Australian Education Research Organisation

How More and Better Evidence Has, Does and Will Improve Australian Education

Dr Zid Mancenido

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~~"the best way to learn is to teach"~~

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Do students learn what they teach when generating teaching materials for others? A meta-analysis through the lens of learning by teaching

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ABSTRACT

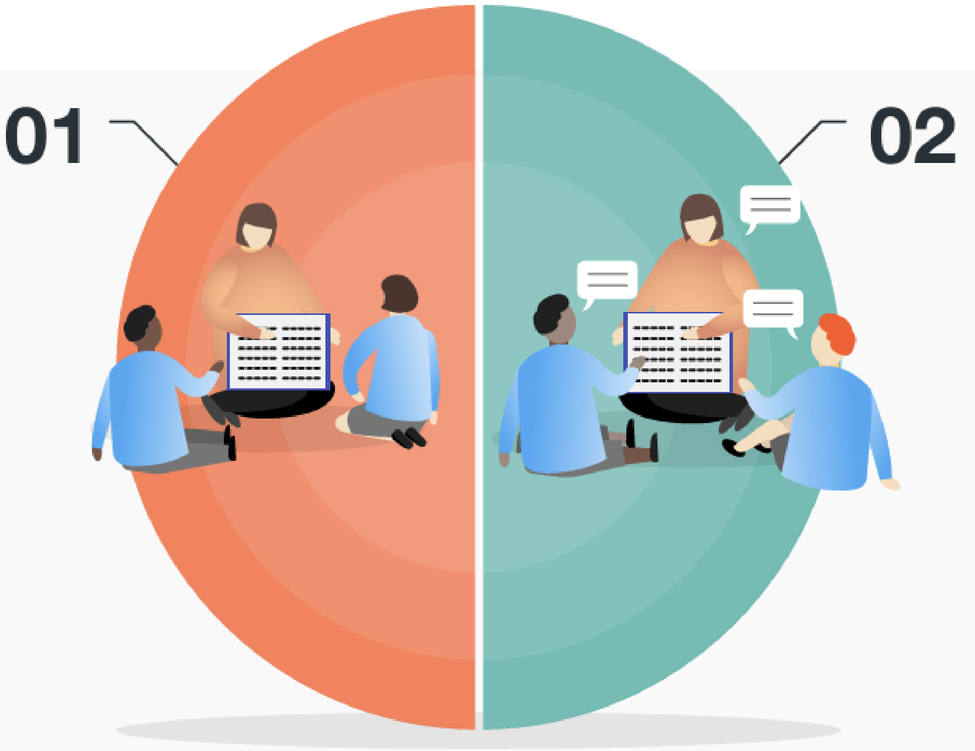
Students can generate teaching materials for others. However, solid evidence of the learning effect for the student creating the material is needed. This meta-analysis aims to explore current evidence of the learning-by-teaching potential effect on students' learning of the content they teach. A total of 23 articles were included in the meta-analysis, providing 62 comparisons between an intervention in which students were required to create a teaching material and an alternative condition. Possible moderators were examined as well (i.e., product, educational level, content area, and access to source material). Results show statistically significant differences in favour of creating teaching materials when compared to business-as-usual or alternative interventions, with an overall effect of 0.17. However, the type of product and the access to source material significantly moderate the findings. Audio-visual and visual materials considerably outperform textual materials. Having no access to the source material is better than having full access to it. No publication bias was detected. However, the type of control group moderates the findings: creating teaching materials shows a significant effect when compared to nonbeneficial interventions rather than to other expected beneficial interventions. Nonbeneficial interventions refer to business-as-usual or alternative interventions that are not expected to influence the outcome much, while beneficial interventions are those that are known or expected to have a positive effect. The findings are discussed based on the different views on the underlying learning-by-teaching mechanisms. Limitations as well as implications for practice, policy, and future research are underlined.

GO! Approach 01

reading aloud to the class without pausing for questions or discussion.

STOP! Approach 02

reading aloud and stopping at different points in the text to ask questions.



Roy et al. (2023) *Teacher Choices: The Story Time Trial, Evaluation Report*. Education Endowment Foundation

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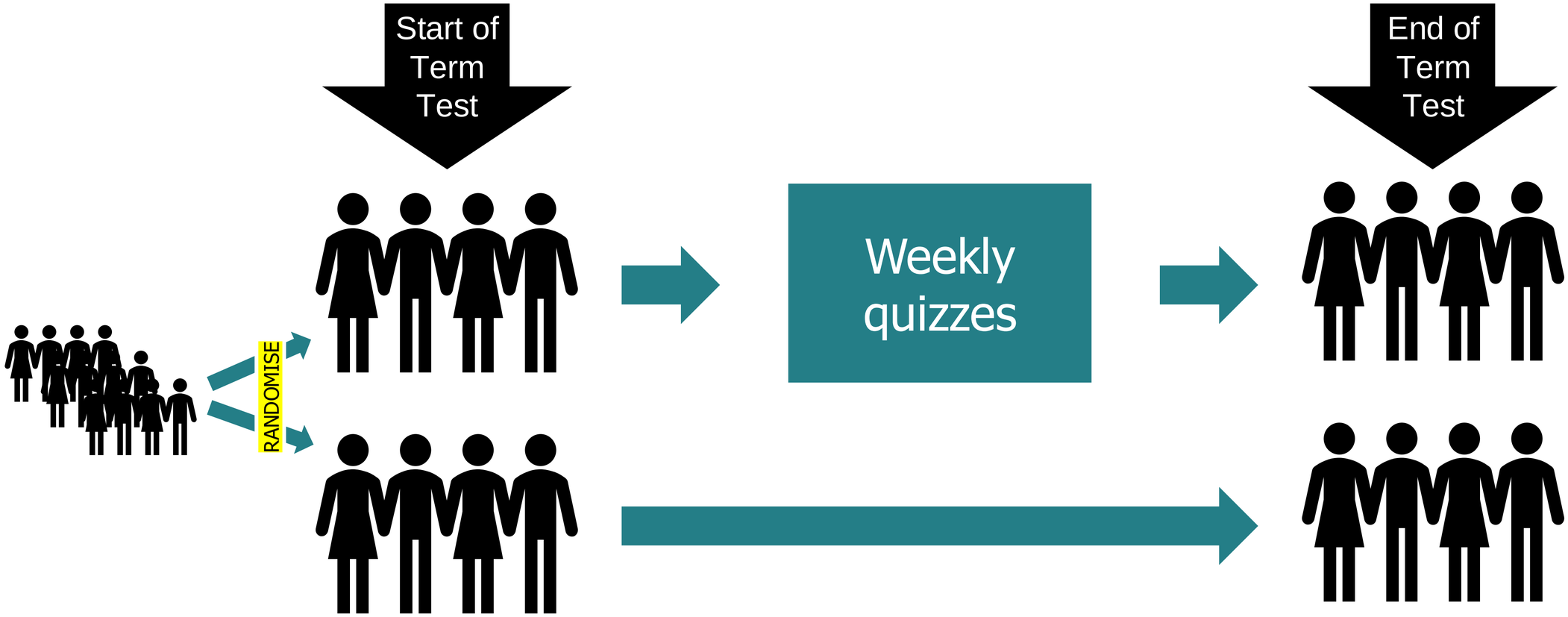
We conduct research and share knowledge to promote better educational outcomes for Australian children and young people.

Say you want to know whether quizzes improve student learning…



Level 1
Low confidence

Research hypothesises why the approach should have positive effects.

Level 2
Medium confidence

Research *associates* the approach with positive effects.

Level 3
High confidence

Research shows the approach *causes* positive effects.

Level 4
Very high confidence

Research conducted in my context or other contexts similar to mine shows the approach *causes* positive effects.

AERO's Standards of Evidence

AMERICAN PSYCHOLOGICAL ASSOCIATION

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Testing (Quizzing) Boosts Classroom Learning: A Systematic and Meta-Analytic Review

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Over the last century hundreds of studies have demonstrated that testing is an effective intervention to enhance long-term retention of studied knowledge and facilitate mastery of new information, compared with restudying and many other learning strategies (e.g., concept mapping), a phenomenon termed *the testing effect*. How robust is this effect in applied settings beyond the laboratory? The current review integrated 48,478 students' data, extracted from 222 independent studies, to investigate the magnitude, boundary conditions, and psychological underpinnings of test-enhanced learning in the classroom. The results show that overall testing (quizzing) raises student academic achievement to a medium extent (g = 0.499). The magnitude of the effect is modulated by a variety of factors, including learning strategy in the control condition, test format consistency, material matching, provision of corrective feedback, number of test repetitions, test administration location and timepoint, treatment duration, and experimental design. The documented findings support 3 theories to account for the classroom testing effect: additional exposure, transfer-appropriate processing, and motivation. In addition to their implications for theory development, these results have practical significance for enhancing teaching practice and guiding education policy and highlight important directions for future research.

Public Significance Statement
Testing (class quizzing) yields a variety of learning benefits, even though learners, instructors, and policymakers tend to lack full metacognitive insight into the virtues of testing. The current meta-analysis finds a reliable advantage of testing over other strategies in facilitating learning of factual knowledge, concept comprehension, and knowledge application in the classroom. Overall, testing is not only an assessment *of* learning but also an assessment *for* learning.

Keywords: academic achievement, meta-analysis, motivation, testing effect, transfer-appropriate processing

- Significantly improves student learning…
- …regardless of format (e.g., MCQ, fill-in-the-blank, cued recall, free recall).
- The more quizzes, the larger the learning gains.
- No difference in effects based on stage of learning, gender, subject, or medium (e.g., paper-pen or online).
- Positive effects for factual and conceptual knowledge, and problem-solving.
- Positive effects also on content that was not quizzed.

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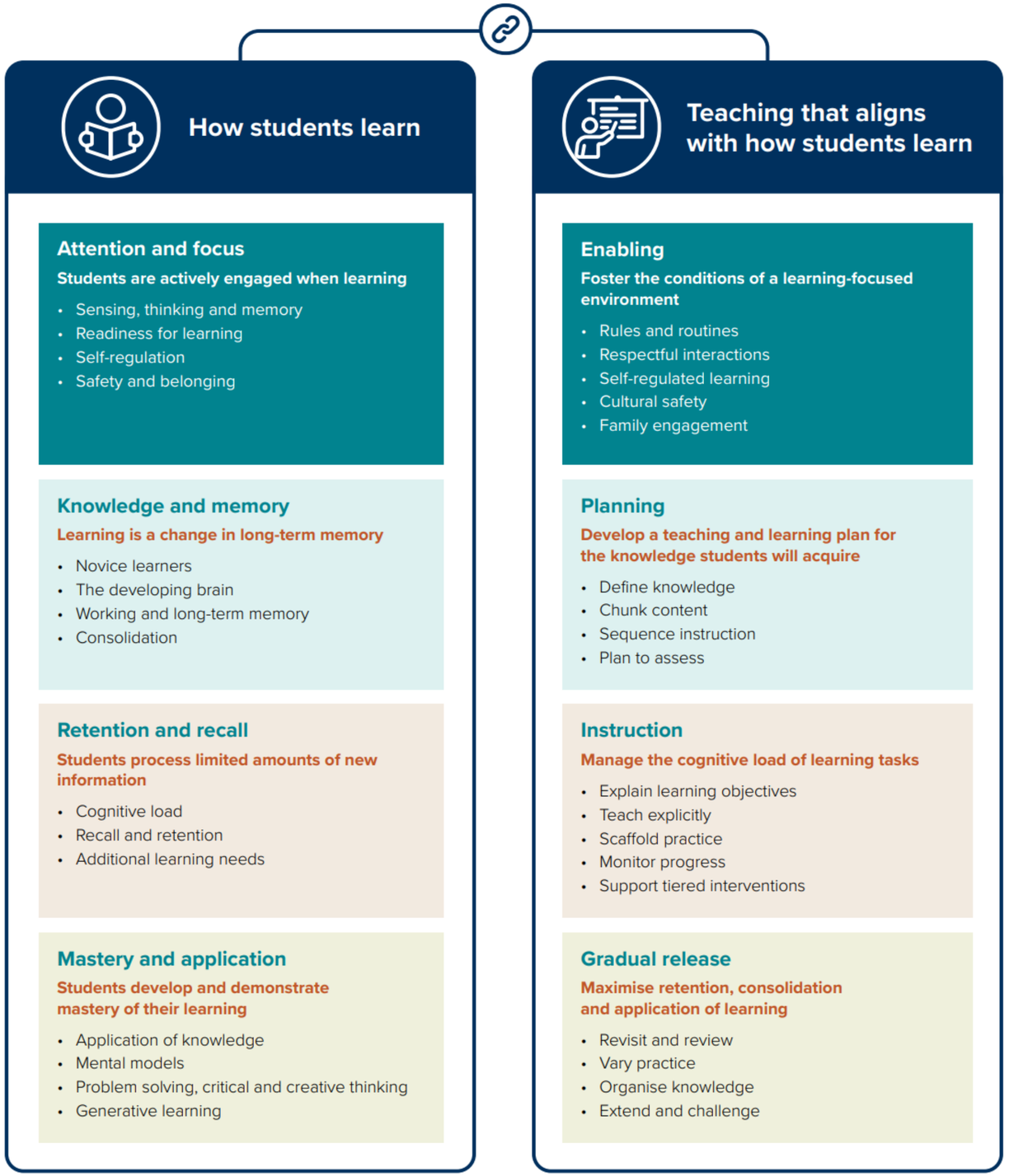
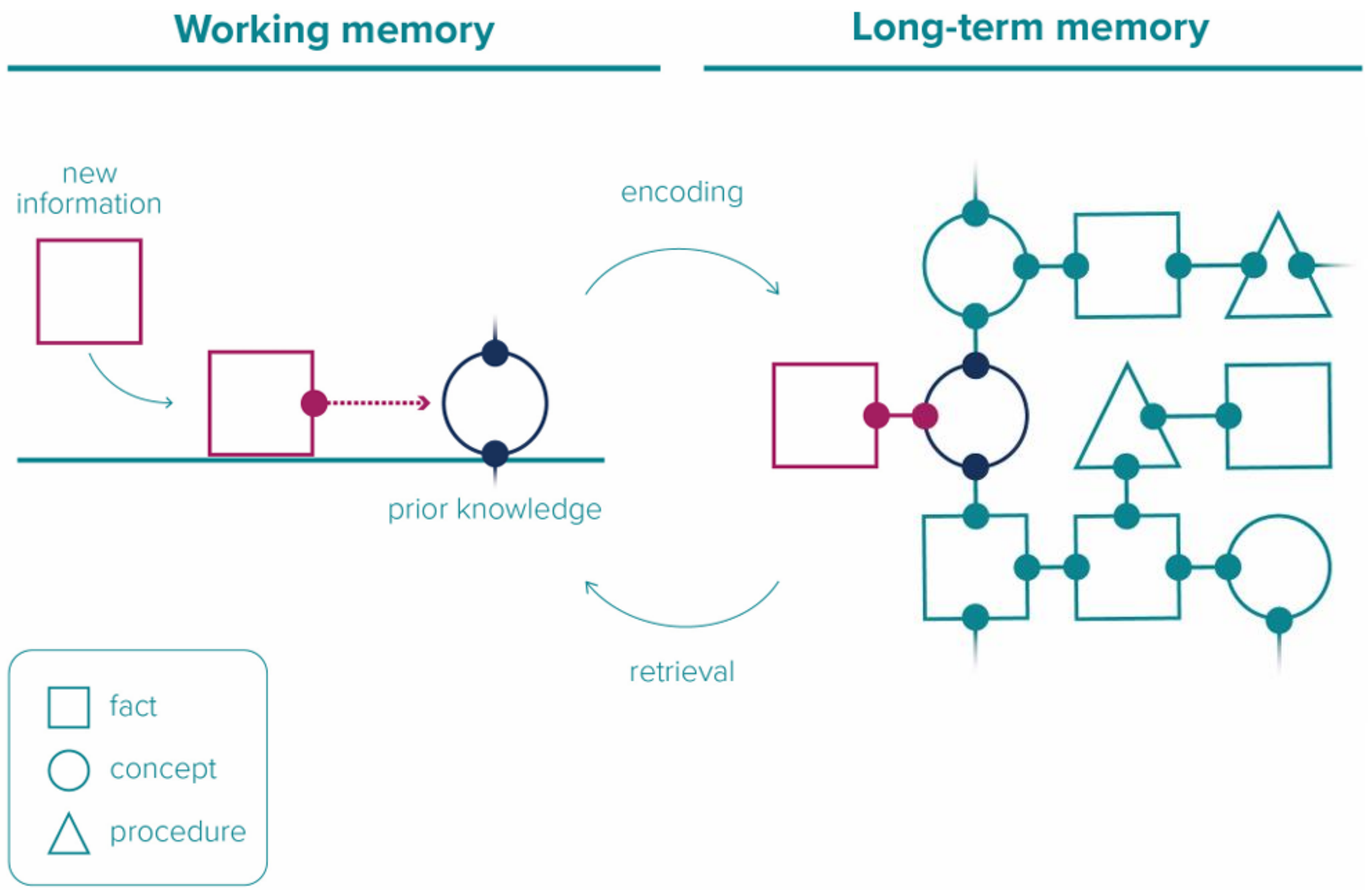
A model of learning and teaching: aligning teaching with how students learn

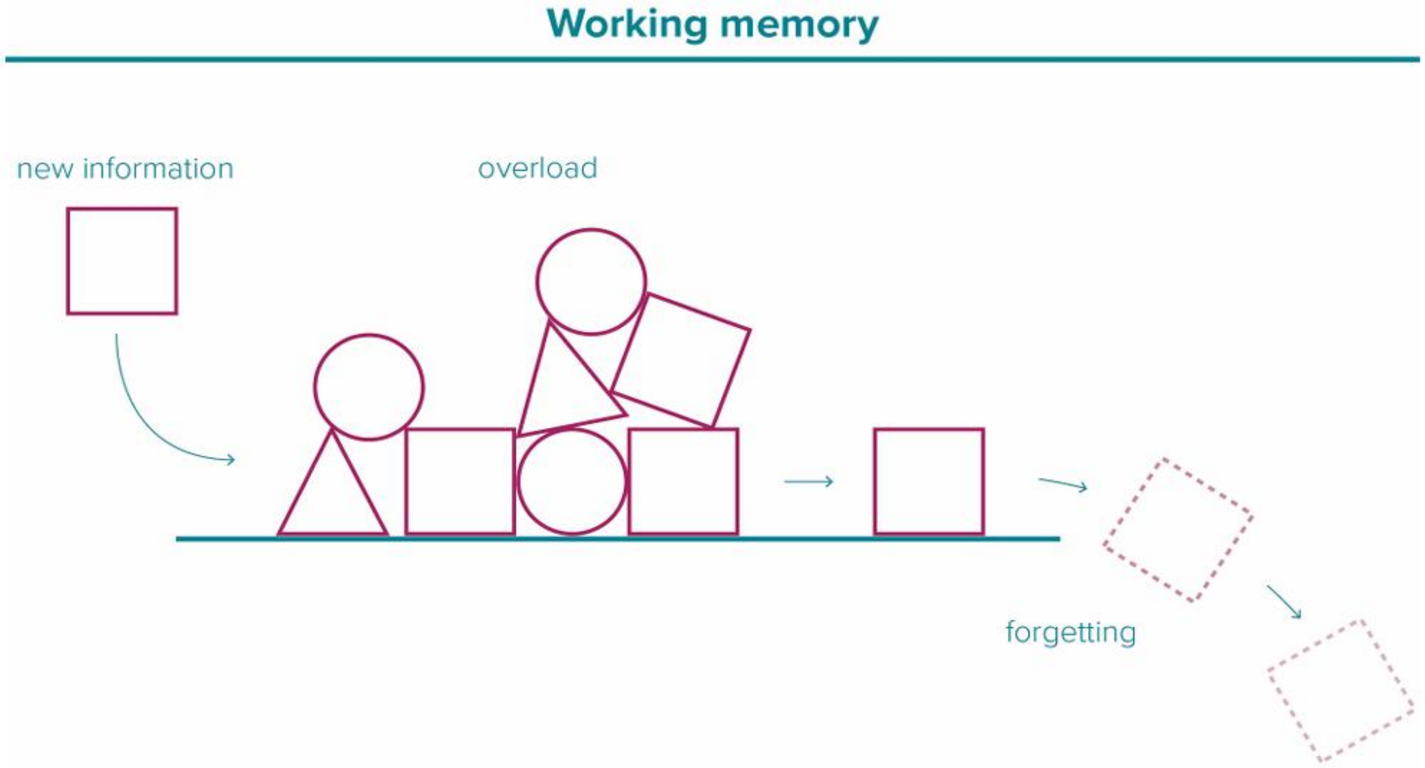


Scan to read AERO's model and overview of *How Students Learn*

Learning involves knowledge being encoded into long-term memory…



… however, overloading working memory can inhibit learning.



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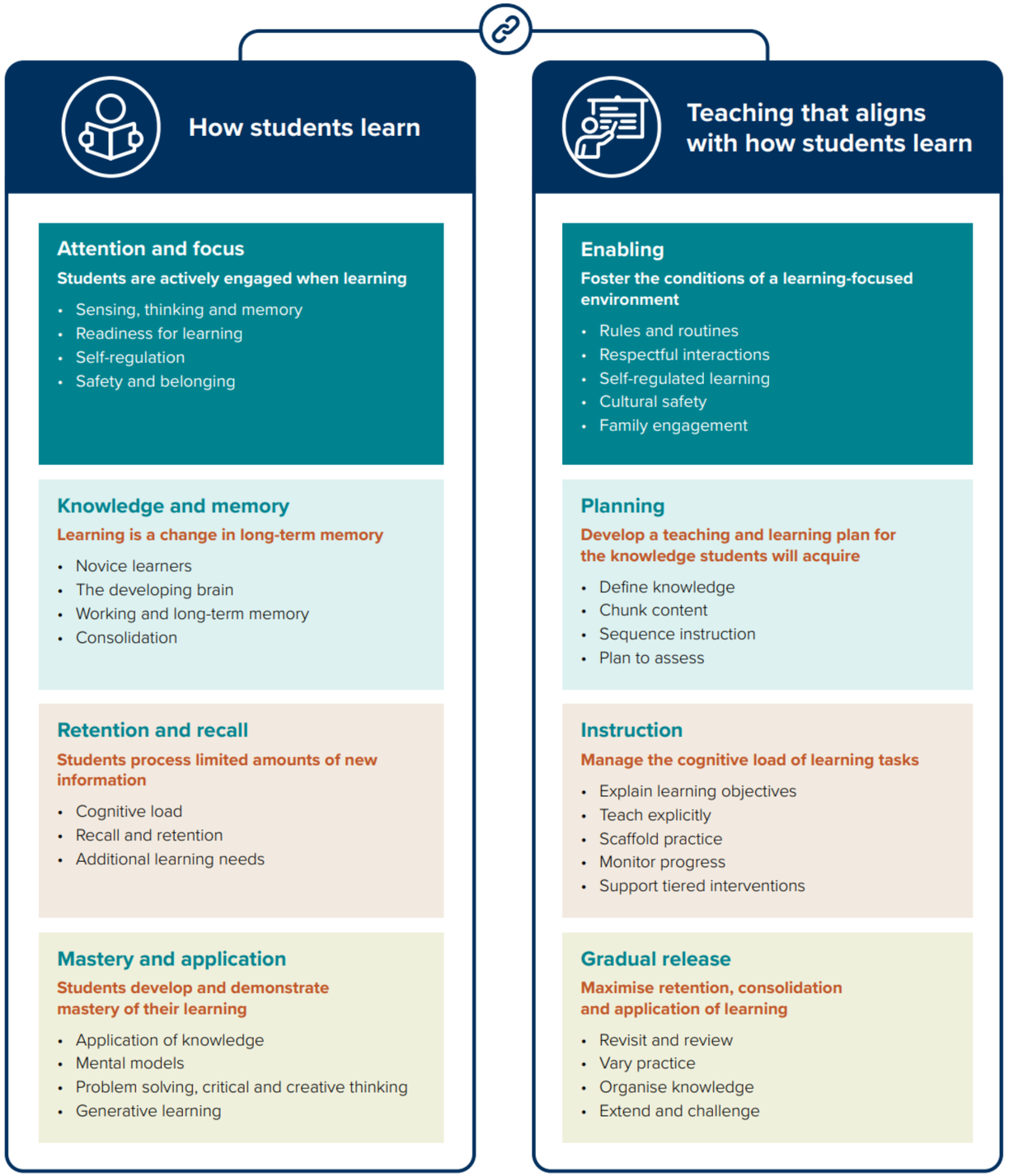

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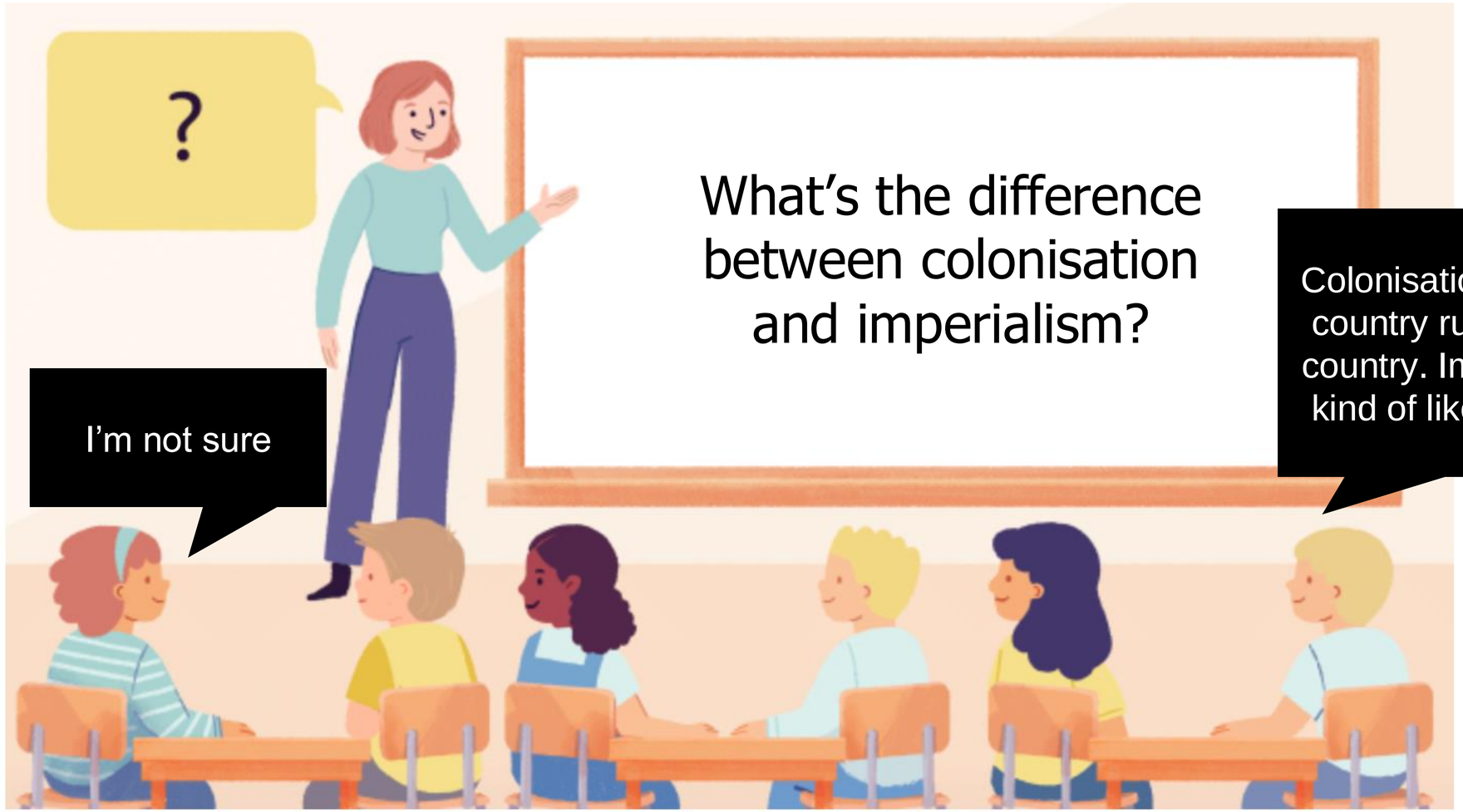
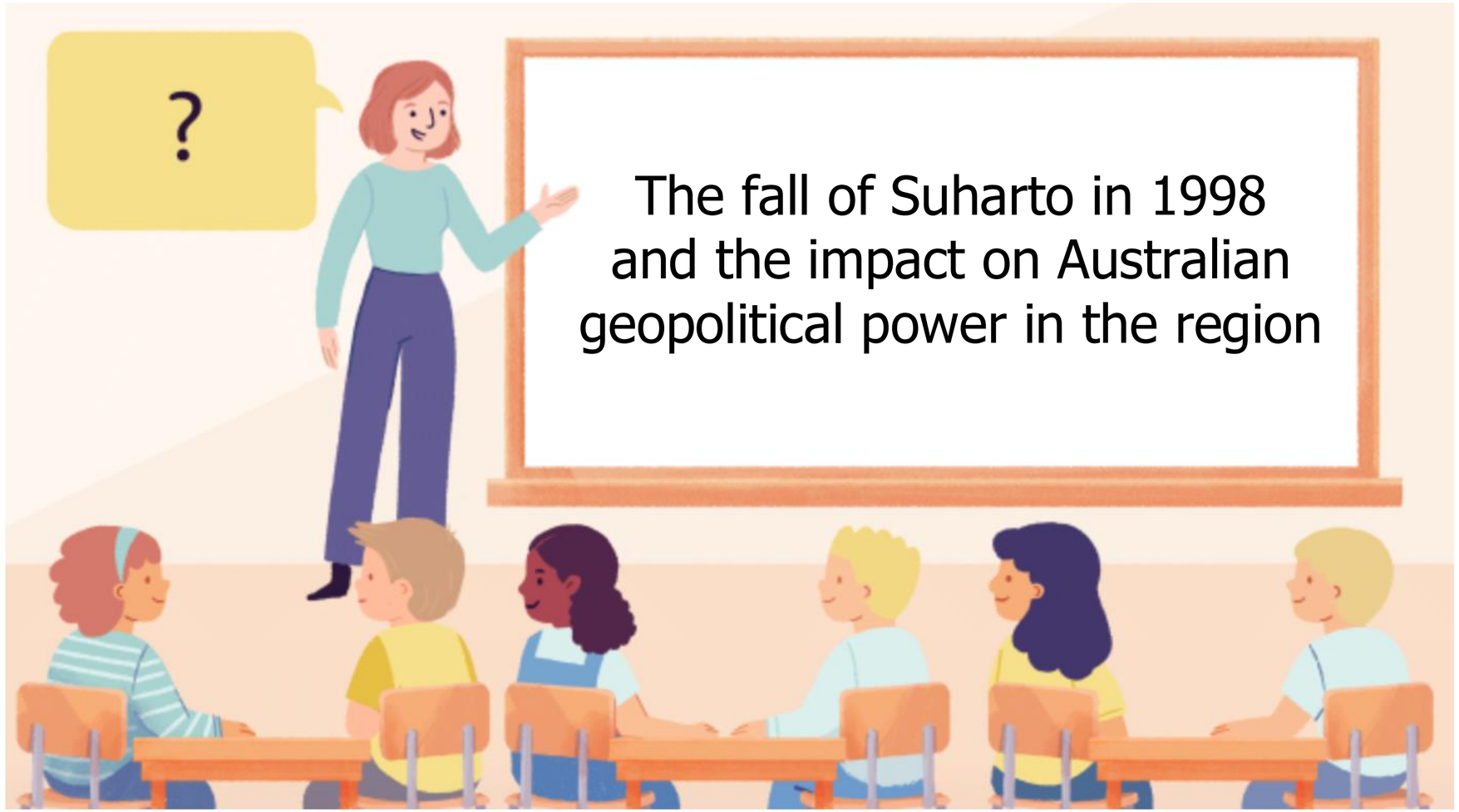


"Let's take a moment to think again, and then turn to the person next to you. Remind each other – what is the difference between colonisation and imperialism? Refer to your notes from yesterday if you need to. Go."



“Use the internet to find five facts about the history and politics of Indonesia, and five facts about the fall of their leader, Suharto. Take 30 minutes, list out your ten facts, and then we’ll come together as a class and share what we’ve learned.”

“I know a student who didn’t learn best this way…”

But what are the most effective teaching practices given how human brains learn?

And what are the most efficient ways of learning given students have limited time?

For more evidence-based research and practical resources

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