Inventive Minds Need Foundations

How creativity thrives with constraints

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Was Sir Ken Robinson right?

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Common Misconception

X Explicit teaching dulls creative thought…

How do we learn?

Simple model of memory

Information processing model
(Dan Willingham)

Diagram by Oliver Caviglioli

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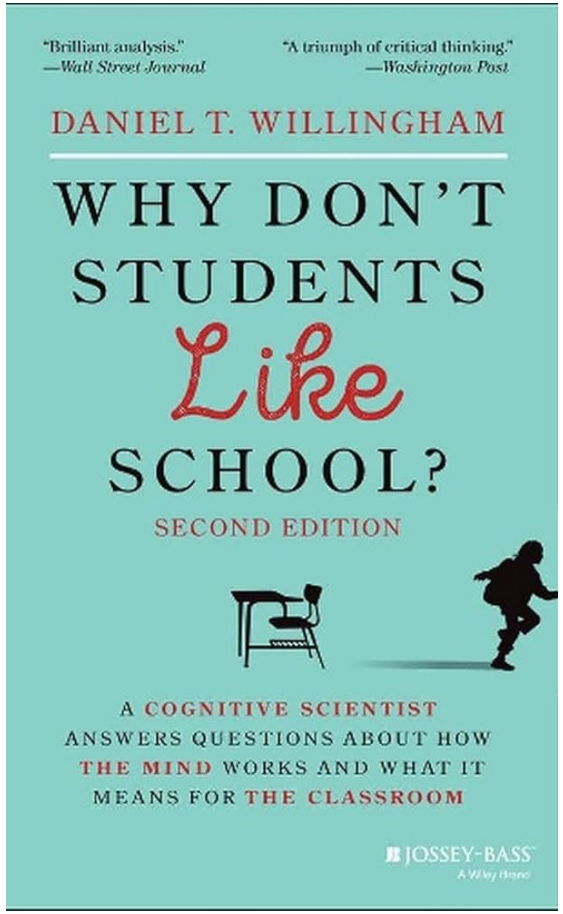
1. **Memory is the residue of thought**
2. **Knowledge must precede skill**
3. **Understanding abstract ideas requires concrete examples**
4. **Practice is essential for mastery and transfer**
5. **Deep knowledge is always the goal**



Also see Dr Jared Cooney Horvath

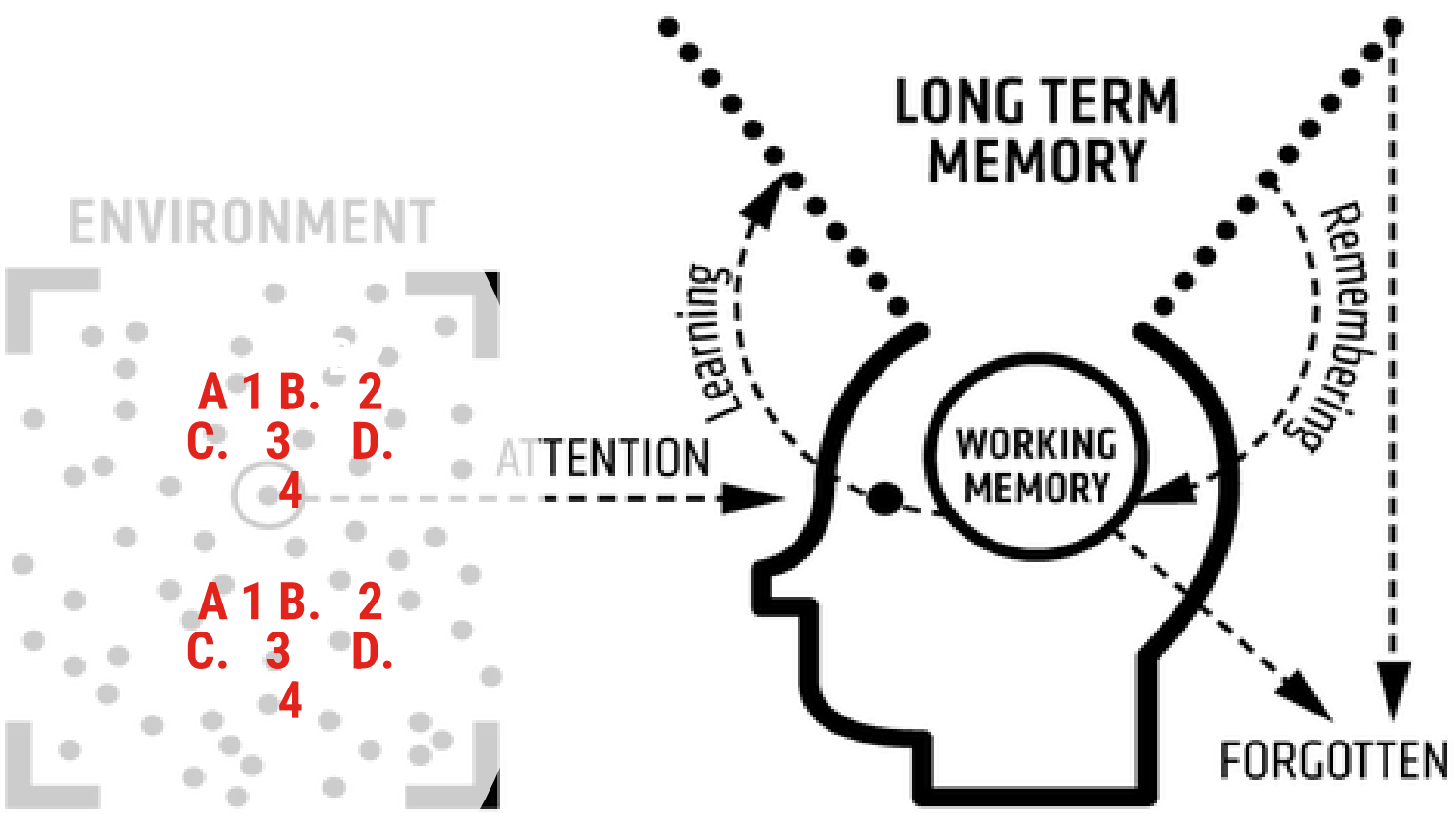
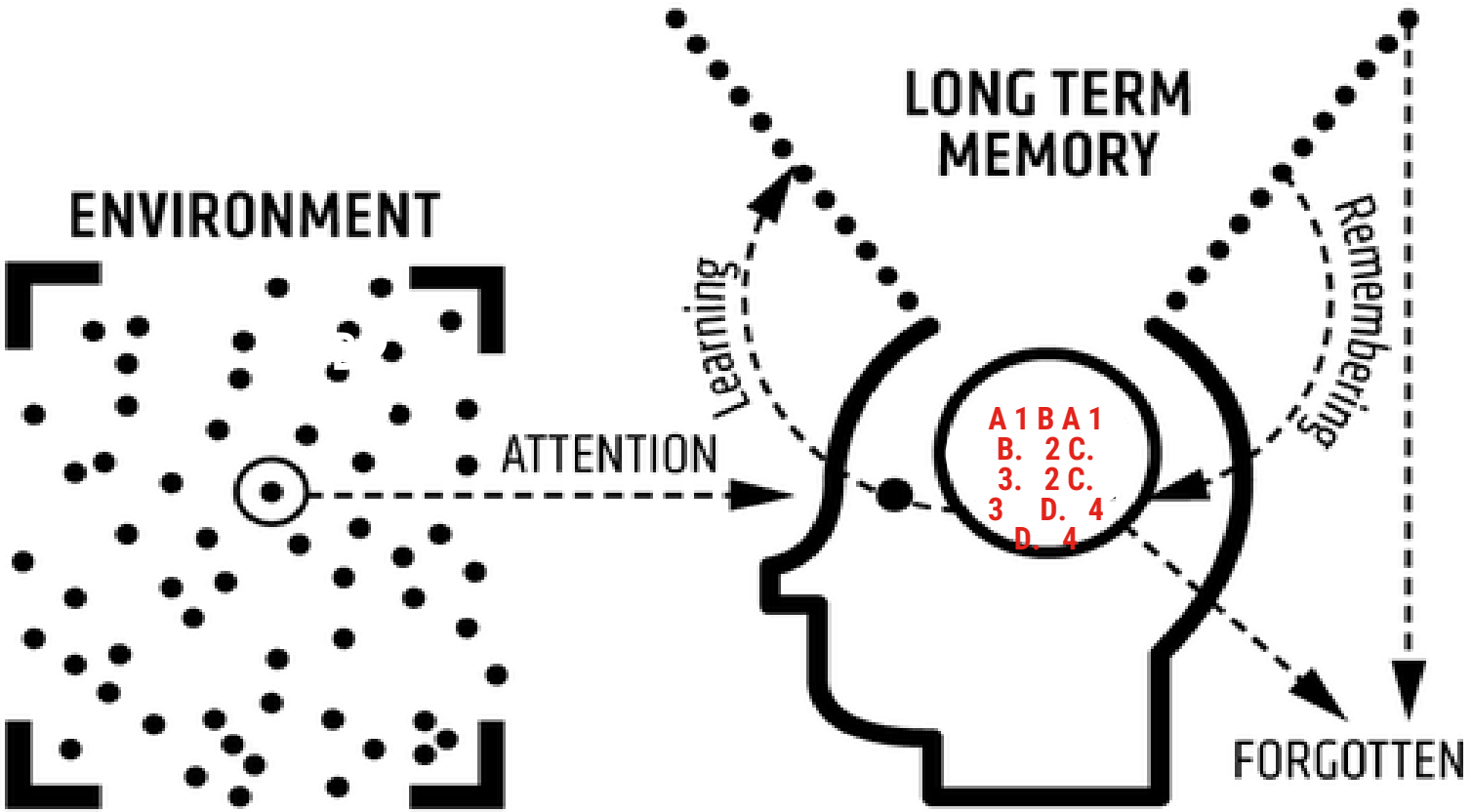
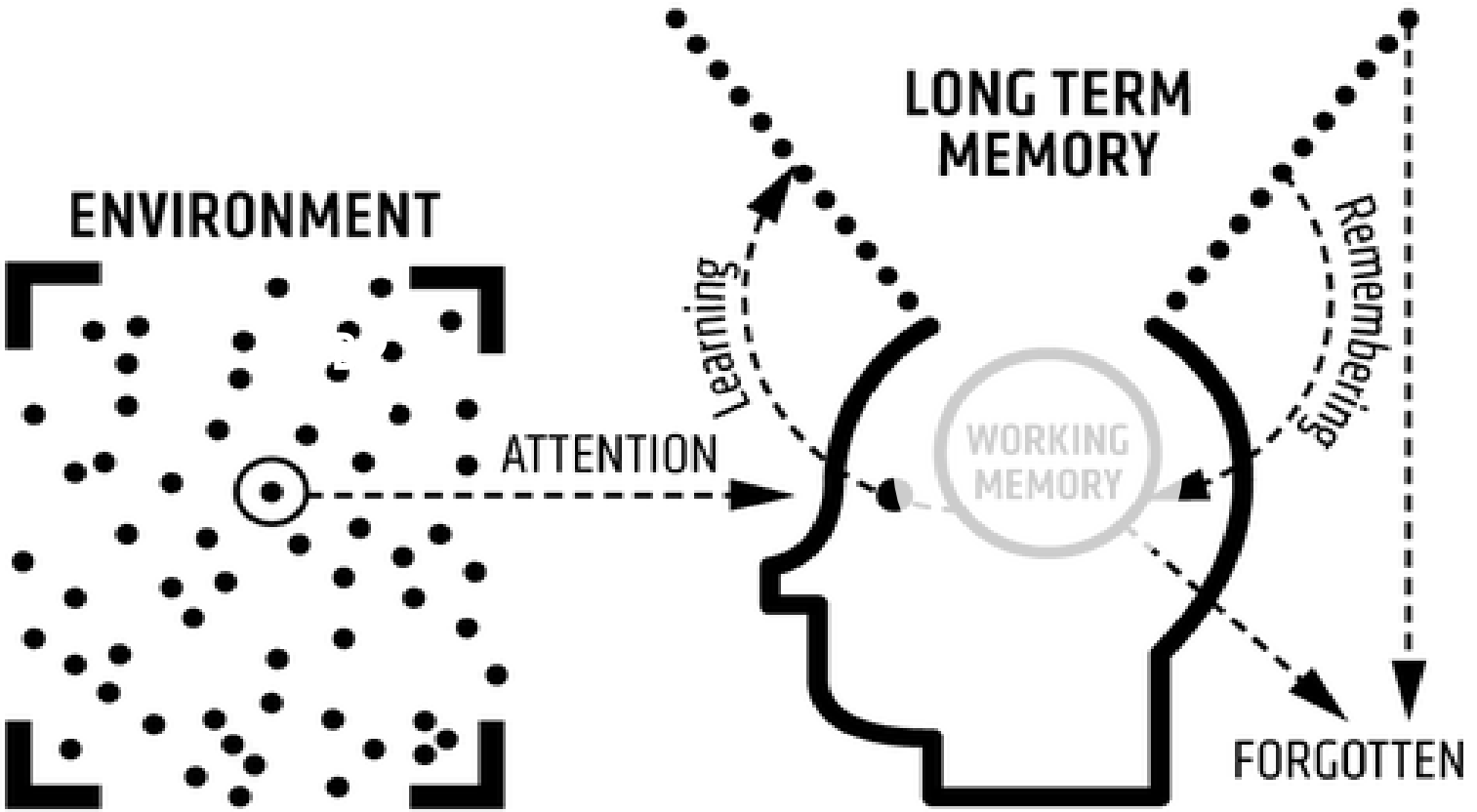


Diagram by Oliver Caviglioli

P. 273 Sweller, Van Merrienboer, & Paas, (2019)


ENVIRONMENT
ATTENTION
LONG TERM
MEMORY
Learning
Remembering
A 1 B A 1
B. 2 C.
3. 2 C.
3 D. 4
D. 4
FORGOTTEN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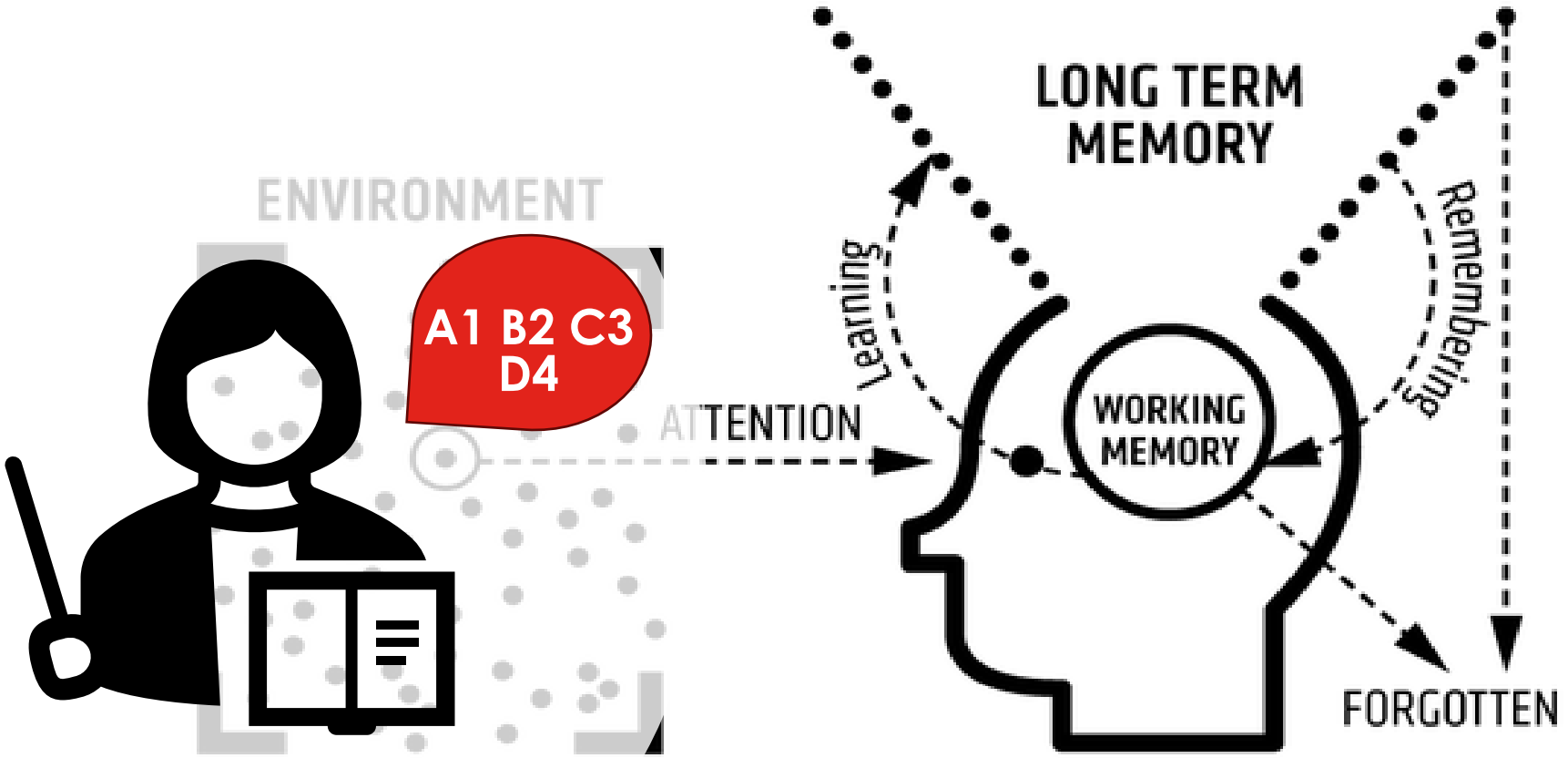
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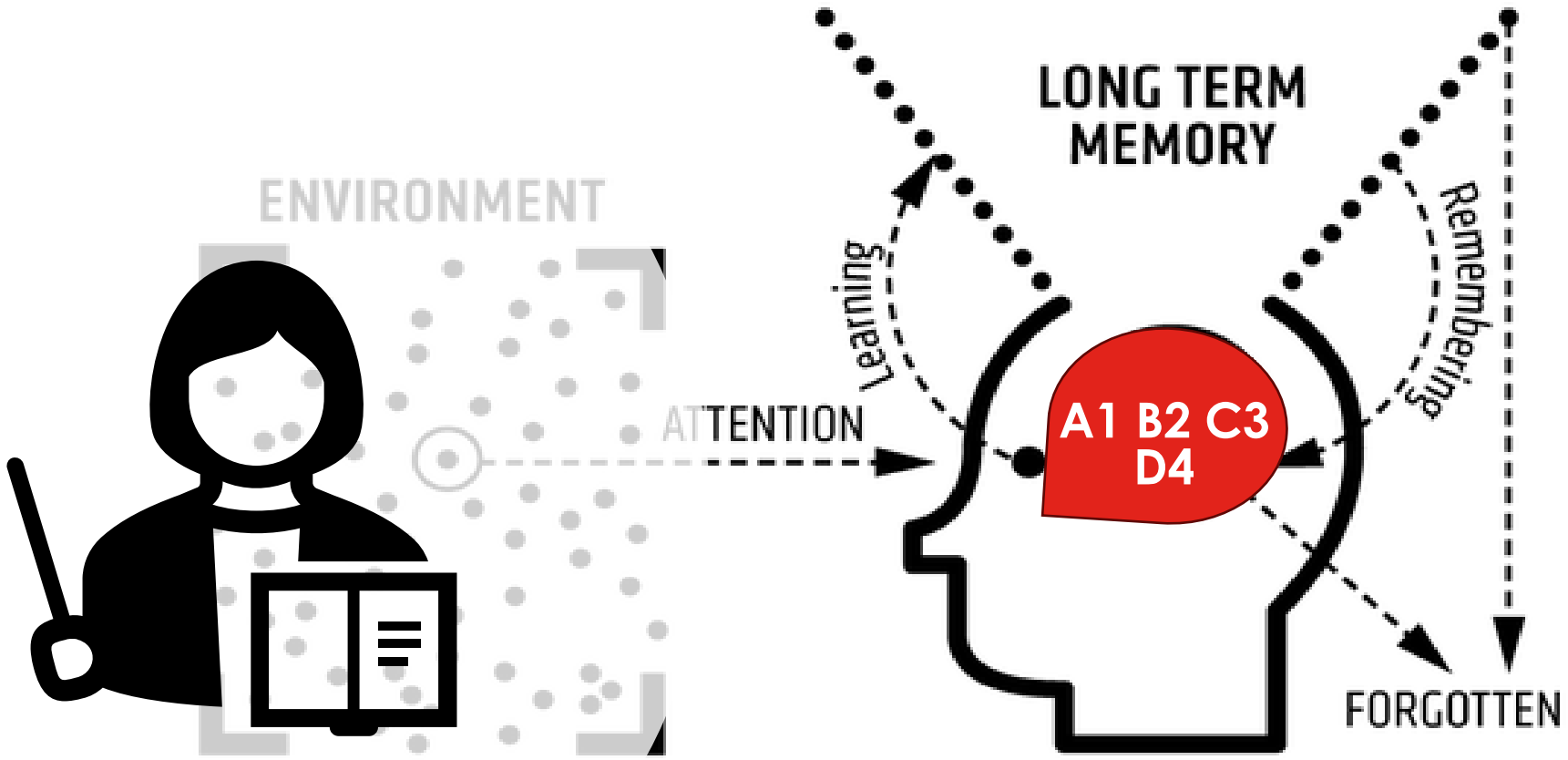
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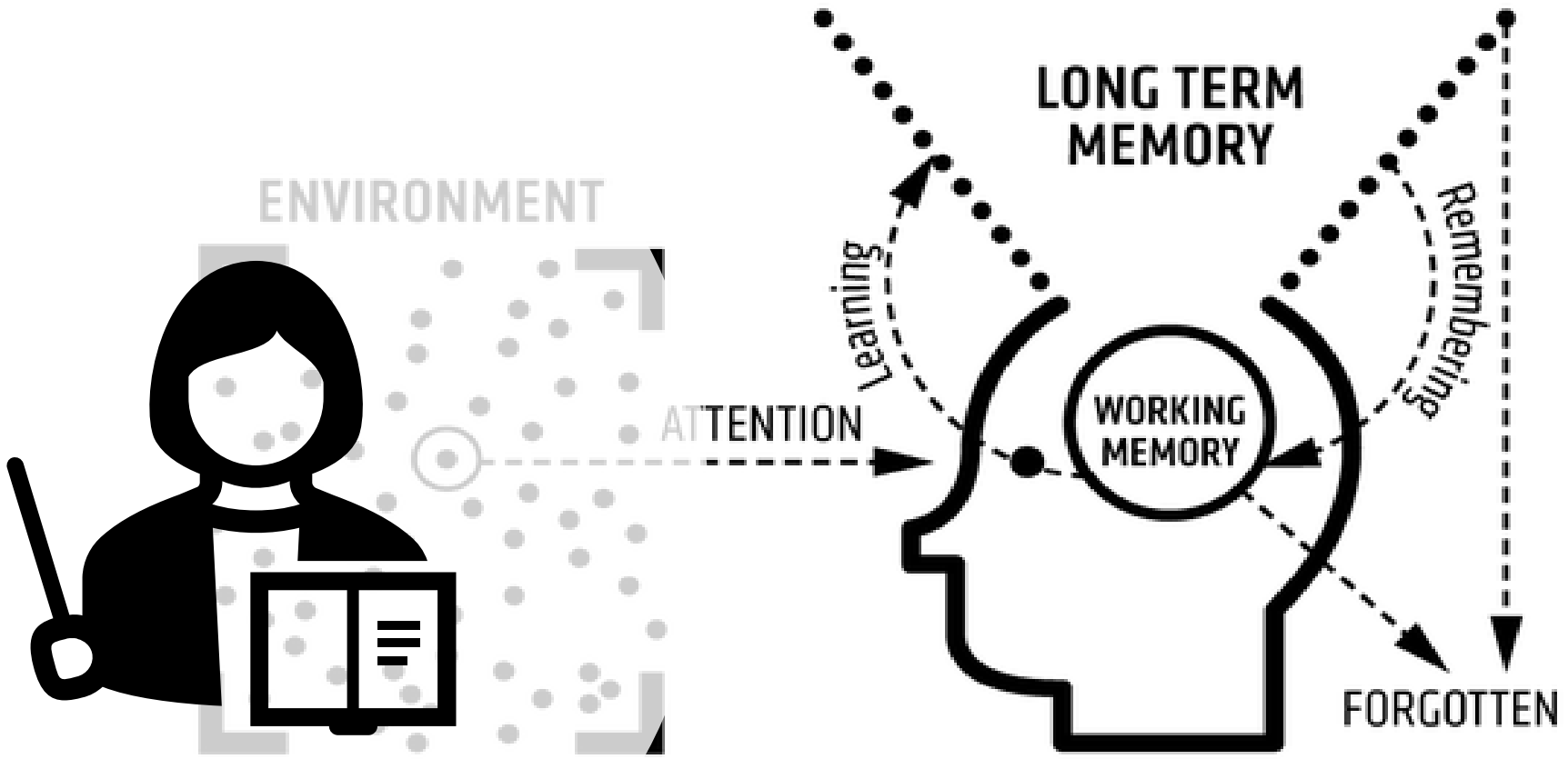
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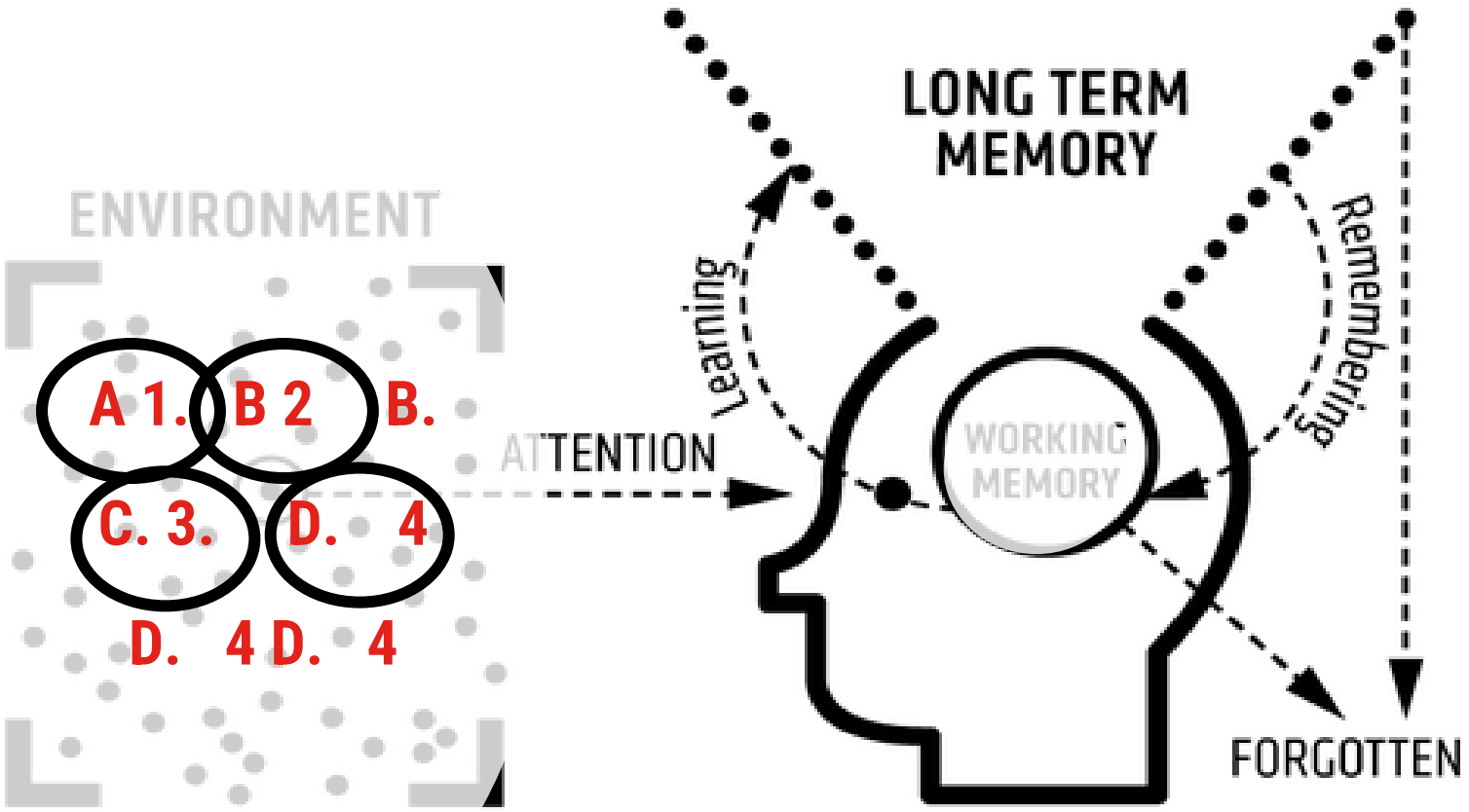
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D. 4 D. 4
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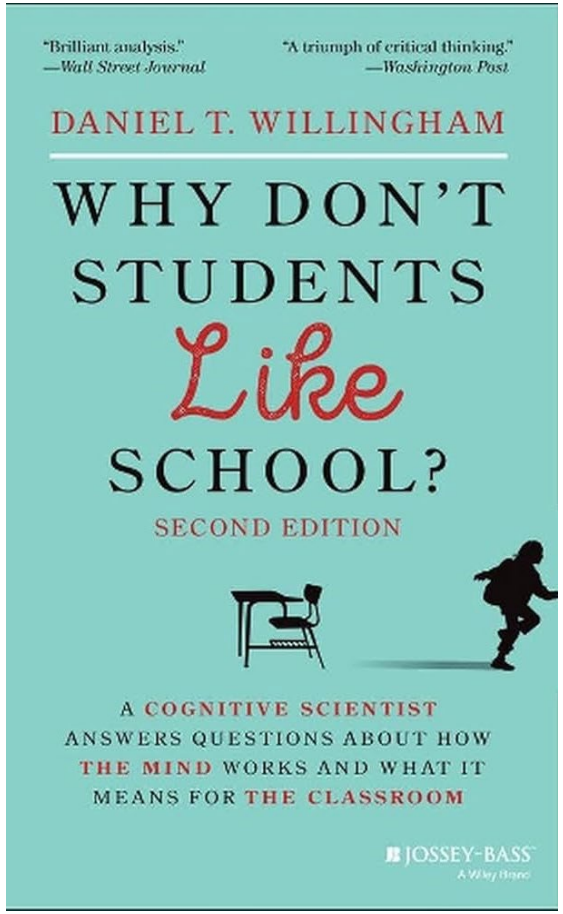
6. The brain is not designed for thinking
7. People enjoy mental work if it is successful
8. People are naturally curious but not naturally good thinkers
9. Expert thinking differs fundamentally from novice thinking



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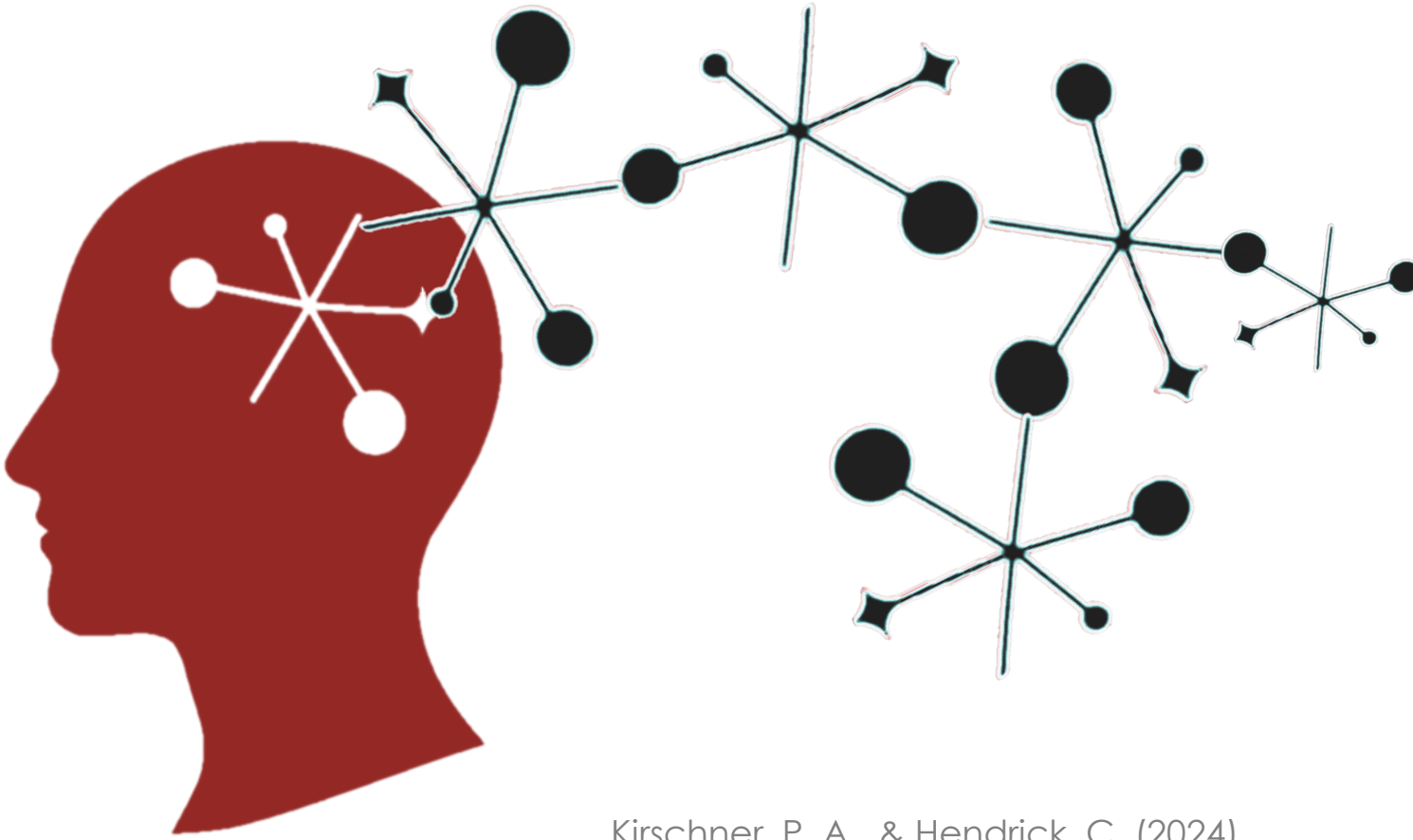
Novices vs. Experts



Kirschner, P. A., & Hendrick, C. (2024). How learning happens: Seminal works in educational psychology and what they mean in practice.

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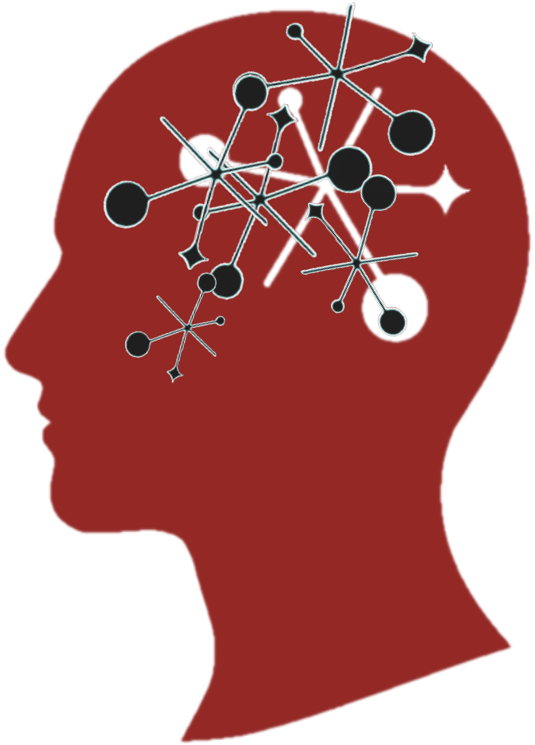

Rich interconnected schemas of knowledge is what sets them apart

See Ausubel, e.g. Ausubel's Meaningful Learning in Action by Sarah Cottinghatt

Novice → Expert continuum

Novices
(in a particular domain)

- Lack sufficient knowledge in that domain
- Benefit from clear explanations, step-by-step instructions, and worked examples
- Struggle with problem-solving in that domain.

Experts
(in a particular domain)

- They have significant relevant knowledge, mapped and organised strategically
- It is the knowledge of the domain which sets novices and experts apart
- Can work without explicit guidance, relying on stored knowledge for problem-solving.

Kirshner & Hendrick (2020). How learning happens

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SURPRISING FACT

Explicit instruction does not kill creativity

Explicit teaching

Access to knowledge

Guidance fading

Error feedback

Increasing independence

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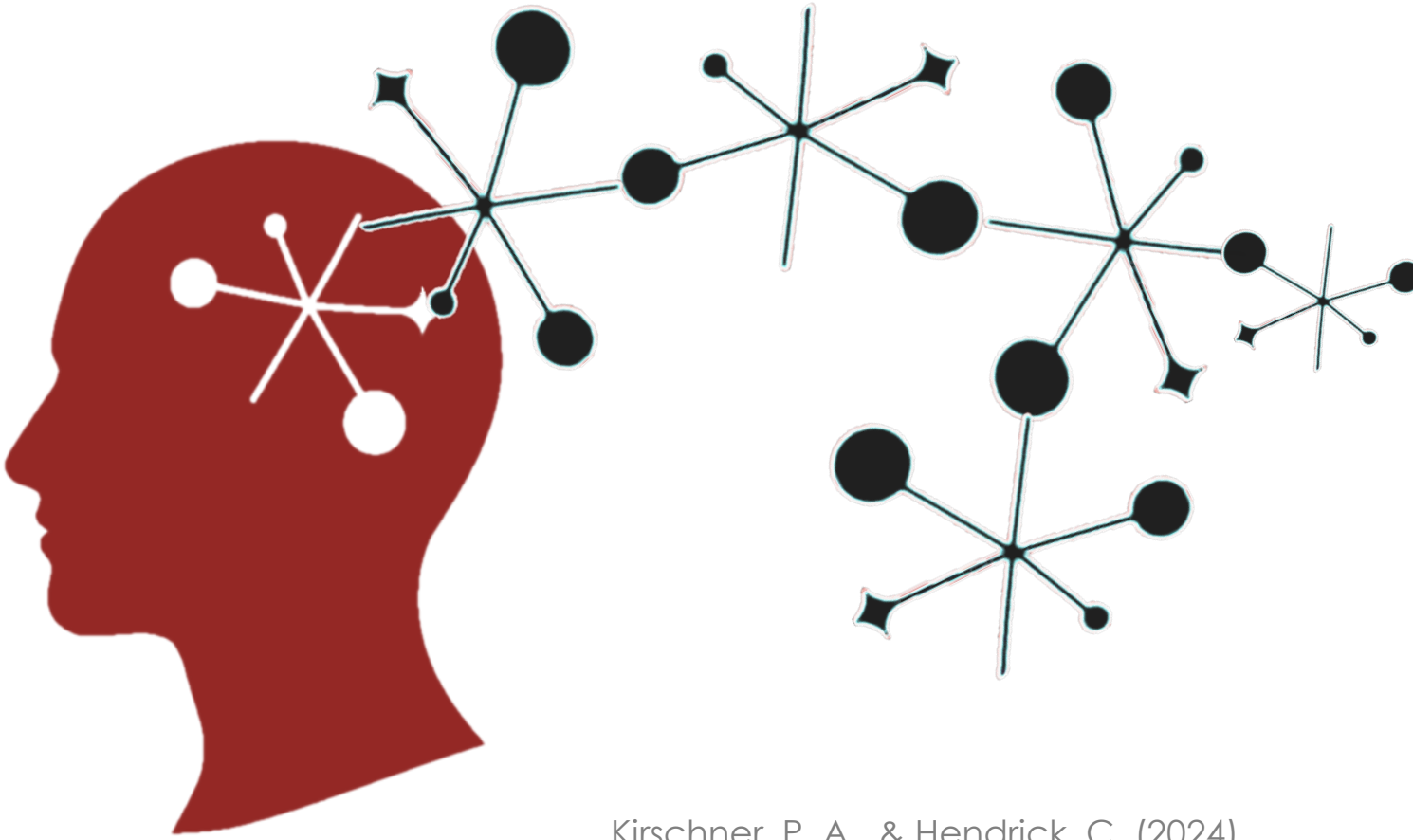
SURPRISING FACT

Knowledge can never be outsourced

Novices vs. Experts



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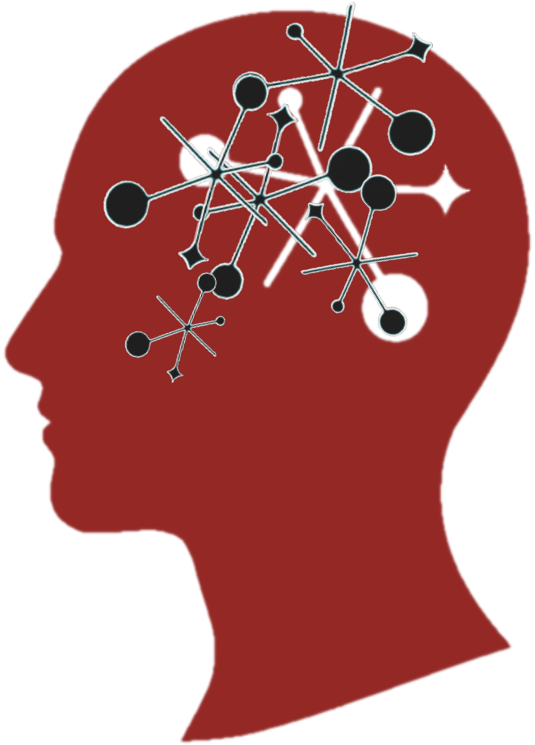

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The creativity process involves …

FOCUSED

DIFFUSE

THOUGHT

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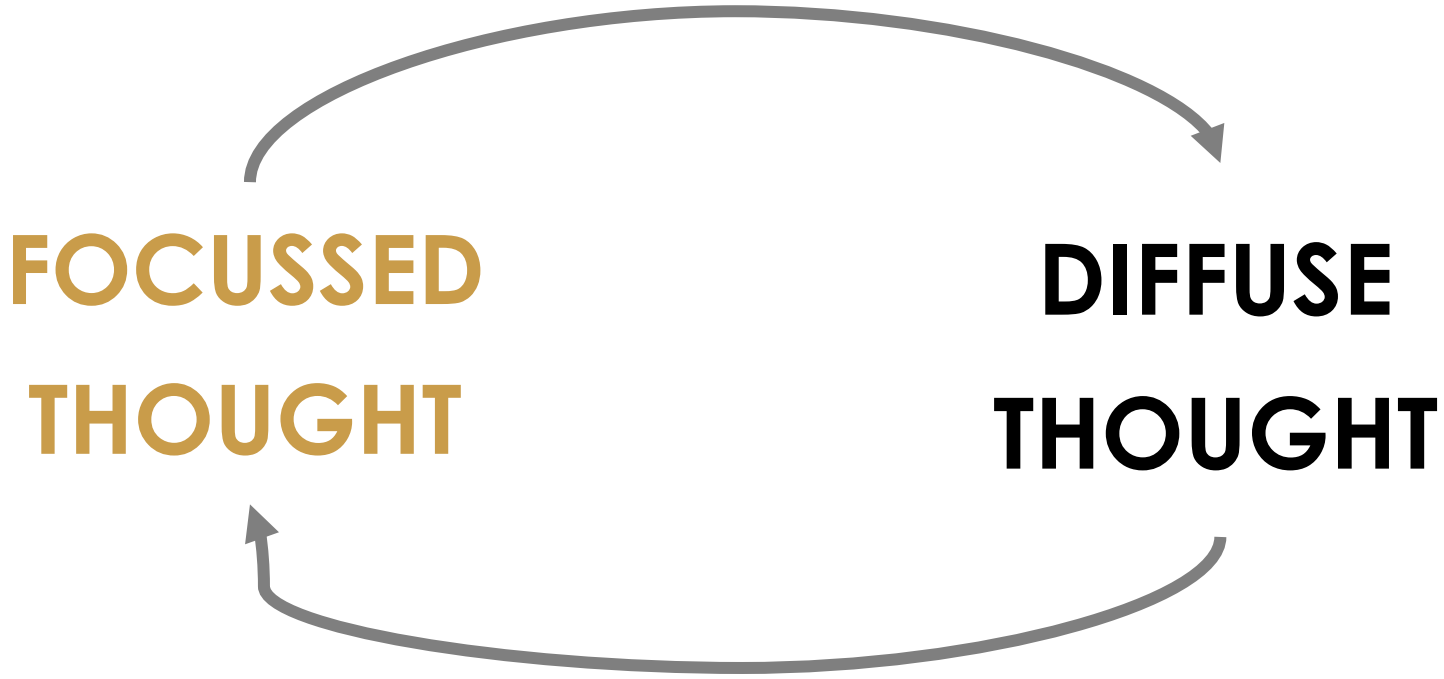
The creative process involves …



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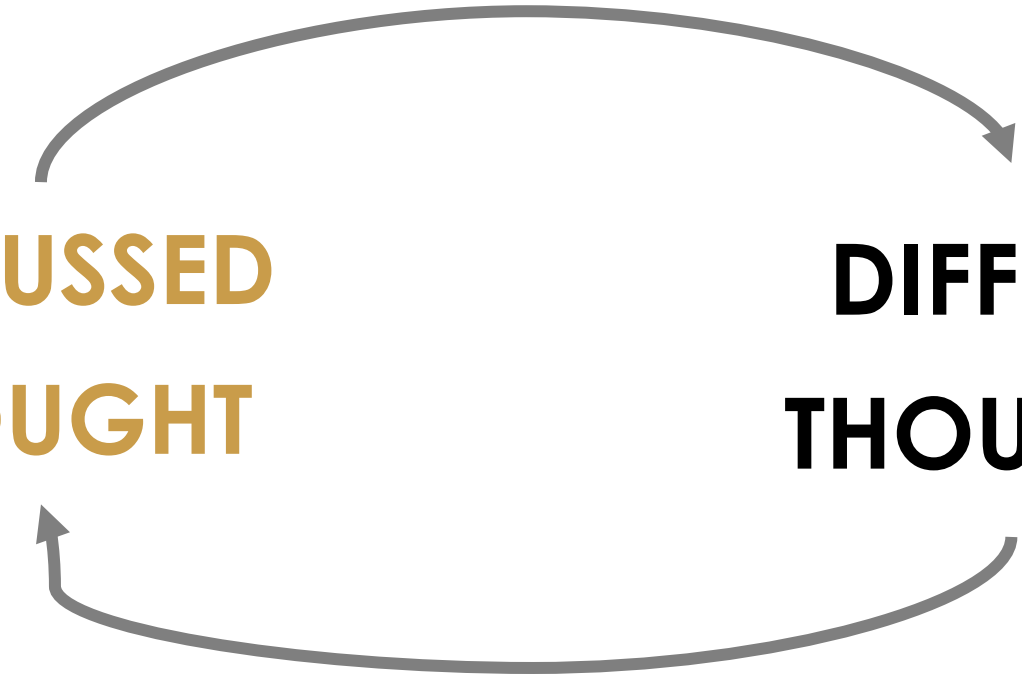

External input can be used

Only involves what's in long term

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OBVIOUS

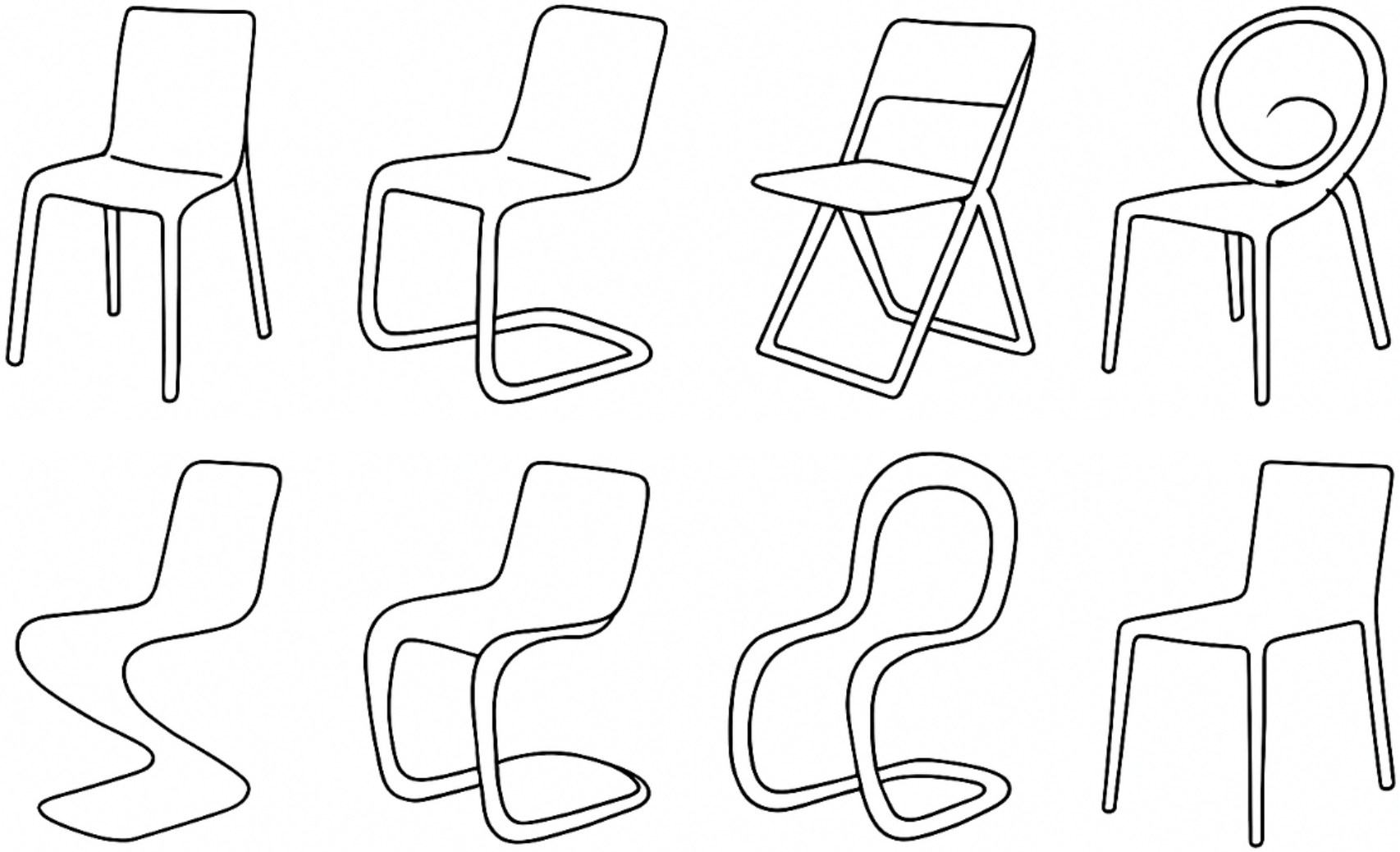
SURPRISING FACT

Knowledge can never be outsourced

What counts as creative?

Novelty

+ Utility



Novelty

+ Utility?

Created using ChatGPT

SURPRISING FACT

Constraint** necessitates **creativity

What else students need to be creative?

Time

Failure / Iteration

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SURPRISING FACT

Creativity happens incrementally over time

What does this mean for my teaching?

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BIG PICTURE

Creativity emerges from:

Knowledge + Constraint + Time + Iteration

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So what is killing creativity ?

See the Haidt's Anxious Generation

↑ ***T****ech*
↓ ***T****ime*
↓ ***T****rying*
↓ *Exper****T****ise*

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Two further bridges to creativity:

(1) Retrieval

Retrieval Practice

Also known as ‘testing effect’

Act of retrieving almost forgotten information

→ reinforces learning more than re-reading or teacher re-explaining

Powerful Teaching: Unleash the Science of Learn
Book by Patrice Bain and Pooja K. Agarwal

Two further bridges to creativity:
(2) Generative tasks

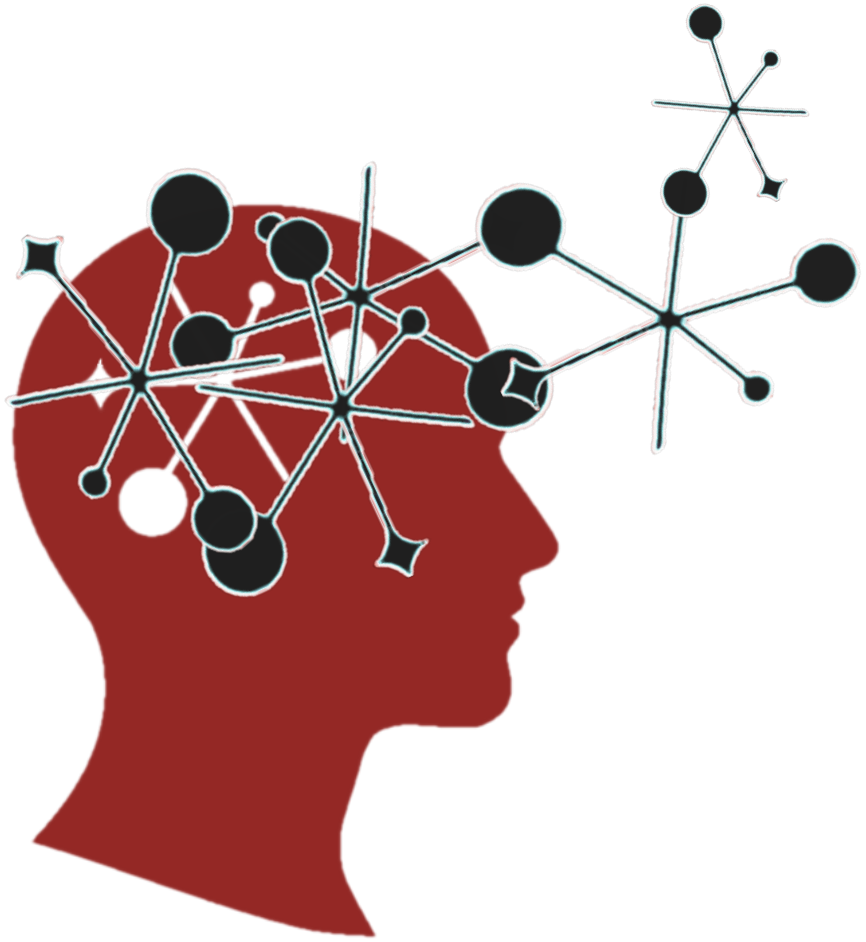
Generative learning

Getting students to generate ideas and connections from long-term memory

- Summarising
- Mapping
- Drawing
- Self-explaining
- Teaching
- Self-testing

See Fiorella and Mayer

Meaningful ←→ Generative learning



See Fiorella and Mayer

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BIG PICTURE

Creativity emerges from:

Knowledge + Constraint + Time + Iteration

A path to creativity?

MODE A ~80%

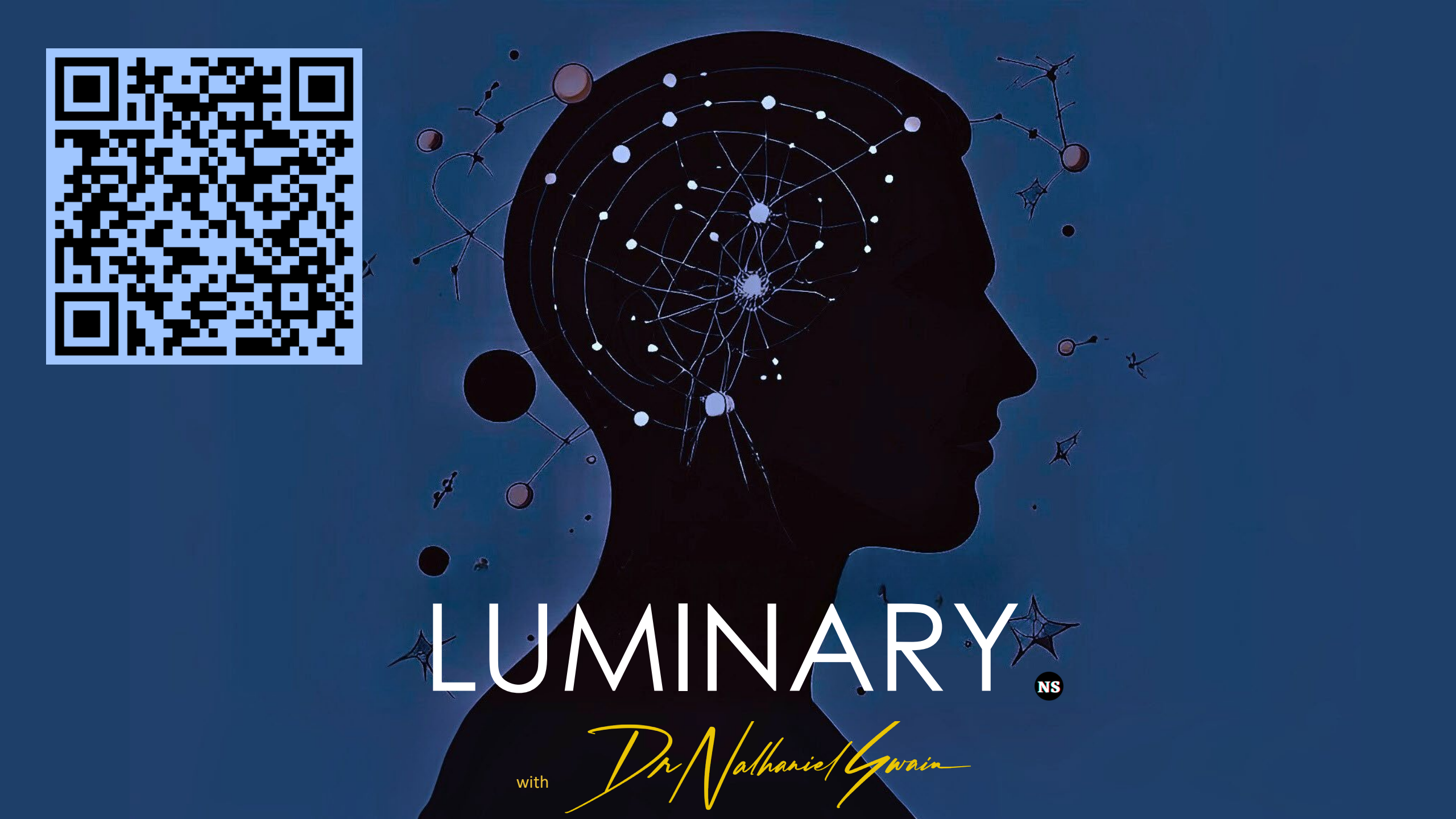
- You explain
- You model
- They practice
- Check and give feedback
- Test them. And again a bit later

Come learn more in my workshop…

MODE B ~20%

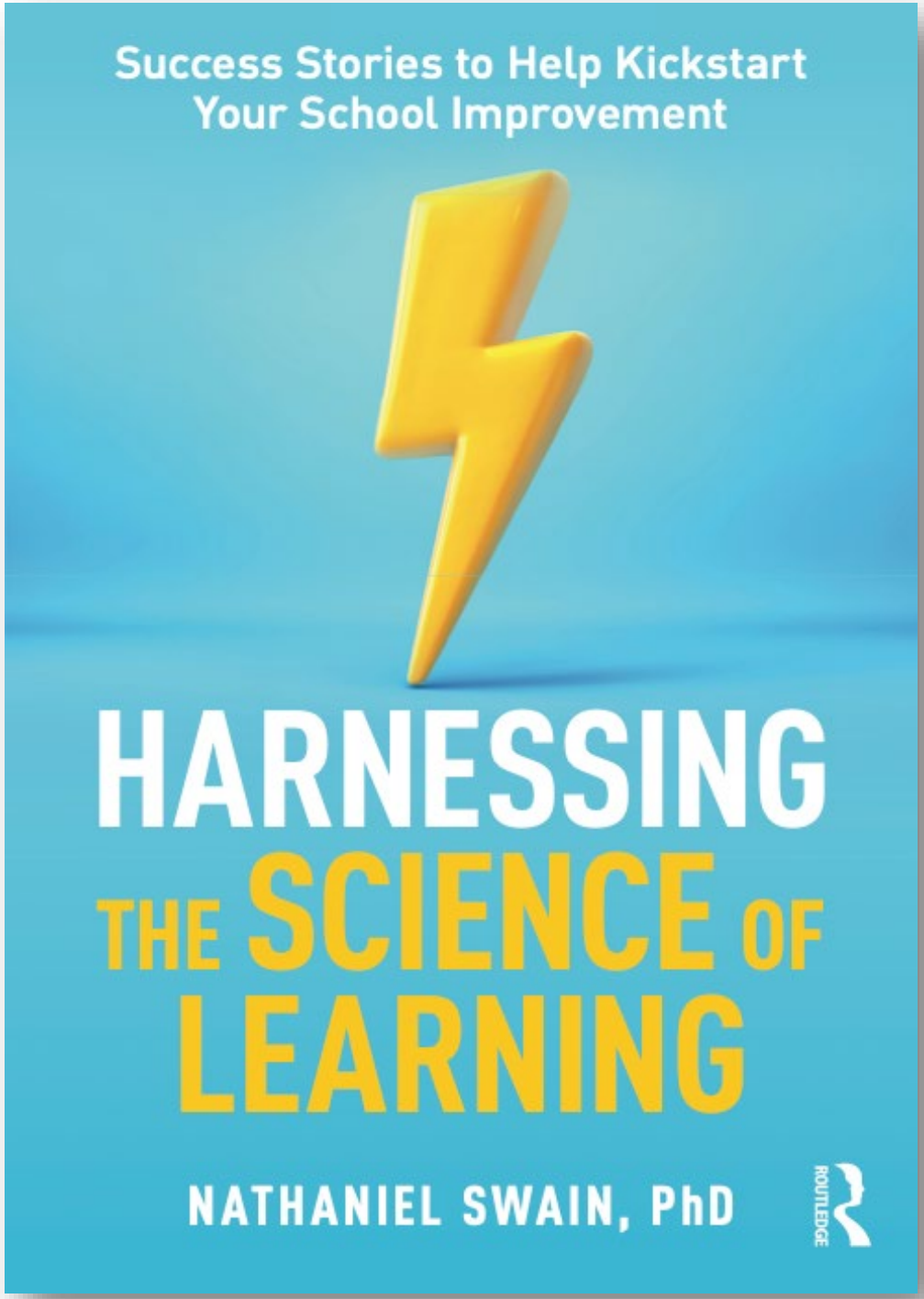
- They Explore; Discover
- Hands-On Experience
- Inspire some AWE
- Go off-trail
- They make things;
  Do projects;
- You set open-ended tasks;
- Give choice


A PODCAST
CHALK DUST
WITH REBECCA BIRCH
& DR. NATHANIEL SWAIN


LUMINARY
NS
with
Dr Nathaniel Gwain

DR NATHANIEL SWAIN

@NathanielRSwain



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