evaluation associates
Te Huinga Kākākura Mātauranga

Connecting assessment for learning and the science of learning for better teaching

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Why this topic?

I believe in assessment

Science of learning is a relatively new term (not concept) to NZC and me

Potential irrational fear!

If it avoids dichotomous thinking, then worth talking about

Where are we at
and
what do we do from here?

My relationship with assesment

- I believe assessment plays an important part in everyday life! We are continually assessing.

- What do you assess in your daily life, hobbies, pastimes or activities?
- Weather, clothes choices, travel routes, groceries.

- Golf and Flyfishing – I've worked out assessment is part of why I love doing both of these things.

A brief history of formative assessment – global context

- Benjamin Bloom: mastery learning foundations and feedback cycles
- Late 20th C Shift: reorientation to an emphasis on formative assessment
  Black & Wiliam (1998): evidence for formative assessment impact
- Royce Sadler: standards, feedback & self-regulation
- Shirley Clarke & Ann Davies: Formative assessment classroom enactment

A brief history of formative assessment – NZ context

- Terry Crooks: formative assessment for learning
- John Hattie: feedback and visible learning
- Helen Timperley: inquiry and evidence use
- Michael Absolum: clarity and practical AfL
- The New Zealand Curriculum: learning-focused assessment system

- A special mention of AtoL

Formative assessment (AfL)

- Involves gathering evidence of understanding
- Is used during learning to inform next steps
- Focuses on improving learning, not judging performance
- Provides feedback that helps learners close the gap
- Supports student self-regulation and agency

Formative assessment is enabled by:

- Clear learning intentions and success criteria
- Modelling (demonstrations, examples, exemplars, co-construction etc.) to make the learning visible
- Tasks and questioning that elicit evidence of learning
- Feedback that identifies next steps
- Time and structures to act on feedback
- Self- and peer assessment
- Responsive teaching decisions
- A classroom culture that supports risk-taking

Science of Learning – Foundations

- Hermann Ebbinghaus – Memory, forgetting, spacing
- Edward Thorndike – Practice, feedback, transfer
- Jean Piaget – Cognitive development
- Lev Vygotsky – Social mediation of learning, zone of proximal development
- George Miller – Working-memory limits

Contemporary Science of Learning advocates

- John Sweller – Cognitive Load Theory
- Paul Kirschner – effective instruction depends on learner expertise: novices need clear, guided instruction, while experts benefit from greater independence and challenge.
- Daniel Willingham – Translated cognitive science into realistic, evidence-informed teaching and assessment practices
- Barak Rosenshine – "Principles of Instruction" describes evidence-based teaching practices that align instruction with how learners process, retain, and use new knowledge.
- Dunlosky et al. – Effective learning strategies

Contemporary Science of Learning advocates

Researcher	Main Focus	Pedagogical Implication
Sweller	Working memory capacity	Reduce cognitive overload; use worked examples.
Kirschner	Expert vs Novice learner needs	Novices need clear, guided instruction, while experts benefit from greater independence and challenge.
Willingham	Thought & memory	Translated cognitive science into realistic, evidence-informed teaching and assessment practices
Rosenshine	Classroom Practice	"Principles of Instruction" describes evidence-based teaching practices that align instruction with how learners process, retain, and use new knowledge.
Dunlosky	Effective learning strategies	Use retrieval practice and spaced repetition.

Science of learning – New Zealand context

- Advocacy is distributed across universities, practitioners, and system agencies, similar to AfL in the early 2000s.
- Often aligned to a knowledge rich curriculum
- The emphasis remains on evidence-informed practice
- Key influences include Drs Nina Hood, Michael Johnston, Allison Arrow, Prof. Graeme Aitken and Minister Stanford.

Science of learning timeline

April 2023: The New Zealand Initiative released its education manifesto Save our Schools, which advocated for a "knowledge-rich" curriculum grounded in the science of learning.

Late 2023–2024: Following the change of government, the "science of learning" became a core pillar of the Ministry of Education's strategy to "teach the basics brilliantly," specifically for literacy and mathematics.

2024: A second Ministerial Advisory Group was established to strengthen the curriculum refresh, specifically using the science of learning to ensure a "knowledge-rich" approach.

2024-2025: The Ministry of Education incorporated "science of learning" principles into the updated New Zealand Curriculum (Te Mātaiaho) and published "The Science of Learning Explained" on Tahurangi.

Connecting assessment for learning and the Science of Learning for better teaching

Learning is a change in long term memory,
and
teaching is a system of decisions
under uncertainty

Learning

From the Science of Learning, learning is understood as durable, retrievable change in long term memory.

> “If nothing has changed in long-term memory, nothing has been learned.”
>
> Kirschner, Sweller & Clark (2006)

Teaching

From AfL teaching is understood to be a decision-making process.

- decisions about what to do next,
- based on imperfect evidence, (learning may be invisible)
- under real time constraints.

> "The only way we can ensure that learning is proceeding in the intended direction is through assessment. That is why assessment is the bridge between teaching and learning."
>
> Wiliam, 2011

Key thoughts

- Formative assessment addresses how decisions are made when learning cannot be directly observed.
- Formative assessment is not competing with cognitive science. In a way it operationalises the science of learning in classrooms.
- Formative assessment does not guarantee learning, but it increases the likelihood that teaching decisions align with how learning develops over time.

Practical application

In classrooms, this is evident when teachers:

- look for patterns of learning across multiple experiences, rather than over-interpreting a single task
- use student responses as valuable information to guide next steps, not final judgments
- adapt instruction responsively, drawing on emerging evidence as learning unfolds

This supports teachers to be thoughtful and evidence-informed, without over-claiming certainty about what students currently know or can do.

Formative assessment works because it activates the same cognitive mechanisms that cause learning

Effective learning (SoL)

Science of learning shows that:

- Remembering things helps us learn them —pulling ideas from memory makes them stick.
- Noticing and correcting mistakes helps deepen understanding.
- Good feedback shapes what learners remember and how they use it in the future.

Effective learning (AfL)

Assessment for Learning research shows that:

- deliberately gathering evidence of student learning,
- using that evidence to guide next teaching steps, and
- actively involving learners in the process

has a strong and positive impact on learning outcomes.

Implications for AfL

The most powerful formative assessment does double duty. It

- generates evidence and
- changes memory.

Therefore not all "checks for understanding" are equal.

Tasks that ask students to remember ideas, explain their thinking, or use learning in new situations achieve more than tasks that only involve recognising an answer or completing an activity.

Feedback should not be judged by it's detail, but by whether it changes future thinking.

Practical application examples

Teachers:

- Use questioning that requires students to retrieve and articulate ideas rather than identify them,
- Have discussions that surface misconceptions, not just confirm correctness

- Feedback is framed mostly around “what to do next” rather than “what went wrong”.

Clarity in learning intentions and success criteria
is cognitively necessary,
not pedagogically optional

Cognitive science says

- Working memory is limited,
- Attention is selective,
  (learners can only focus on some information at a time, not everything they see, hear, or are presented with).
- Learning is impaired when cognitive load is poorly managed.

AfL emphasises clarity

- Clarity of learning intentions,
- Shared understanding of success,
- Transparent criteria

From a cognitive perspective 'clarity' is a way of:

- reducing cognitive load,
- stabilising attention,
- supporting schema formation (helping learners build organised, usable understanding).

Implications for AfL

This reframes how learning intentions and success criteria should be understood.

They function as cognitive scaffolds, not simply communication tools.

This can mean:

- Clarity is most important when content is complex or unfamiliar
- Success criteria should cue what to attend to and what to retrieve
- Clarity is lost when expectations are either too vague or overly specified.

Practical application

In classrooms:

- Learning intentions should be specific to the knowledge or thinking being developed,
- Success criteria are used to support judgment and self monitoring, not compliance,
- Exemplars are shared to help learners understand what quality looks like, not to tell them exactly what their work should look like.

A couple of callouts

- Modelling – examples, demonstrations, exemplars, co-constructed exemplars.

- Teacher content knowledge: recognising and interpreting evidence of learning in relation to the curriculum.

Science of Learning

- How memory changes
- Cognitive mechanisms (retrieval, load, spacing, feedback)

Explains WHY learning does or does not stick

Assessment for Learning

- Instructional decisions
- Task design
- Use of evidence

Teaching is shaped by decisions based on evidence of learning.

Assessment for Learning

- Gathering info about student thinking
- Interpreting what that tells us
- Adjusting teaching in response

Explains HOW teaching responds to uncertain evidence of learning.

In summary - How these ideas fit together

- The Science of Learning helps us understand how learning actually happens —how experiences change memory over time.
- Formative assessment helps us understand what learners know right now —using evidence to guide next steps.
- Teaching sits at the intersection, bringing both together in day-to-day practice.

- When all three work together, teaching is informed, responsive, and effective.

When one piece is missing?

Science of Learning without formative assessment

- Teaching is research-based, but rigid —it lacks real-time insight into who is learning and what they need next.

Formative assessment without the Science of Learning

- Teaching is responsive to evidence, but inefficient —feedback and decisions aren't always aligned with how learning and memory actually develop.

Potential irrational fear? – I think I'm ok!

"Formative assessment is essential to explicit teaching because it helps teachers check what students understand at each step of the learning process.

It allows them to adjust their instruction in real time by clarifying, modelling, or reteaching, so that every student can confidently move forward with new learning."

Mathematics and English curriculum documents

October 2025

Sunday Read: From Chefs to Short-Order Cooks

"This shift is embedded in the reverse engineering of the NZ Curriculum into a syllabus. Programmes become scripted. Scope and sequence is rigidly prescribed for all teachers and learners as part of an industrial mindset and methodology. Success is reduced to measuring the faithfulness of execution. Those pedagogical choices that are left to be made by leaders are limited to narrow, pre-approved options."

(AEC, 2026)

Final quote

Extract from: A knowledge-rich curriculum underpinned by the science of learning

If it is used well, formative assessment is one of the most powerful tools at teachers' disposal.[34] It is a highly effective way of managing the intrinsic cognitive load associated with learning, because it helps students integrate new learning into their existing cognitive schemas in long term memory. Effective formative assessment has three essential components:

- The teacher and student must have clear understanding of the learning goal that the student is working towards, and of the key steps to attaining that goal.
- The teacher must be able to assess where a student is on the pathway towards that goal.
- The teacher must be able to provide feedback that assists the student to move towards the goal.

Johnston, Hood, and Aitken – June 2024

Thoughts and questions

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