

Science of Learning Principles

Cognitive Load Theory

1. The worked example effect
2. Completion tasks
3. The split attention effect
4. The modality effect.
5. The redundancy effect
6. The Imagination Effect
7. The isolated interacting Elements effect
8. The expertise reversal effect
9. The guidance fading effect
10. The goal-free effect

<https://blog.innerdrive.co.uk/10-principles-cognitive-load-theory>

Rosenshine

- 1) Begin the lesson with a review of previous learning.
- 2) Present new material in small steps.
- 3) Ask a large number of questions of all students
- 4) Provide models and worked examples.
- 5) Practise using the new material.
- 6) Check for understanding frequently and correct errors.
- 7) Obtain a high success rate.
- 8) Provide scaffolds for difficult tasks.
- 9) Independent practice.
- 10) Monthly and weekly reviews

<https://blog.innerdrive.co.uk/guide-to-rosenshine-principles-of-instruction>

PEN Principles & SLRC

- 1) Written Text & Spoken Word
Do Not Mix
- 2) Visual Images & Spoken Word
Mix Well
- 3) Spatial Predictability Guides
Attention
- 4) Spacing Out Practice Enhances
Memory
- 5) Leverage Context According to
Outcome
- 6) Multitasking Impairs Learning
- t) Mix Up Practice Tasks
- 8) Embrace Error to Drive
Learning
- 9) Active Recall Trumps Passive
Review
- 10) First Impressions Colour
Future Judgements
- 11) Find the Story behind the
Facts
- 12) Pre-activate Strategies to
Guide Learning

<https://www.slrc.org.au/resources/pen-principles/>

POWERFUL TEACHING

- 1) Empower teaching with
retrieval practice
- 2) Energize learning with spaced
practice
- 3) Energize learning with
interleaved practice
- 4) Engage students with
feedback-driven metacognition

<https://www.powerfulteaching.org/>

CESE NSW: Strategies

Strategy 1: Tailor lessons according to students existing knowledge and skill. (Element Interactivity effect)

Strategy 2: Use lots of work examples to teach students new content or skills (Worked Example effect)

Strategy 3: Gradually increase independent problem solving as students become more proficient. (Expertise Reversal effect)

Strategy 4: Cut out inessential information. (Redundancy effect)

Strategy 5: Present all the essential information together. (Split-attention effect)

Strategy 6: Simplify a complex information by presenting it both orally and visually (Modality effect)

Strategy 7: Encourage students to imagine concepts and procedures that they have learned (Imagination effect)

<https://education.nsw.gov.au/about-us/educational-data/cese/publications/practical-guides-for-educators/cognitive-load-theory-in-practice>

THE LEARNING SCIENTISTS

- 1) Space out study over time
(Spaced practice)
- 2) Practice bringing information to mind
(Retrieval practice)
- 3) Explain and describe ideas using
personal details (Elaboration)
- 4) Switch between different ideas
and topics when studying
(Interleaving)
- 5) Use specific examples to
understand abstract ideas
(Concrete examples)
- 6) Combine words and visuals and
improve comprehension (Dual
Coding)

<https://www.learningscientists.org/>

REFERENCES:

Agarwal, P and Bain, P. (2021). *Powerful Teaching*. <https://www.powerfulteaching.org/>

CESE . (2017) *Cognitive Load Theory in Practice*. NSW Government.
<https://education.nsw.gov.au/about-us/educational-data/cese/publications/practical-guides-for-educators/cognitive-load-theory-in-practice>

CESE . (2022) *Cognitive Load Theory: Research that teachers really need to understand*. NSW Government.
<https://education.nsw.gov.au/about-us/educational-data/cese/publications/practical-guides-for-educators/cognitive-load-theory-in-practice>

Rosenshine, B. (2012). 'Principles of Instruction' in *American Educator*.
<https://www.aft.org/sites/default/files/periodicals/Rosenshine.pdf>

Science of Learning Resource Centre. (2022). *PEN Principles*. <https://www.slrc.org.au/resources/pen-principles/>

The Learning Scientists. (accessed March 2022)
<https://www.learningscientists.org/>

The Ten Principles of Cognitive Load Theory
<https://blog.innerdrive.co.uk/10-principles-cognitive-load-theory>

Extension Reading

Ambrose, S. and colleagues. (2010). *How Learning Works: Seven research-based Principles for Smart Teaching*. Jossey-Bass

Deans for Impact. (2025). *The Science of Learning*. www.deansforimpact.org