Self-explanation
49 MS1s recruited for two 2-hour sessions covering 4 topics:

- Seizures
- Optic Neuritis
- Migraine
- Myasth. Gravis

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

6 MONTH FOLLOW UP TEST

Proportion Correct

No Self-Explanation  Self-Explanation  p<0.0001

Study: .20  .29

Test: .36  .40
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?

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

<table>
<thead>
<tr>
<th>MORNING REPORT</th>
<th>CLINIC/WARDS</th>
<th>STRUGGLING LEARNER</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Flashback Friday”</td>
<td>• Finish pre-clinic conference with a 3 question quiz</td>
<td>• Coach them to do MKSAP questions</td>
</tr>
<tr>
<td>• “Pimping”</td>
<td></td>
<td></td>
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Take Home Points

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

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<td>• Send email with take home points later in day</td>
<td>• Discuss management of diabetes over 4 weekly sessions</td>
<td>• Coach them to reflect on their learning at the end of each week</td>
</tr>
<tr>
<td>• Tie in learning from prior cases</td>
<td>• Go over one chest X-ray every day</td>
<td></td>
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Take Home Points

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

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<td>• Focus on key learning points regarding multiple aspects of the case</td>
<td>• Focus on multiple small learning points for each patient</td>
<td>• Coach them to mix up their MKSAP quizzing</td>
</tr>
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</table>
Take Home Points

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

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| • 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 outloud |
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Sources

Questions/Comments?

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