Te Tāhuhu o te Mātauranga
Ministry of Education

He mea tārai e mātou te mātauranga
kia rangatira ai, kia mana taurite ai ōna huanga.

We shape an education system that delivers
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TE MANU KA RERE

Accelerating literacy and numeracy using the science of learning practices across the curriculum

Webinar 5

Ben Laybourn & Deirdre McCracken

Karakia timatanga

Tau mai te mauri o te wānanga,
Ki runga ki ēnei pūkenga,
Kia mātāmua ai, ko te ako kounga, a te tamaiti,
Ko ia ki mua, ko ia ki muri o ēnei kōrero,
Kia puta ai ia, ki te whaiao, ki te ao mārama!
Hui e, tāiki e!

Bestow the life force of learning,
Upon these repositories,
So that aspiration of quality learning for our children is paramount,
And remains at the forefront of all of our works,
So that they may flourish and thrive,
For all eternity!

Tikanga mō tēnei hui ā-ipurangi

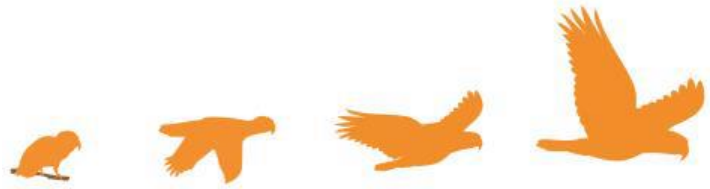
Webinar protocols

- Please stay on mute
- Please introduce yourself with your name and school in the ‘chat’
- Feel free to put questions in the chat as we go
- There is an additional Q&A at the end
- This session is being recorded and will be available online

Ma te huruhuru, te manu ka rere

Adorned with feathers, the bird is able to fly

Ngā kaupapa o te wā



Kaupapa matua

The purpose of the ‘Science of Learning’ webinar is to support leaders and kaiako to:

1. Develop a knowledge of **Science of Learning strategies**
2. Develop a knowledge of **targeted and accelerative teaching practices**
3. **Accelerate literacy and numeracy learning** across the curriculum

In turn... those present in this webinar can affirm or introduce **strategies that support the mahi** their senior leadership teams, kaiako and ākonga are doing **to develop whole school literacy and numeracy, te reo matatini and pāngarau** (TRMP) **practices and capabilities** that will enable ākonga to successfully achieve the NCEA co-requisites.

The Science of Learning

Definition

The science of learning is the study of how people learn. This science brings together robust evidence and insights from multiple fields of study to describe how people learn biologically, developmentally, cognitively, culturally, emotionally, and socially.

Te Poutāhū, 2024

The Science of Learning Explained (education.govt.nz)

Building understanding

Exploring the Science of Learning can help us:

- build a shared understanding of how people learn - biologically, developmentally, cognitively, culturally, emotionally, and socially.
- consider how a shared understanding might strengthen teaching and learning.
- establish a common language for teaching and learning to support a shared understanding.

Image from: Vecteezy

The Science of Learning

Key considerations

1. Explicit teaching – Formative assessment teaching strategies
2. Cognitive load theory - From short-term to long-term memory
3. Interleaving, retrieval and spaced practice
4. Metacognition and feedback
5. Emotions and a calm environment

Unpacking the Science of Learning

Questions to consider throughout...

1. What is your current shared understanding of the Science of Learning?
2. How are you currently using the Science of Learning to strengthen learning capability in your school?
3. What key practices might you strengthen to accelerate learning in your context?
4. What aspects of the Science of Learning might you need to explore further?
5. How might you best plan for the implementation of the Science of Learning practices?

Using the Science of Learning

How we might approach this...

Science of Learning

key considerations

+

Practical Strategies

linked to the Science of Learning

+

Application

to literacy & numeracy learning across the curriculum

The link to accelerated learning?

Taken from a report prepared for the Ministry of Education in 2024

"The concept of accelerated learning in relation to children's oral language, reading, writing, and mathematics refers to advancing the learning of children [who need to build prior knowledge] related to content at their current year level. Accelerated learning is achieved through **specific teaching strategies**, learning conditions, or scaffolded supports that enable learners to acquire skills more rapidly than they would under 'usual teaching conditions'.... **[It] relies heavily on continuous monitoring of student progress against benchmarks and progress indicators, ensuring that the learning process remains aligned with year-level expectations**."

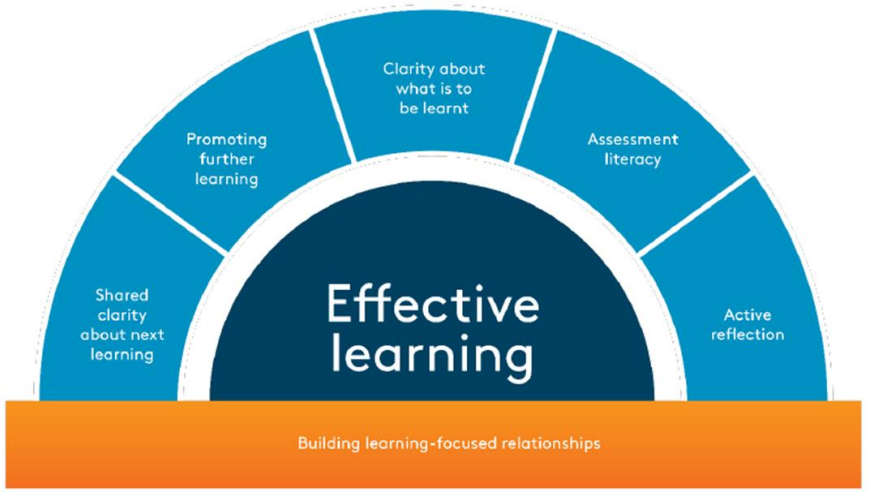
(Gillon et al., 2024, Accelerating Learning in Oral Language, Reading, Writing and Mathematics, p. 13)

1. Explicit teaching

Two useful models that include key considerations:

Assessment for Learning
Combined Teacher and Student Capabilities Matrix

Evaluation Associates | Te Huinga Kākākura Mātauranga



High Impact Teaching Strategies

Victoria Institute of Teaching, Australia

Setting goals	Structured lessons	Explicit teaching	Worked examples	Collaborative learning
Multiple exposures	Good questions	Effective feedback	Metacognitive strategies	Differentiated learning pathways

Adapted from:
0000highimpactteachstrat.pdf & Using-DETs-HITS-as-a-CRT.pdf

Explicit teaching

Clearly and directly show ākonga 'how to', by...

- Setting clear learning intentions and success criteria
- Modelling and scaffolding the learning
- Using clear, accessible, and culturally responsive language
- Actively monitoring ākonga understanding and respond in real time
- Providing supported and independent practice opportunities

Structure of an explicit lesson

Opening

Engagement

Preview

(learning intensions, success criteria & personal learning goals)

Review of last lesson

Body

Modeled and exemplified practice
(I do)

Supported practice
(we do)

Independent practice
(you do)

Closing

Self-reflection against success criteria & goals

Review of learning

Preview the next lesson

Assignment of 'to dos'

Throughout the lesson... involve students, monitor performance, provide feedback.

Practical examples applied to literacy and numeracy

Clear, modelled & checked learning

In a ***Year 12 English*** class studying film, the teacher clearly models how to write a paragraph that integrates evidence:

Learning intention: “To write a film analysis paragraph using PEEL structure.”

The teacher models this live, explaining each decision while writing: “Here, I’m linking my example to the director’s purpose…”

Checks for understanding are built in through questioning and peer discussion.

Multiple Exposures

In a ***Year 11 Numeracy*** unit on percentages and interest, students engage with the concept across several lessons and formats:

Monday: Direct instruction and textbook practice

Wednesday: Real-world application (calculating loan repayments)

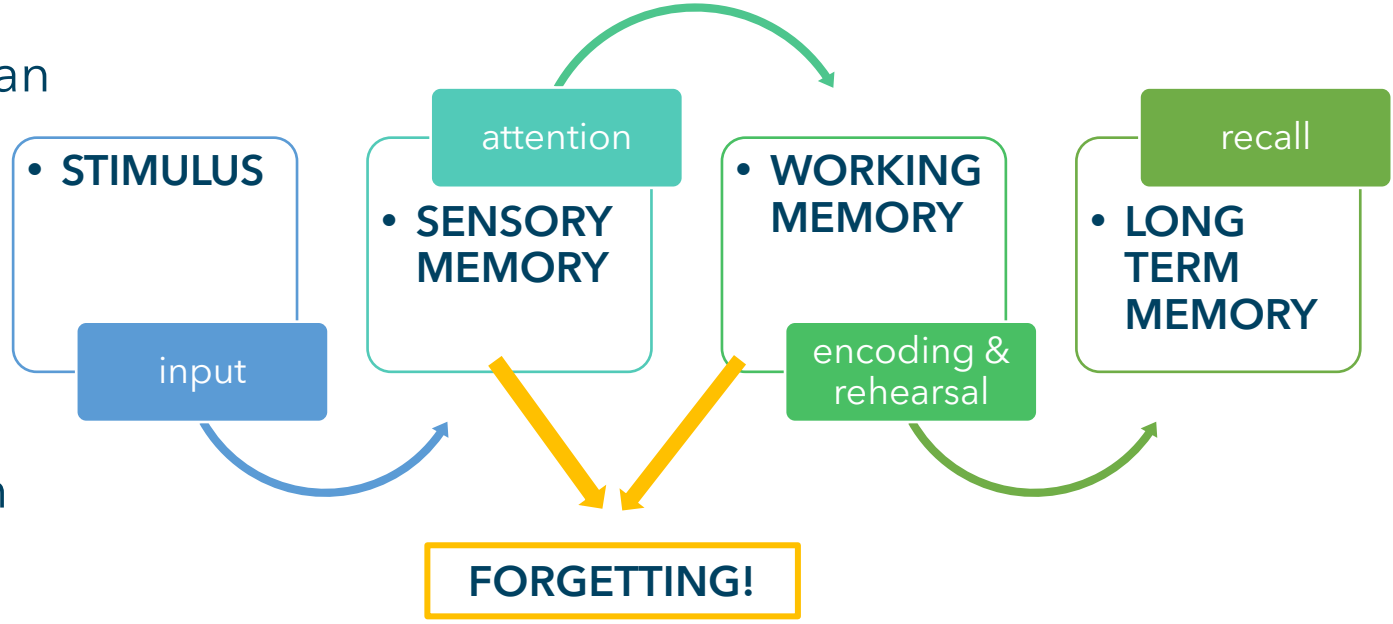
Friday: A Kahoot quiz and a group problem-solving task

Spaced, varied practice ensures the concept is revisited and reinforced over time.

2. Cognitive load theory from working memory to long-term memory

Cognitive Load Theory is an instructional design theory that deals with how the human brain processes and stores information. (Gerjets, Scheiter & Cierniak, 2009).

A person can only process so much information at once – too much information can lead to **cognitive overload**, which hinders how much of the information can be transferred from the working memory to the long-term memory.



Adapted from:
https://www.achpernsw.com.au/teaching-with-an-understanding-of-cognitive-architecture/

Cognitive load - Practical strategies

Summary Table:

Strategy	Cognitive Load Principle	Learning Memory Effect
Dual coding	Engages visual + verbal channels	Enhances encoding and recall
Worked examples with scaffolding	Reduces extraneous load	Supports schema formation and automation
Integrated materials	Minimises split attention effect	Increases cognitive efficiency
Spaced retrieval practice	Promotes retrieval strength over time	Builds durable long-term memory

Combine visuals with verbal explanations

Dual Coding in English and Social Studies (Literacy Support)

Curriculum Area: English, History, Geography

Practice: Combine visuals with verbal explanations to support comprehension and memory of abstract or dense content.

Description: In a Year 10 history lesson on colonisation, the teacher presents a timeline with key events and accompanying images, while verbally explaining each. Students then create their own annotated visuals to summarise a passage of text. In English, this is applied by using storyboards to map narrative structure or character development.

Why it works: Dual coding theory supports long-term memory by engaging visual and verbal processing pathways simultaneously. This reduces intrinsic load and enhances semantic connections to content.

Retrieval practice spaced out over time

Spaced Retrieval Practice in Health and PE (Embedding Numeracy and Literacy)

Curriculum Area: Health and Physical Education

Practice: Use retrieval practice spaced over time to reinforce vocabulary and key concepts.

Description: In a Year 11 health class studying nutrition, students regularly quiz each other (or use flashcards) on terms like *glycemic index*, *micronutrients*, or *energy balance*, spaced across several lessons. Teachers incorporate quick low-stakes retrieval checks at the start of each class to refresh key numeracy skills (e.g., reading nutrition labels, calculating energy needs).

Why it works: Retrieval practice, especially when spaced over time, is a proven way to shift learning from short-term to long-term memory. It strengthens memory traces and supports recall under pressure.

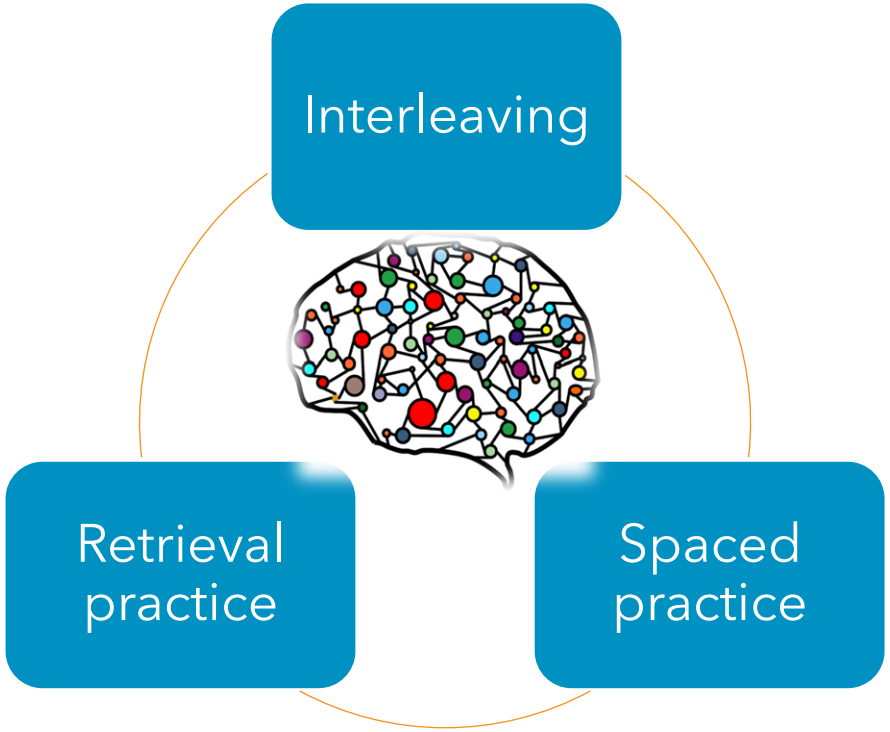
3. Interleaving, Retrieval and Spaced Practice

Interleaving practice is a learning strategy where you mix or interleave different topics or subjects while studying, rather than focusing on one topic at a time.

Retrieval practice and spaced practice are both learning strategies that enhance retention, but they focus on different aspects of memory.

Retrieval practice involves repeatedly trying to recall information from memory, which strengthens memory pathways.

Spaced practice on the other hand, involves distributing learning activities over time, rather than cramming, which allows the brain to consolidate memories more effectively.



https://www.needpix.com/photo/1637259/

Adapted from: https://www.mathematicshub.edu.au/plan-teach-and-assess/teaching/teaching-strategies/spaced-interleaved-and-retrieval-practice/

Practical strategies

Summary of practices across the curriculum:

Strategy	Classroom Application	Benefit
Spaced Practice	Revisiting core numeracy or key concepts weekly in Health and Social Sciences.	Strengthens long-term retention
Retrieval Practice	Brain dumps, low-stakes quizzes, and no-notes summarising tasks.	Strengthens recall and identifies gaps
Interleaving	Alternating related problem types in Maths, or content strands in PE or Science.	Encourages flexible thinking and transfer

Mix related concepts

Interleaving Practice

Curriculum Areas: Maths, Business Studies, PE
Strategy: Mix related concepts instead of **practicing** one in isolation (once ākonga have the knowledge)
How It Works: Encourages deeper learning by *comparing and contrasting* different types of problems.

Example: In a Year 10 Maths class, instead of doing 10 problems on just Pythagoras' Theorem, students alternate between:

- Pythagoras' Theorem
- Trigonometric ratios
- Finding the area of a triangle

This requires them to choose the correct method each time, strengthening both discrimination and conceptual understanding.

In PE theory, students rotate between content areas like body systems, nutrition, and training principles in one lesson series—reinforcing transfer across topics.

Integrate diagrams and instructions

Reducing Split Attention

Curriculum Areas: Digital Tech, Science, Design

Strategy: Integrate diagrams and instructions

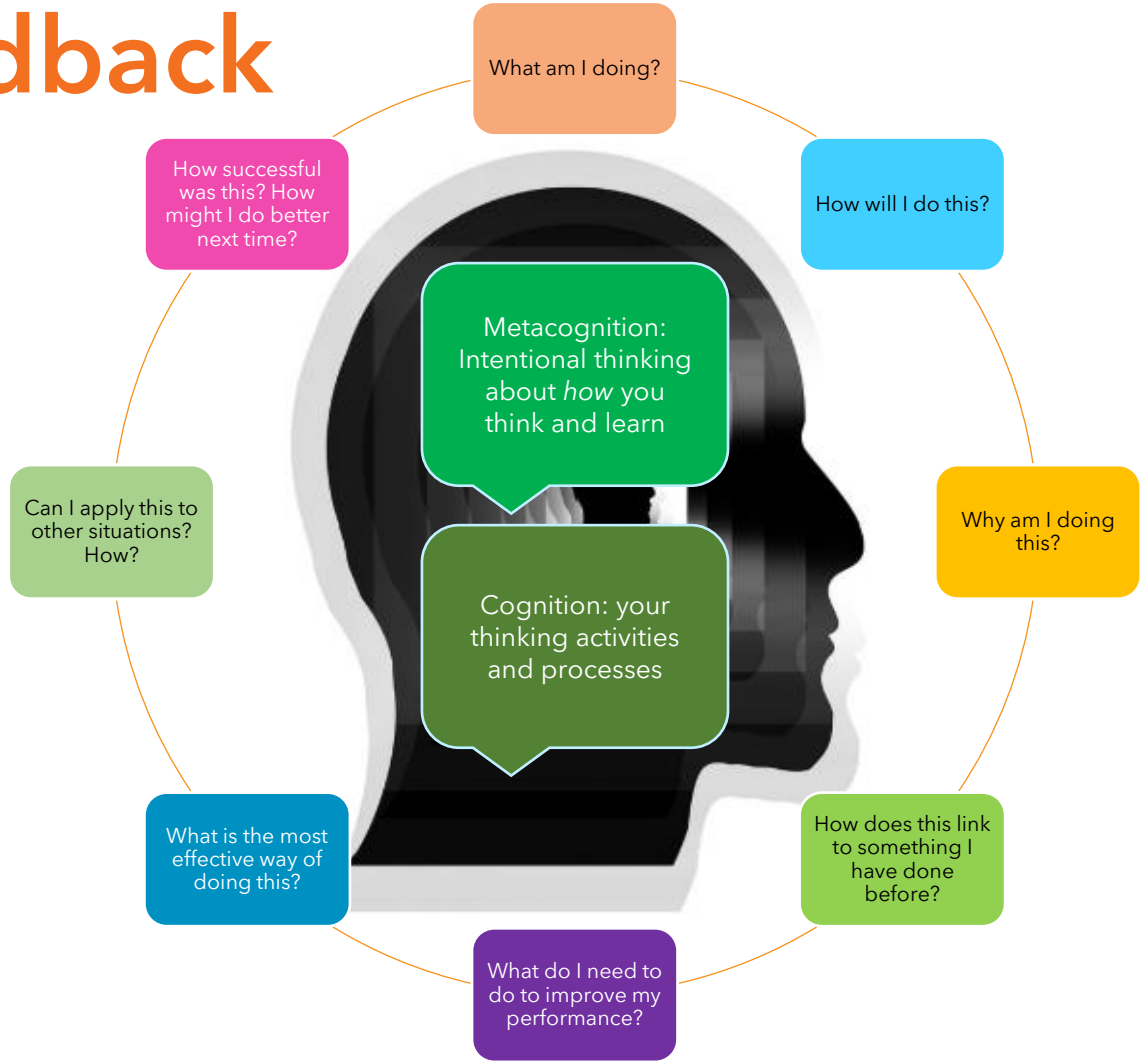
How It Works: Minimises unnecessary mental processing caused by having to combine information from multiple sources.

Example: In Science and Design, instead of having students look at a separate diagram and text, the teacher overlays labels and instructions directly on a diagram of an experiment setup or to create an effective and attractive design composition following the fundamental principles of design. In Digital Technology, coding steps are annotated directly on screenshots of code blocks or interfaces.

4. Metacognition and feedback

Key considerations

Feedback significantly impacts metacognition, the ability to monitor and regulate one's own thinking. Effective feedback helps students understand their learning progress, identify areas for improvement, and develop metacognitive skills. However, the effectiveness of feedback can vary depending on the nature of the feedback and the task difficulty.



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Adapted from:
SPH Metacognition - St Philip Howard Catholic Voluntary Academy

"Metacognition is the process of stepping back from the thoughts and getting enough distance to allow us to see those thoughts for what they really are..."

Dr Julie Smith, University of Edinburgh, Developmental Psychology in Education

Practical strategies

Summary of practices across the curriculum:

Practice	Type	Curriculum Focus	Why It's Effective
Metacognitive reflection journals	Metacognition	English, History, Social Sciences	Promotes self-awareness and transfer of literacy skills
Peer feedback with checklists	Feedback + Metacognition	English, Health, Business	Encourages critical thinking and reinforces literacy conventions through student dialogue
Goal-referenced feedback loops	Feedback	Maths, Science	Supports progression by linking feedback to clear criteria

Self-reflection

Metacognitive Self-Reflection Journals in English and Humanities

Curriculum Areas: English, History, Social Studies
Strategy: Structured student self-reflection using prompts

Example: After completing a persuasive writing task in Year 10 English, students complete a reflection journal entry using prompts such as:

What strategies did I use to plan my writing?

Where did I get stuck, and how did I overcome it?

What feedback did I act on from my draft?

What will I do differently next time?

Similarly, in History, students reflect on how they approached interpreting primary sources.

Why It Works: Encouraging students to think about their own thinking helps them become more aware of their learning processes, which improves self-regulation, motivation, and transfer of skills. It deepens literacy by promoting intentional learning rather than task completion.

Formative feedback

Goal-Referenced Feedback Loops in Mathematics and Science

Curriculum Areas: Maths, Science

Strategy: Use of formative feedback linked directly to learning intentions and success criteria.

Example: In a Year 11 science class, students receive feedback on their investigation reports, focused on the learning intention: *"Explain and evaluate patterns in your data."*
Feedback is specific and forward-looking: *"You've described the pattern, but now you need to explain why it occurred using scientific reasoning—refer back to your hypothesis."*

In Maths, teachers use digital platforms like Education Perfect or Google Docs comments to provide quick, targeted feedback on algebra problems.

Why It Works: Effective feedback is timely, specific, and actionable. When clearly tied to learning goals, it helps students know where they are, where they need to go, and how to close the gap, strengthening both numeracy and higher-order reasoning.

5. Emotions and a calm environment

Key considerations

Emotions **significantly impact learning**, with calm and regulated emotional states promoting better retention and comprehension. When students feel calm and supported, their prefrontal cortex, responsible for higher-level thinking, can take over, facilitating effective learning. Conversely, negative emotions like stress or anxiety can interfere with learning by triggering the amygdala, the brain's fear center, and hindering information processing.

Key considerations

1. Classroom environment and culture
2. Positive teacher-student relations
3. Cultural identity and practice
4. Co-constructed tikanga/rules/ways of being
5. Restorative and relational practice
6. Positive/negative balance
7. Have fun

https://www.needpix.com/photo/64297/

Adapted from:
1 Chalk Board Brain & Post Its Royalty-Free Images, Stock Photos & Pictures | Shutterstock

Emotions and Calm - Practical strategies

Summary of practices across the curriculum:

Practice	Key Emotional/Cognitive Benefit	Literacy/Numeracy Impact
Co-constructed tikanga and rules	Increases emotional safety, ownership, and regulation	Builds confidence to speak, read, write, or problem-solve
Positive teacher-student relationships	Reduces anxiety, increases motivation and focus	Students more willing to take risks and ask questions
Cultural identity and affirming tasks	Promotes pride, connection, and deep engagement	Strengthens expressive and critical literacy
Restorative, relational, and fun culture	Keeps the learning environment positive and brain-friendly for thinking	Supports sustained focus and emotional readiness to learn

Pro-actively build relationships

Positive Teacher-Student Relationships and the “2x10 Strategy”

Curriculum Areas: Any subject

Practice: Foster whanaungatanga through brief, daily personal connection.

Example: A Maths teacher uses the 2x10 strategy: 2 minutes a day for 10 days connecting with a disengaged student about their life—sport, hobbies, or whānau.

In English, students start the week with check-in cards: “How are you feeling?” with a space to add thoughts like “Tired today” or “Excited for kapa haka.”

Why It Works: When ākonga feel seen, safe, and valued, their capacity for learning grows. Short, genuine interactions build trust, reduce stress, and support equity by affirming each learner’s mana and voice.

Using humour, circle check-ins & restorative kōrero

Restorative and Fun Relational Practice to Support Calm Learning States

Curriculum Areas: Across the curriculum
Practice: Use inclusive humour, circle check-ins, and restorative conversations

Example: In a Year 11 Science class, the teacher starts Friday with a 5-minute "circle chat":

- *"One thing that made me smile this week…"*
- *"One thing I'm proud of in this class…"*

When issues arise, the teacher has a quiet restorative kōrero with the student:

- *"What happened?"*
- *"How were others affected?"*
- *"What needs to happen to put things right?"*

In Maths, the teacher adds short number puzzles, celebrates "math wins," and uses light, culturally sensitive humour to maintain a positive learning tone.

Why It Works: Joy and connection lower stress and support equity by creating safe, inclusive spaces where all learners can engage. Restorative kōrero builds accountability while strengthening relationships, helping every ākonga stay regulated and ready to learn.

Acceleration in literacy

The research tells us that...

...the identified strategies work best when integrated consistently and adapted to student needs, fostering both procedural fluency and conceptual depth.

Acceleration in Literacy

Intervention focus and specific teaching strategies

- **Explicit instruction** on text structure enhances expository reading comprehension for adolescents with dyslexia or learning disabilities.
- **Direct vocabulary instruction** and reading comprehension strategies effectively improve adolescent reading skills.
- **Teaching reading comprehension strategies** explicitly is more effective than implicit learning through reading practice.
- **Learning the meaning and structure of key vocabulary** in target texts supports reading comprehension.
- **Addressing disengagement in learning** through motivation strategies that consider student interests and background knowledge is beneficial.

Acceleration in Numeracy

Intervention focus and specific teaching strategies

- **Structured Lessons** ensure consistent skill development and conceptual understanding across all year levels.
- **Explicit Instruction** is especially effective for both foundational learning in primary and advanced concepts in secondary.
- **Online Delivery of Explicit Instruction** is valuable during remote learning.
- **Mathematical Language Development** supports conceptual understanding and communication, with growing complexity through the years.
- **Concrete–Pictorial–Abstract (CPA) Approach** helps develop strong number sense and supports learning from primary through to secondary.
- **Use of Number Lines** aid understanding of numerical relationships (whole numbers, fractions, negatives), and remain useful into secondary for operations, data analysis, and coordinate graphing.
- **Word Problem Instruction** teaches students to identify, categorise, and solve word problems using real-world contexts and algebraic reasoning builds applied problem-solving skills at all levels.

Questions & sharing ideas

Unpacking the Science of Learning

We invite you to continue to consider these questions...

1. What is your current shared understanding of the Science of Learning?
2. How are you currently using the Science of Learning to strengthen learning capability in your school?
3. What key practices might you strengthen to accelerate learning in your context?
4. What aspects of the Science of Learning might you need to explore further?
5. How might you best plan for the implementation of the Science of Learning practices?

Next steps:

What actions will you commit to?

Karakia whakamutunga

Tēnei rā te whakairi ake i te kete o te wānanga,
Tōna mauri nō runga, nō Rangi, nō raro, nō Papa,
Tēnei te mauri o te mātauranga ka whakatakina ake,
Kia wātea ai ēnei pūkenga,
Hui e, tāiki e!

May we close these discussions of learning,
Whose essence is derived from both divine and earthly sources,
The life force of knowledge is reaffirmed
to allow this gathering to finish,
Forever bound!

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