

Knowledge Matters Campaign

Literacy and the Science of Learning Podcast

Study Guide, Episodes 1-2

Just about everyone in education agrees that we should teach our students to think. Over the last thirty years or so, this has led many people to suggest that we should teach thinking skills. The logic is attractive. After all, if we teach our students to think, then they will be able to use those thinking skills wherever they want to. Unfortunately, as we have learned, such thinking skills programs have been a waste of time, not because they were badly designed, or poorly implemented, but because those generic thinking skills do not exist.

This is not obvious, because when we ask historians and mathematicians to describe what they mean by, for example, critical thinking, they say very similar things. This has led people to conclude that critical thinking is a single skill, but it is not. Critical thinking in mathematics and in history are superficially similar skills that rely on fundamentally different mental processes. In particular, when our students think critically or creatively, they do not do this by applying generic skills but by drawing on vast reserves of knowledge. That is why knowledge matters.

Now many students acquire much of these reserves of knowledge from their home environment, but many do not. Teaching for equity requires ensuring that all students acquire these reserves of knowledge, and these podcasts are intended to help teachers ensure that their students acquire the knowledge they need to flourish and thrive.

Big-picture goals

1. Understand why Dylan Wiliam argues that knowledge—not generic “skills”—is the non-negotiable foundation of expertise.
2. Describe how working memory, long-term memory, storage strength, and retrieval strength interact in learning.
3. Identify classroom practices that protect working-memory capacity and strengthen long-term retention.
4. Apply at least three evidence-based study or teaching techniques (e.g., spaced retrieval, interleaving, worked examples).



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Episode snapshots

Episode	Core message	Must-know concepts	Illustrative examples
1 – “Why knowledge matters”	All high-level performance is underpinned by vast, well-organised stores of domain knowledge. Skills grow out of this knowledge rather than replacing it.	<ul style="list-style-type: none">• Biologically primary vs secondary knowledge• Working-memory bottleneck & cognitive load• Borrowing & re-organising principle	<ul style="list-style-type: none">• Chess grandmasters playing simultaneous games• Radiographers spotting tumours novices miss
2 – “How memory works”	Long-term learning depends on strengthening storage and retrieval. Successful, effortful recall beats re-reading every time.	<ul style="list-style-type: none">• Storage strength vs retrieval strength• Spaced practice, interleaving, practice testing	<ul style="list-style-type: none">• Remembering the word for “ear” in a language formerly studied• Flash-card self-quizzing versus highlighting

Glossary

- **Biologically primary knowledge** – Abilities humans evolved to pick up naturally (e.g., spoken language).
- **Biologically secondary knowledge** – Culturally invented skills such as reading or algebra that require explicit teaching.
- **Working memory** – Limited-capacity “mental workspace” used for conscious processing.
- **Long-term memory** – Practically limitless store of facts, experiences and procedures.
- **Cognitive load** – Total mental effort being used in working memory.
- **Storage strength** – How deeply information is encoded and interconnected.
- **Retrieval strength** – How easily information can be accessed at a given moment.



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- **Interleaving** – Mixing topics or problem types within a single practice session.
- **Spaced practice** – Spreading study or review sessions over time.
- **Practice testing** – Actively recalling information (self-quizzes, flash cards, low-stakes tests).

Takeaways and teacher moves

Principle	Why it matters	Classroom moves
Build background knowledge first	Transferring facts to long-term memory frees up working memory for higher-order thinking.	Embed micro-explainer segments before open-ended tasks; pre-teach essential vocabulary.
Manage cognitive load	Overloading working memory stalls learning because spare working memory is needed to store things in long-term memory	Use worked examples, fade guidance gradually, avoid split-attention layouts.
Teach for durable, not temporary, retrieval	High retrieval strength today can mask limited storage strength .	Replace last-minute cram sheets with low-stakes quizzes spaced across days or weeks.
Make retrieval effortful, but achievable	Hard-won recall produces the biggest learning gains (“desirable difficulty”).	Convert notes to questions; schedule “brain-drain” quizzes as forgetting sets in.
Mix, don’t block	Interleaving fosters discrimination between similar concepts.	Write mixed-topic problem sets (e.g., perimeter and area) rather than unitary drills.

Discussion questions

1. Explain, in your own words, why knowledge makes thinking “cheaper” in working memory.
2. How does Sweller’s digit-span task (discussed in Episode 1) illustrate the effects of prior knowledge on apparent memory limits?



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3. What are the key differences between storage strength and retrieval strength?
4. Echoing E.D. Hirsch, Jr., William suggests that “skill is really knowledge.” Do you agree? If yes, give concrete examples from your own discipline. If no, say why not.
5. Where in your curriculum might students’ working memory become overloaded? How could you redesign those moments?
6. How would you design a mini-lesson that combines worked examples and a retrieval opportunity?
7. Spaced practice can feel slower and less comfortable than massed practice. How could you sell its value to students (or colleagues)?
8. Think of a topic students “knew yesterday but forgot today.” How might storage and retrieval strength explain this, and what would you change next time?

Activities

Purpose	Activity
Check understanding	Create a two-column chart: Primary knowledge we acquire naturally vs. secondary knowledge that needs explicit teaching. Fill it with examples from your subject.
Embed retrieval	After each lesson, write two “exit-ticket” questions for use next week that require students to recall—not reference—the content taught today.
Contrast study habits	Give students a short text and assign half to re-read and half self-quiz. One week later, test both groups on the content and compare results.

Further reading

- Bjork, R. & Bjork, E. (2020). “[Making things hard on yourself, but in a good way.](#)”
- Brown, P. C., Roediger III, H. L., & McDaniel, M. A. (2014). “[Make it stick.](#)”
- Dunlosky, J. et al. (2013). “[Improving students’ learning with effective study techniques.](#)”



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- Sweller, J. (2011). "[Cognitive Load Theory](#)."
- Wiliam, D. (2018). [Embedded Formative Assessment](#).

