Why are students so bad at learning?

Amarbeer Singh Gill

@SinghAmarbeerG

www.bit.ly/UnpackingEducation

Why are ~~students~~ *we all* so bad at learning?

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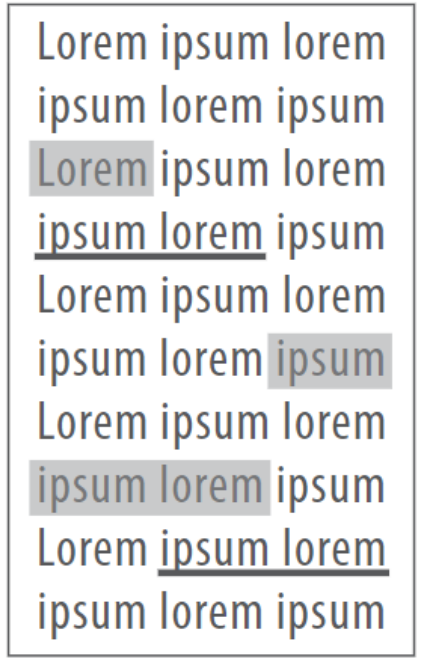
Revision techniques

Some of the most popular revision techniques…

- Re-reading
- Underlining
- Highlighting
- Summarising from text
- Mnemonics



Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4-58.

The most effective strategies

- Practice testing
- Spaced practice

1. **Why can students do something well at one point in time, but not another?**
2. **Why do students choose and use poor strategies?**

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4-58.

Strong Performance ≠ Embedded Learning

Teaching Implications

Student Implications

“

Learning … [is] the more or less permanent change in knowledge or understanding

”

Bjork, E.L. & Bjork, R.A. (2011) “Making things hard on yourself, but in a good way: creating desirable difficulties to enhance learning”, in M.A. Gernsbacher et al. (eds.) Psychology and the Real World: essays illustrating fundamental contributions to society, Worth Publishers, p.57

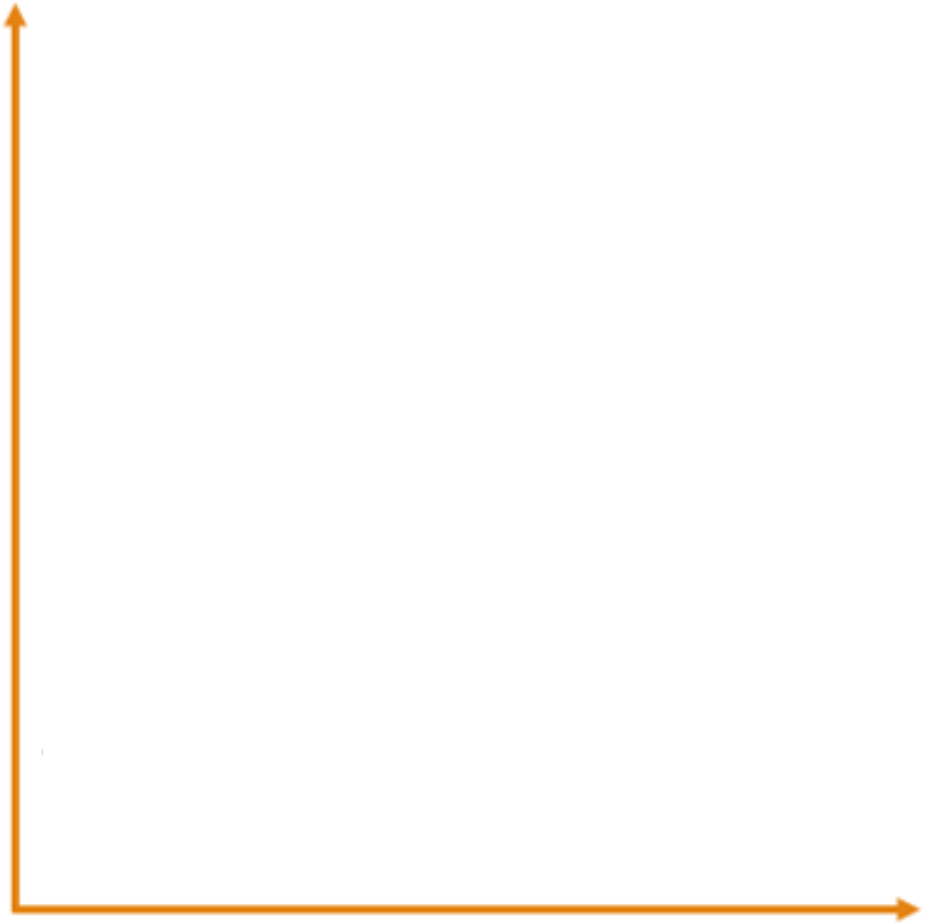
“

The critical distinction between learning, as measured by long-term retention,…and [short-term] performance, as measured during acquisition.

”

Soderstrom, N. C., & Bjork, R. A. (2015). Learning versus performance: An integrative review. *Perspectives on Psychological Science, 10*(2), 176-199.

Retrieval & Storage Strengths



Yan, V. (2016, May 10). *GUEST POST: Retrieval Strength Vs. Storage Strength — The Learning Scientists*. The Learning Scientists. https://www.learningscientists.org/blog/2016/5/10-1

Retrieval Strength & Performance

- High retrieval strength ≈ Strong performance
- High storage strength ≈ Embedded learning
- Lower performance can lead to improved learning

Check-Point

From the below, write the numbers of the statements that are **TRUE**.

1. Retrieval strength measures how durable a memory is.
2. Retrieval strength can go up or down.
3. Learning is a permanent change in knowledge or understanding, whereas performance is a short-term change in knowledge or understanding.
4. We should constantly retrieve stuff to maintain a high retrieval strength.

Check-Point

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Summary

Learning vs Performance	• Learning is a ***permanent*** change in knowledge. • Performance are demonstrations of ***in the moment understanding and abilities***.
Memory "strengths"	• Retrieval strength is how **easily accessible** a memory is, and **can fluctuate**. • Storage strength is how **deeply entrenched** a memory is, and **only accumulates**.
Bringing it all together	High RS = High performance ≠Embedded learning

Strong Performance ≠ Embedded Learning

Teaching Implications

Student Implications

Why are programmes of teaching often less than successful in achieving their long-term goal of learning? One reason is that teachers are at risk of assuming that ***performance during instruction*** is a reliable index of learning. In fact, such performance is often ***not*** a reliable index of learning.

Bjork, R. A., & Bjork, E. L. (1992). A new theory of disuse and an old theory of stimulus fluctuation. *From learning processes to cognitive processes: Essays in honor of William K. Estes, 2*, 35-67.

Implications for teaching

1. Short-term performance is a poor proxy for long-term learning

“

Performance is what students can do. It is all that we can ever observe. Learning takes place inside a student’s mind and as such cannot be observed directly.

”

Didau, D., & Rose, N. (2016). *What Every Teacher Needs to Know About Psychology*. Woodbridge: John Catt Educational Ltd.p.57

Implications for teaching

1. Short-term performance is a poor proxy for long-term learning
2. You can only measure performance – learning is an invisible process

Implications for teaching

1. Short-term performance is a poor proxy for long-term learning
2. You can only measure performance – learning is an invisible process
3. Into the classroom:
    1. Something being taught ≠ something being learnt
    2. Can they do it correctly now VS can they do it correctly consistently
    3. Impairing performance *can* boost learning

Distributed Practice

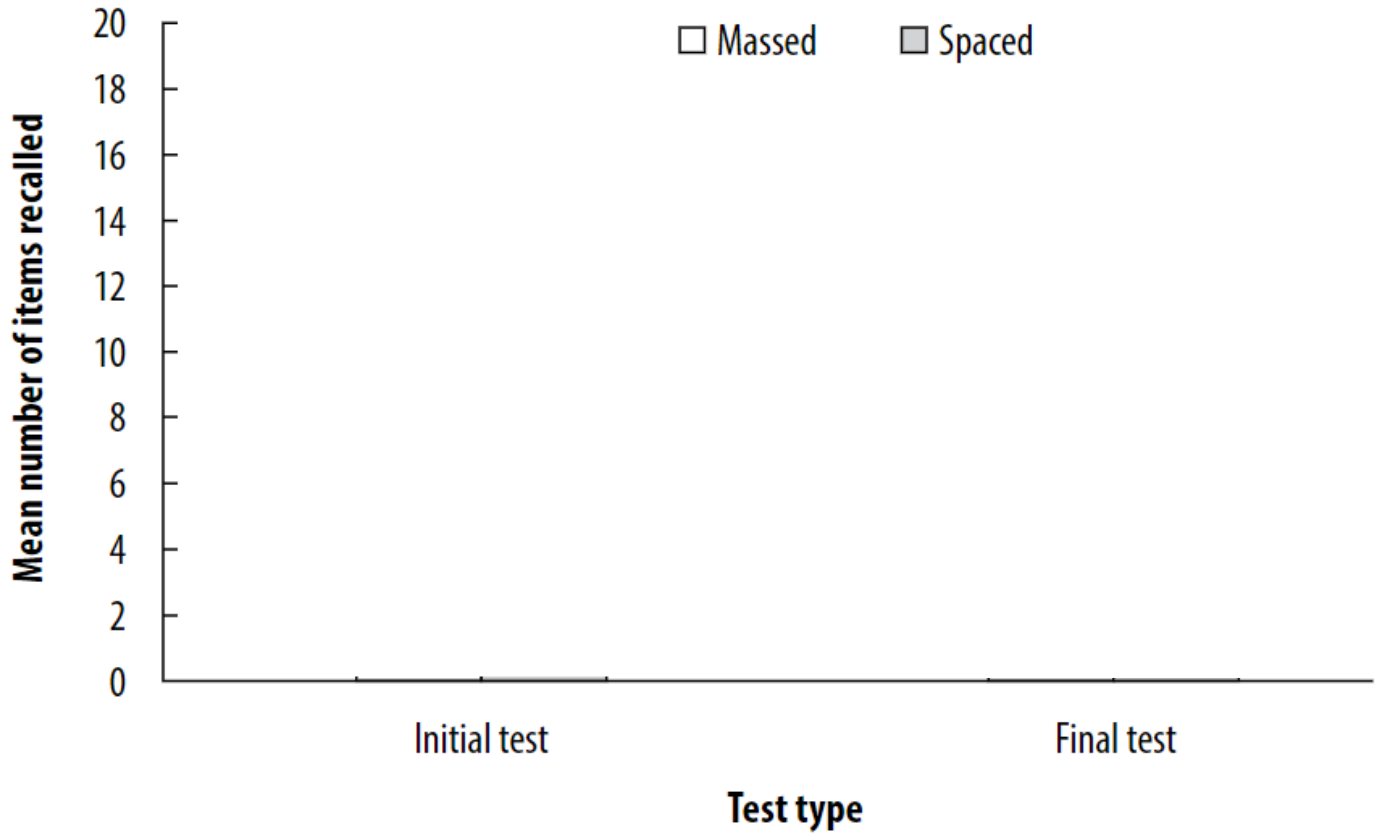
What it is

Why it works

Into the Classroom

Limitations

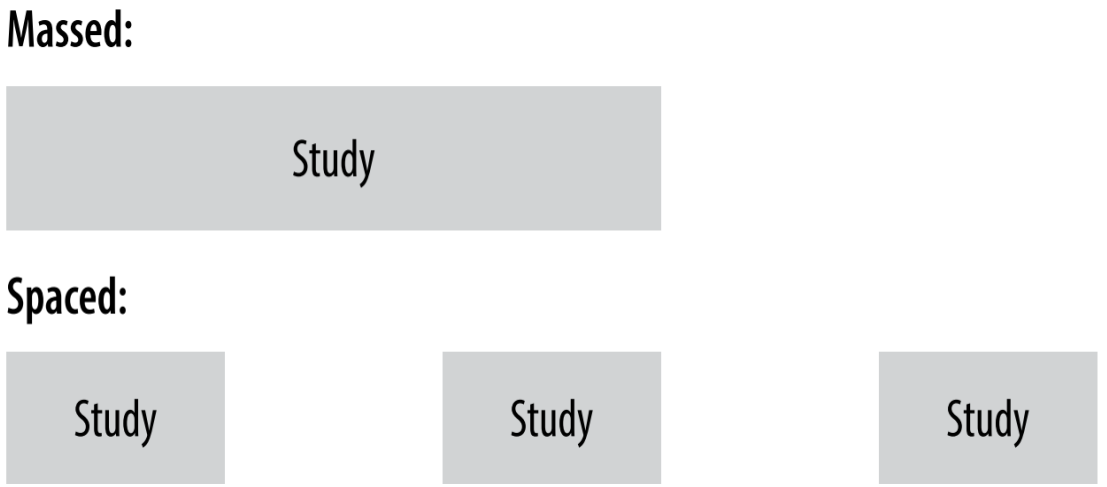
Distributed Practice



Roediger, H. L., & Pyc, M. A. (2012). Inexpensive techniques to improve education: Applying cognitive psychology to enhance educational practice. *Journal of Applied Research in Memory and Cognition, 1*(4), 242-248.

Distributed Practice – What is it?

- In contrast to massed practice.
- Spaced practice involves following that up by regularly coming back to key ideas.
- “Just because it has been taught, doesn't mean it has been learnt”



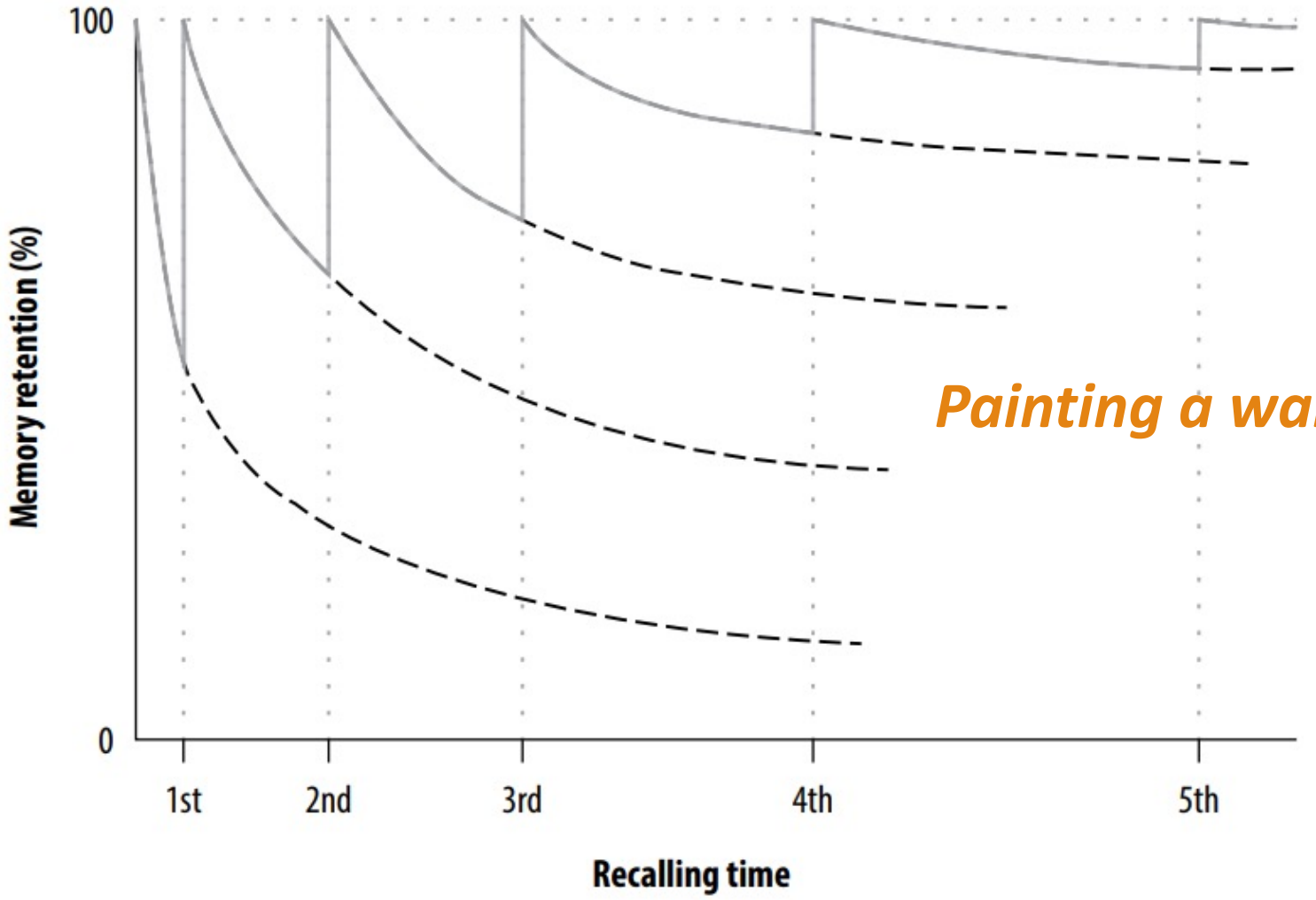
“We have been wrong about memory. It's not a system orientated to the past but one whose role is to send data to the future so that we may later access it […] By repeating the information several times at long intervals, we help our brain convince itself that this information is valuable enough to be delivered to our future self.”

Dehaene, S. (2020). *How we learn: The new science of education and the brain*. Penguin UK.

Distributed Practice – Why does it work?

Each time we return to material, it is:

- Relearnt quicker.
- Retained for longer.



Distributed Practice – Into the Classroom

Mechanisms:

- What are the key concepts in my subject/a particular topic?
- What will be most beneficial for students to return to over the long-term?
- What will be most beneficial for students to return to prior to what I'm about to teach?

Methods:

- Starter that review previous learning
- Cumulative practice tests
- Review/recap/reusing homeworks
- Helping students to plan out their revision

Distributed Practice – Example

1: Which is the largest continent?

2: How many people live in Europe?

3: What is the imaginary line around the earth that goes through Africa?

4: What is a mega city?

5: Is Australia an island?

6: Is it sunny during winter in Antarctica?

https://teachers.thenational.academy/units/seven-continents-cf8c/quiz?src=subject

Distributed Practice – Example

1: Which is the largest continent?

- Africa
- Asia
- Europe
- Antarctica
- Australia
- North America
- South America

2: How many people live in Europe?

- 40 million
- 1.2 billion
- 579 million
- 741 million

3: What is the imaginary line around the earth that goes through Africa?

- Equator
- Ecuador
- Ethiopia

4: What is a mega city?

- A mega city, is a city which has a population of more than 10 million.
- A mega city, is a city which has over 10,000 buildings.
- A mega city, is a large area of land.

5: Is Australia an island?

- Yes
- No

6: Is it sunny during winter in Antarctica?

- Yes, it's very hot
- Yes, the sun shines all the time
- No, it's dark and cold
- No, it's sunny but cold

https://teachers.thenational.academy/units/seven-continents-cf8c/quiz?src=subject

Distributed Practice - Limitations

- Need to have corrective feedback.
- Difficulty needs to be *moderated*.
- Likely no such thing as an “optimal” gap

Interleaving

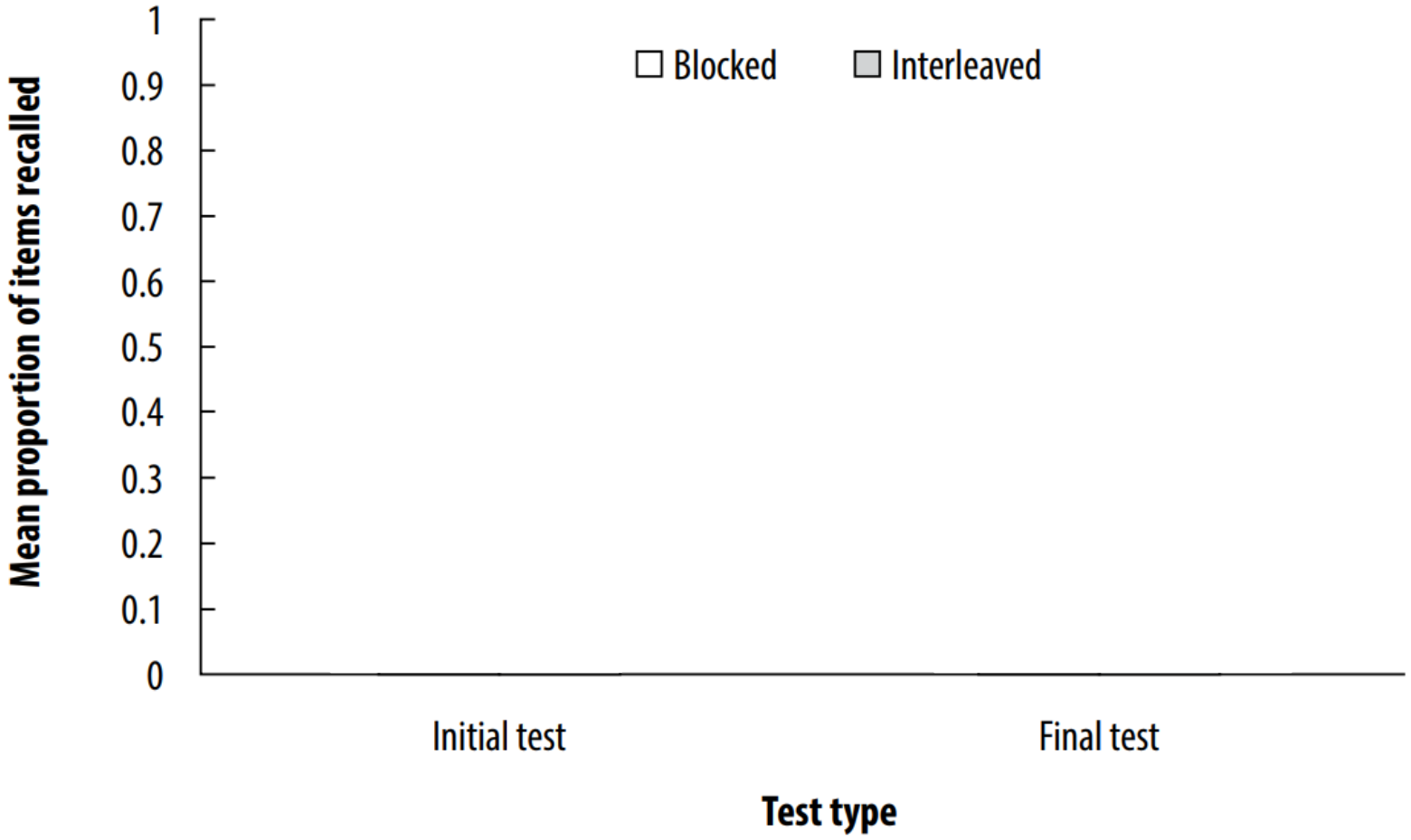
What it is

Why it works

Into the Classroom

Limitations

Interleaving



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Interleaving – What it *isn't*

Lesson	Topic
1	Adding fractions
2	Probability
3	Area of a triangle
4	Subtracting fractions

Interleaving – What it *isn't*

Study slo	Topic
1	rench
2	glish
3	laths
4	French

Interleaving – What is it?

- More relevant for conceptual understanding.
- Mixing up of *related* problems.
- Students are forced to discriminate; not just apply a method.

“

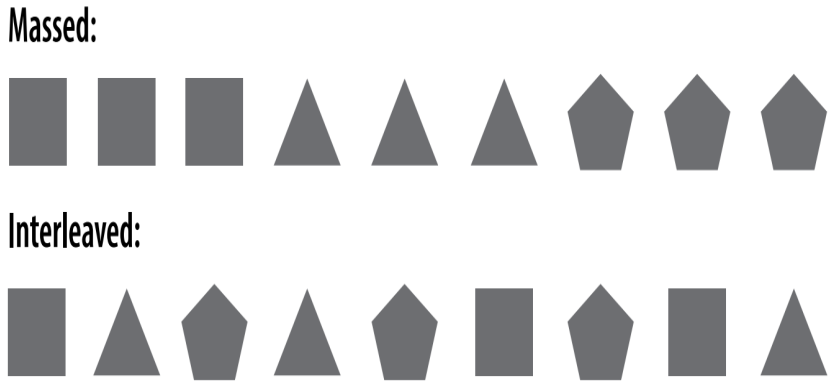
Interleaving is thought to assist the drawing of comparisons between related but discrete items of learning.

”

Perry, T., Lea, R., Jørgensen, C.R., Cordingley, P., Shapiro, K. & Youdell, D. (2021) *Cognitive Science Approaches in the Classroom: a review of the evidence,* Education Endowment Foundation

Interleaving – Why does it work?

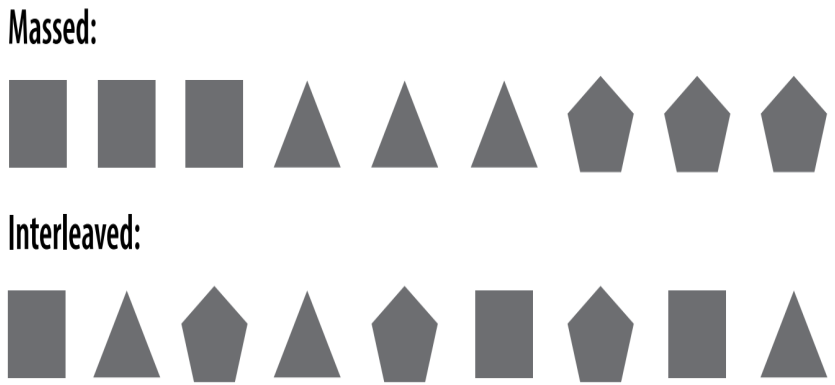
- Inherent distribution
- Discernment leads to focus on key features
- Multiple opportunities for retrieval



Interleaving – Into the Classroom

Mechanisms:

- What do I want students to focus on?
- What is *this task* asking them to focus on?
- Does the task repeatedly direct attention to the same concept?
- Are students likely to be able to make links between each occurrence of the same concept?



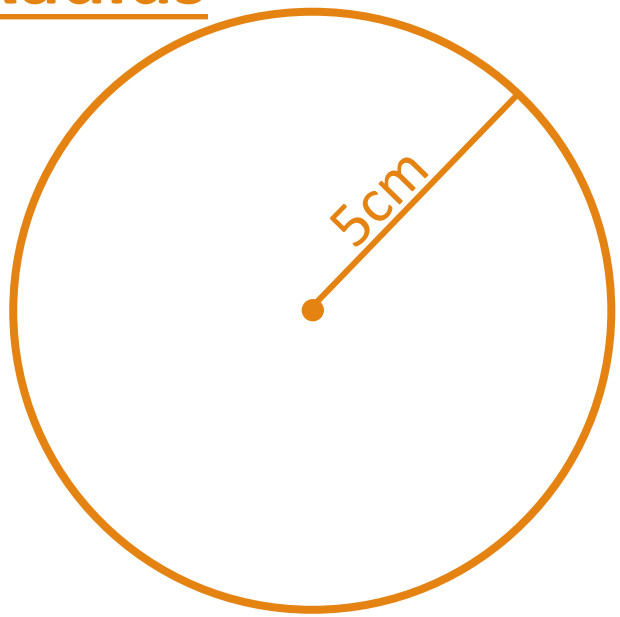
- What success rate am I looking for? What am I likely to get?
- What happens if there's a difference between these two?

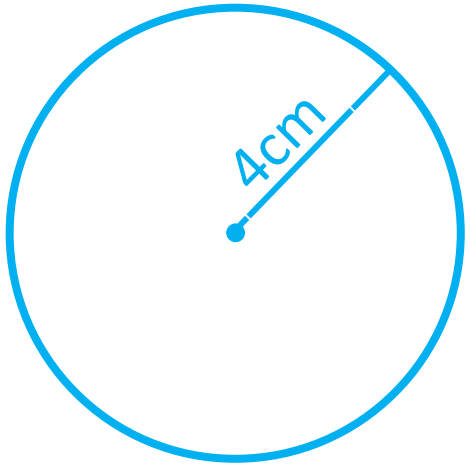
Methods:

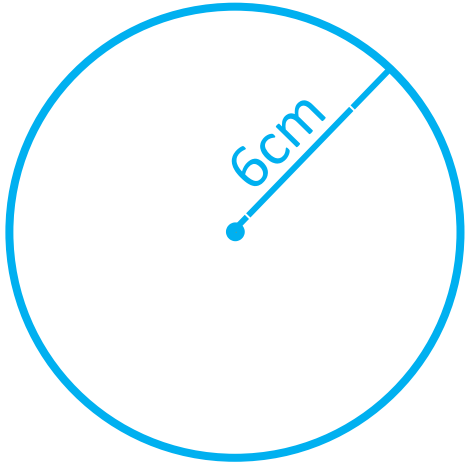
- Can combine with distributed/retrieval practice
- Mixed exercises at the end of a topic
- Reintroduce old ideas when teaching related new ideas

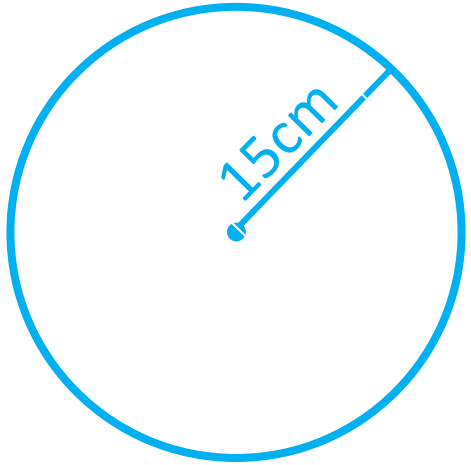
Interleaving – Example

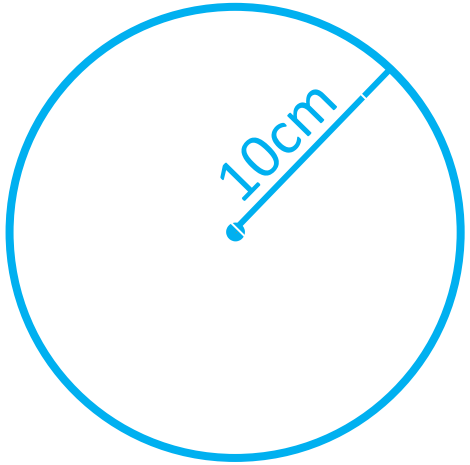
Radius











Interleaving – Example

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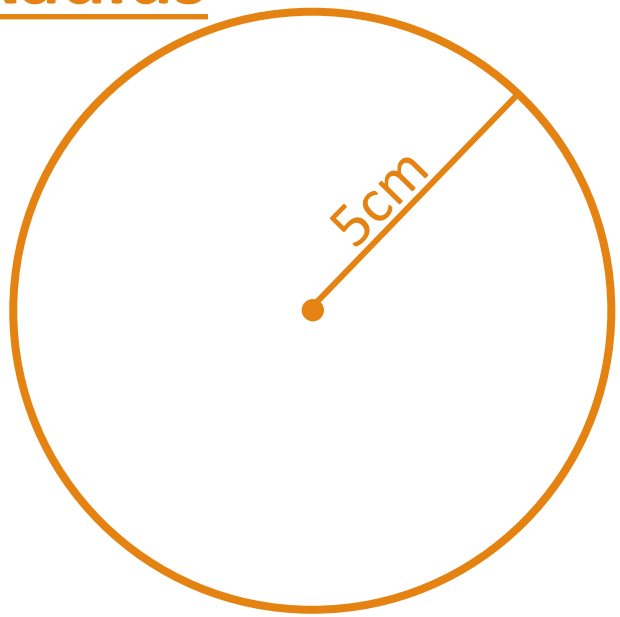
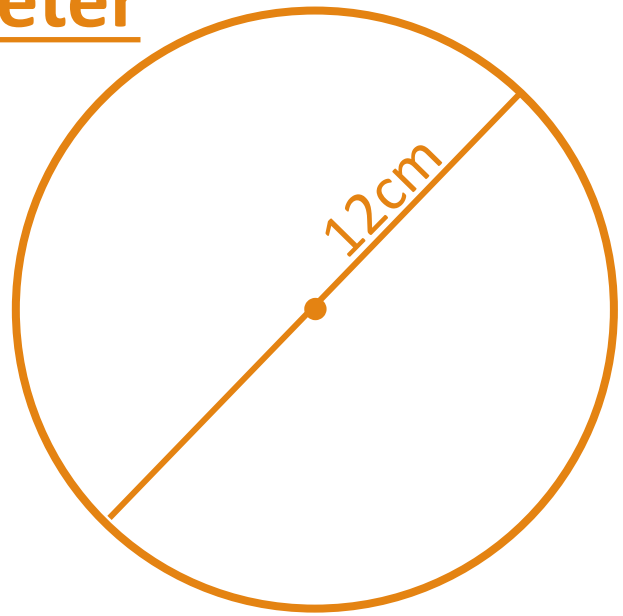
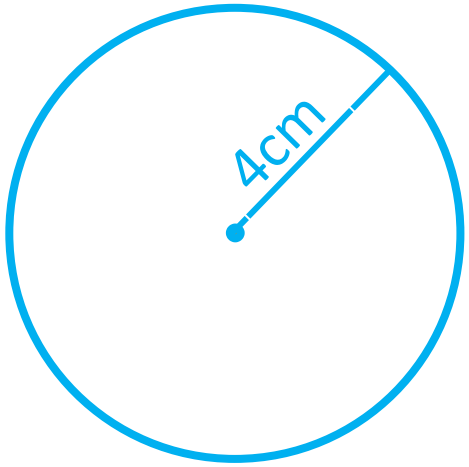
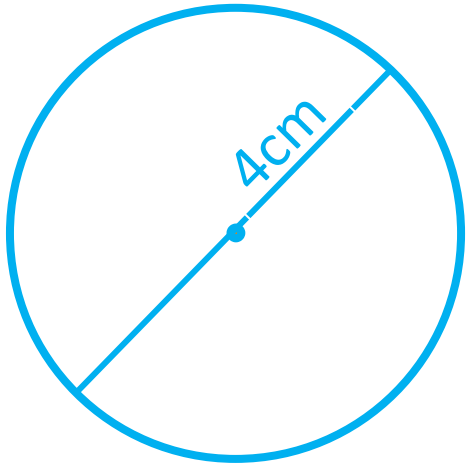


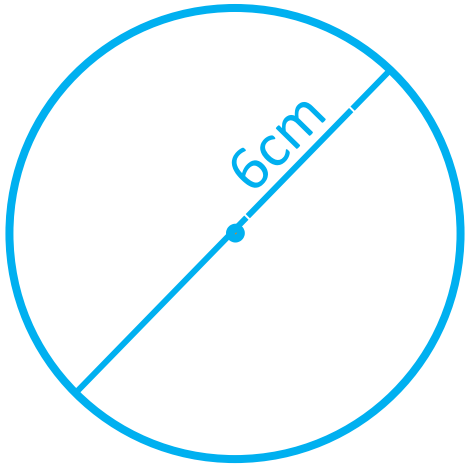
Diameter

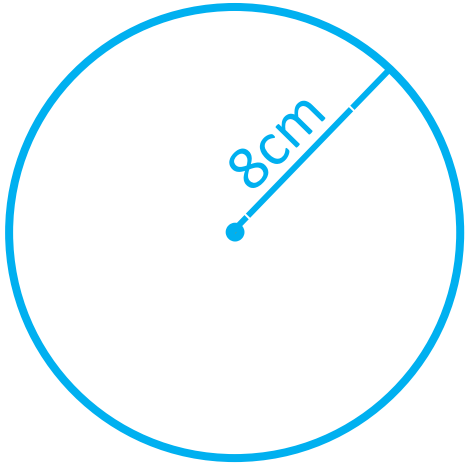


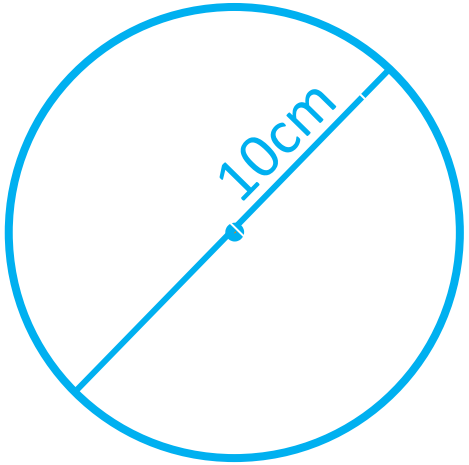
Interleaving – Example

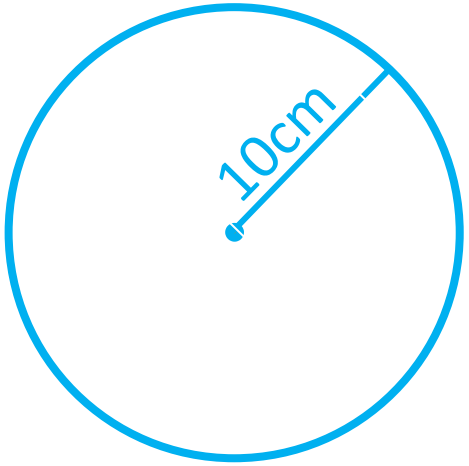












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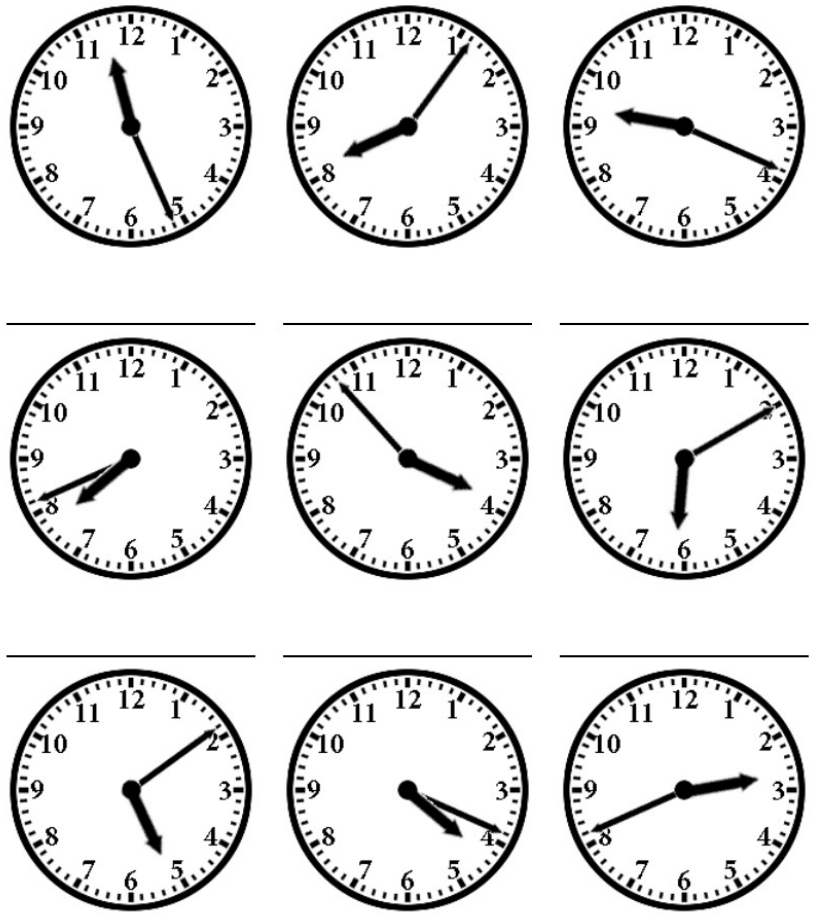

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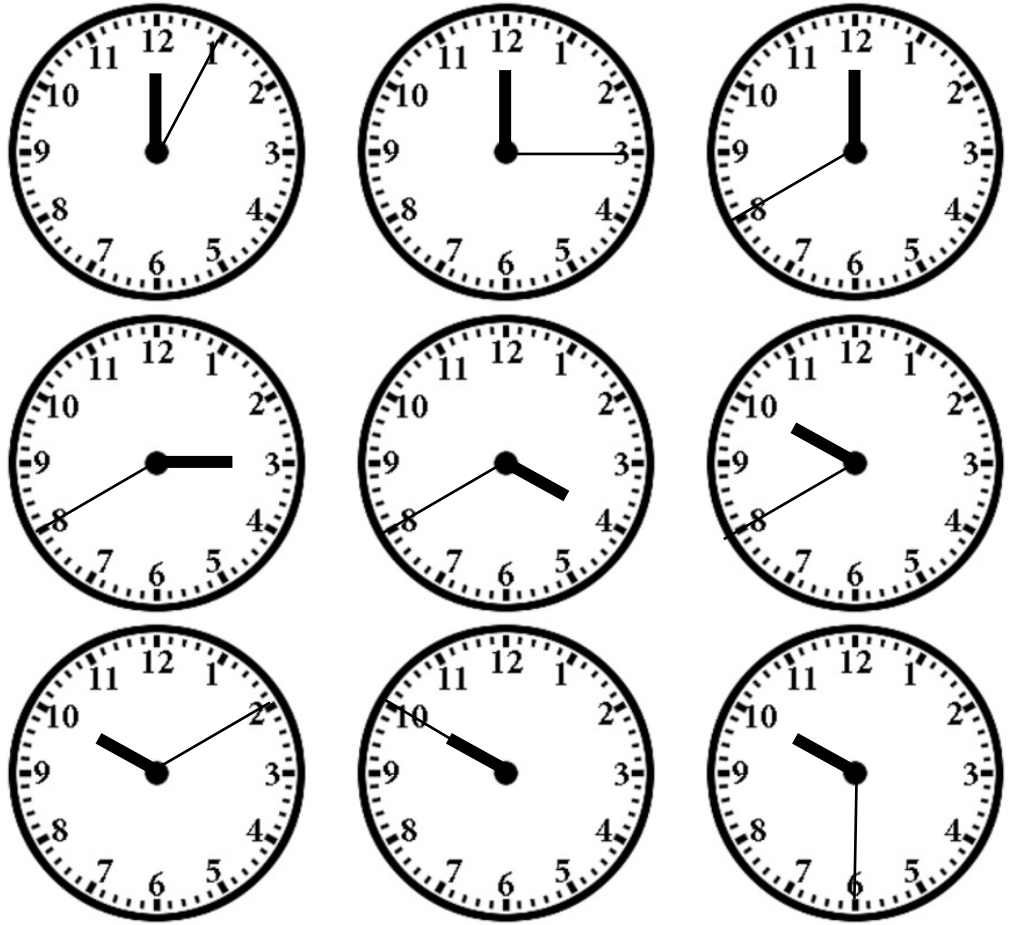

Interleaving – Example

- PE:
  - Varying types of cricket shots
  - Varying the distance from which basketball free throws are made
- Art:
  - Varying the styles of artists

Where we can ask the question:
“What similar concepts/features do students constantly mix up?”

Interleaving – Limitations

- Purpose is key – think backwards from goal.
- Mixing up between disciplines is best avoided.
- Potentially limited application
- Moderating difficulty

Check-Point

From the below, write the numbers of the statements that are **TRUE**.

1. Storage strength measures how durable a memory is.
2. Retrieval strength can fluctuate.
3. We will always forget new information.
4. Retrieval practice is the best way of studying.
5. Interleaving is the random mixing up of concepts.

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*RELATED

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Student Implications

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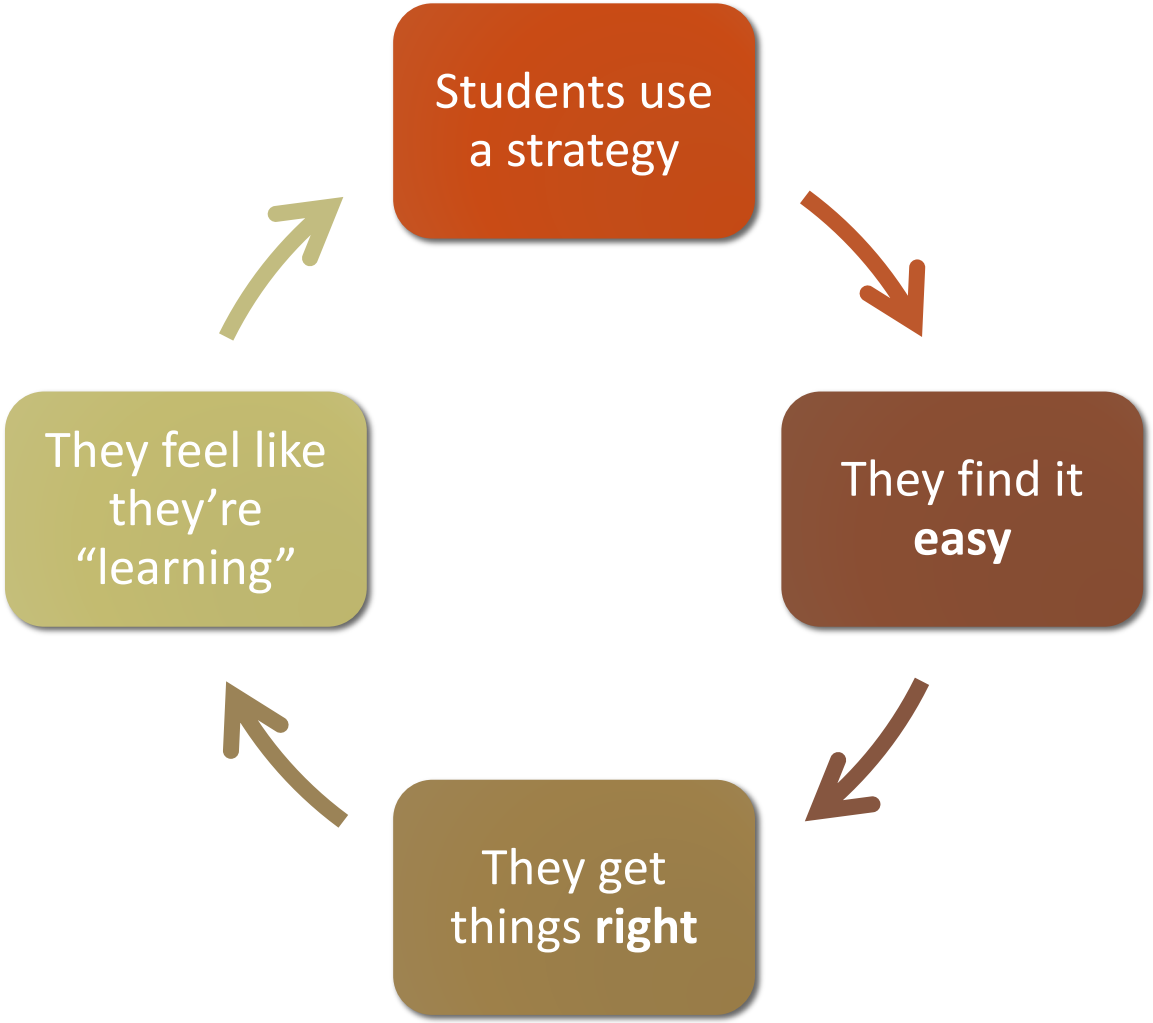
Learners are captured by gains in short-term performance and can mistakenly conflate such gains with long-term learning.

”

Soderstrom, N. C., & Bjork, R. A. (2015). Learning versus performance: An integrative review. *Perspectives on Psychological Science, 10*(2), 176-199.

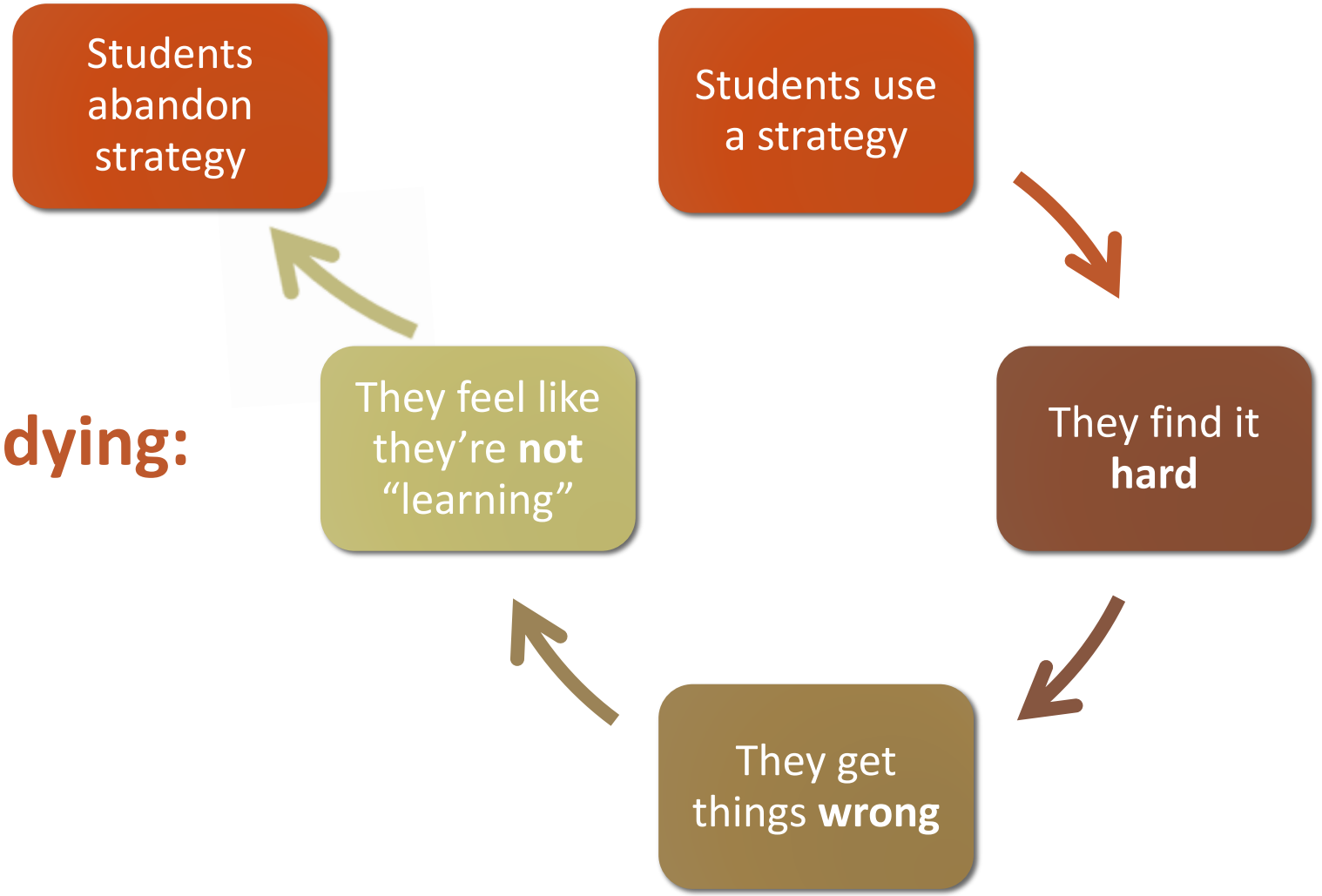
Implications for studying

The "Virtuous" Cycle of Studying:



Implications for studying

The "Vicious" Cycle of Studying:



Implications

1. Be aware of push/pull factors
2. Be mindful of what students do when you tell them to revise
3. You can control what you can control

Summary

Spaced Practice	• Spacing practice tends to be better than massing. • Involves thinking hard and ***regularly returning*** to target knowledge. • Can be combined with the other strategies such as practice testing or interleaving.
Interleaving	• Involves students ***discriminating between related concepts***. • Students should be familiar with the concepts in isolation, before they are brought together.
Student Study Habits	• There is a virtuous circle ***pulling students towards*** poor learning strategies. • There is a virtuous circle ***pushing students away*** from better learning strategies. • Spending time on teaching students ***how to learn*** alongside what will benefit them in the long-run.

Key Takeaways

1. Forgetting is inevitable – don't be captured by short-term success.
2. Hampering performance can be demotivating, but *purposeful* hampering can maximise learning.
3. There is no such thing as a "good" or "bad" strategy.

Thank you!

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