

SCIENCE ^{OF} LEARNING

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The Science of Simplicity

Applying Cognitive Load Theory to Instructional Design

Jamie Clark

Jamie Clark

@XpatEducator

- **Head of Professional Growth**
- **English Teacher**
- **Instructional Designer**
- **Author of *Teaching One-Pagers***

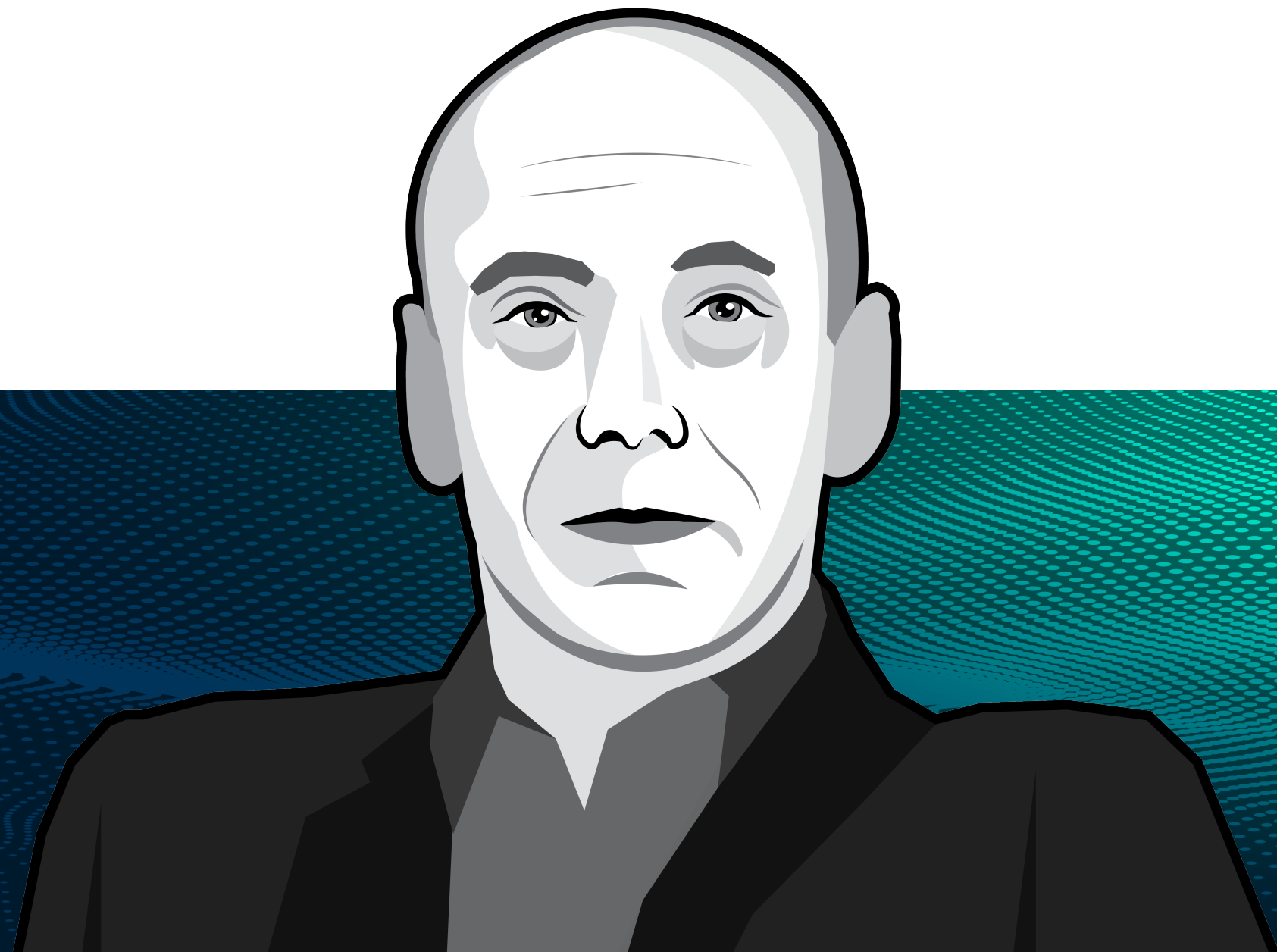


Session Objective

You will learn how...

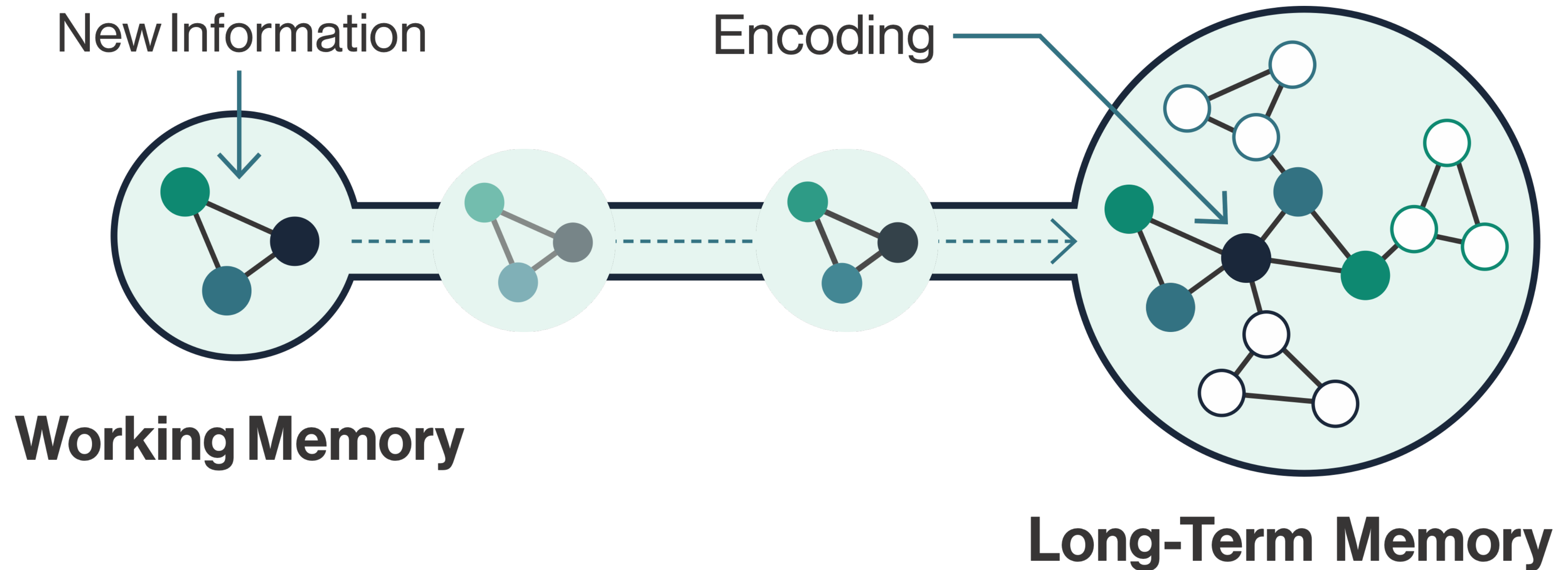
Applying the principles of Cognitive Load Theory helps educators to design clear and effective instructional materials that reduce students' cognitive load.

“The aim of all instruction is to **alter long-term memory. If nothing has changed in long-term memory, nothing has been learned.”**



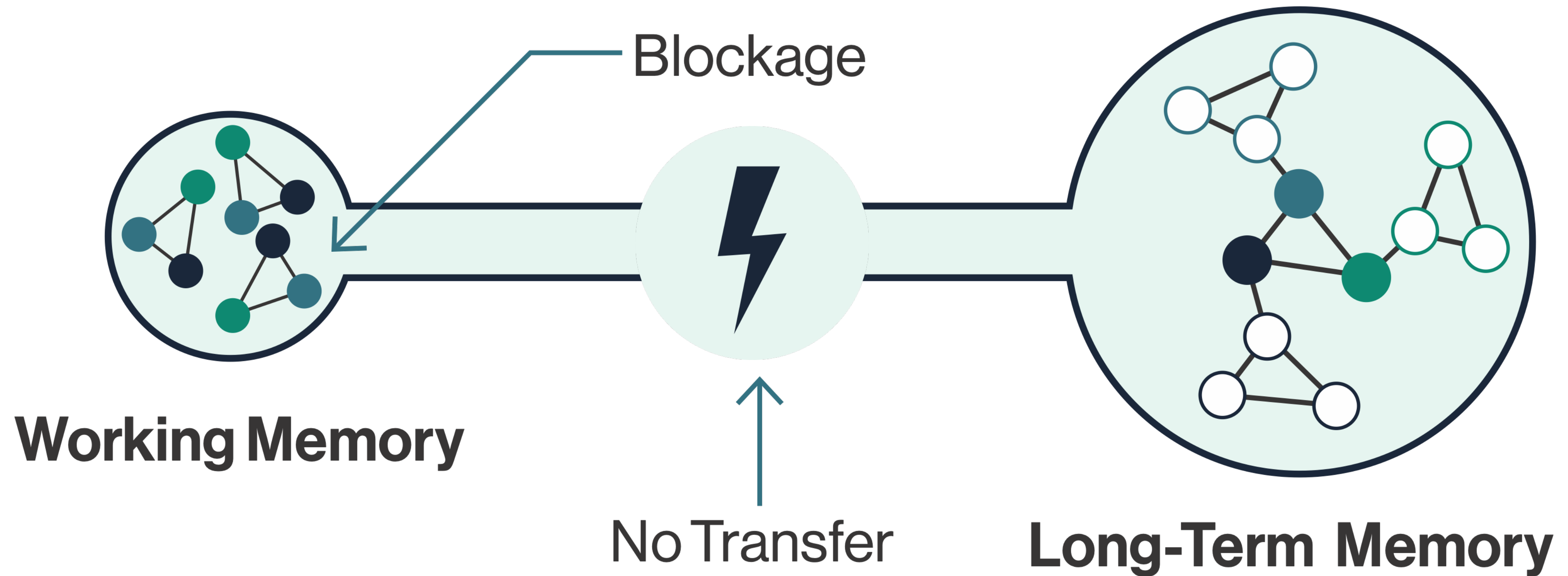
Paul Kirschner et al. (2006)

✓ How Learning Happens



REFERENCE Diagram adapted from InnerDrive's 'Working Memory vs Long-Term Memory'.

⊗ Cognitive Overload



REFERENCE Diagram adapted from InnerDrive's 'Working Memory vs Long-Term Memory'.



The Coherence Effect

Strategy 1 Cut the Clutter!

“Students learn more deeply when extraneous words, pictures, and sounds are **eliminated rather than included.”**



Richard E. Mayer (2001)

The Coherence Effect

Occurs when extraneous, irrelevant, or decorative information is included, distracting from the core content.

NOTE Sweller refers to this same effect more broadly as **The Redundancy Effect**

Classroom Example

A Year 9 History teacher is introducing the causes of World War II to her class using the following PowerPoint slide.





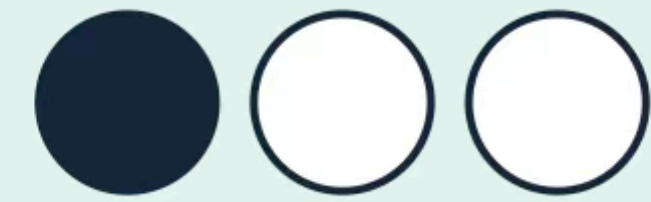
- 1. What might overload students' working memory?**
- 2. Where have you seen this before in your subject?**
- 3. How might you fix this problem?**

Cut the Clutter!

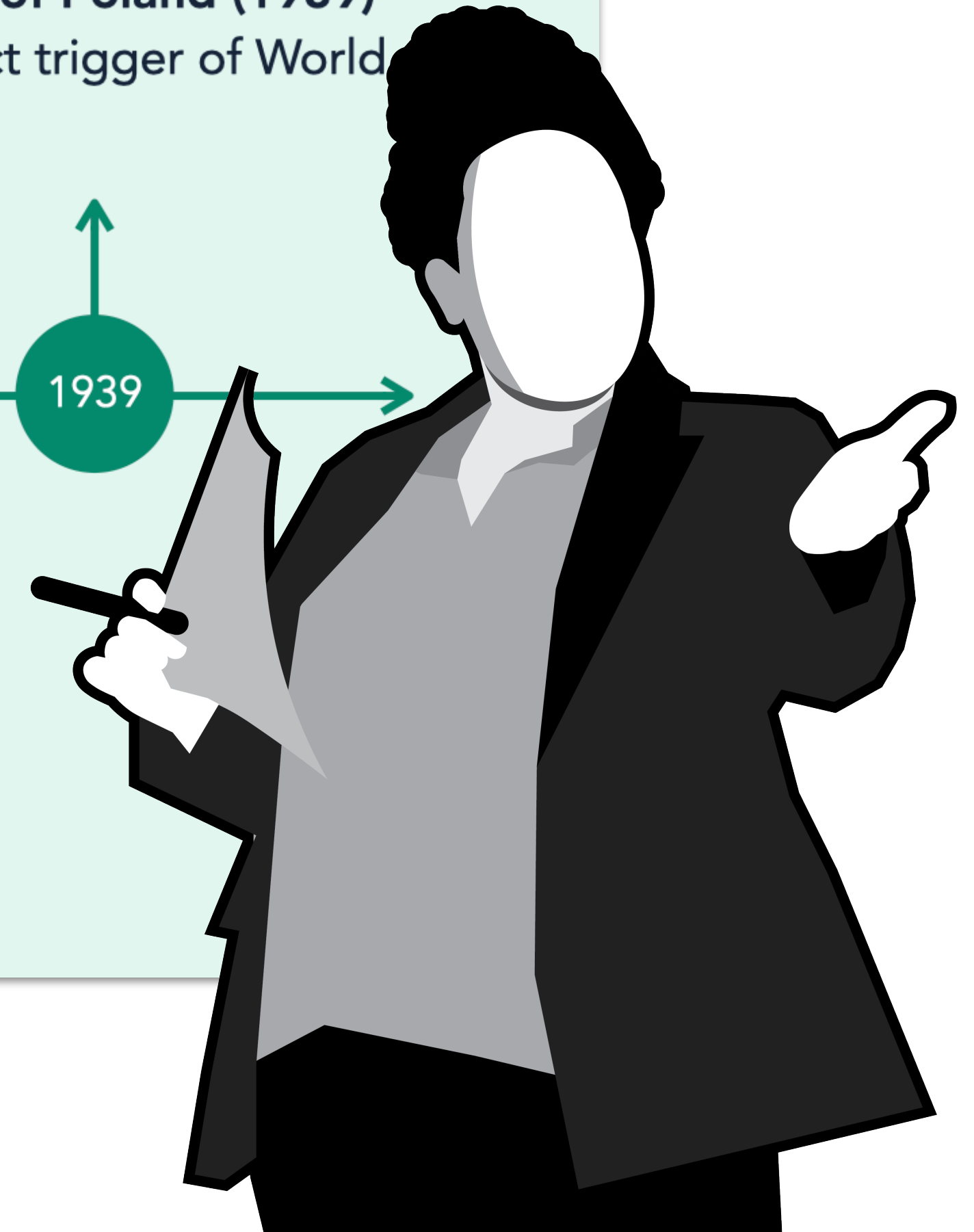
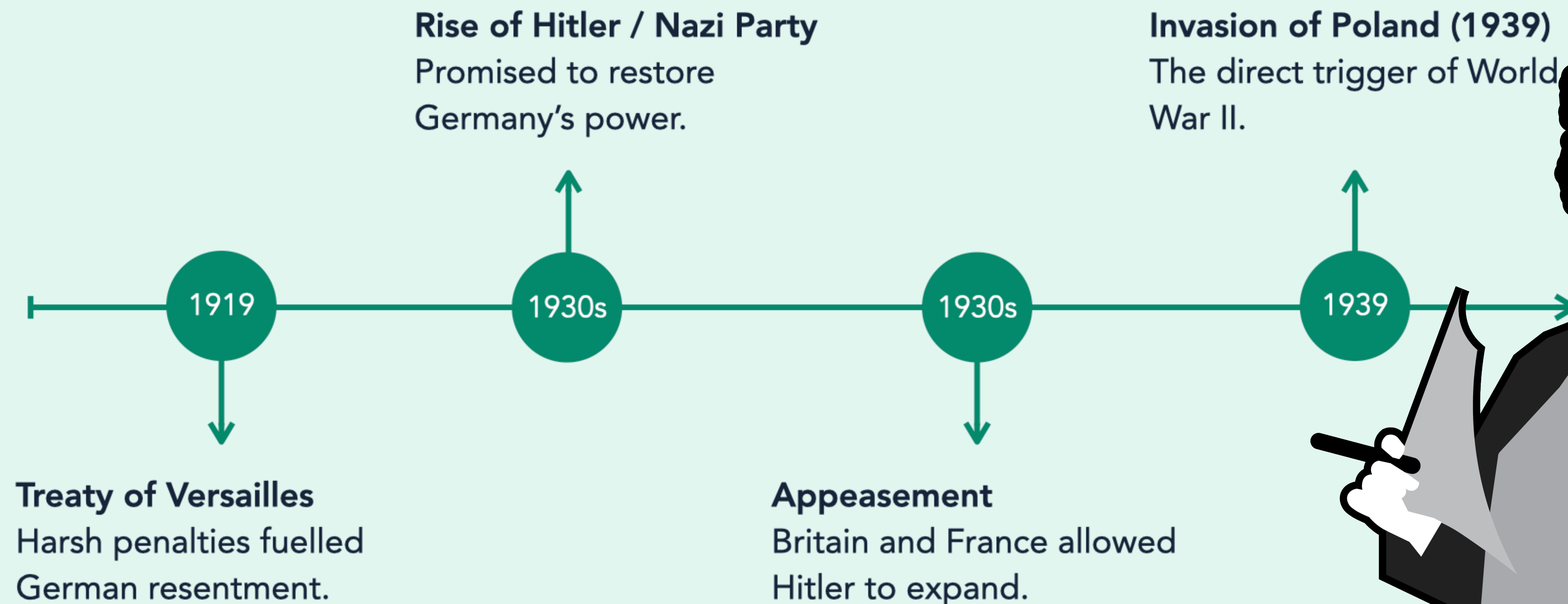
Avoid The Coherence Effect by...

- ✓ Editing long text into concise bullet points or timelines for clarity.
- ✓ Breaking content into sections or spread it across multiple slides.
- ✓ Removing distracting or decorative visuals.

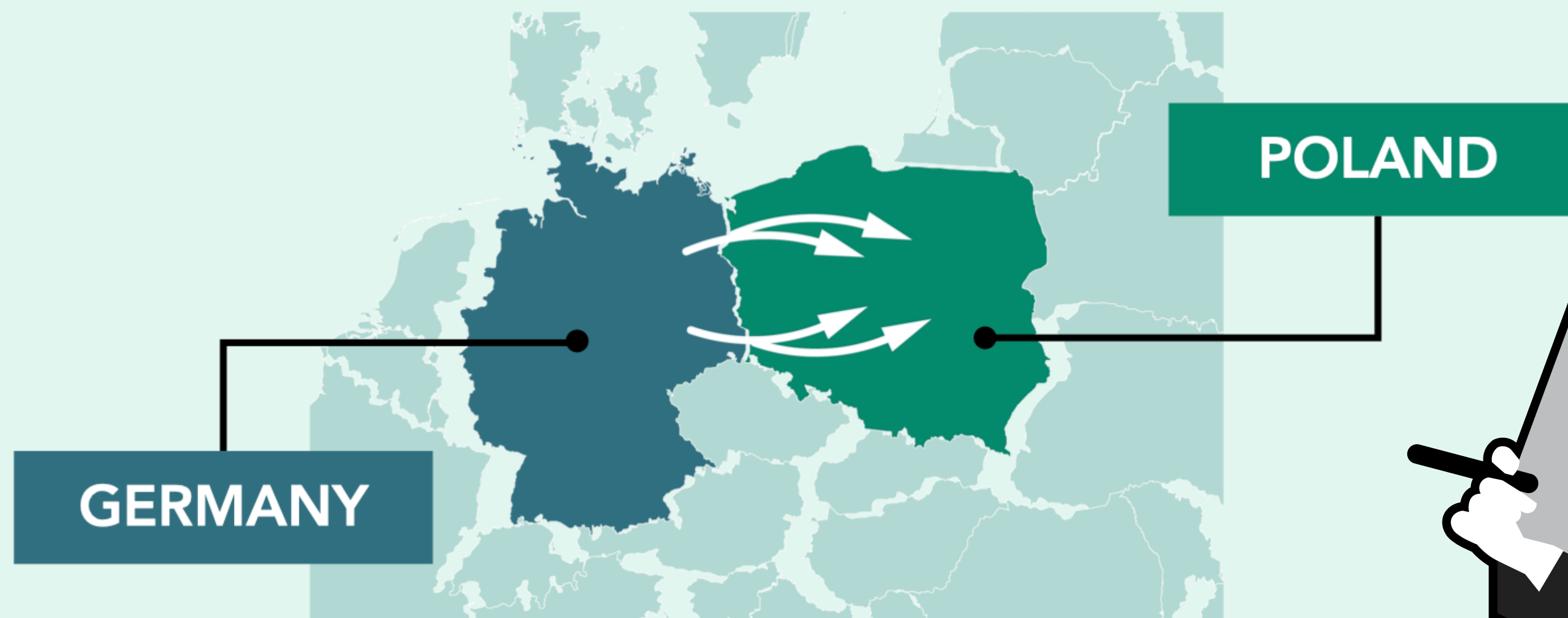
The Main Causes of World War II



The Main Causes of World War II



Invasion of Poland (1939) – Direct trigger of World War II.





The Causes of World War II

World War II was caused by a variety of factors that built up over time. The Treaty of Versailles, signed in 1919, imposed harsh penalties on Germany, leading to economic hardship and resentment. This dissatisfaction contributed to the rise of Adolf Hitler and the Nazi Party, which promised to restore Germany's former glory. During the 1930s, Britain and France followed a policy of appeasement, allowing Hitler to expand Germany's territory unchecked. This emboldened him further, leading to the invasion of Poland in 1939, which directly triggered the outbreak of the war.



The Main Causes of World War II



- **Treaty of Versailles**

Harsh penalties fuelled German resentment.

- **Rise of Hitler and the Nazi Party**

Promised to restore Germany's power.

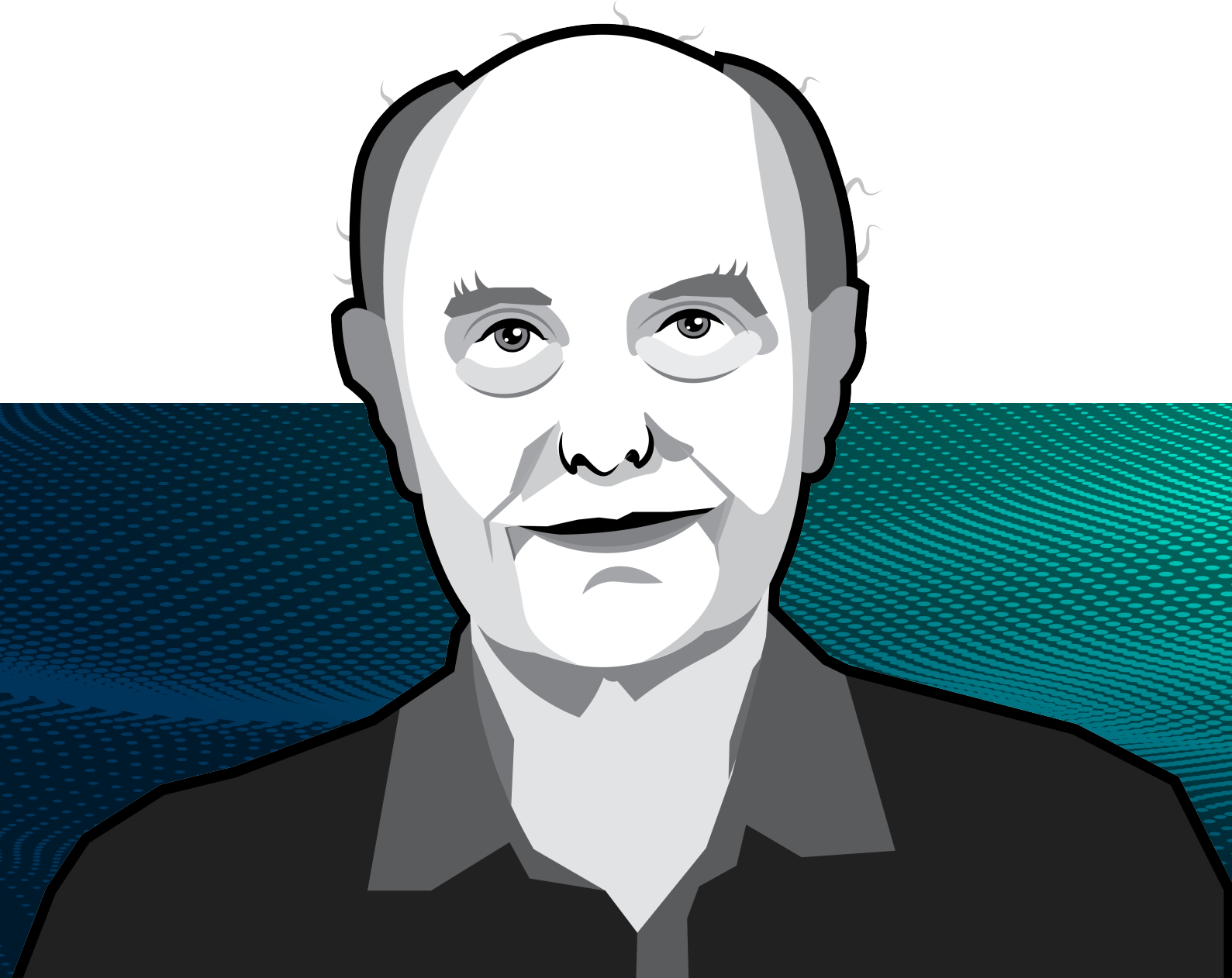
- **Appeasement**

Britain and France allowed Hitler to expand.

The Transient Information Effect

Strategy 2 Keep Key Info Visible!

**“Excess cognitive load can
be caused by excessive
transient information.”**



John Sweller et al (2011)

The Transient Information Effect

Occurs when key information is presented briefly and then disappears, making it harder for students to retain and process.

Classroom Example

A Year 6 teacher explains multiplication using decimals while showing a step-by-step worked example on PowerPoint slides.

Step 1

We ignore the decimals first, then adjust at the end.

$$3.2 \times 1.5$$

Step 2

Ignore the decimals and multiply as whole numbers:

$$32 \times 15 = 480$$

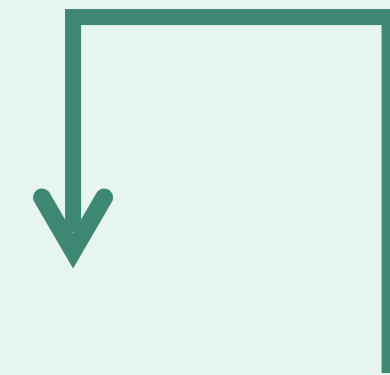
Step 3

The original numbers have two decimal places:

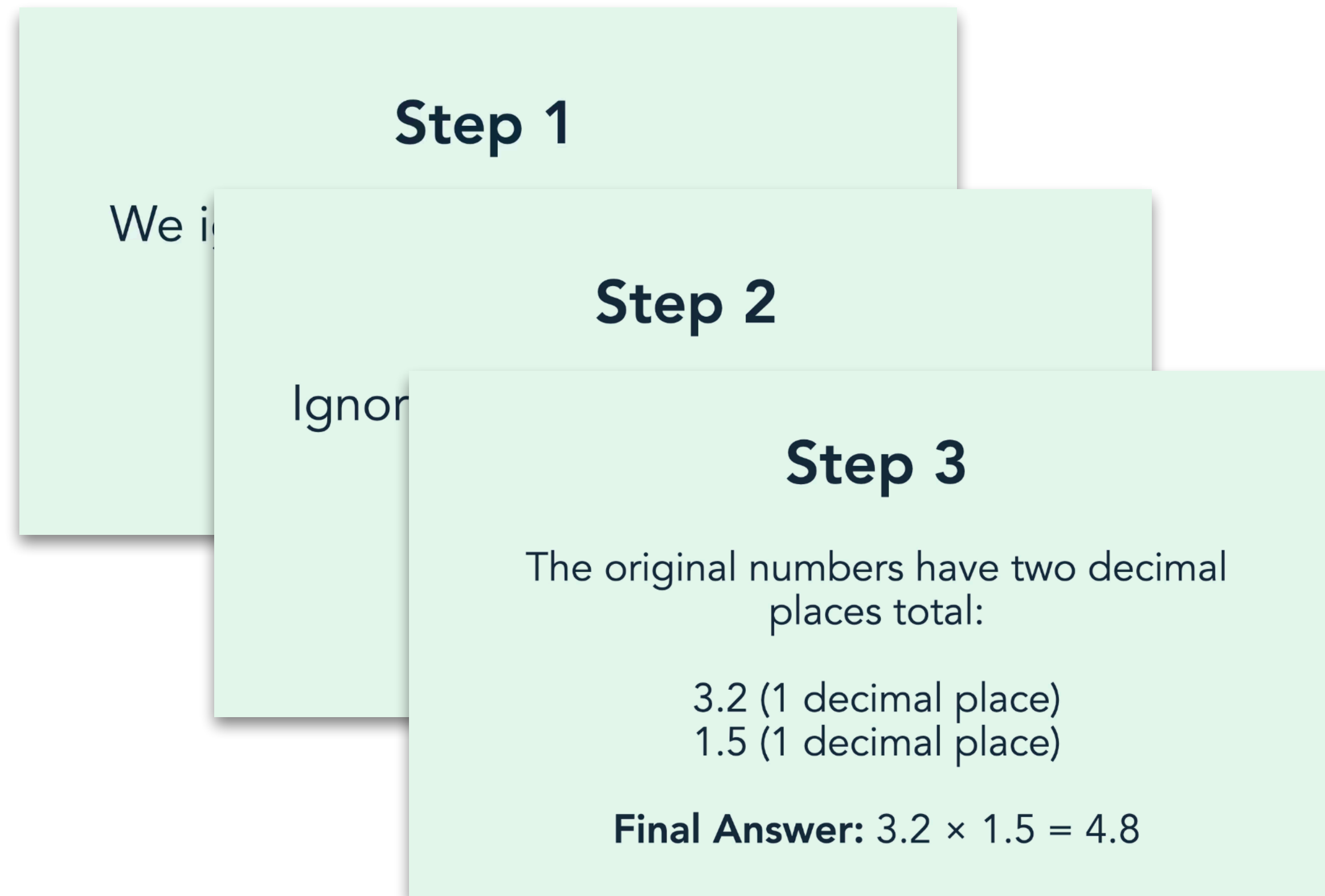
$$32 \times 15 = 480$$

3.2 (1 decimal place)

1.5 (1 decimal place)



Final Answer: $3.2 \times 1.5 = 4.80$



1. What might overload students' working memory?
2. Where have you seen this before in your subject?
3. How might you fix this problem?

Keep Key Info Visible!

Avoid The Transient Information Effect by...

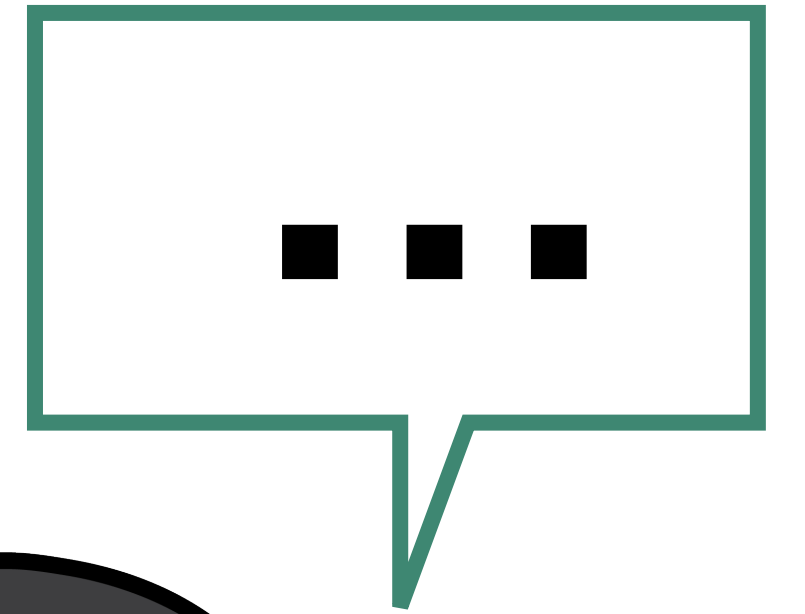
- ✓ Providing handouts with summaries or steps for key information.
- ✓ Consistently structuring content clearly into sections or boxes.
- ✓ Using navigation aids such as tabs, cues or headings.

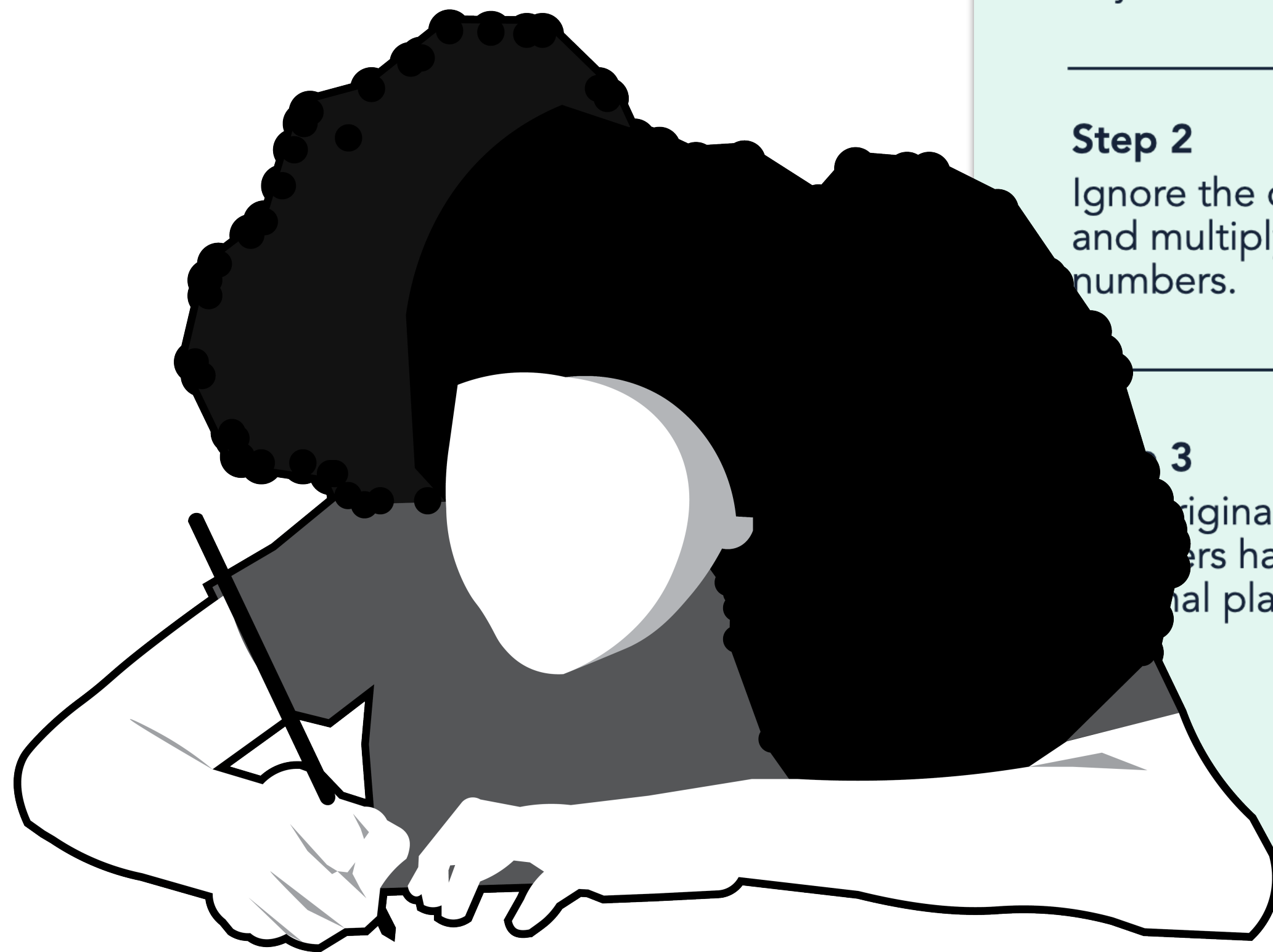
- 1
- 2
- 3

Step 1

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Multiplication

Decimals

Division

Decimals

Step 1

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$$3.2 \times 1.5$$

Step 2

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The original numbers have two decimal places:

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3.2 (1 decimal place)

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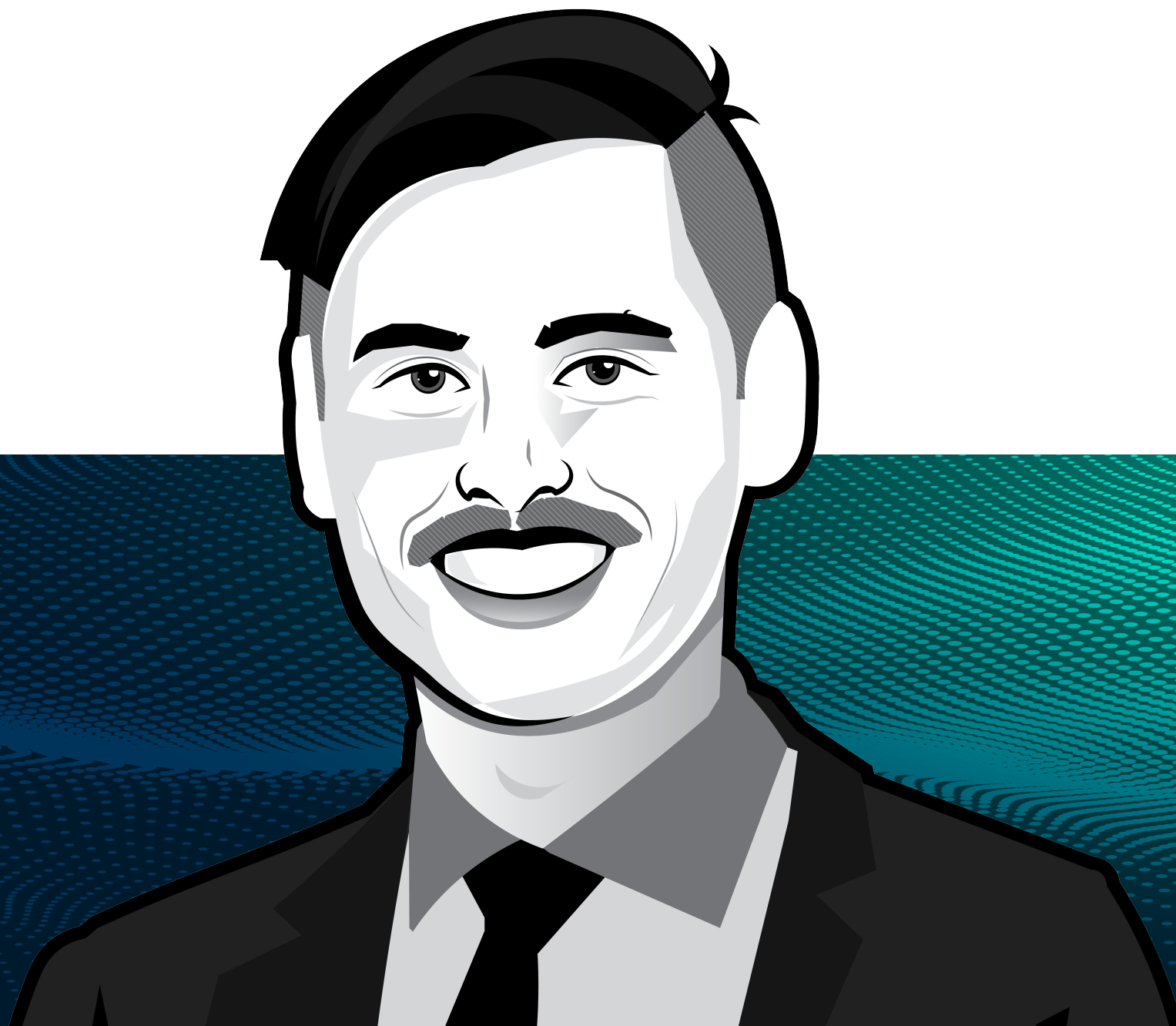
Final Answer:

$$3.2 \times 1.5 = 4.80$$

The Split Attention Effect

Strategy 3 Keep it Together!

“Information that must be combined should be placed together in space and time.”



Ollie Lovell (2020)

The Split Attention Effect

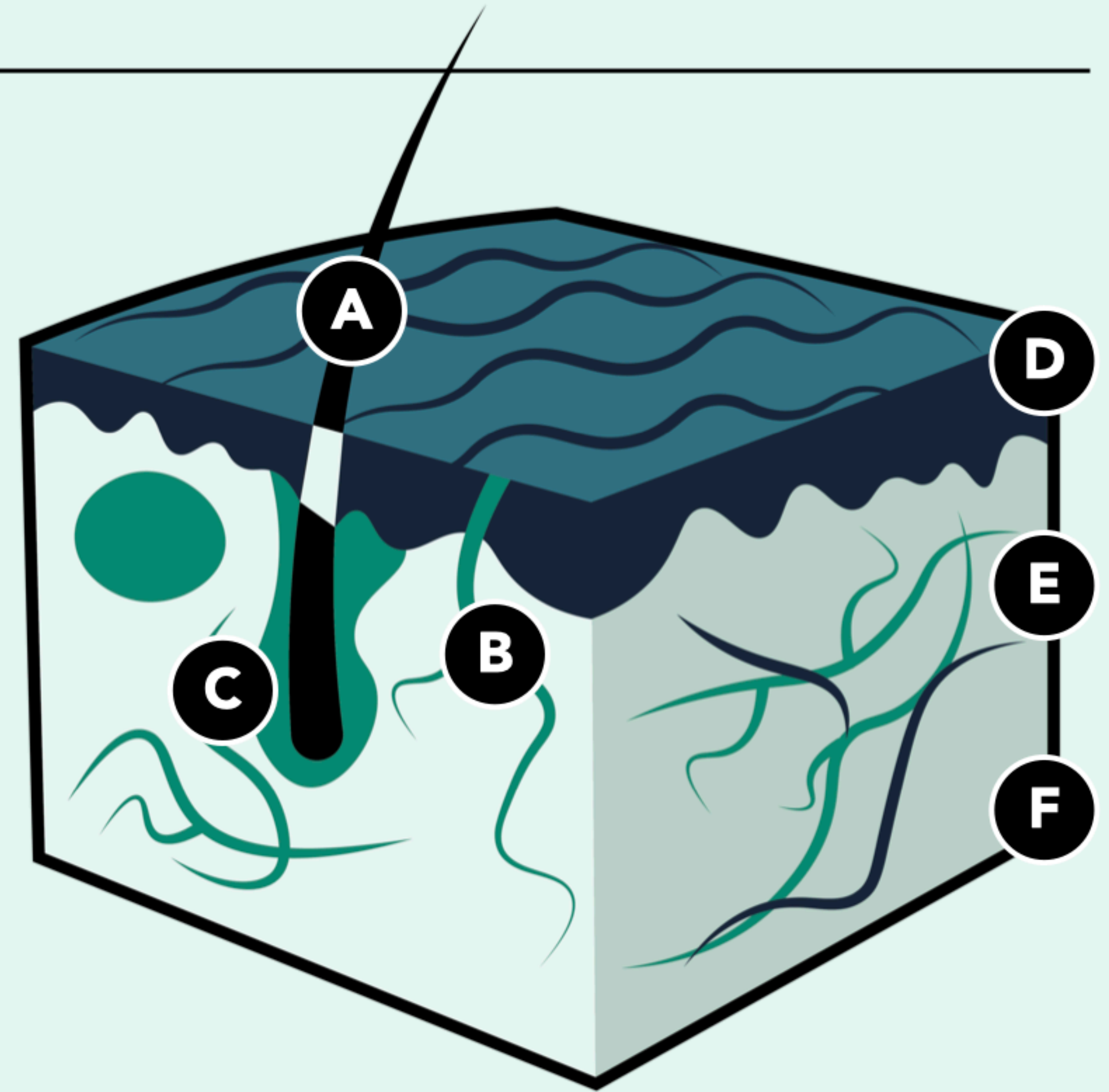
Occurs when students must divide their attention between multiple sources of information that need to be mentally integrated.

Classroom Example

A Year 11 Biology teacher is explaining the layers of the human skin as he shows the following diagram displayed on a PowerPoint slide.

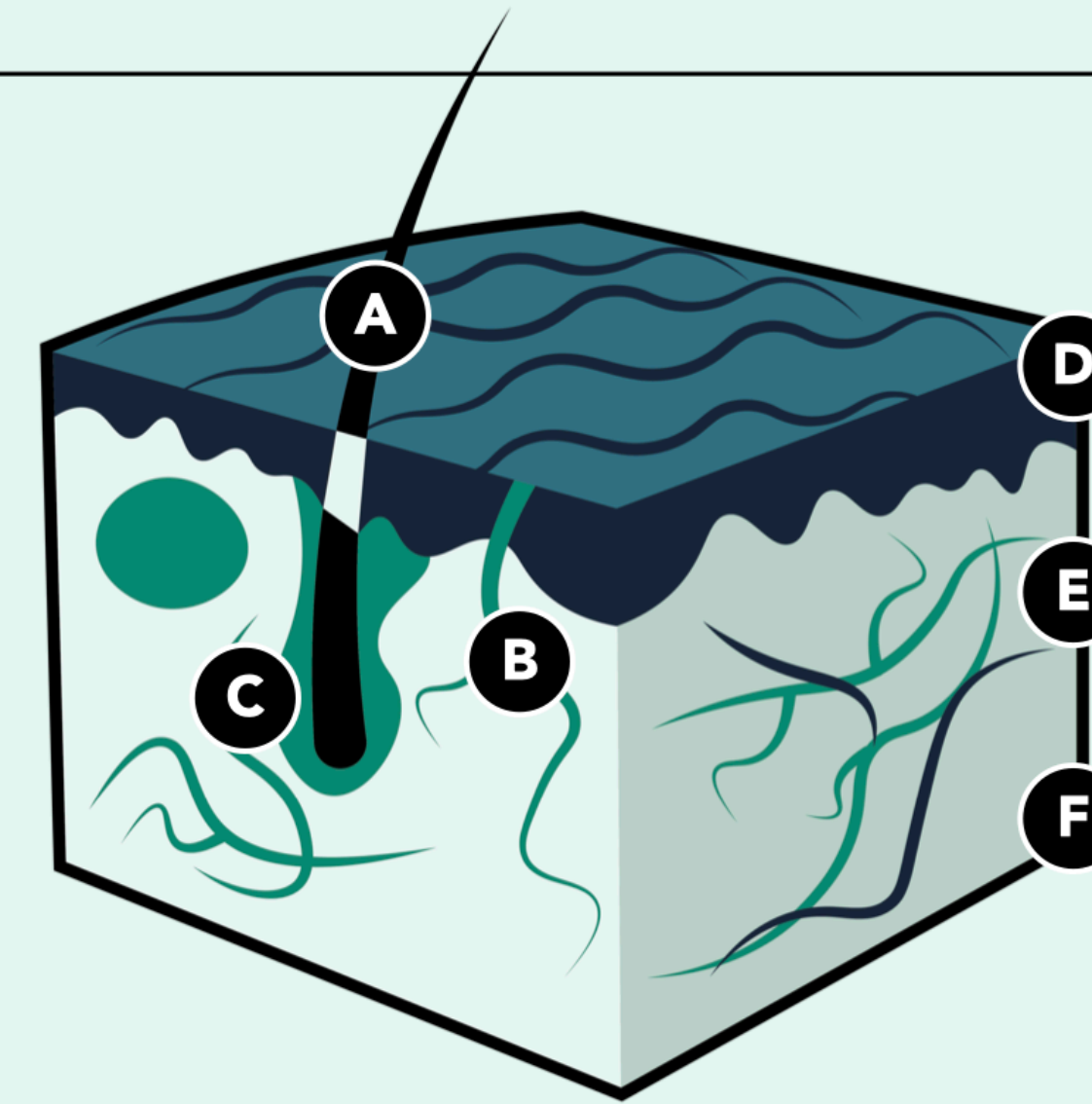
The Layers of Human Skin

- A** **Hair Shaft** The visible part of the hair that extends above the skin's surface, made of keratin.
- B** **Pore** A small opening on the skin's surface that allows sweat and oil to be released.
- C** **Hair Follicle** A tube-like structure where hair grows, supplying nutrients and anchoring the hair root.
- D** **Epidermis** The outermost layer of the skin that acts as a protective barrier against the environ.
- E** **Dermis** The thicker middle layer of the skin that contains blood vessels, nerves, and glands.
- F** **Hypodermis** The deepest layer of the skin, made of fat and connective tissue,



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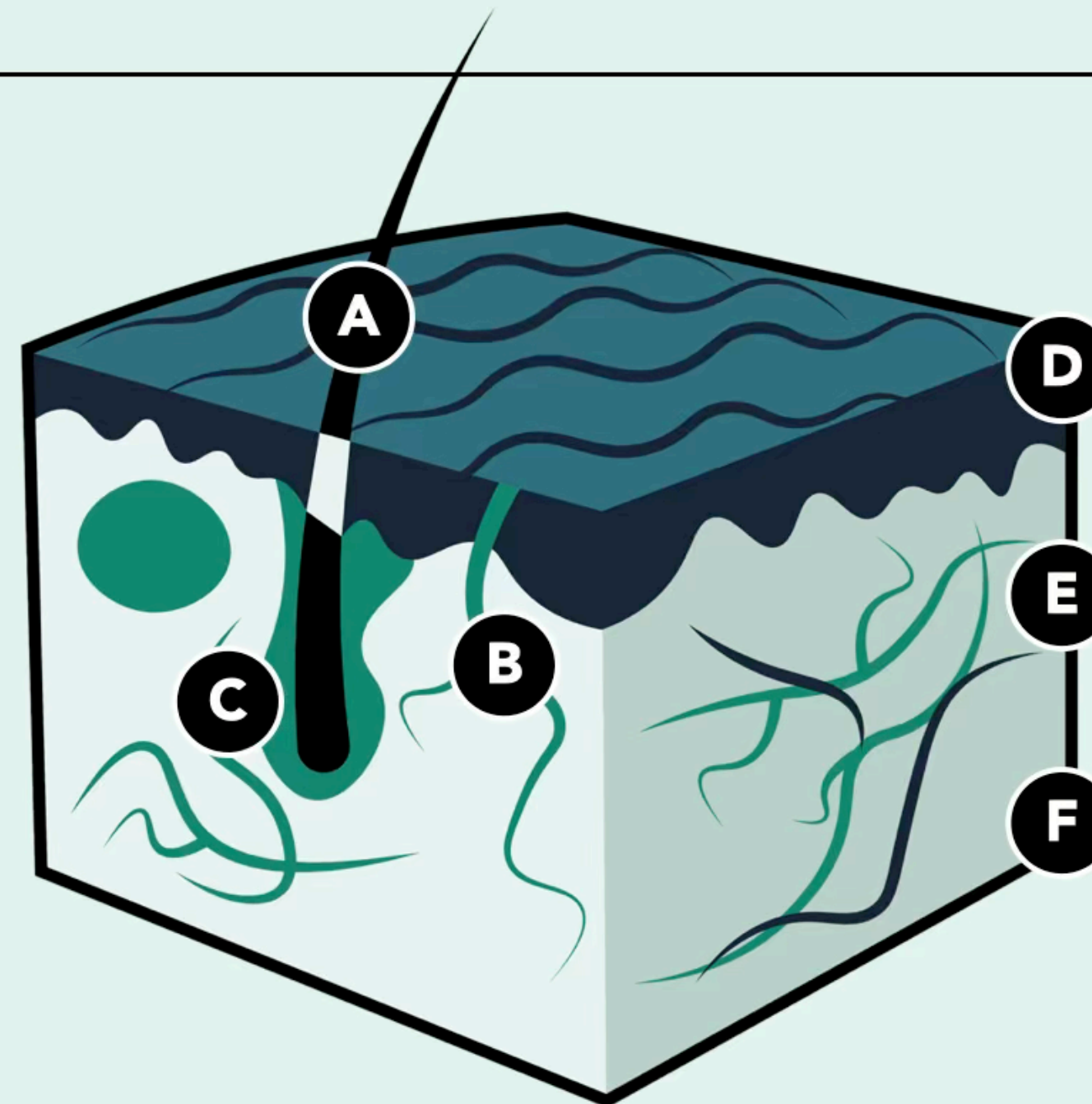
Keep it Together!

Avoid The Split-Attention Effect by...

- ✓ Integrating labels directly into diagrams.
- ✓ Provide summaries to capture all required information on one page.
- ✓ Using spoken explanations instead of written text with visuals.

The Layers of Human Skin

- A** **Hair Shaft** The visible part of the hair that extends above the skin's surface, made of keratin.
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Summary

Pitfalls and Best Practices

Avoid!

Overloading working memory by considering...

- × **Coherence Effect** = Too much unnecessary stuff.
- × **Transient Information Effect** = Stuff that disappears too quickly.
- × **Split-Attention Effect** = Too many things to focus on.

Remember!

Optimise cognitive load in instructional design by...

- ✓ Focusing only on key information.
- ✓ Keeping essential information visible.
- ✓ Combining related information.

Teaching
one **Pagers**

Evidence-informed summaries for
busy educational professionals



Jamie Clark

 **JOHN CATT**
FROM HODDER EDUCATION

A JOHN CATT PUBLICATION

Teaching
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Evidence-informed summaries for
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2
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Jamie Clark

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THE SCIENCE OF SIMPLICITY

APPLYING COGNITIVE LOAD THEORY TO INSTRUCTIONAL DESIGN



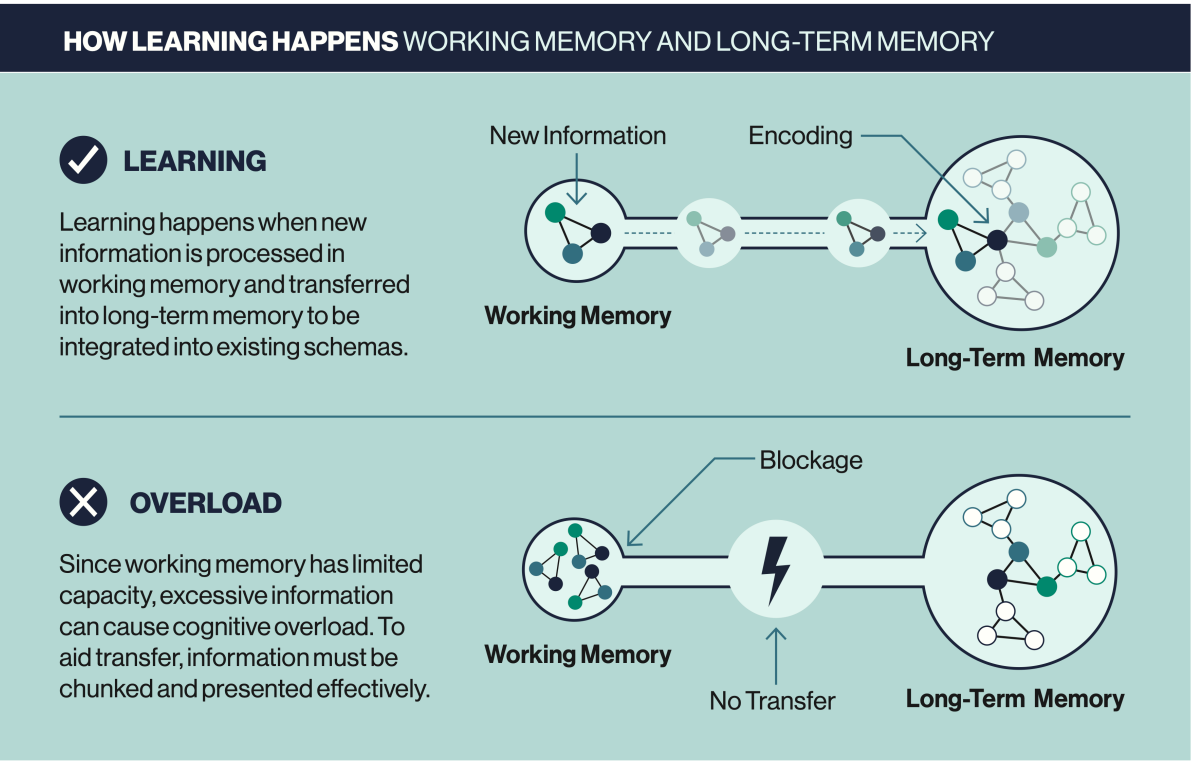
The aim of all instruction is to alter long-term memory. If nothing has changed in long-term memory, nothing has been learned.
'Why Minimal Guidance During Instruction Does Not Work' 2006



Students learn more deeply when extraneous words, pictures, and sounds are eliminated rather than included.
Multimedia Learning 2001

COGNITIVE LOAD THEORY + INSTRUCTIONAL DESIGN

Effective instructional design isn't just about presenting information—it's about making learning clear and manageable. Cognitive Load Theory (CLT) helps educators structure materials to reduce cognitive overload, improving learning. By overcoming The Coherence Effect, The Transient Information Effect, and The Split-Attention Effect, teachers can cut unnecessary distractions, keep key information manageable, and integrate content effectively. This one-pager provides practical strategies and examples to create learning materials that support student thinking, not overwhelm it.



REFERENCE Diagram adapted from InnerDrive's 'Working Memory vs Long-Term Memory' poster.

POORLY DESIGNED LEARNING RESOURCES = COGNITIVE OVERLOAD

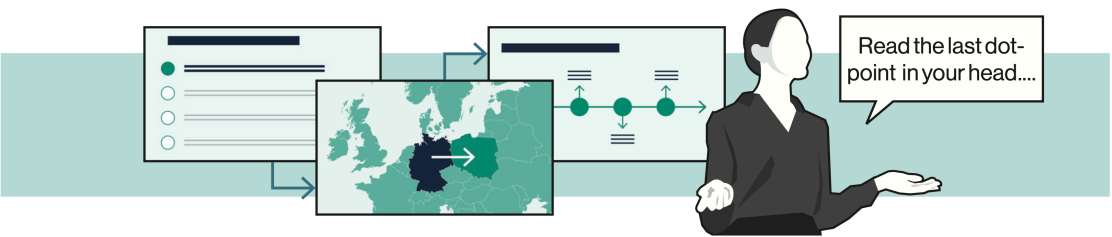
Poorly designed learning materials can overload working memory, making it harder for students to process and retain information. For example, a science PowerPoint slide filled with dense text and irrelevant images can distract students from key learning (Coherence Effect). A history lesson where key dates are only spoken without written support can cause students to forget crucial details (Transient Information Effect). Similarly, a math lesson where students must constantly switch between a diagram and separate explanations can confuse them and slow down learning (Split-Attention Effect).



Cognitive load theory has been designed to provide guidelines intended to assist in the presentation of information in a manner that encourages learner activities that optimise intellectual performance
'Cognitive Load During Problem Solving: Effects on Learning' 1988



Extraneous load is minimised by good instructional design... Information that must be combined should be placed together in space and time.
Cognitive Load Theory in Action 2020

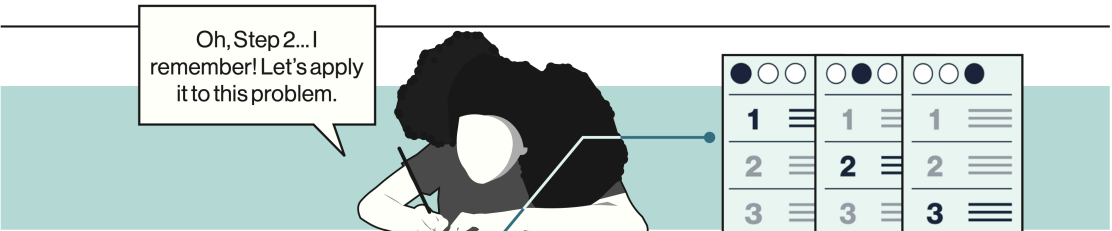


1. THE COHERENCE/REDUNDANCY EFFECT CUT THE CLUTTER!

The Coherence Effect (also known as The Redundancy Effect) occurs when extraneous, irrelevant, or decorative information is included, distracting from the core content, causing cognitive overload. When designing lessons, educators can avoid The Coherence Effect by...

- ✓ Editing long text into concise bullet points or timelines for clarity.
- ✓ Breaking content into sections or spreading it across multiple slides.
- ✓ Removing distracting or decorative visuals.

EXAMPLE A History teacher introduces the causes of World War II using slides with bullet points, a simple map, and a structured breakdown across multiple slides. She allows students to read the information first before expanding on the points.

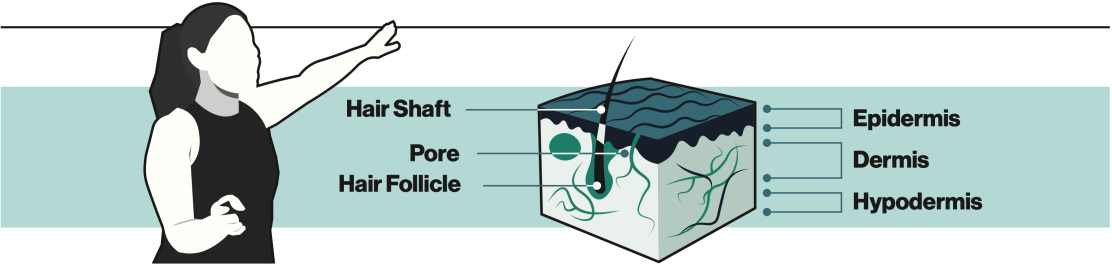


2. THE TRANSIENT INFORMATION EFFECT KEEP KEY INFO VISIBLE!

The Transient Information Effect occurs when key information is presented briefly and then disappears, making it harder for students to process, causing extraneous cognitive load. When designing instructional materials, educators can avoid The Transient Information Effect by...

- ✓ Providing handouts with summaries, steps or checkpoints of key information.
- ✓ Consistently structuring content clearly into logical sections or boxes.
- ✓ Using navigation aids such as tabs, cues or headings in PowerPoints and handouts.

EXAMPLE A Primary teacher explains multiplication using decimals while showing a worked example across several PowerPoint slides. To capture the transient information and free-up working memory, she creates a step-by-step handout containing an example with all the steps.



3. THE SPLIT-ATTENTION EFFECT KEEP IT TOGETHER!

The Split-Attention Effect occurs when students must divide their attention between multiple sources of information that need to be mentally integrated. When designing instructional materials, educators can avoid The Split-Attention Effect by...

- ✓ Integrating simple labels directly into diagrams.
- ✓ Providing summaries to capture all required information on a single page spread.
- ✓ Using spoken explanations instead of written text with visuals (leverage Modality Effect).

EXAMPLE A Biology teacher explains the layers of the human skin by showing a diagram on a slide. To reduce cognitive load, she integrates labels directly onto the diagram rather than listing them separately. She also hands out a one-pager containing all of the required information.

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MAKING RESEARCH-BASED INSTRUCTIONAL DESIGN CHOICES



JARED COONEY HORVATH

When it's time to teach, PowerPoint should be a scaffold—not the star. Students come to learn from you, not your slides. Be the crux of the lesson and let handouts do the supporting, not the heavy lifting.

'The Neuroscience of PowerPoint' Keynote Melbourne CSHE (2015)



JAMIE CLARK

Simplicity isn't dumbing down—it's clearing the path. When we strip away the noise, we amplify what matters most: thinking, connection, and transferring learning to long-term memory.

'The Science of Learning Conference' (2025)

Fonts and Backgrounds

Use serif fonts such as *Georgia* for printed text (e.g. handouts or booklets) and sans serif fonts like *Helvetica* for screens or slides to enhance readability. Stick to simple backgrounds—white or black—to minimise distractions and keep the focus on your content.



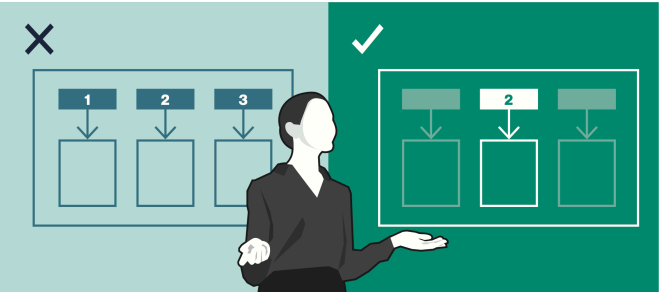
Cue Key Information

Signal key information to guide learner focus and reduce cognitive load. Use exogenous visual cues such as highlighting, arrows, bold text, consistent headers, and numbering to make structure clear and draw attention to what matters most in your resources.



Reveal and Dim Objects

In slideshows, reveal and dim objects to manage attention and avoid overload. Present information gradually—too much at once can overwhelm learners, while simplicity helps them focus and retain key points. Mark simple steps or sections on your handouts.



Use Supporting Visuals

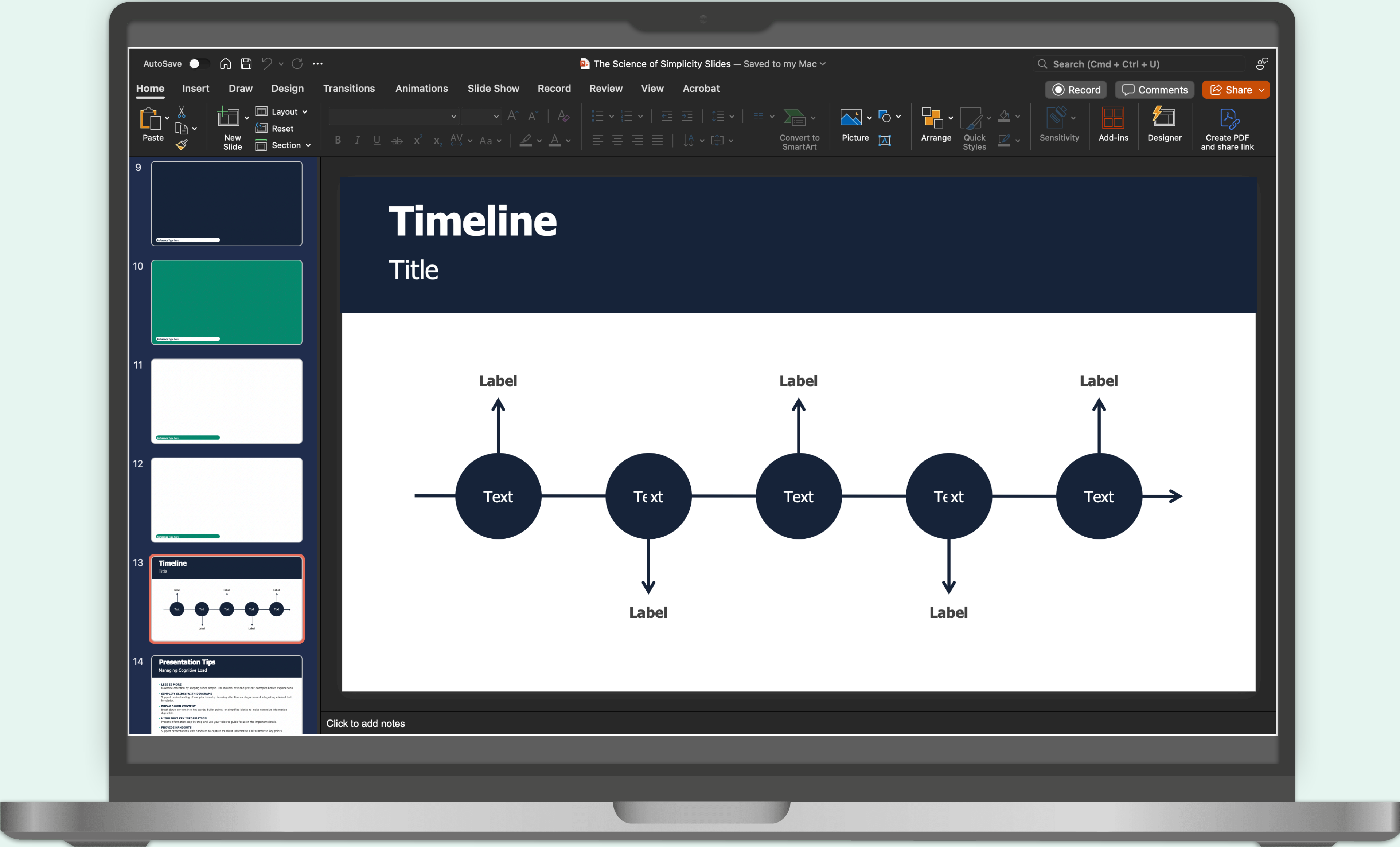
Use supporting visuals that directly reinforce what you're teaching, not just for decoration. Choose meaningful images or diagrams and place any related text close to the image to help learners make clear connections without searching through the resource.



Segment into Sections

Break content into clearly defined sections or smaller chunks to reduce cognitive load and maintain attention. Avoid overwhelming layouts by using a consistent and familiar layout or pattern to free up attention for learning, not navigation or searching for information.





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MAKING

JARED COO HORVATH

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'The Neuroscience of PowerPoint' K. Horvath, Melbourne CS (2015)

PAUL KIRSCHNER

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RICHARD E. MAYER

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'Multimedia Learning' 2001

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APPLYING COGNITIVE LOAD THEORY TO INSTRUCTIONAL DESIGN

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The Science of Simplicity
Applying Cognitive Load Theory to Instructional Design

Jamie Clark
@KpsEducator

- Head of Professional Growth
- English Teacher
- Instructional Designer
- Author of 'Teaching One-Pagers'

Session Objective
You will learn how...

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"The aim of all instruction is to alter long-term memory. If nothing has changed in long-term memory, nothing has been learned."

Paul Kirschner et al. (2006)

How Learning Happens

New Information → Encoding → Working Memory → Long-Term Memory

Cognitive Overload

Working Memory → Blockage → No Transfer → Long-Term Memory

1. THE COHERENCE EFFECT CUT THE CLUTTER!

The Coherence Effect occurs when extraneous, irrelevant, or decorative elements are included, distracting from the core content, causing cognitive overload.

✓ How Learning Happens

New Information → Encoding → Working Memory → Long-Term Memory

REFERENCE Diagram adapted from InnerDrive's 'Working Memory vs Long-Term Memory'.

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