

How Cognitive Load Theory changed my teaching



Tuesday 7 February 2023
7.15am-8.30am AEST

with



Dr. Zach &
Groshell
from the podcast
*Progressively
Incorrect*



Kathleen
O'Rourke
NSW DET

MIDDLE
LEADERS'
FORUM

 **THINK FORWARD**
EDUCATORS

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If you'd like to find out more about opportunities at the Catalyst project, and Catholic Education in Canberra, including the professional development and the way that they are engaging Australian and world leaders in evidence-based education, and even to explore employment opportunities, just click on the Catalyst logo.



What is
Cognitive Load
Theory?

Is learning a natural, “easy” process?

Primary Knowledge

Speaking one’s first language

Identifying faces and expressions

Walking and balancing

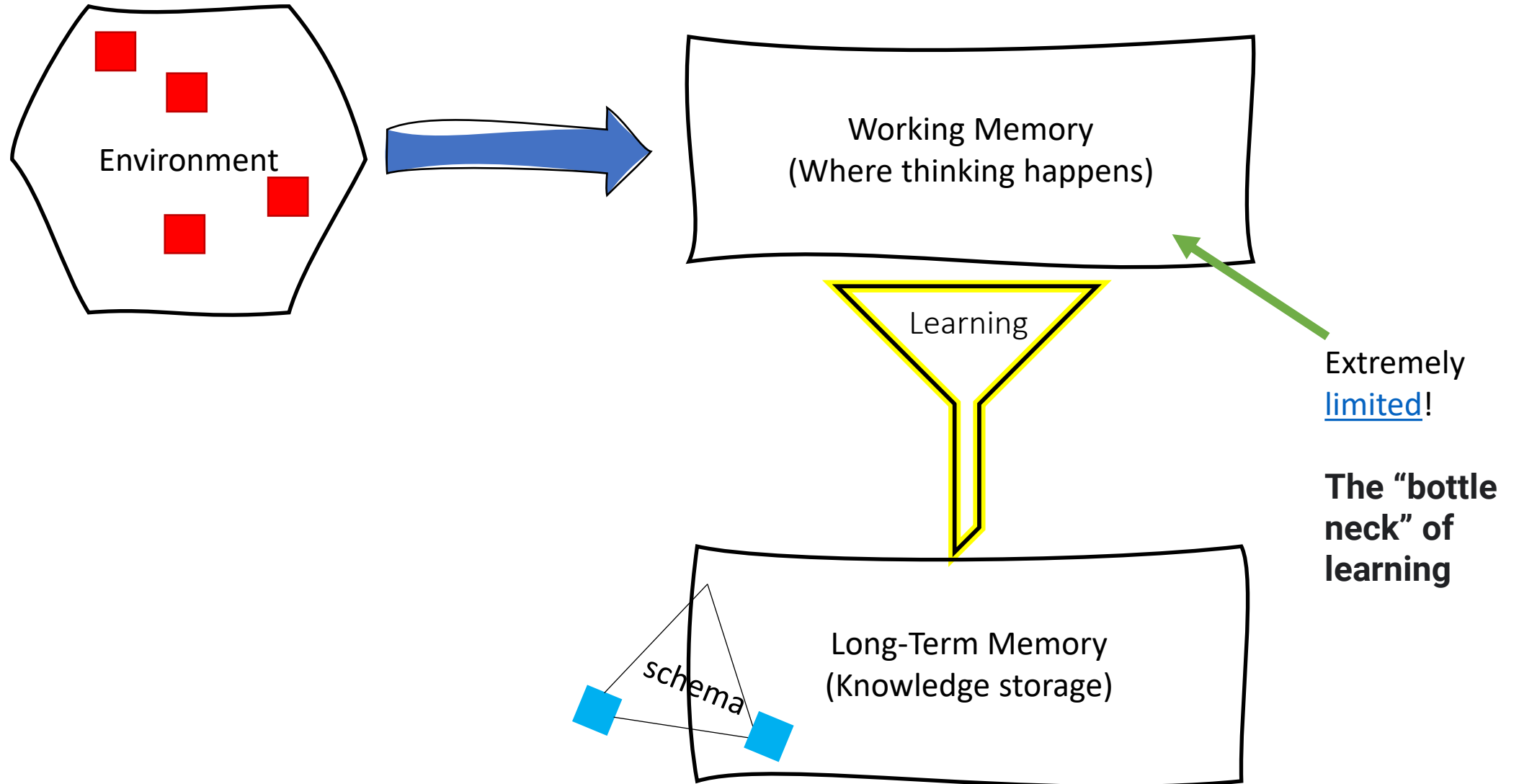
Secondary Knowledge

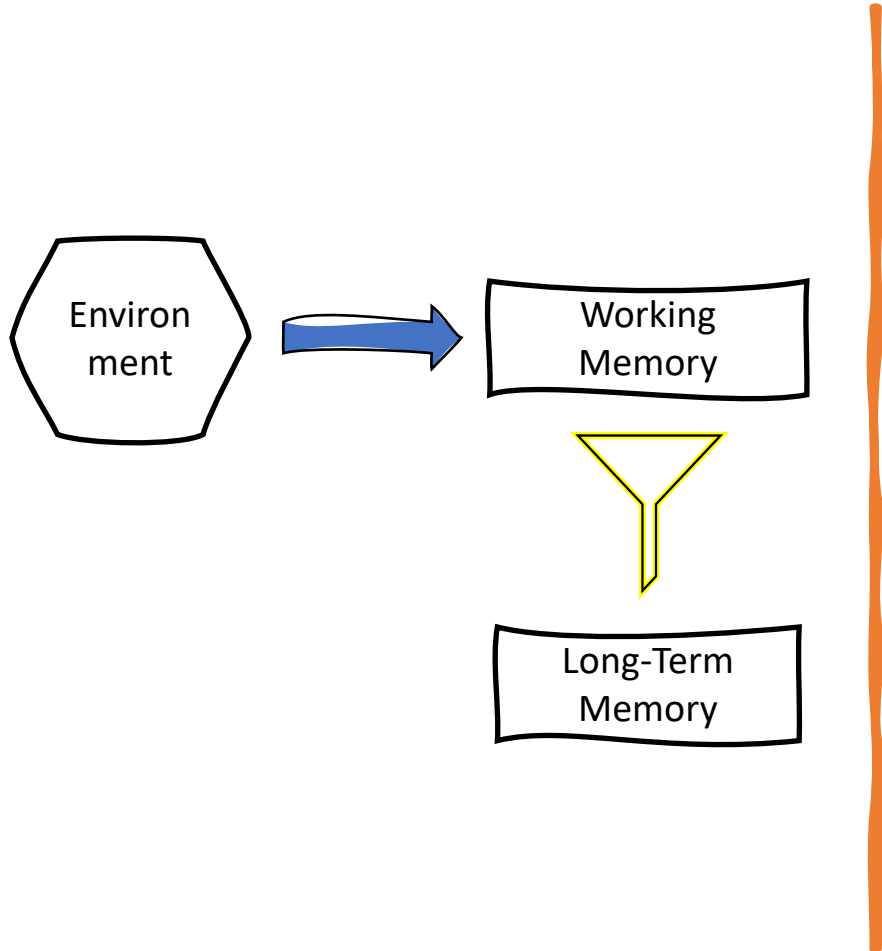
Learning to read

Learning to write

Learning maths

Model of the Mind

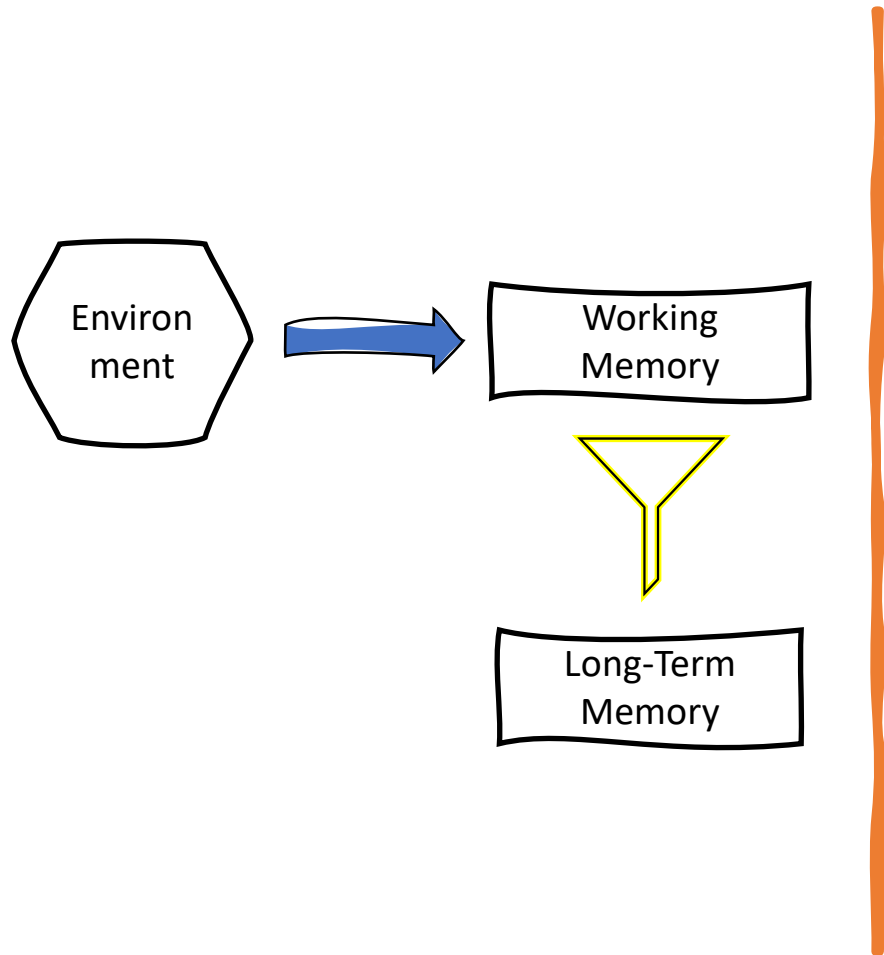




Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

7	8	9	Span
4	5	6	- 6 +
1	2	3	○ Slow
Forward	0	New Test	● Fast

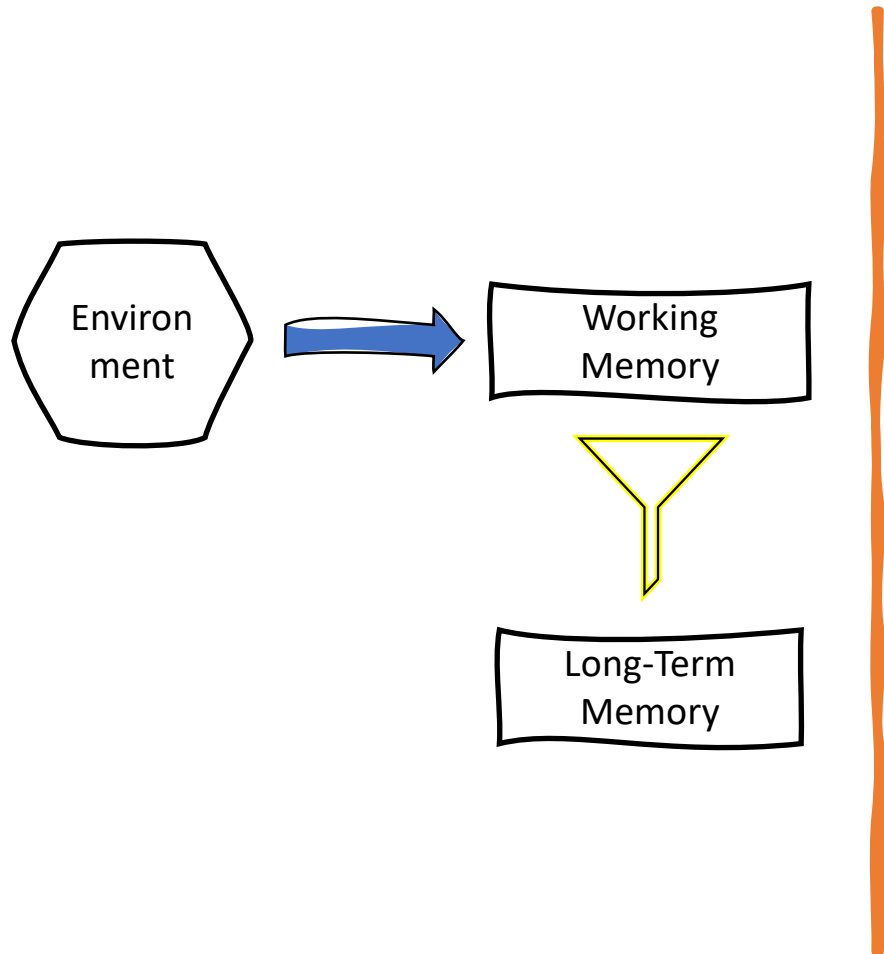


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

5

7	8	9	Span
4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

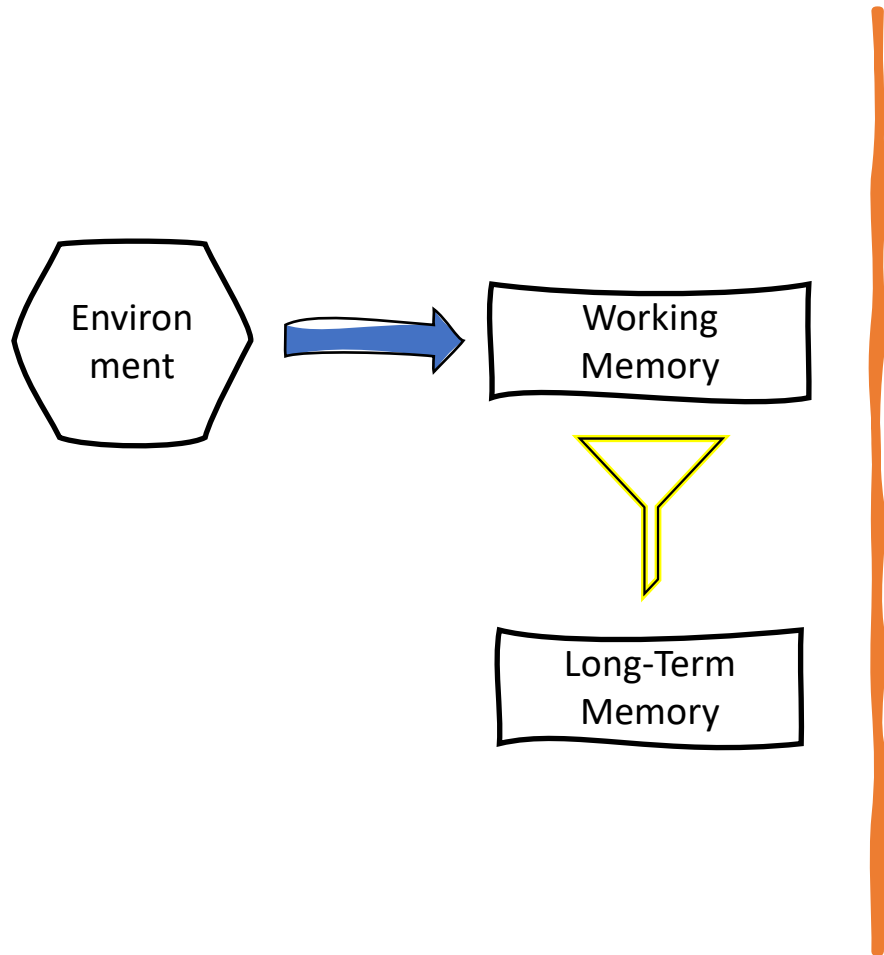


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

7

7	8	9	Span
4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

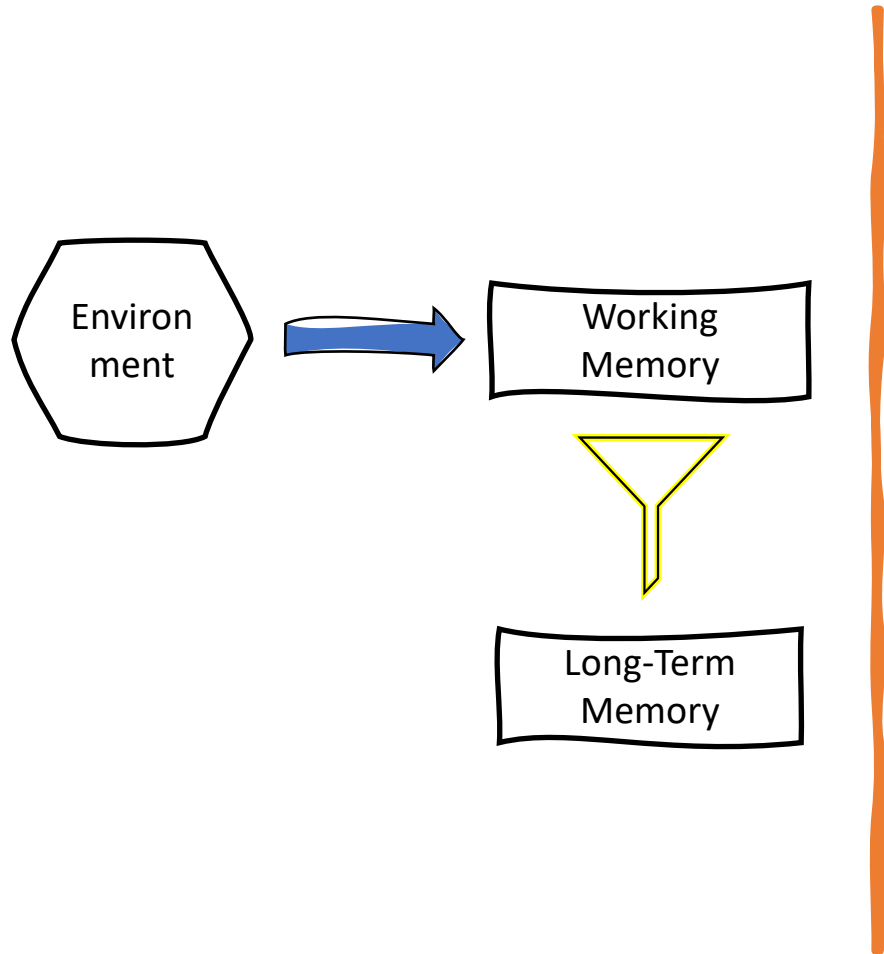


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

1

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4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

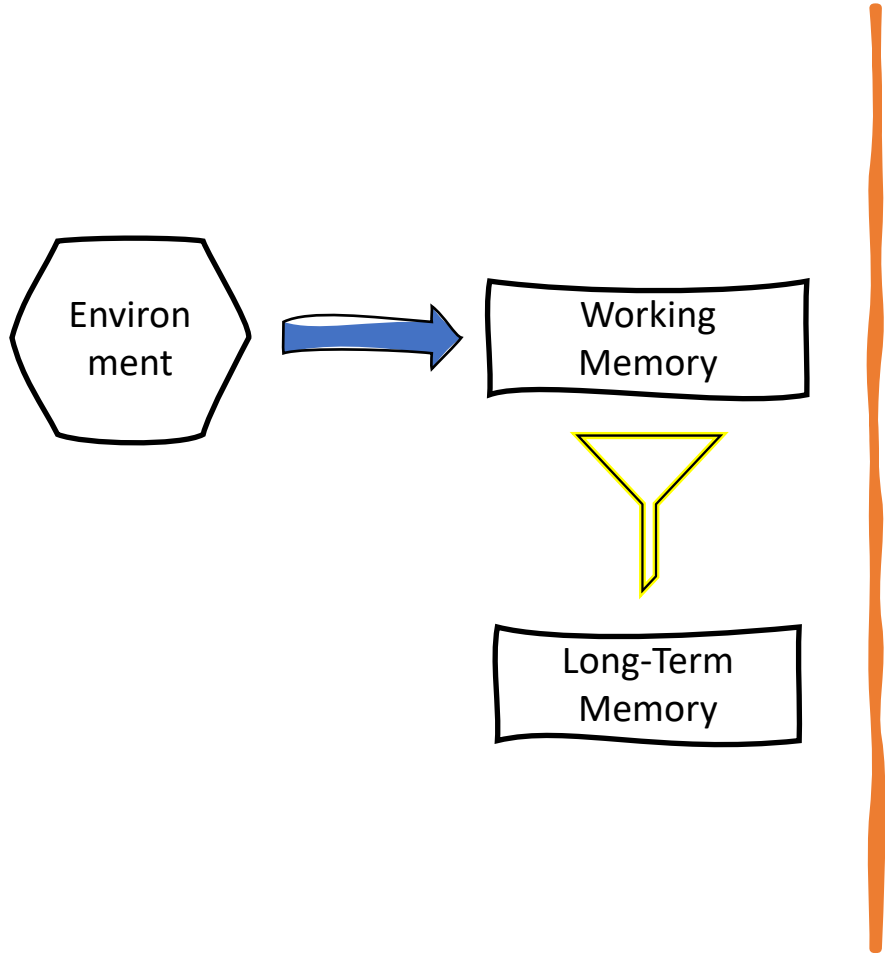


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

4

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1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

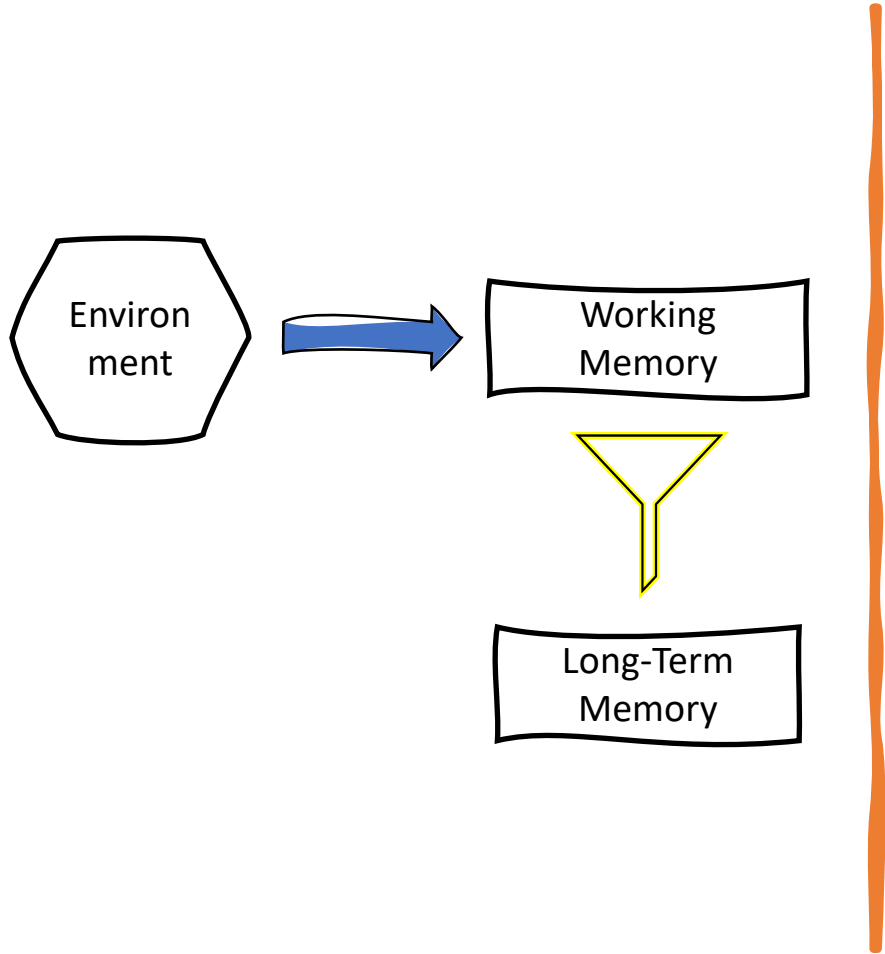


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

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4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

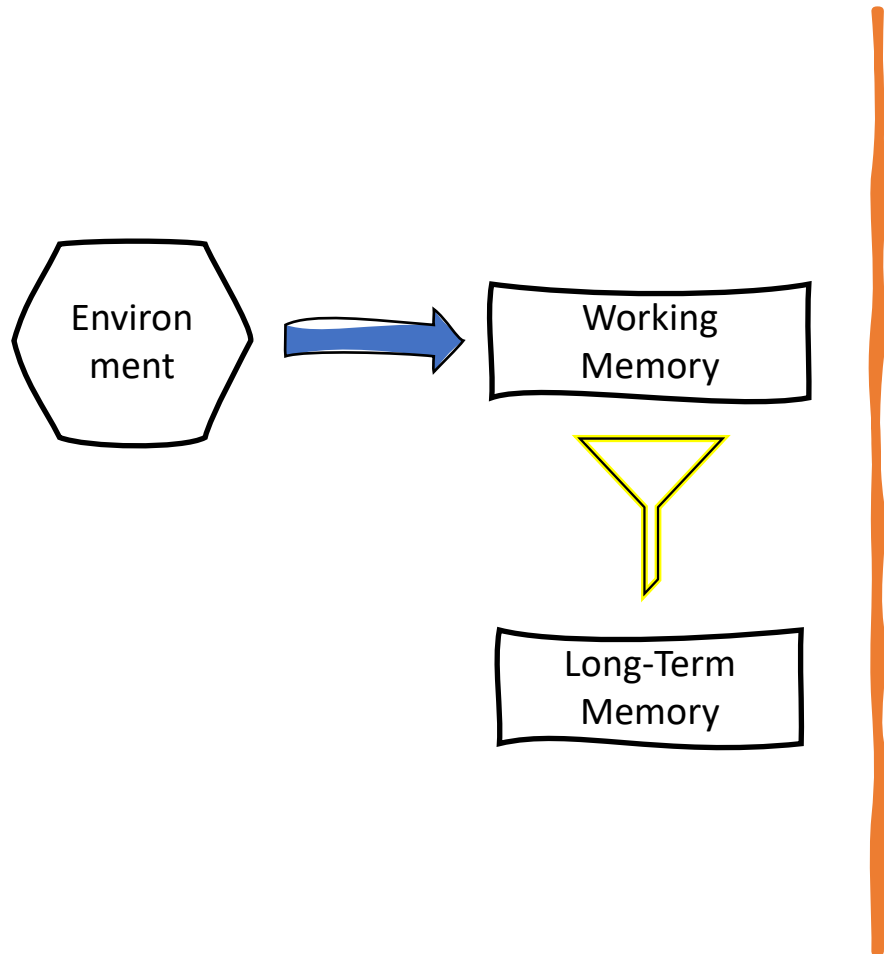


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

3

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1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

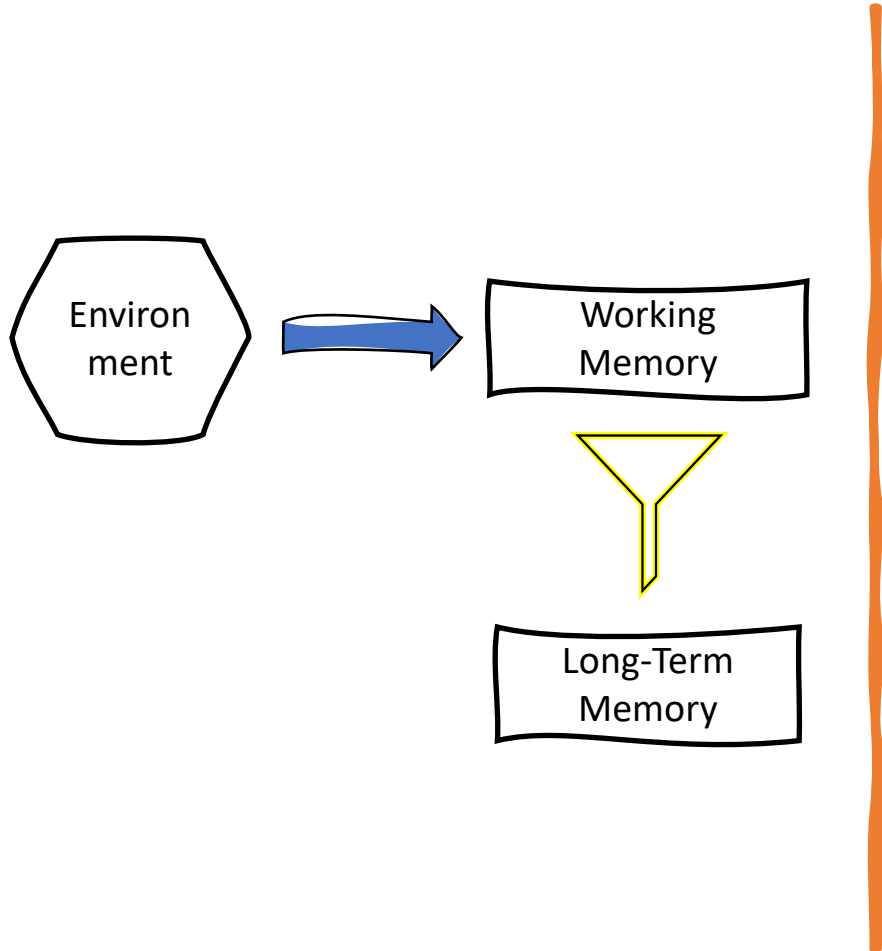


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

9

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4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

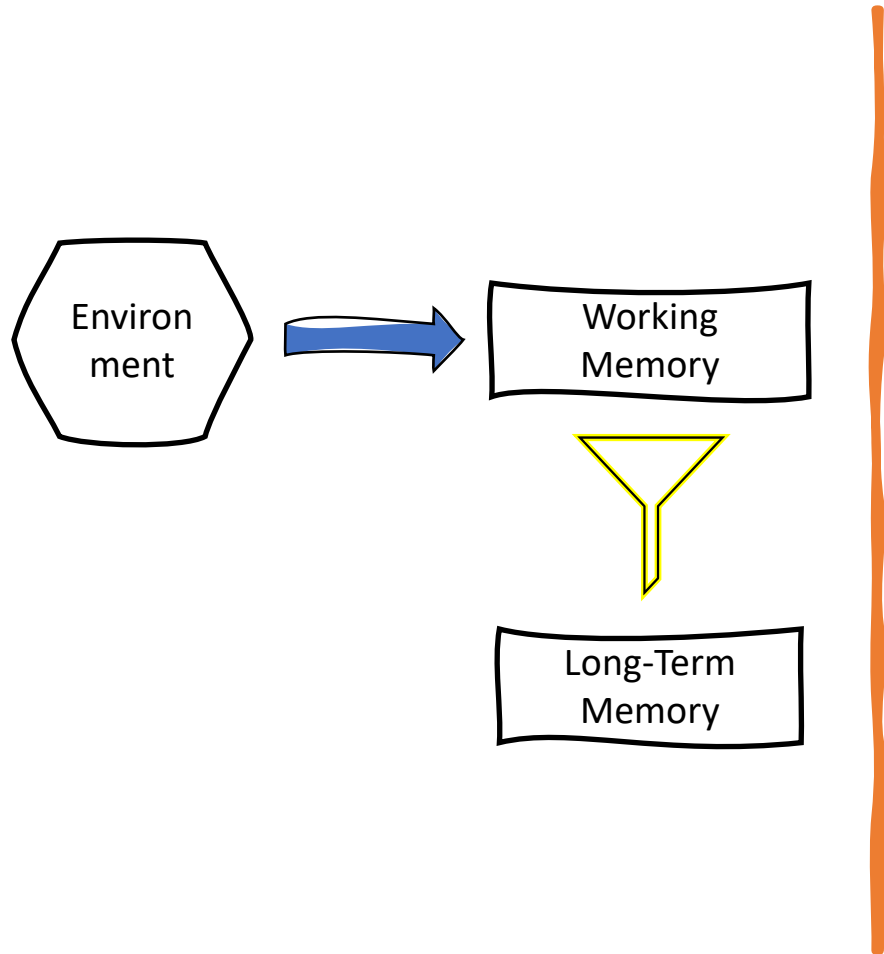


Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

8

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4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast



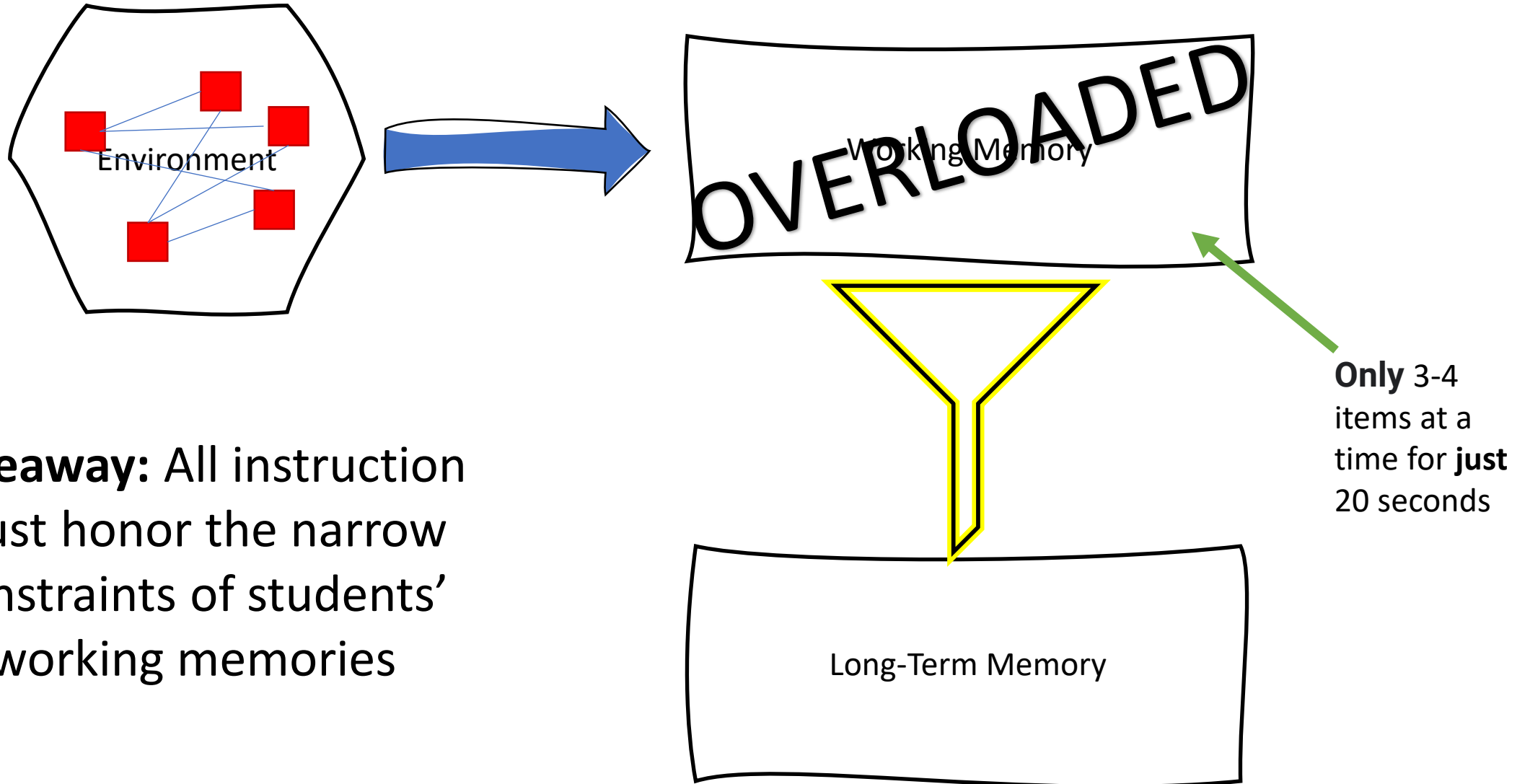
Digit Memory Test by MyBrainTest.org

Please enter shown numbers in Forward order

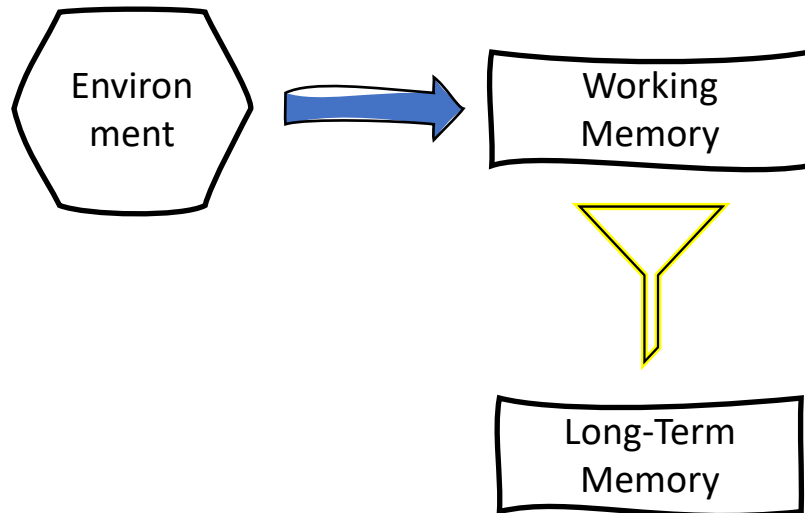
8, 9, 3, 5, 4, 1, 7, 5

7	8	9	Span
4	5	6	- 6 +
1	2	3	<input type="radio"/> Slow
Forward	0	New Test	<input checked="" type="radio"/> Fast

Model of the Mind



Takeaway: All instruction must honor the narrow constraints of students' working memories



Long-term memory helps us to “cheat” the limitations of working memory

o l h 2 i o p o c x 4 t t 9 m s u p x h o o 1 p

h i p p o p o t o m u s x o x o 1 4 9 2 c l t

4 Classroom Shifts

1

Cut irrelevant information

2

Break material down into bite-sized pieces

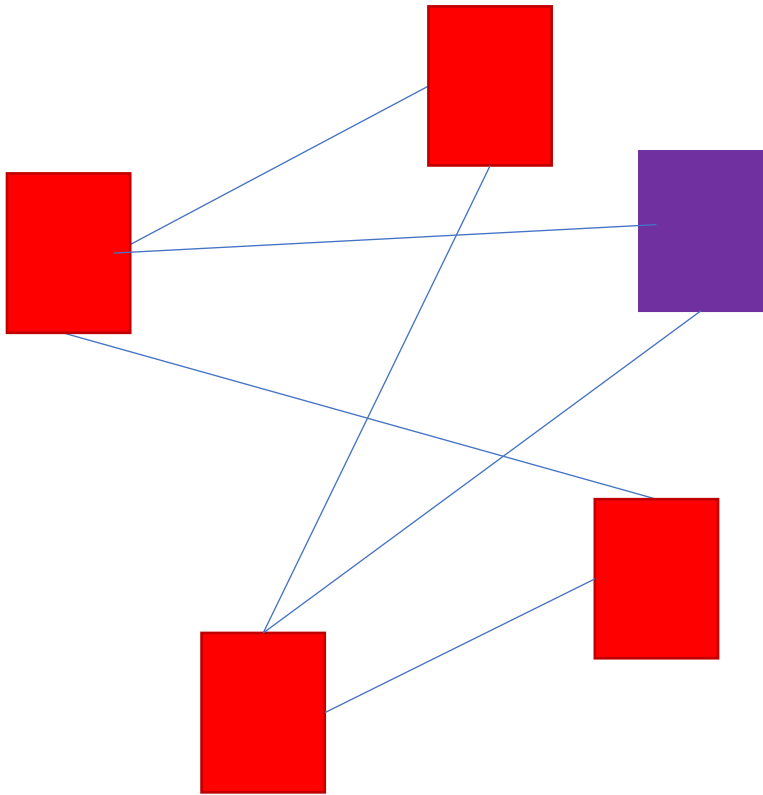
3

Use step by step examples and diagrams to explain difficult concepts

4

Gradually fade supports

Cut Irrelevant Information

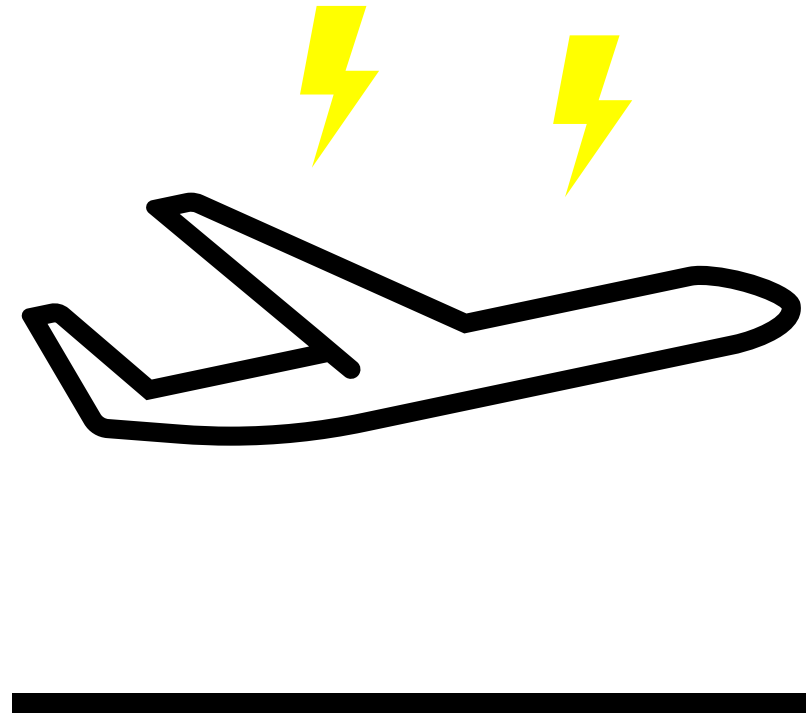
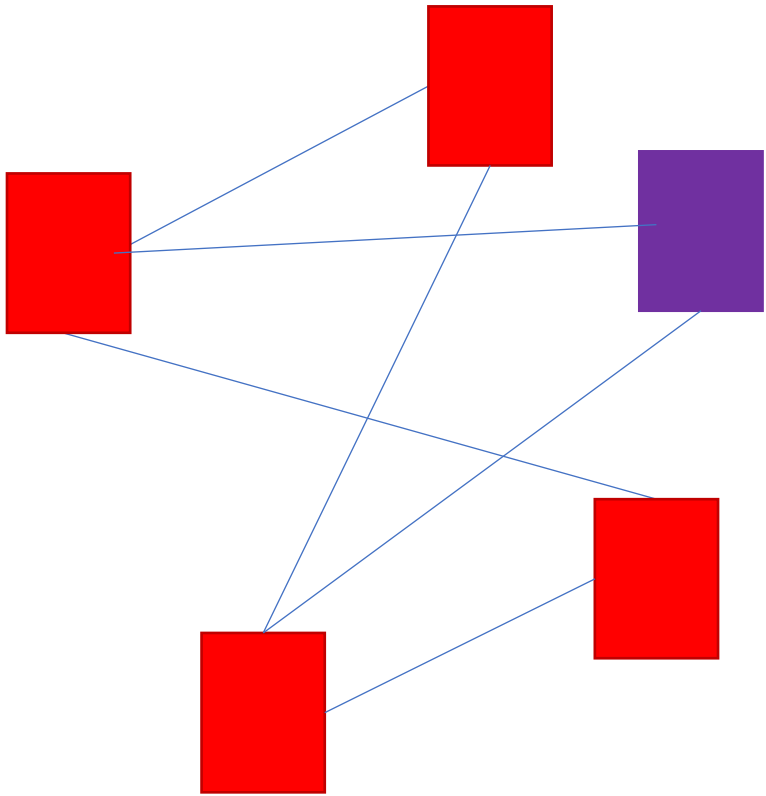


This mathematics lesson *might* enable you to understand a *little more* about *some things* we *usually* call number patterns. *Maybe* before we get to *what is likely* the main idea of the lesson, you should review *a few* prerequisite concepts. *Actually*, the first concept you need to review is positive integers. *As you probably know* a positive integer is any whole number greater than zero.



This mathematics lesson will enable you to understand number patterns. Before we get to the main idea of the lesson, the first concept you need to review is positive integers. A positive integer is any whole number greater than zero.

Cut Irrelevant Information



Cut Irrelevant Information

Focus: The Latin prefix *de-* meaning 'opposite, down, off, away from'



*What does the prefix **de-** mean?*

Opposite (We are going to declutter the room..)

Away from (We had to deduct the meal.)

Off (We will defend the castle.)

Down (We can decode that word.)

Cut Irrelevant Information

hydro -
WATER



Greek Etymology

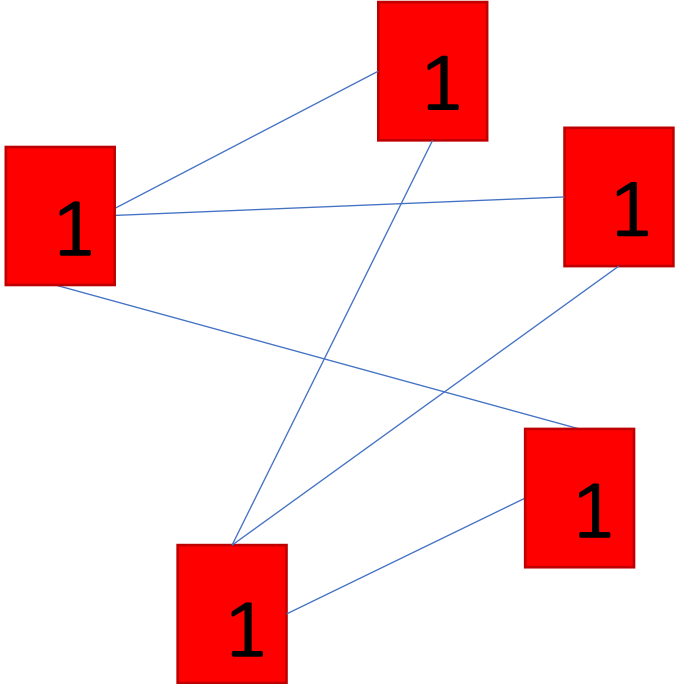


Take a moment to
empathize with your
struggling learners.

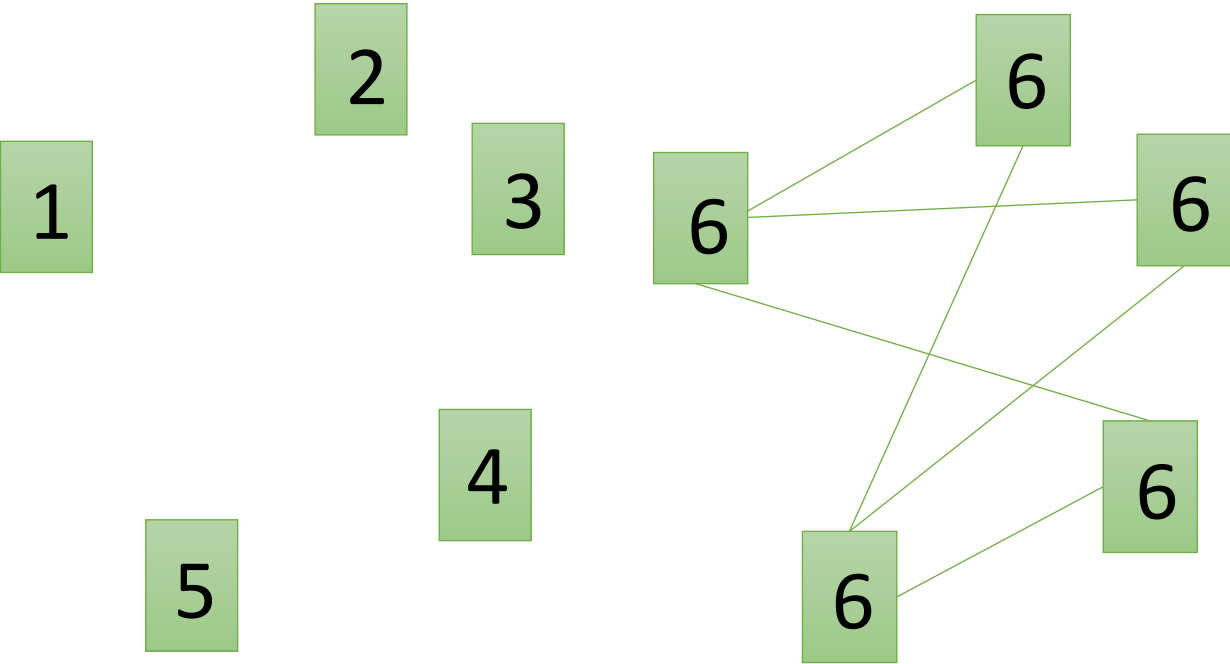
**How might decluttering
explanations and classrooms
help meet their needs?**

Break Materials Down Into Bite-Sized Pieces

Don't



Do



Break Material Down Into Bite-Sized Pieces

On an analog clock:

The short hand shows hours.

The long hand shows minutes.

When the time is half past:

The short hand points halfway between two hours.

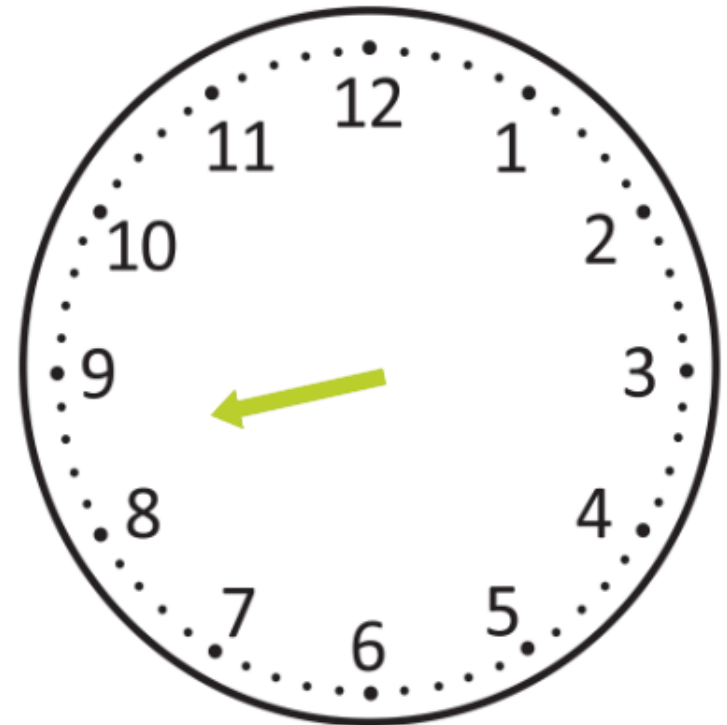
The long hand points to the 6.



Break Material Down Into Bite-Sized Pieces

The hour hand

When we use the hour hand to show half past, we draw it halfway between the numbers.



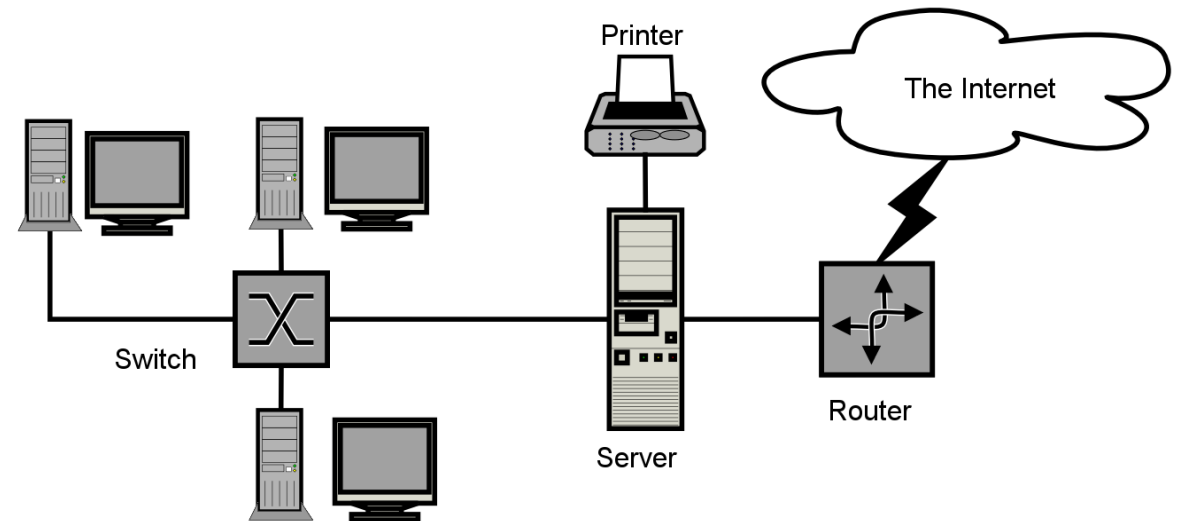
Identify a complex whole task in your subject of expertise.

What are its parts and how do you sequence them effectively?

Use Step-by-Step Examples and Diagrams to Explain Difficult Concepts

- Silent Teacher
- Mini whiteboards: “I do, you copy”
- Stop, Study, Signal

$$\begin{aligned} & \frac{2}{3} + \frac{1}{2} \\ & \begin{array}{c} \swarrow \quad \searrow \\ 2 \times 2 \quad 1 \times 3 \\ \downarrow \quad \downarrow \\ 3 \times 2 \quad 2 \times 3 \end{array} \\ & = \frac{2 \times 2}{3 \times 2} + \frac{1 \times 3}{2 \times 3} \\ & = \frac{4}{6} + \frac{3}{6} \\ & = \frac{4+3}{6} \\ & = \frac{7}{6} \end{aligned}$$



Use Step-by-Step Examples and Diagrams to Explain Difficult Concepts

In the number 1348, what's the value of the 3?

thousands	hundreds	tens	ones
1	3	4	8

300 or 3 hundreds

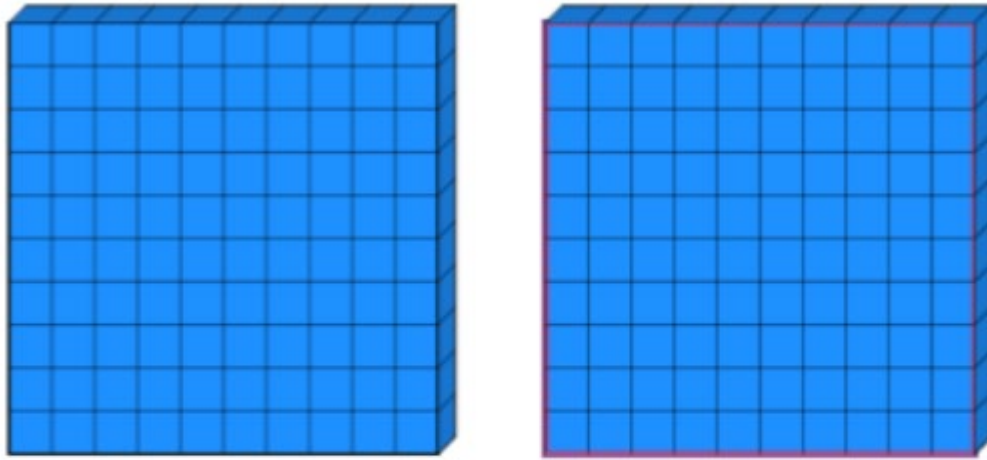
STEPS

1. Read the number
2. Identify the place value of the 3
3. Write the number

Use Step-by-Step Examples and Diagrams to Explain Difficult Concepts

6. How many? *

1 point



Mark only one oval.

- 50
- 100
- 200
- 2000

What are your main tips
for modeling and
providing examples
effectively?

Gradually Fade Supports



I do

Fully demonstrate, explicitly break down the material, one step at a time



We do

Give partial examples, present material in larger chunks, introduce variation



You do

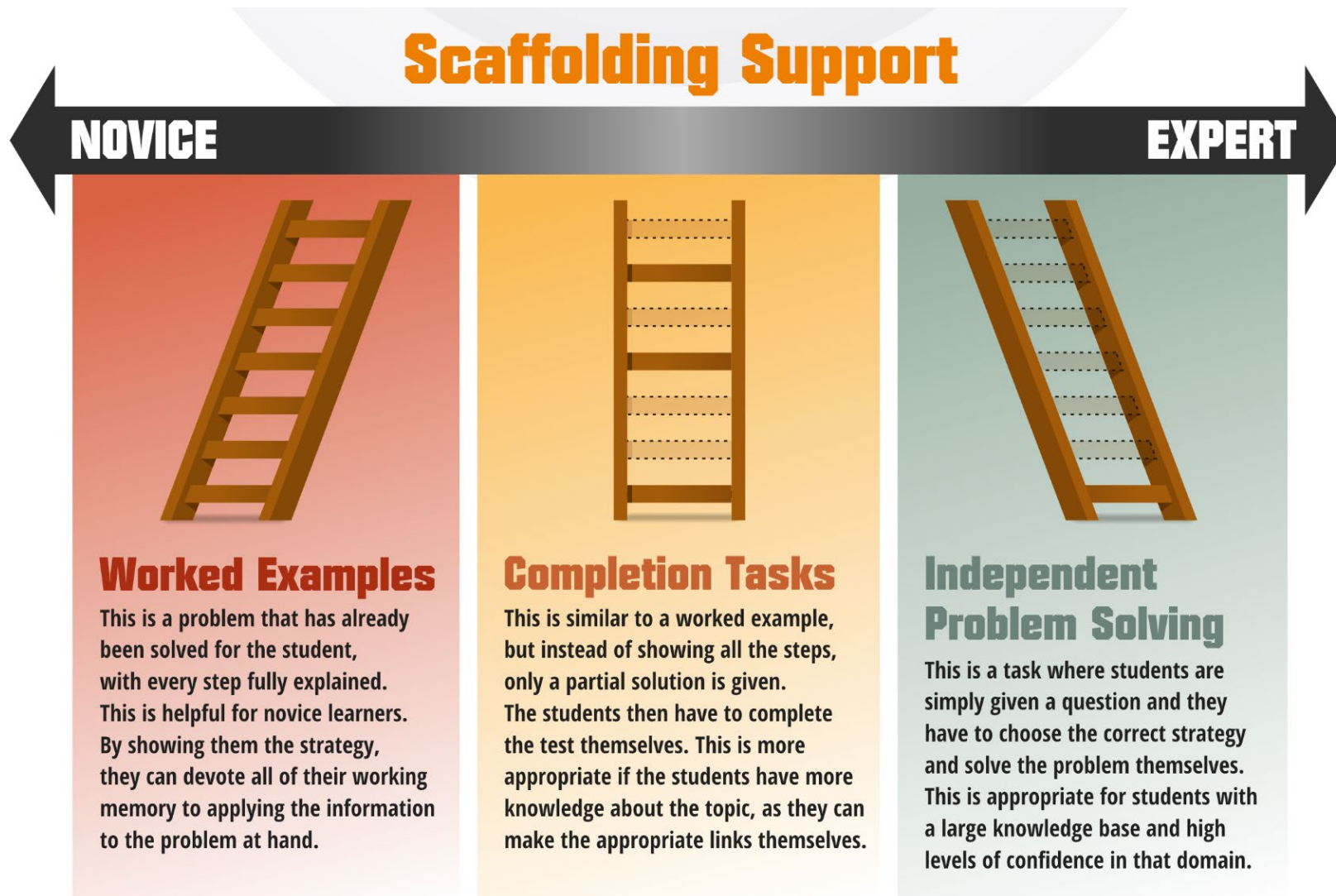
Give opportunities for independent problem solving of whole tasks



Novice

Expert

Gradually Fade Supports



*Graphic freely available on Innerdrive.co.uk

Gradually Fade Supports

1 **Identifying Subject and Predicate**

2 **Identify meaning**
*to identify something means to find it and point it out
*when we identify something in the forest, we find it and point it out (we might identify an animal like "Look, I see a mouse!")
*today we will identify what the subject and the predicate of a sentence is.

3 **Sentence meaning**
Sentences tell a complete thought
they tell **WHO** the sentence is about they tell **WHAT HAPPENED**
The **subject** tells who the sentence is about
The **predicate** tells what happens

4 **What makes a sentence?**
A sentence must contain a **SUBJECT** and a **PREDICATE**.
SUBJECT (who or what) and **PREDICATE** (what the subject does or is)
Kenji look some great photos.
Which part of the following sentence is the subject?
To cover reading books:
A. Tea
B. Loves
C. Reading
D. Books

5 **What makes a sentence?**
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Kenji look some great photos.
Which part of the following sentence is the subject?
To cover reading books:
A. Tea
B. Loves
C. Reading
D. Books

6 **I will identify the subject and predicate of sentences.**

7 **Identifying the Subject**
A cat strolled over the bridge. The cat saw a dog.
A cat strolled over the bridge. The cat saw a dog.
A bird ate the seed. The lady caught the bird.
A bird ate the seed. The lady caught the bird.
Steps:
1. Read the sentence aloud.
2. Identify the subject (tells us a who)

8 **Identifying the Subject**
A cat strolled over the bridge. The cat saw a dog.
A bird ate the seed. The lady caught the bird.
Steps:
1. Read the sentence aloud.
2. Identify the predicate (tells what happens)

9 **Identifying the Predicate**
A cat strolled over the bridge. The cat saw a dog.
A bird ate the seed. The lady caught the bird.
Steps:
1. Read the sentence aloud.
2. Identify the predicate (tells what happens)

10 **Identifying the Predicate**
A bird ate the seed. The lady caught the bird.
Steps:
1. Read the sentence aloud.
2. Identify the predicate (tells what happens)

11 **Today we have learnt about subjects and predicates.**
The **subject** tells who the sentence is about
The **predicate** tells what happens
Example:
The **naughty dog** made a mess.
The **naughty dog** made a mess.
Steps:
1. Read the sentence aloud.
2. Identify the subject (tells us a who)

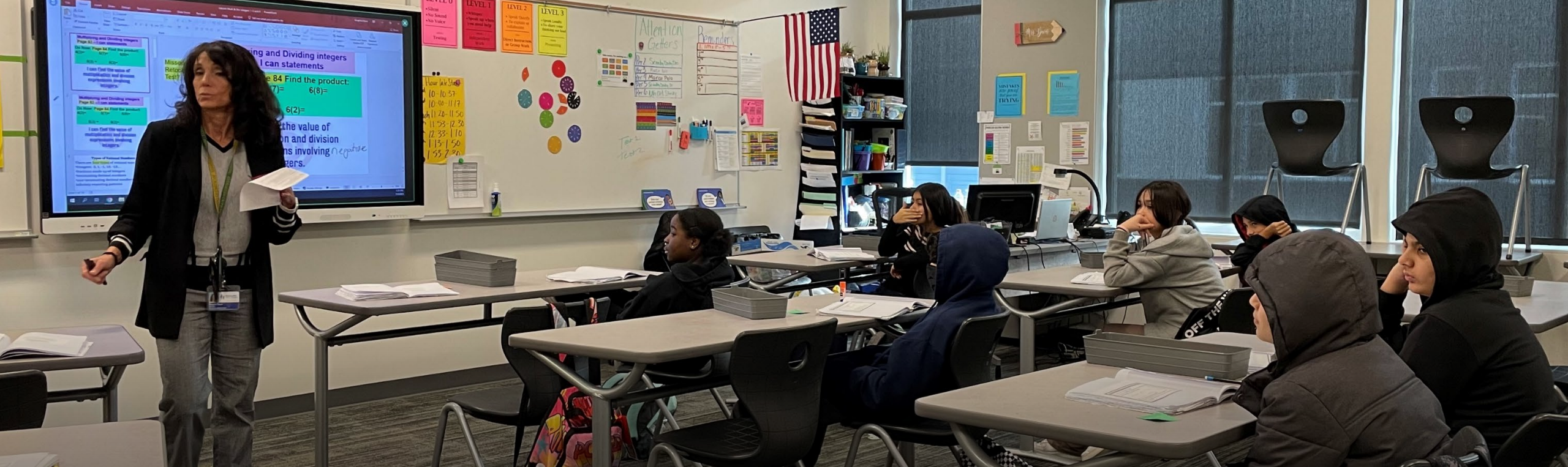
12 **Your task today**
Identify the subjects and the predicates in these sentences. Write the sentences in your book and underline the subject with a red pencil, and the predicate with a blue pencil.
1. The children ran to the car.
2. The animals slept at the zoo.
3. The man lost his hat.
4. Sara loved eating carrots.
5. Mr Bates bought a new car.
Challenge: Make up your own sentence and identify the subject and the predicate.
Steps:
1. Read the sentence.
2. Copy the sentence into your book.
3. If a subject underline with a red.
4. If predicate underline with blue.

13 **Why do we need to know that sentences need a subject, predicate, nouns and verbs to be complete?**
• To help us edit our writing.
• To make sure our writing makes sense.

14 **Identifying Subject and Predicate**

15 **Identifying a Subject and Predicate**
A mouse walked through the woods. The mouse met a fox.
A mouse walked through the woods. The mouse met a fox.
Steps:
1. Read the sentence aloud.
2. Identify the subject (tells us a who)
3. Identify the predicate (tells what happens)

What formative
assessment strategies do
you use to determine
when to fade supports?



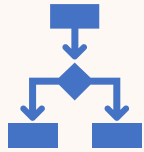
Coaching with Cognitive Load Theory in Mind



5 Coaching Moves



Prompt the teacher
to scan the room



Prompt the teacher
to think in options



Prompt the teacher
to re-start



Slide in



Probe the teacher's
thinking

Prompt the teacher
to scan the room



Prompt the teacher to think
in options



Prompt the teacher to
re-start



Slide in



Probe the teacher's thinking

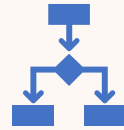
5 + 1 coaching moves



Present on CLT at
your context



Prompt the teacher
to scan the room



Prompt the teacher
to think in options



Prompt the teacher
to re-start



Slide in



Probe the teacher's
thinking

What's your next move?



Q&A



References and Resources

- The model of the mind in this presentation was inspired by the model popularized by D.T. Willingham's book, "[Why Don't Students Like School?](#)"
- The scaffolding graphic is from [Innerdrive.co.uk](#)
- I was granted permission to use the fractions worked example by CLT researcher, Ou hao Chen
- If you want to read more about the origins of cognitive load theory, check out this [article](#).
- If you're looking for a book on how cognitive load theory applies to teaching, consider Oliver Lovell's book, [Sweller's Cognitive Load Theory in Action](#).
- [This](#), from NSW Centre for Education Statistics and Evaluation, has good materials to create a PD on cognitive load theory for your school.
- [This](#) for recent developments in cognitive load research.
- [This](#) is an important article on cognitive load and instructional guidance and [this](#) is more of a magazine version of the same thing in the American Educator.
- [This](#) is for cognitive load and educational technology, but it's paywalled. Contact the researchers for a copy.
- [Here's](#) an article applying cognitive load theory to teacher training.