Richer Retrieval: Developing strategies for retrieval practice to consolidate and elaborate knowledge in primary science

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Context: This poster presents the early stages in the design of a programme to support primary (elementary) teachers to use retrieval strategies to extend and deepen pupils' understanding and belief in their own ability to gain and use science knowledge. It addresses the narrow application of retrieval practice currently seen in many English primary schools, usually in the form of low-stakes tests (Bates and Shea, 2024 Perry et al 2021) that support automaticity but have limited potential for building more complex schemas. It assumes that useful schema-building involves 'processes of organisation, comparison, or elaboration' (Perry et al 2021: 135).

Aim: The programme provides teachers with science topic-specific strategies and teaching and learning materials to build complex schemas of science knowledge by drawing together research from cognitive psychology (e.g. Blunt and Karpicke, 2014), neuroscience (e.g. Shimamura, 2018) and education research into dialogic talk (Alexander, 2008, Mortimer& Scott (2003).

Design Based Research: Professional experience was valued in the design of the programme and materials. It explores in primary school practice Shimamura's claim that: 'When we use relational memory techniques, such as forming verbal/visual mediators, applying the 3 C's [compare, contrast, categorise], forming metaphors/analogies, and constructing schematic organizations (outlines, concept maps), we are facilitating memory consolidation and long-term retention through elaboration and reactivation' (Shimamura 2018: 27). We worked with 11 teachers across 6 schools gathering data on their responses to the programme and what they noticed about pupil responses to the activities used.

Rich Retrieval Strategy Design:

Slide for pupils with teacher guidance
Takes 5-10 minutes of a science lesson
Uses one Rich Retrieval strategy: Compare, Contrast, Categorise, Connect, Create, or Question (5Cs & a Q)
Provokes retrieval of specific curriculum knowledge
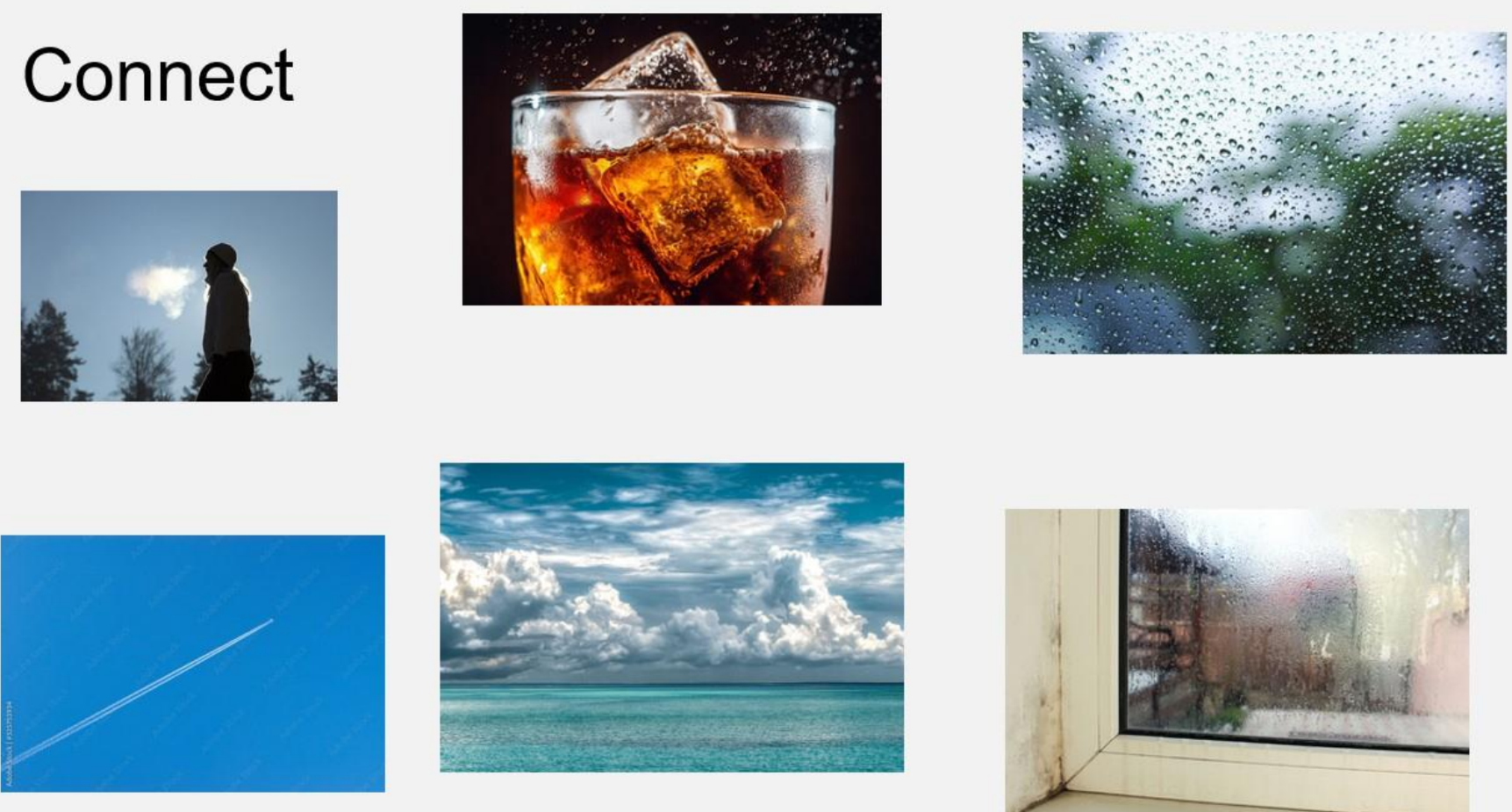Provokes dialogic talk
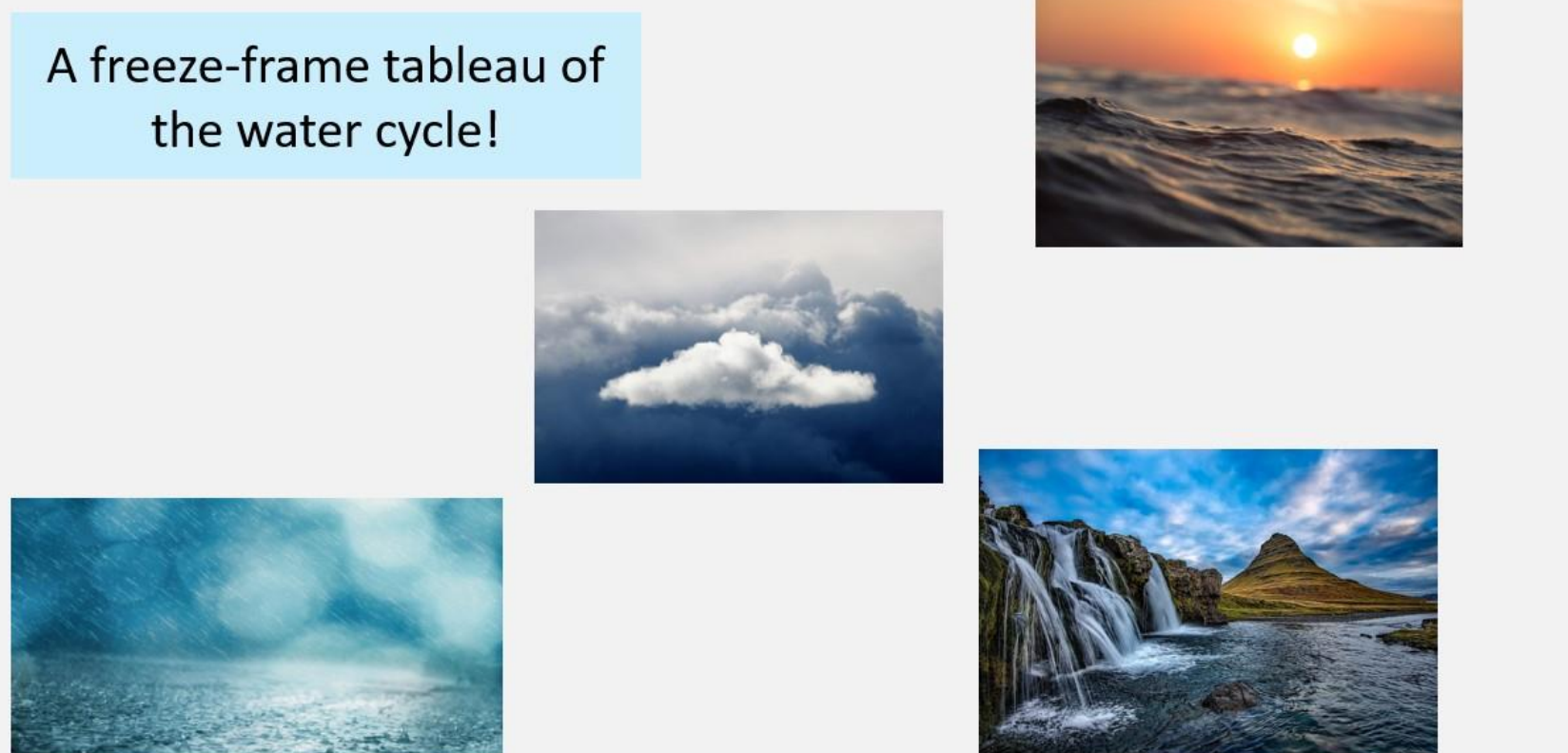Progress from consolidation to elaboration
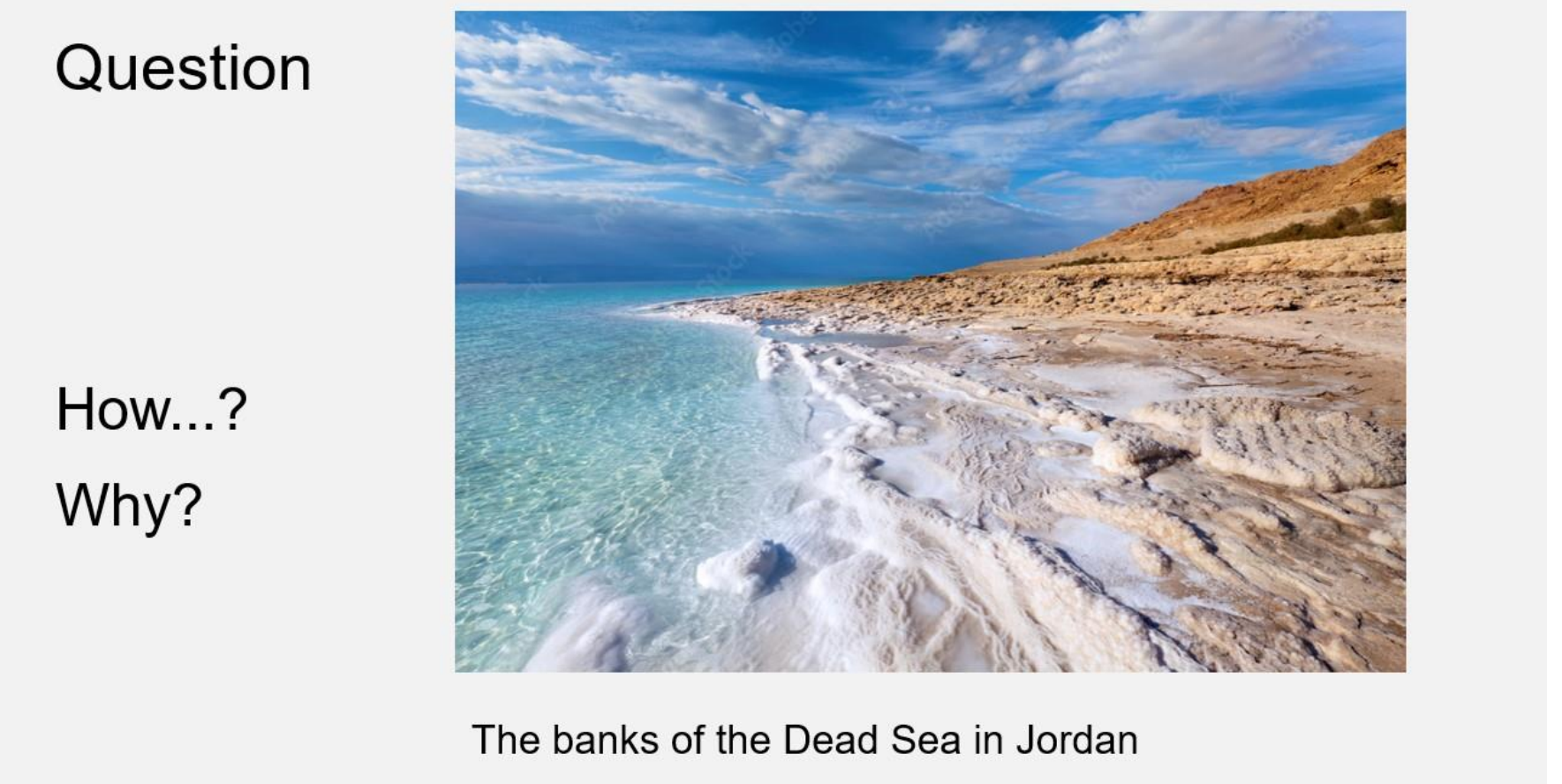
Compare and contrast

Categorise

solid   liquid

Connect

Create

A freeze-frame tableau of the water cycle!

Question

How...?
Why?
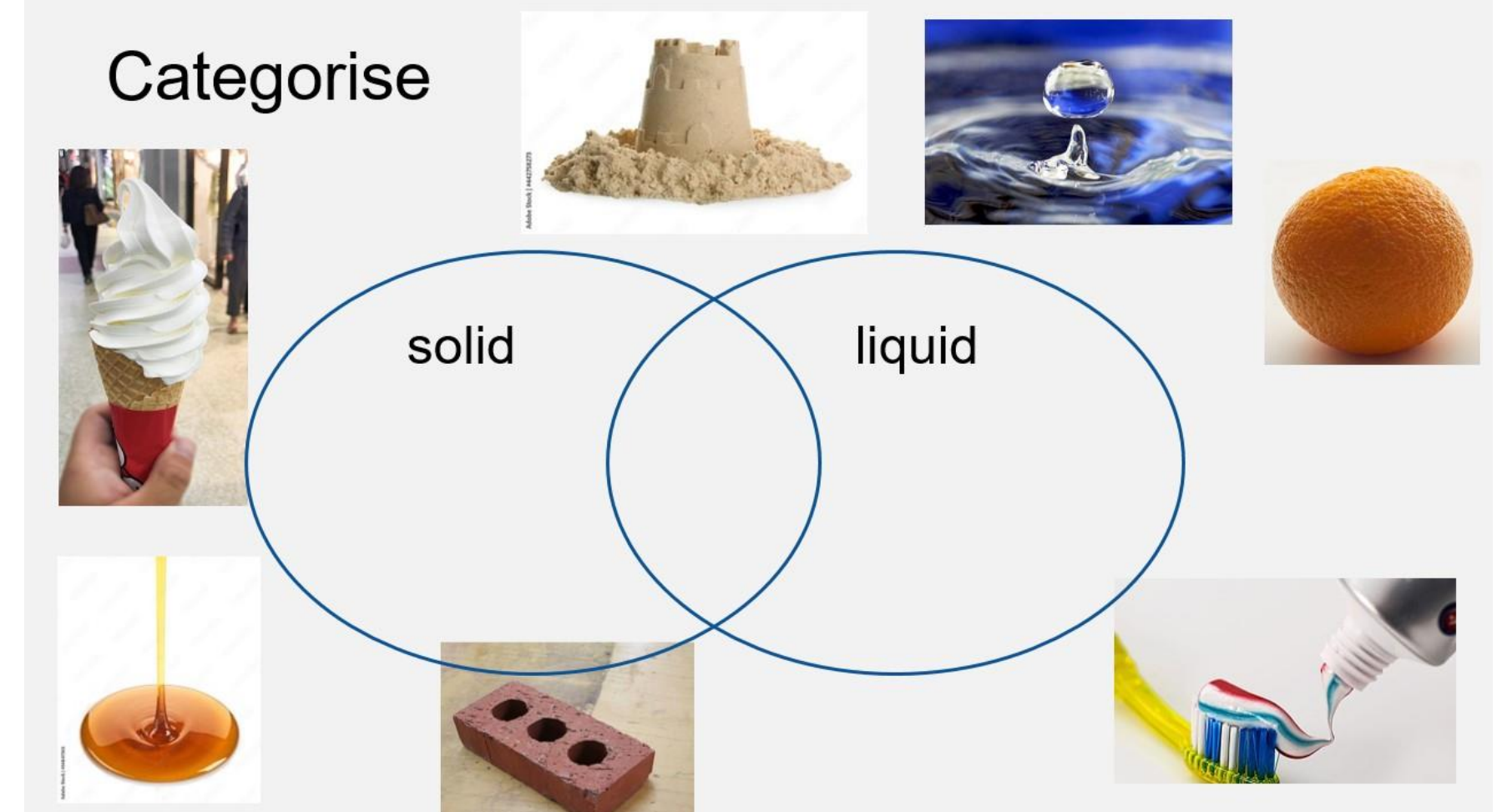
The banks of the Dead Sea in Jordan

Conjecture map for Rich Retrieval (June 2024)

High level conjecture	Embodied design features	Mediating processes	Outcomes
	Tools and materials, task structures, participant structures, discursive practices	Observable interactions, participant artifacts	Learning, Interest/Motivation, etc.

High level conjecture

Cued pupil talk that involves both retrieval of prior learning and elaboration will support the development of rich concepts and schemas in KS2 science.

Embodied design features:
- Meeting with school leader to explain the project.
- Bank of expert-designed Rich Retrieval strategies with teacher guidance that focus on consolidating and elaborating key knowledge.
- 2 days of in-person professional development for teachers introducing and modelling rich retrieval strategies, their purpose and how dialogic talk supports their implementation.
- Pairs of teachers in school plan for and reflect on use of rich retrieval strategies.
- 2 twilight webinars for implementation support.

Mediating processes:
- In weekly paired planning time, teachers select and adapt appropriate rich retrieval strategies to build into existing planning.
- Teachers use one rich retrieval strategy (out of 5Cs and a Q) in 5-10 mins in every science lesson (approx weekly).
- When using rich retrieval teachers use dialogic talk: listening, questioning and responding to pupil ideas to connect and elaborate them.
- Teachers select appropriate Rich Retrieval strategies, judging when to focus on consolidation and when on elaboration.

Outcomes:
- Pupils are engaged.
- Pupils quickly recall and use key vocabulary for the topic.
- Pupils make connections with relevant personal knowledge and experiences and beyond the science curriculum.
- Pupils make connections between science concepts.

References
Photo credits – BSU Adobe Creative Stock
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Bates, G. and Shea, J. (2024), Retrieval Practice "in the Wild": Teachers' Reported Use of Retrieval Practice in the Classroom. Mind, Brain, and Education. https://doi.org/10.1111/mbe.12420
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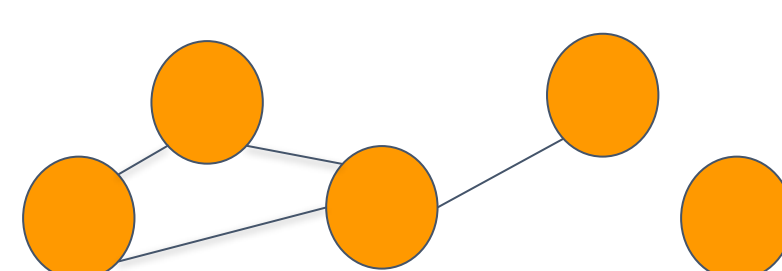
Next steps:
- Trial with more classes
- Explore the talk provoked
- Explore individual/collective retrieval
- Consider relationship with teacher science knowledge
We are keen to collaborate with neuroscientists and other educators. **Do get in touch!**