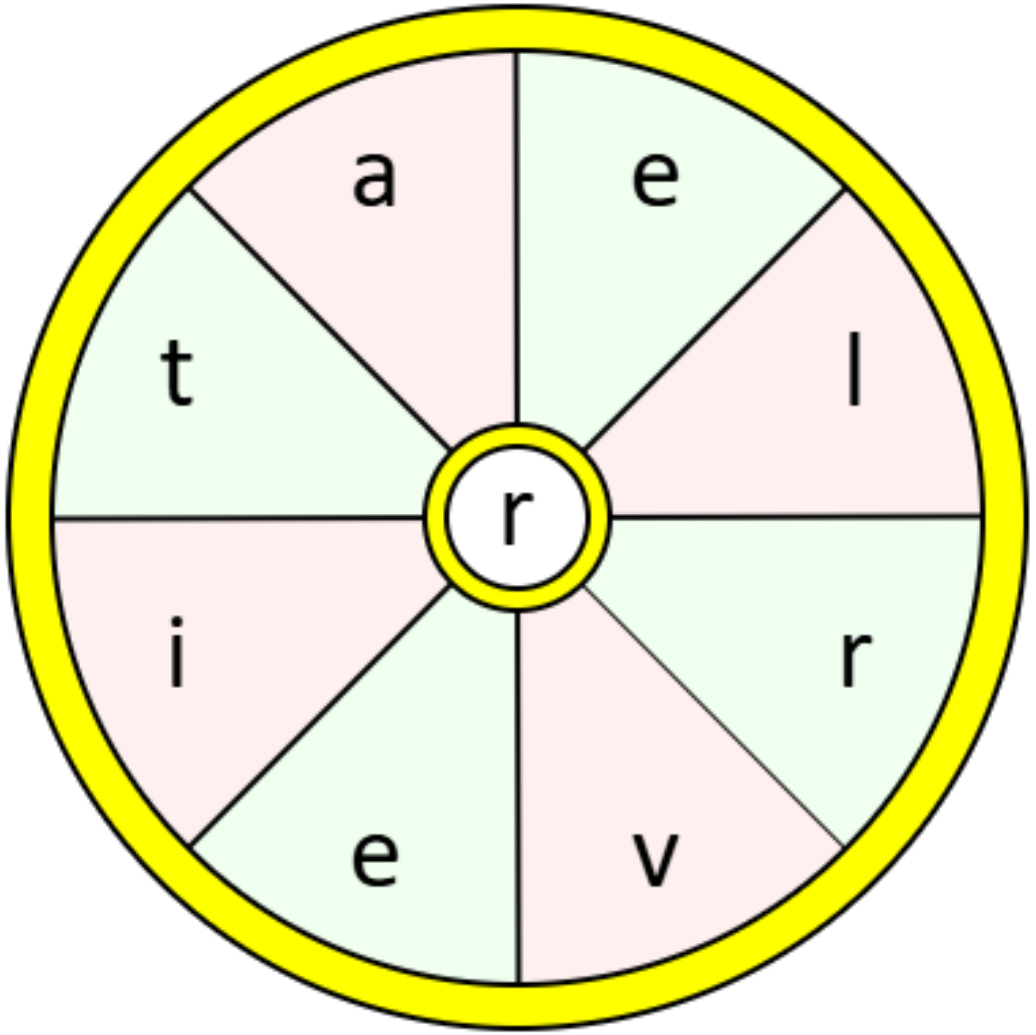
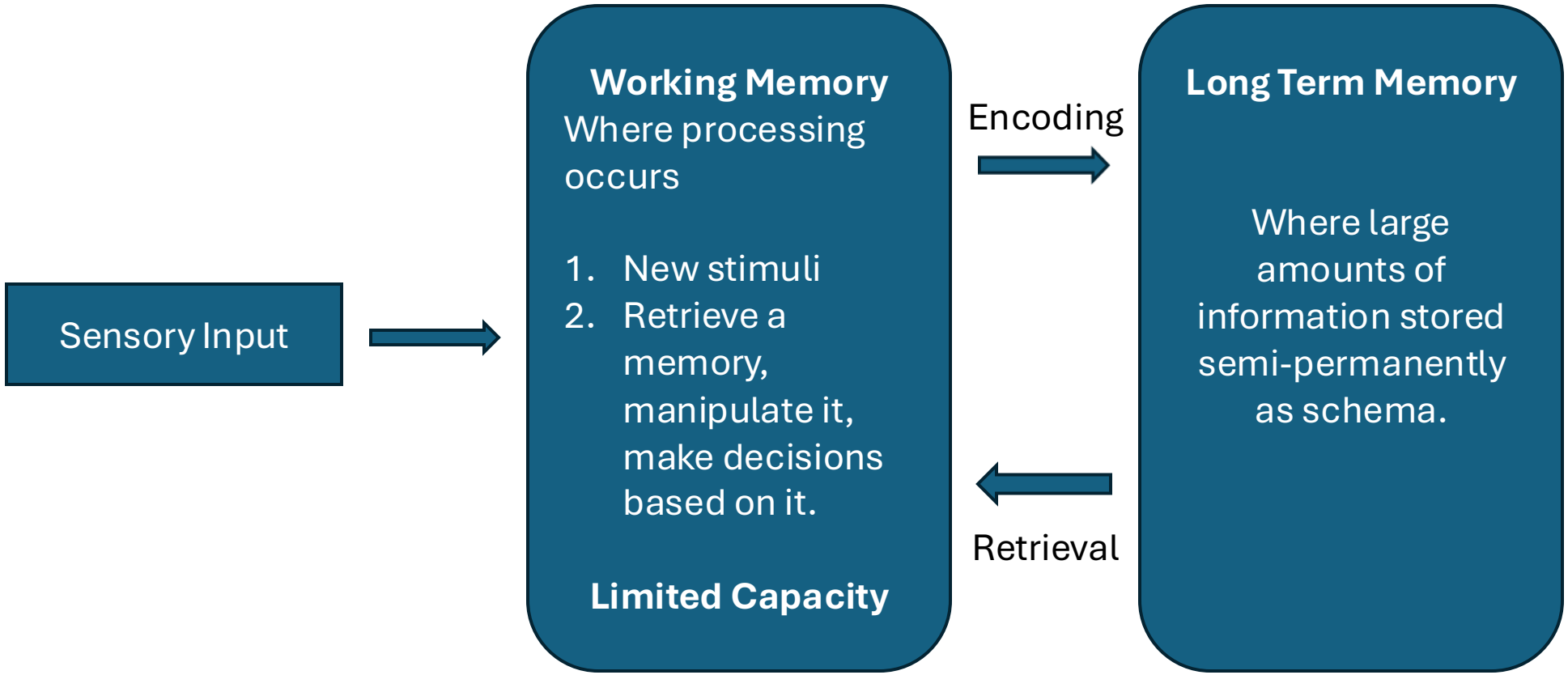
SEEK THE HEIGHTS

The Science of Learning: Pedagogy at MHS

Hei Mahi: How many words can you make? Each word must be at least 3 letters and contain the central ‘r’.



Memory and Cognitive Load



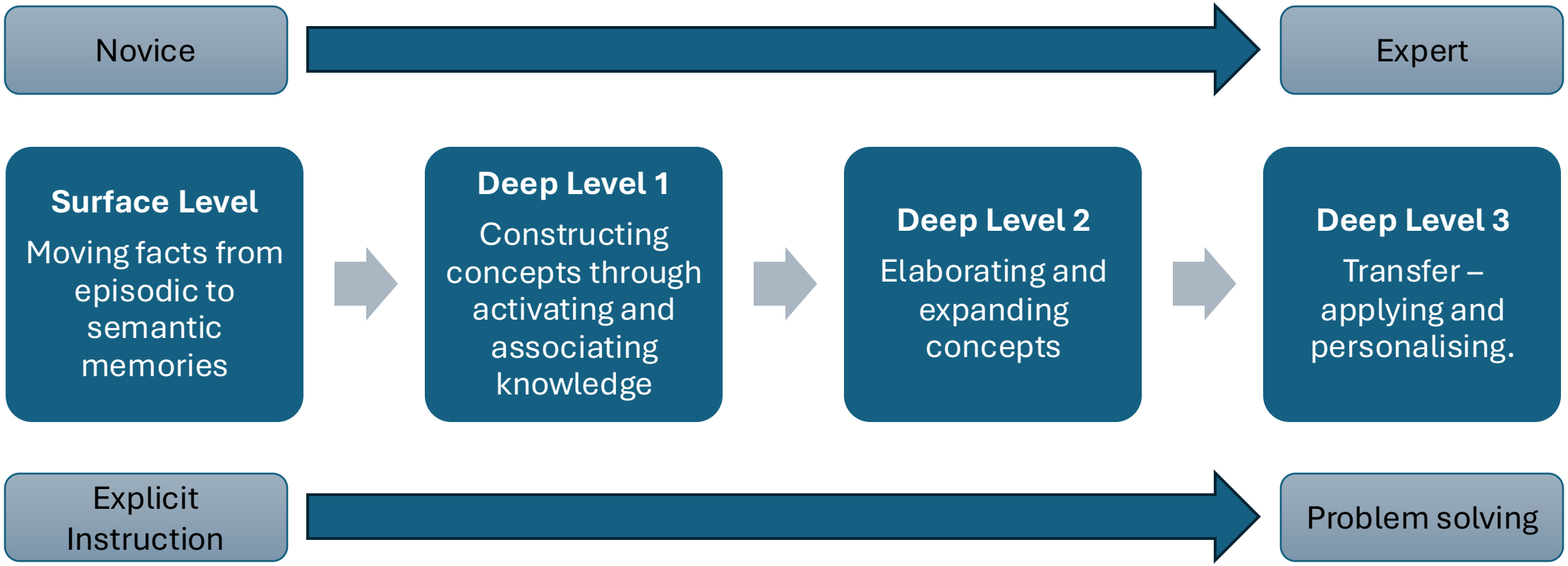
Working Memory

- Working memory is temporary storage.
- New information must be processed before moving to long term.
- Typically 5 to 9 items or chunks of new information at a time.
- We can work on only a limited number of items when a task requires working memory to process a new task.
- We can only hold this limited information in working memory for about 20 seconds without needing to prompt our memory.
- These limitations result in cognitive load whenever we are presented with new information

Long Term Memory

- Has no known limits.
- When familiar information is transferred from long-term memory back to working memory to be used for reasoning or problem solving, working memory has no limits on its capacity.
- Working memory only has limits on new information.
- When information is stored in the long-term memory, the contents of our mind change = learning process.

The Stages of Learning



In the Classroom

To promote deep learning in the classroom it is important to focus on three basic components:

1. **Reducing cognitive load**
2. **Retrieval Practice**
3. **Spaced Practice**

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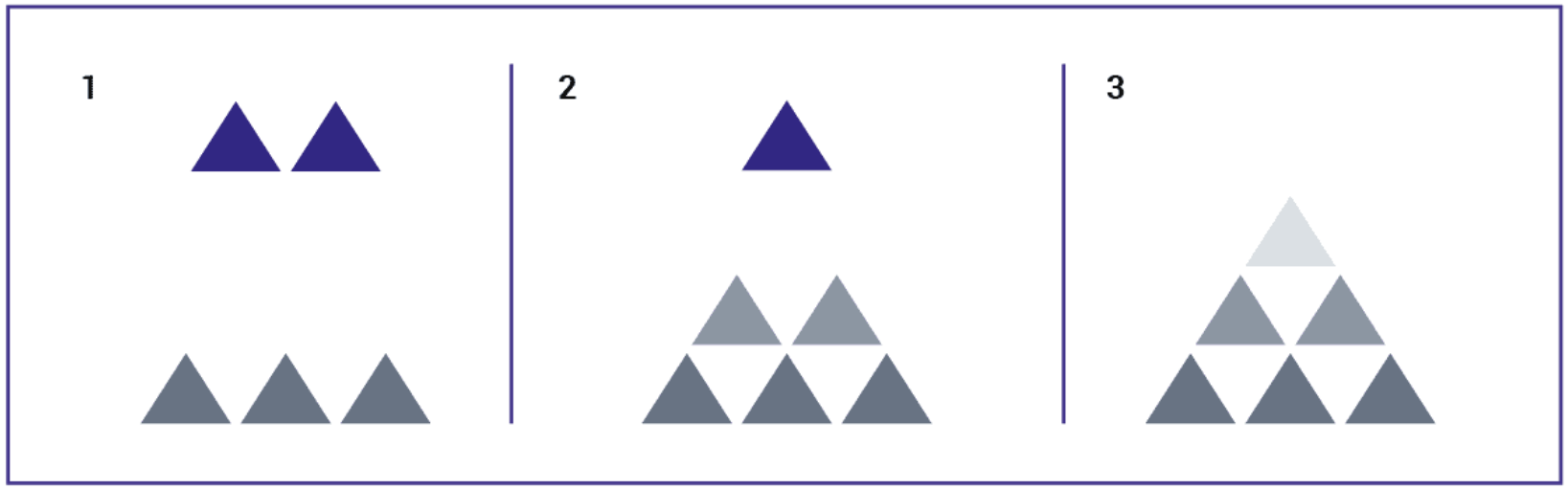
Reducing Cognitive Load

- Ausubel, 1968: '*If I had to reduce all of educational psychology to just one principle, I would say this: the most important single factor influencing learning is what the learner already knows. Ascertain this and teach accordingly.*'

New Information

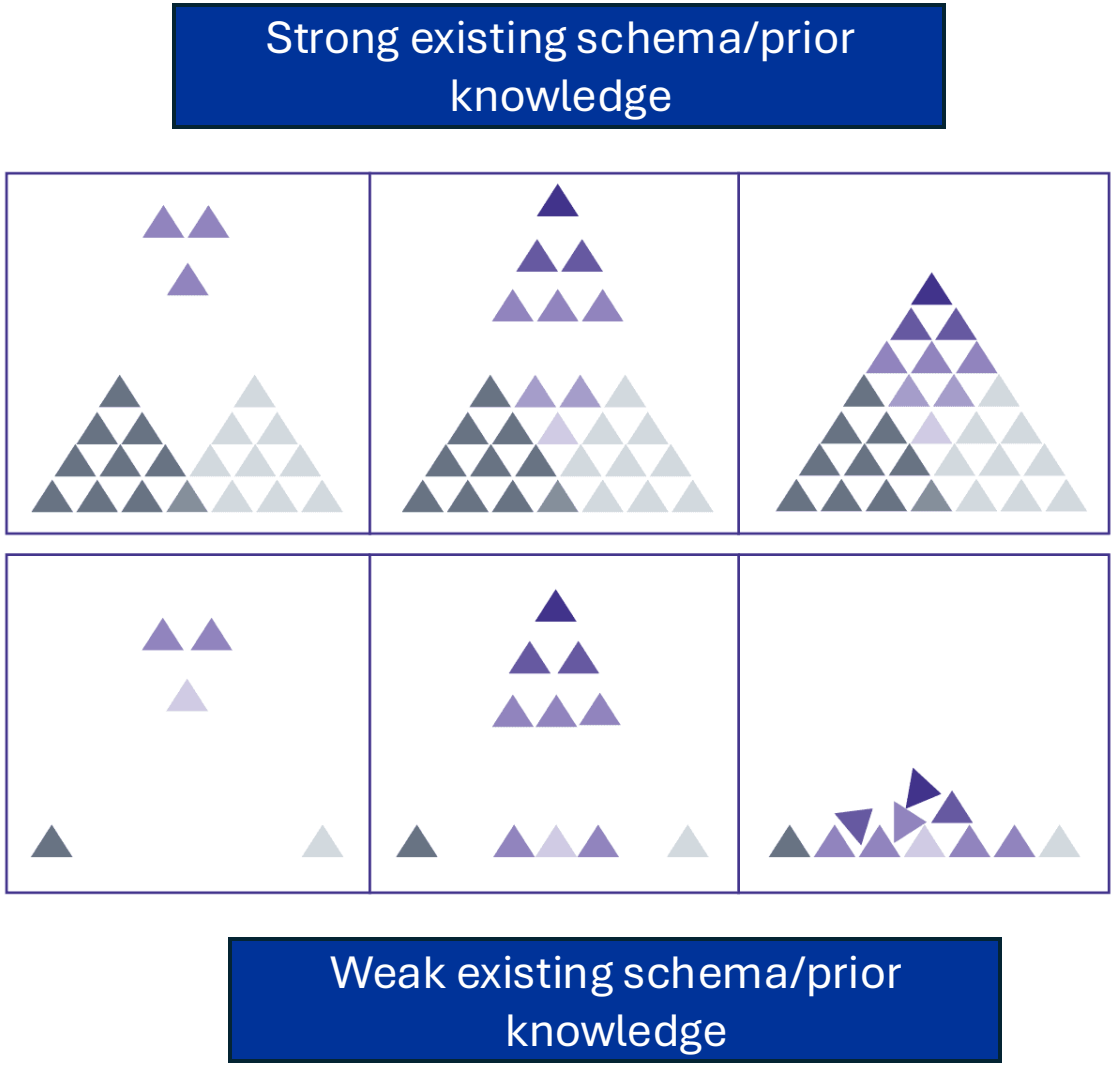
Prior Knowledge



- There are two important features of the way our brains learn:

1. It is hierarchical: new knowledge must be built on existing knowledge
2. It is based on meaning: the glue that puts the pieces together is our ability to use the new in the context of the existing

- As we learn more, we create more pyramids and more opportunities for higher-order learning (where a whole pyramid becomes just a brick in a new one) and interdisciplinary learning (that is supported by several other pyramids), as illustrated in the upper section of the diagram below.
- When foundational knowledge and understanding are not in place, as in the lower section of the diagram, learning will not be successful because the new information cannot connect with existing knowledge.



Pause

How do you currently incorporate prior knowledge into your practice?

What else could you try?

Retrieval Practice

- We need 3 encounters with new information.
- Retrieval practice creates pathways to long-term memory.
- The Matthew Effect: knowledge begets knowledge.
- Teachers must address misconceptions quickly or they will become encoded in long-term memory.

Quiz

Review/Exit Ticket

Flash Cards

Dual Coding
Mindmaps/diagrams/
pictures

Think/Pair/Share

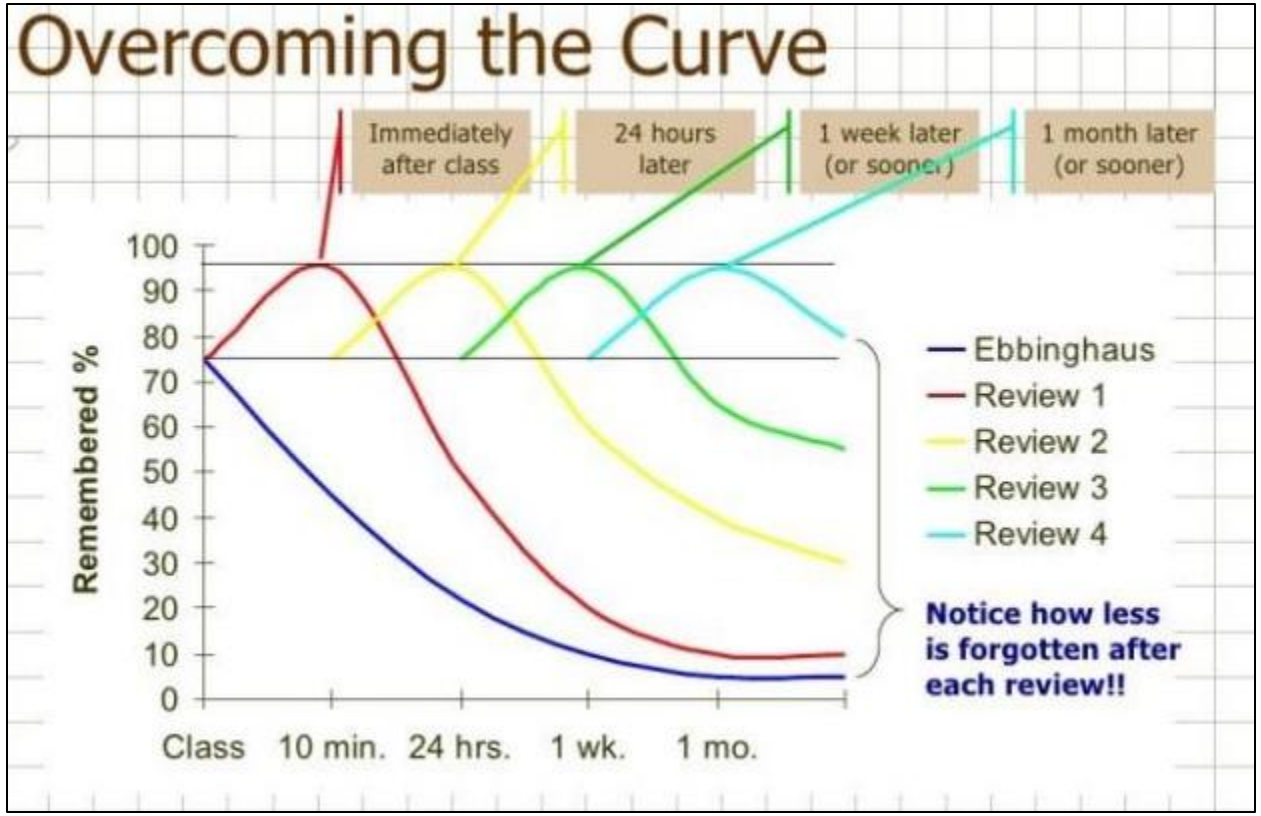
Multiple Choice

Conditions for Retrieval Practice

- It must be active
- Everyone must participate
- Low stakes
- Ensure feedback is given and corrections made
- Varying levels of difficulty/complexity

Spaced Practice

- Space practice over time. Repeatedly rehearsing the material in the same study session will not have long-term effects and may even impair learning. In other words, cramming is not effective for the long term.
- It is recommended to repeat the same material on different days to produce long-term results.
- As we practise more, the information becomes more stable and more accessible. It means that:
- It will ‘survive’ long gaps.
- Subsequent repetitions will take much less effort.



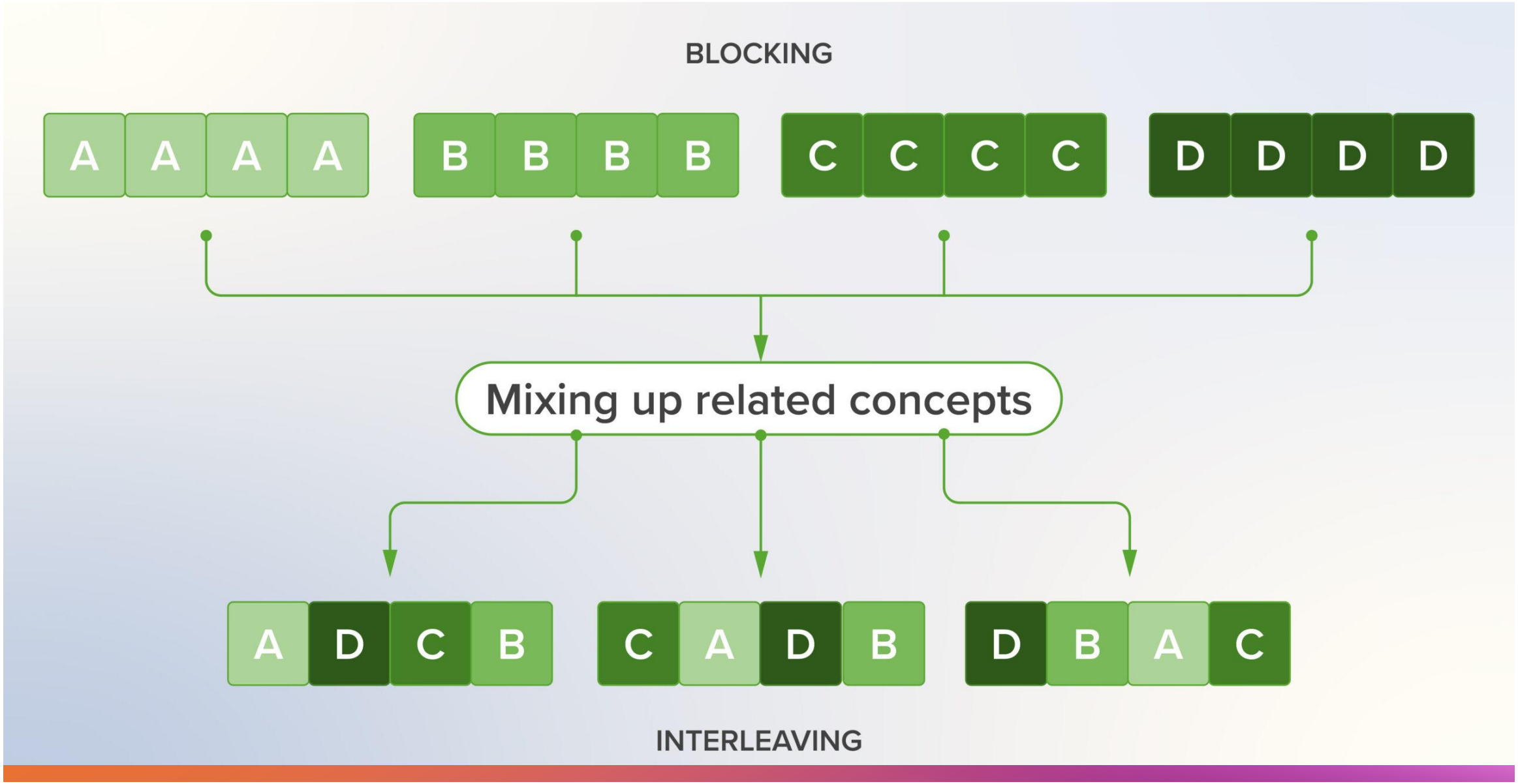
Pause

What strategies do you currently use to encourage retrieval practice?

What else could you try?

Interleaving

- This approach involves mixing up the order of tasks rather than repeating the same kind of task over, and over again.
- Mixing up the order of learning creates spaces and distractions between two repetitions of the same material, which forces students to re-engage with the material and invest effort in reconstructing the information.
- For example, rather than having students complete a set of addition problems followed by a set of subtraction problems and so on, it is more effective to interleave different kinds of arithmetic problems.
- This approach strengthens learning because it requires students to consciously select the most appropriate strategy for solving the problem rather than automatically using the same strategy they used for the previous problem in the group.


BLOCKING
A A A A
B B B B
C C C C
D D D D
Mixing up related concepts
A D C B
C A D B
D B A C
INTERLEAVING

How does this influence pedagogy at MHS?

- The Science of Learning underpins much of the research that we use to inform teaching and learning PLD. For example:
  - culturally responsive pedagogy (Russell Bishop and Mere Berryman)
  - formative assessment (Dylan Wiliam)
  - differentiation, universal design for learning (UDL) and high impact teaching strategies (HIT)
  - engagement strategies (Doug Lemov, Mark Dowley)
- It influenced the introduction and development of Knowledge Books and 100% sheets.

Week 2-4 EPiC

2

Week 2 – Differentiation and UDL. Please use the sign up form to select the beginner or stretch workshop.

3

Week 3 – Engagement and behaviour management. Building on the session last term. Sign-ups for beginner and stretch will be made available next week.

4

Week 4 – Formative Assessment. Beginner and stretch workshops will be available.