

# MAKING COMPUTING MEMORABLE

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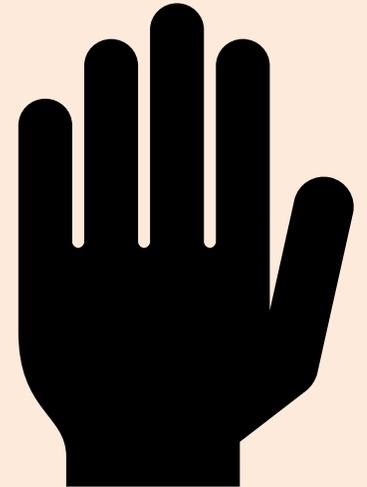
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# Prior Knowledge

Does your school subscribe to any form of retrieval practice at present?



# Widewell Primary Academy, Plymouth, GOOD

## Inspected 19th & 20th October 2021

Leaders have recently developed the computing curriculum. This is carefully planned and well sequenced. In the early years, adults encourage children to be confident when using technology. Pupils' understanding of computing develops well across the school. This leads to some pupils having strong knowledge and skills. Pupils enjoy learning about computing. However, some teaching is not based on secure knowledge about what pupils can already do. This means that for some pupils, the computing curriculum is not as ambitious as it could be. As a result, these pupils do not always achieve as well as they could.

# Widewell Primary Academy, Plymouth, GOOD

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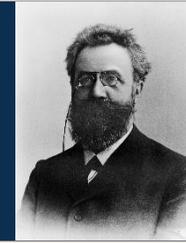
Leaders have recently developed the curriculum. This is carefully planned and well sequenced for the years, adults encourage children to be confident with technology. Pupils' understanding of computing is good across the school. This leads to some good progress in knowledge and skills. Pupils enjoy learning about computing.

However, some teaching is not based on secure knowledge about what pupils can already do. This means that for some pupils, the computing curriculum is not as ambitious as it could be. As a result, these pupils do not always achieve as well as they could.

lack of pre-testing,  
formative assessment,  
summative assessment,  
curricula progression or  
retrieval practice?

# MEMORY THEORIES

# Ebbinghaus (1885) A Beginning



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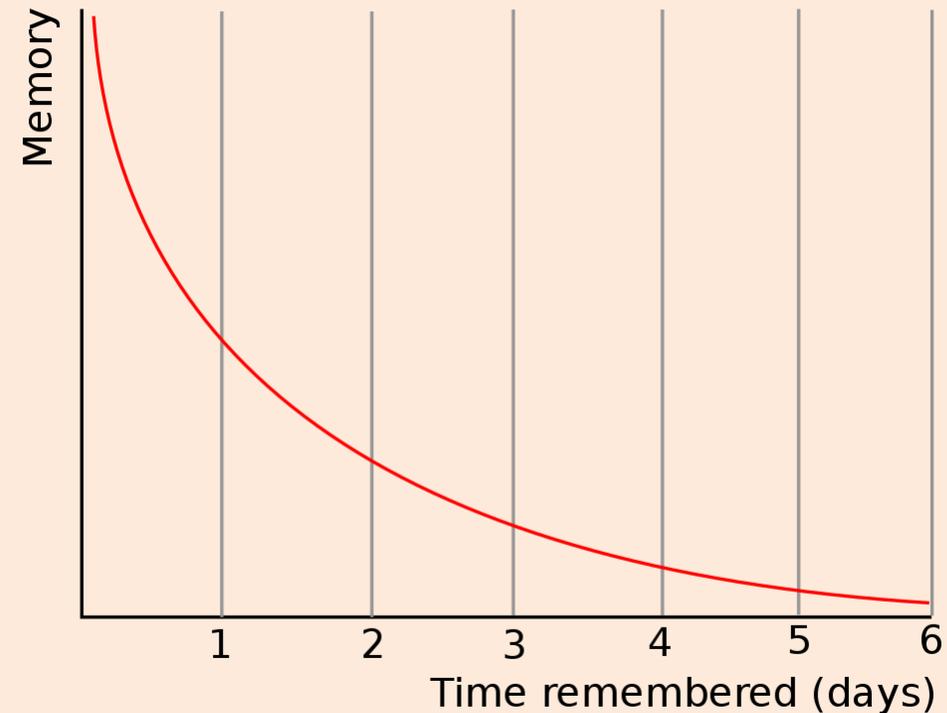
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## Memory decays over time

Speed of forgetting can be influenced by

- How meaningful material is
- How it is represented
- Stress
- Amount of sleep
- *Spaced retrieval*
- Mnemonics

## Forgetting Curve

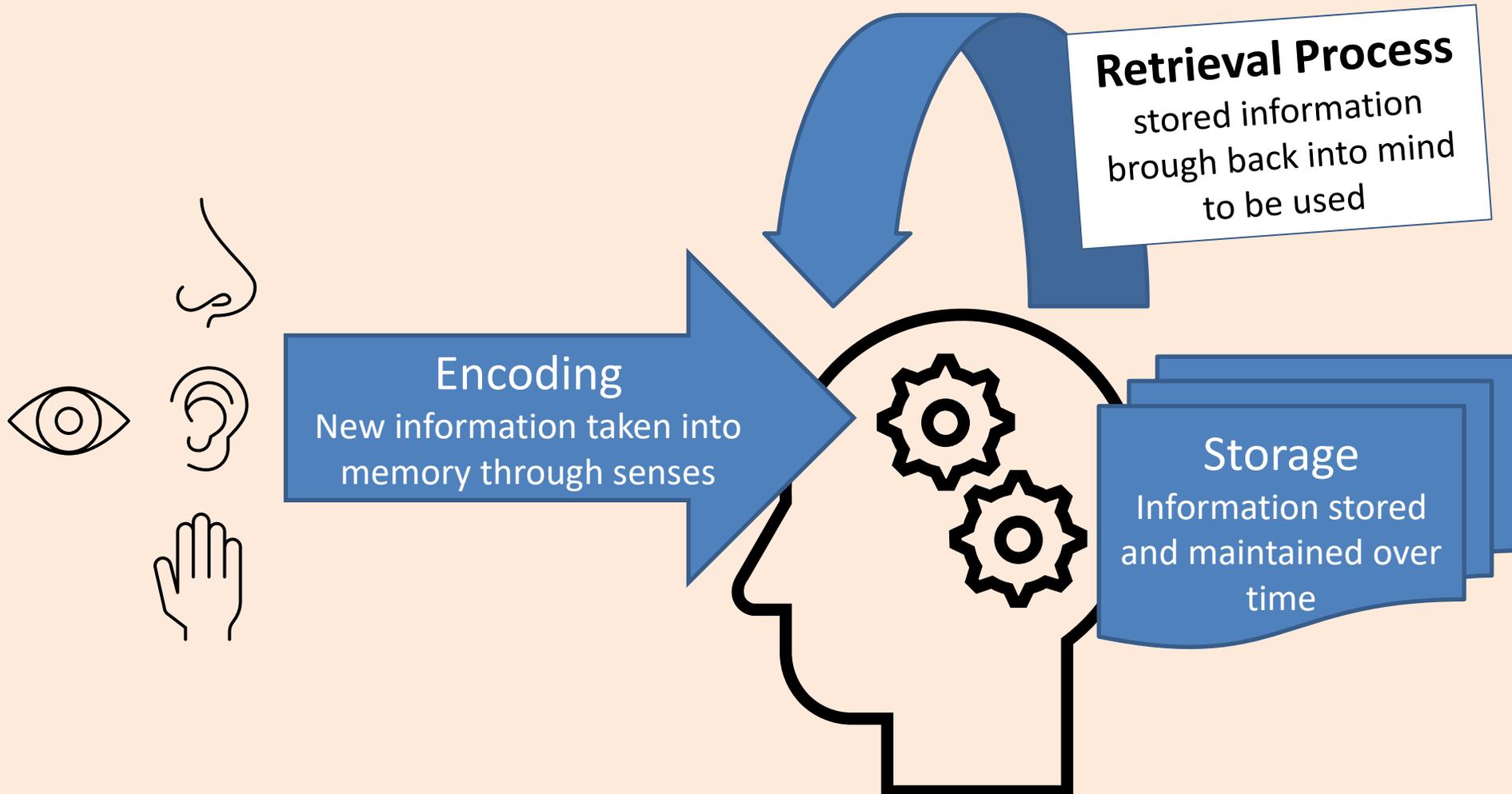


# General Memory Process Theory

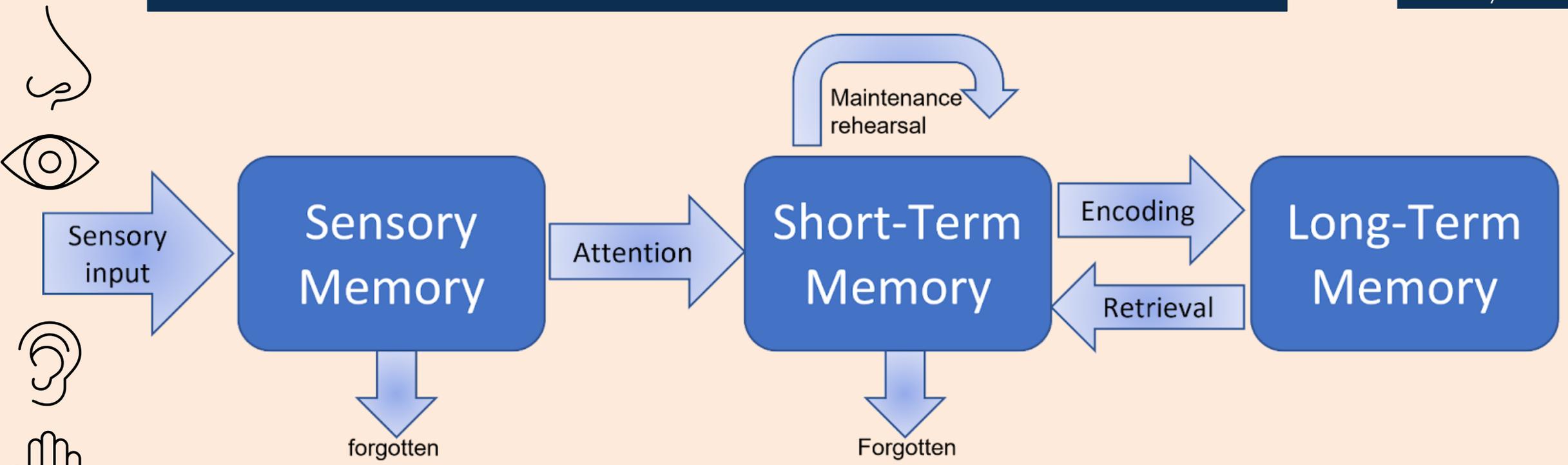


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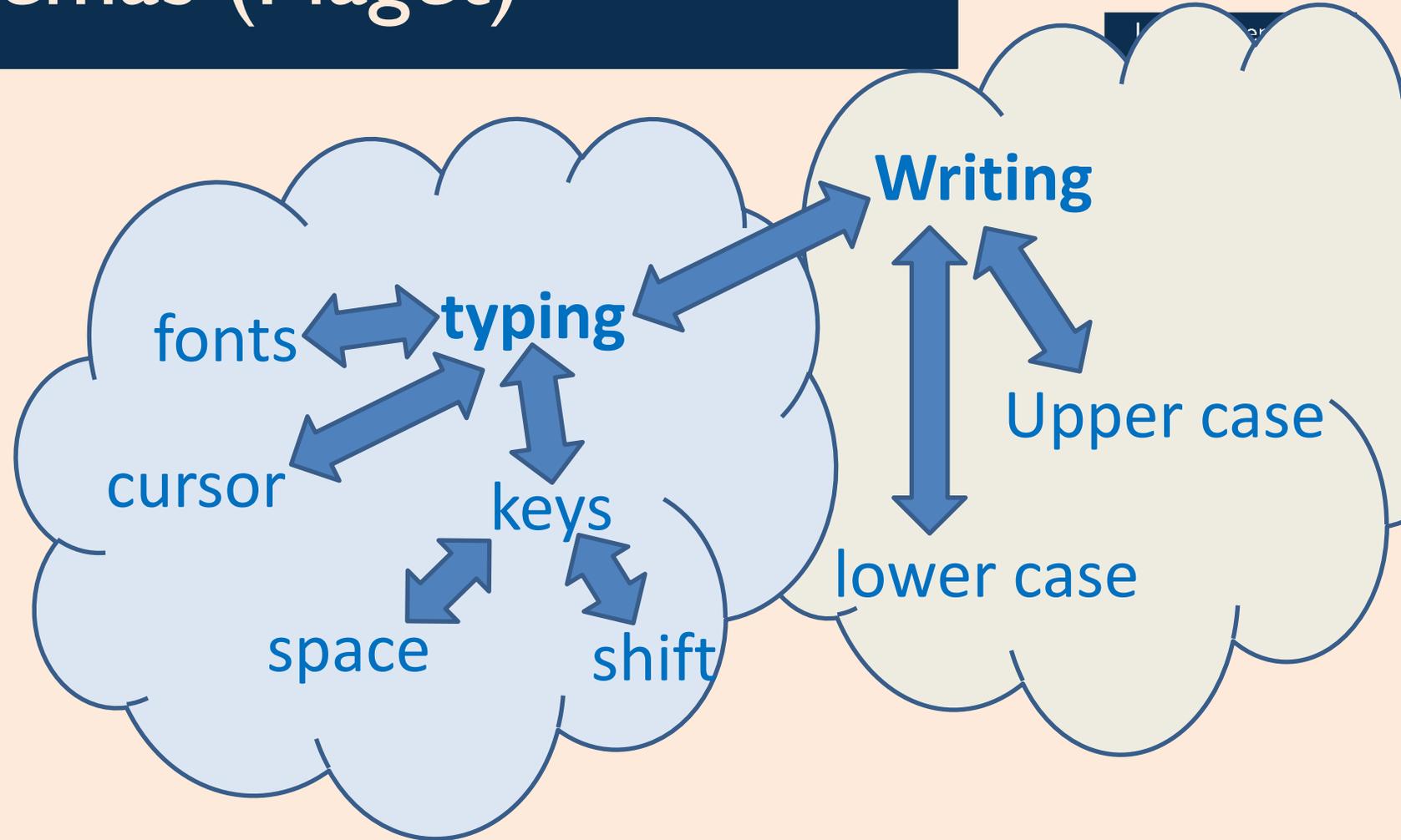
# Atkinson-Shiffrin Model 1968+



Name	How long it last for	Storage capacity	Alternative names
<b>Sensory memory</b>	0.25-4 seconds	Very large	Sensory register
<b>Short term memory</b>	5-20 seconds	Between 5-9 items only	Working memory
<b>Long term memory</b>	Possibly until death	Unlimited but with operating restrictions	

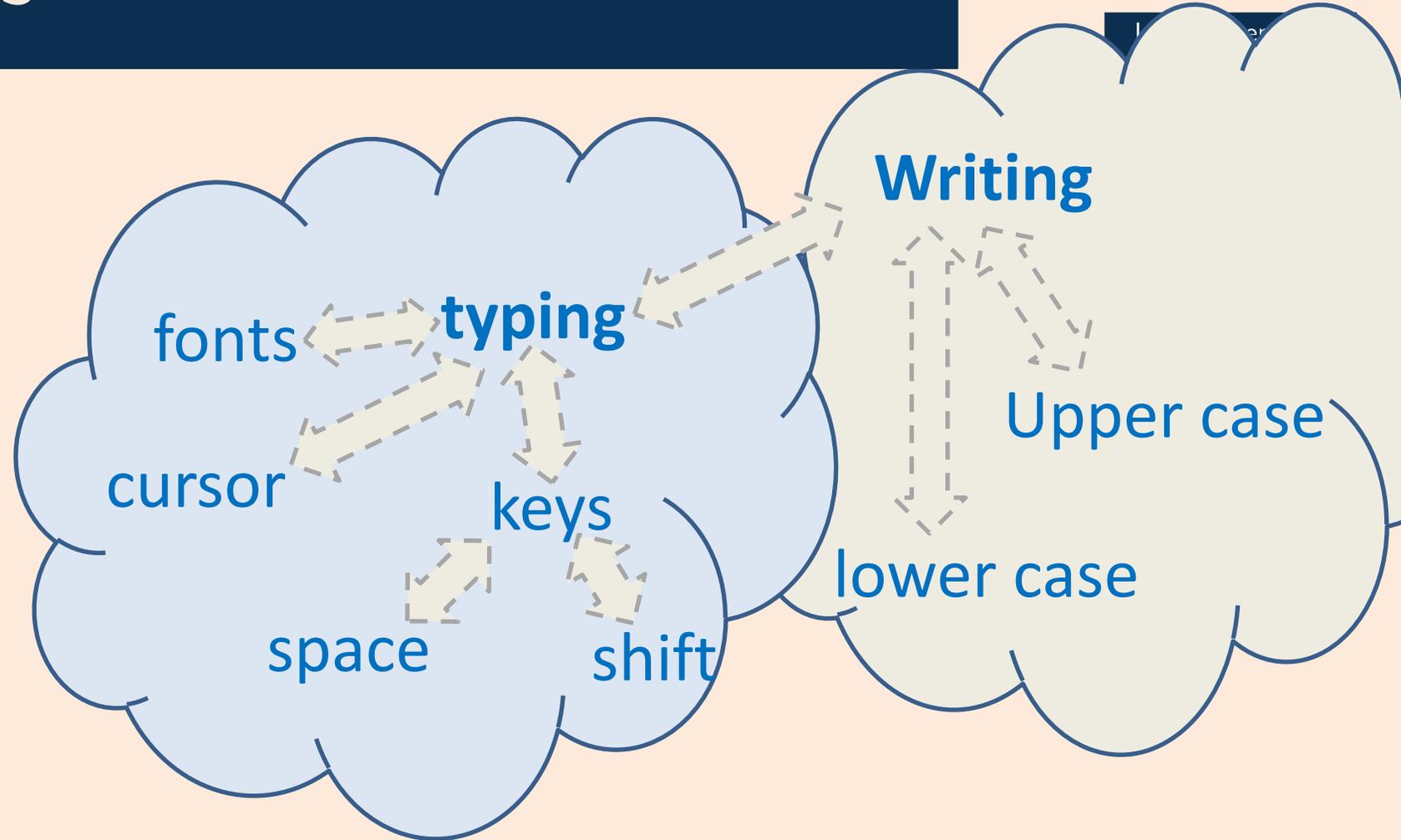
# Memory Schemas (Piaget)

An organised group of past experiences and associations, which help inform decisions and make predictions



# Memory Loss

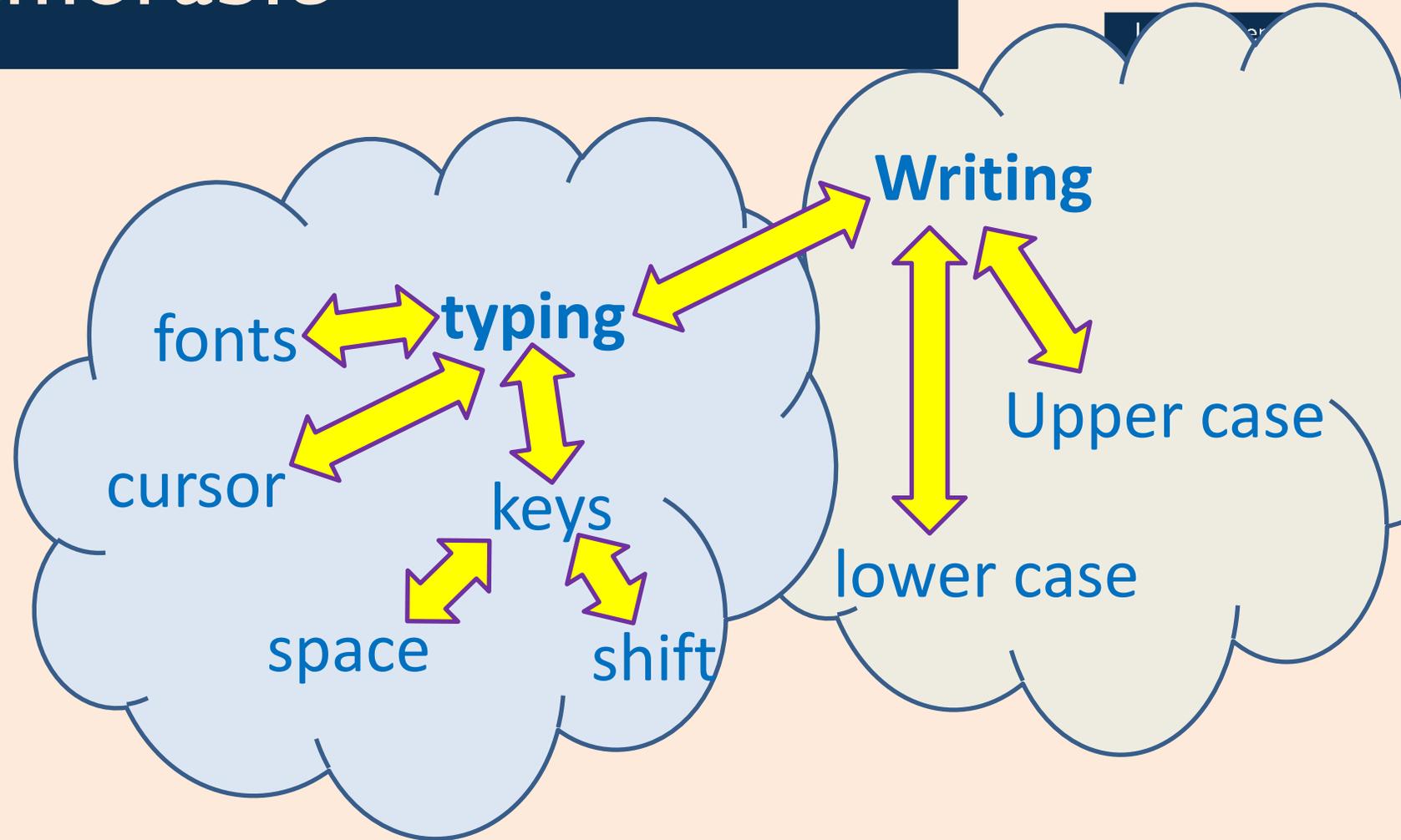
Thought to be the  
breaking down of  
the associations  
between items



# Making it Memorable

When we can connect something old to something new it helps us better understand the new.

Piaget



# Making it Memorable Exercise

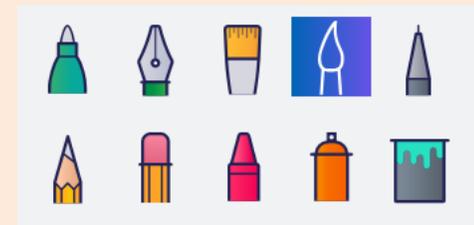
When we can  
connect something  
old to something  
new it helps us  
better understand  
the new.

Piaget

Consider these computing modules

Is there any prior computing or other memory  
schema that could be signposted to help pupils  
understand how these work or what they do?

KS1 Using a digital painting  
package to draw a picture

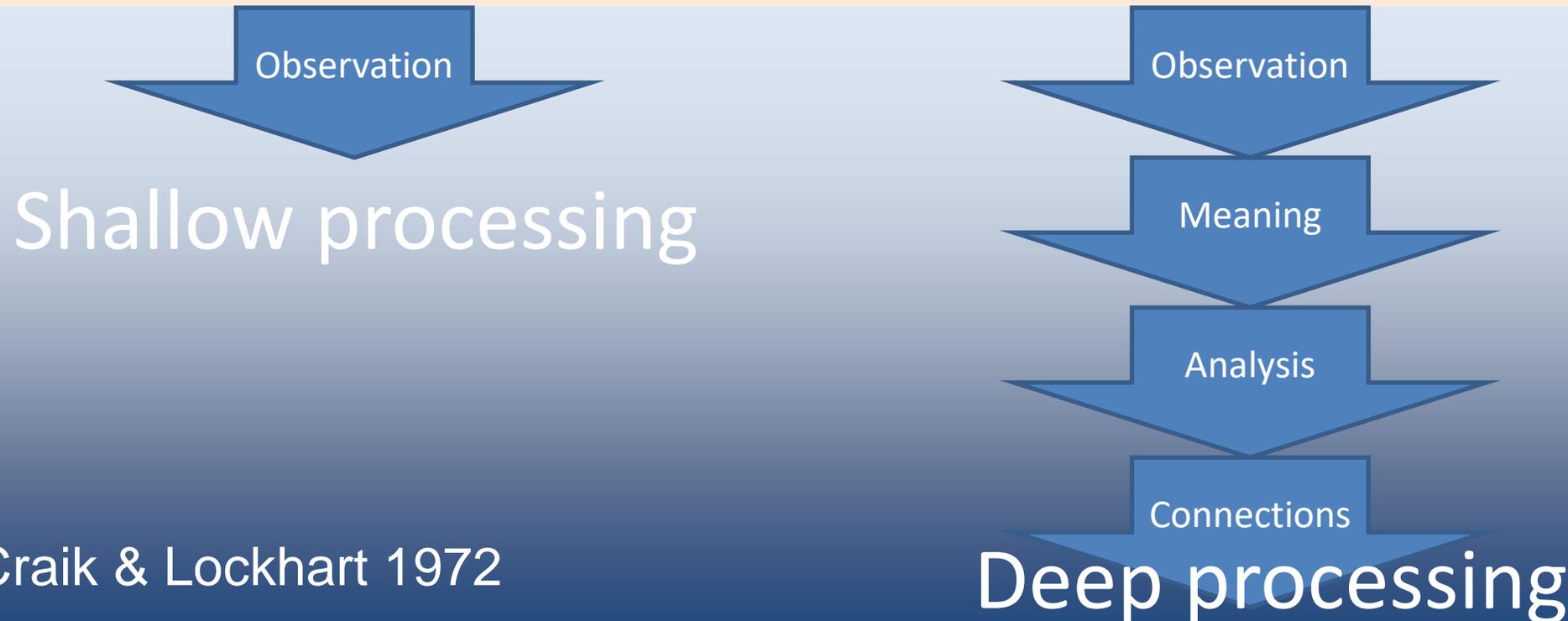


Paint 3D Pallet

KS2 Desktop Publishing

# Levels of Processing Theory

The ability to remember depends upon the depth of information processing. If the information is processed at a superficial and shallow level we forget things quicker. If the information is processed at a deeper level we will remember information for longer.



Craik & Lockhart 1972

# Making it Memorable

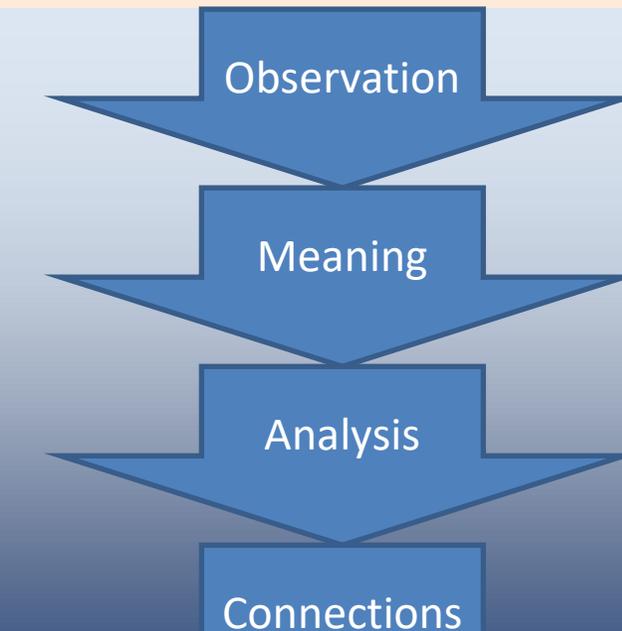
When we provide analysis of why we do things (conditional knowledge) we are strengthening memories.

*Why we don't underline in digital documents (IT/DL)*

*Font families (Serif & San Serif) (IT/DL)*

*Definite and indefinite loops (CS)*

*Reasons to protect personal info (DL)*



Craik &  
Lockhart 1972

Deep processing

# Making it Memorable

When we provide analysis of why we do things (conditional knowledge) we are strengthening memories.

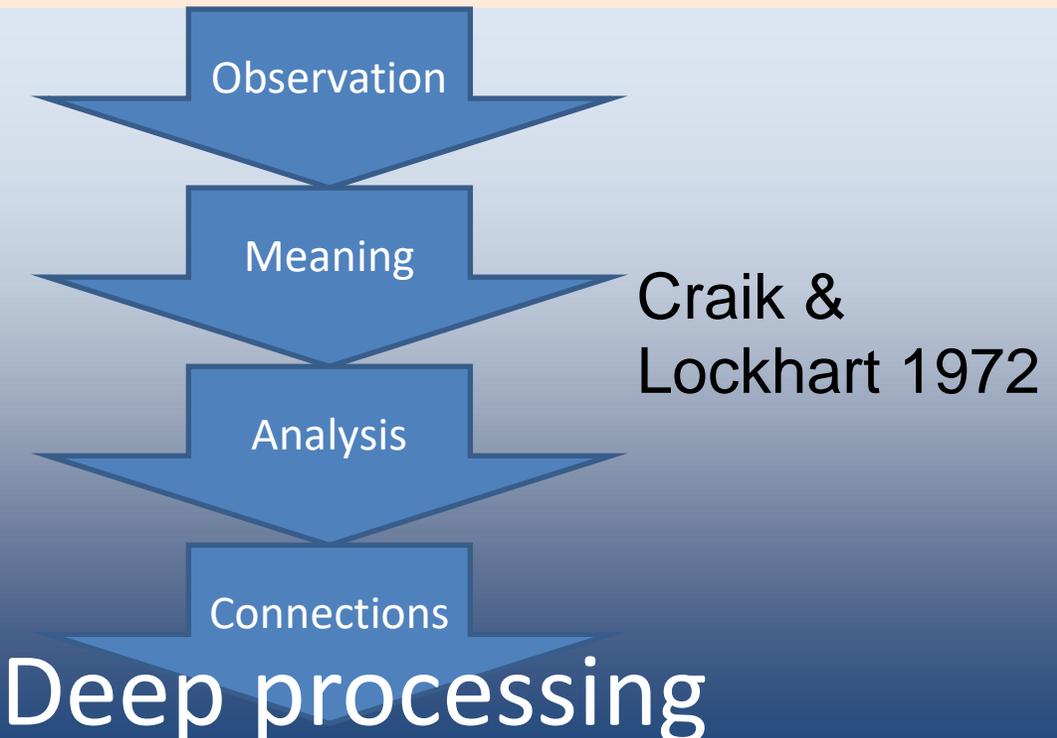
*Why we don't underline in digital documents (IT/DL)*

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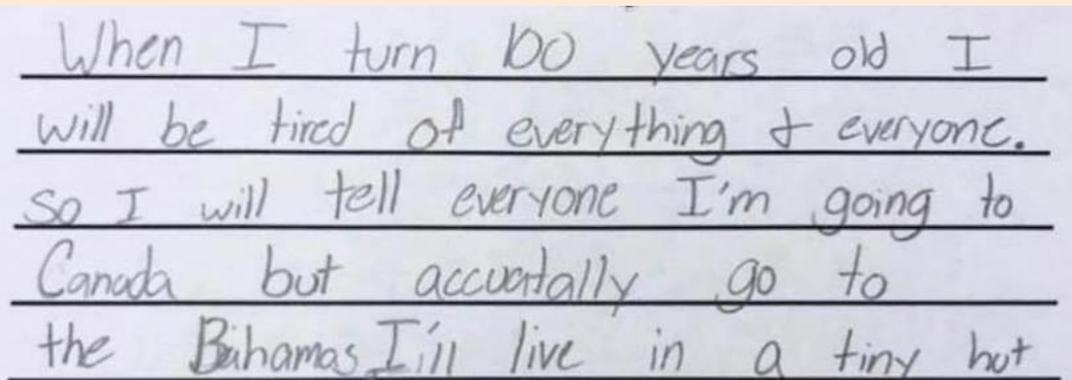
*Definite and indefinite loops (CS)*

*Reasons to protect personal info (DL)*

*Are there aspects teachers do but they don't know why?*  
*Do we include enough conditional knowledge in our support for our colleagues?*  
*Do we know enough?*



# How does my new learning connect to my old learning?



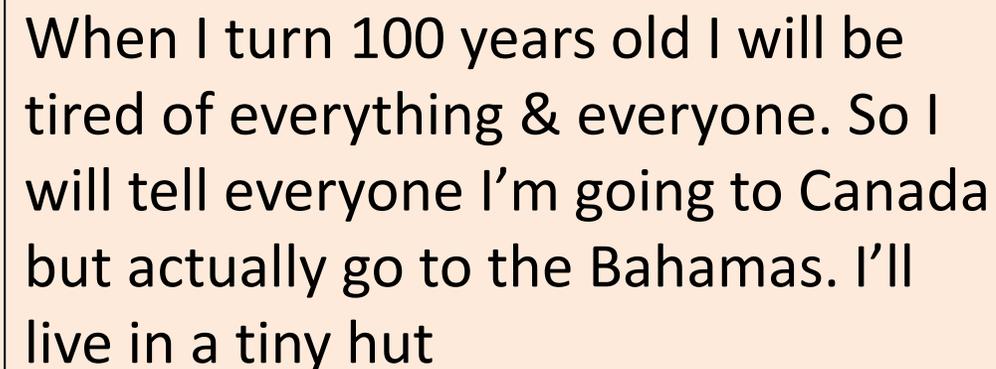
When I turn 100 years old I  
will be tired of everything & everyone.  
So I will tell everyone I'm going to  
Canada but actually go to  
the Bahamas. I'll live in a tiny hut

## Positives

Personal, individual style, unique

## Negatives

Hard to correct or adapt, could be hard to read,  
harder to copy or print, only one font



When I turn 100 years old I will be  
tired of everything & everyone. So I  
will tell everyone I'm going to Canada  
but actually go to the Bahamas. I'll  
live in a tiny hut

## Positives

Easier to read, easy to change, easier to print or copy,  
professional looking, many fonts, quicker to create?

## Negatives

Less personal, ideas can be unique but style will be  
similar to others using same font

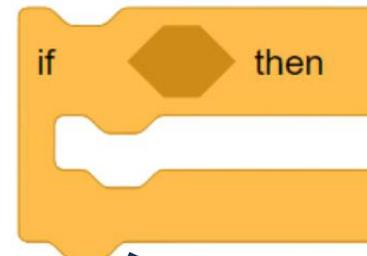
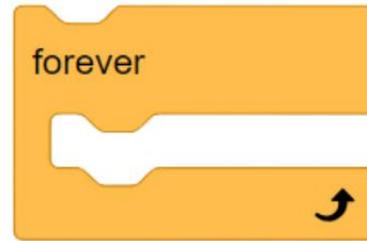
# How does my new learning connect to my old learning?



What positives and negatives can you find between hand-drawn and digital art?

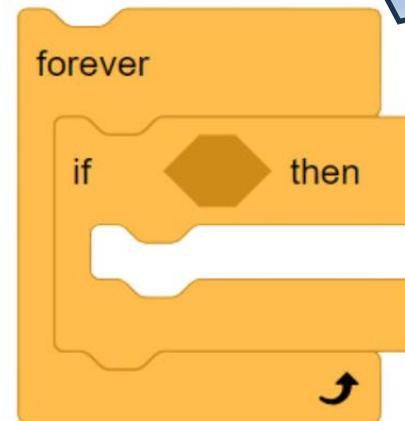
# How does my new learning connect to my old learning?

loops



Conditions

Conditions  
inside a loop



## SYNTHESIS PROMPT:WHAT DID I LEARN?

A synthesis prompt asks students to articulate the new connections, or new insights, that have helped expand their existing schema (knowledge/concept base).An indicator of synthesis is the ability to extend to successfully transfer new learning to a different context or problem (Donovan & Bransford, 2005).

### Generalised questions...

- How do I summarise the big ideas in my new learning?
- How do I connect the big ideas in my new learning to one another?
- How does my new learning connect to my old learning?
- What do I understand about my old learning because of my new learning?
- What did I learn? Why does it matter?
- What new questions do I have?

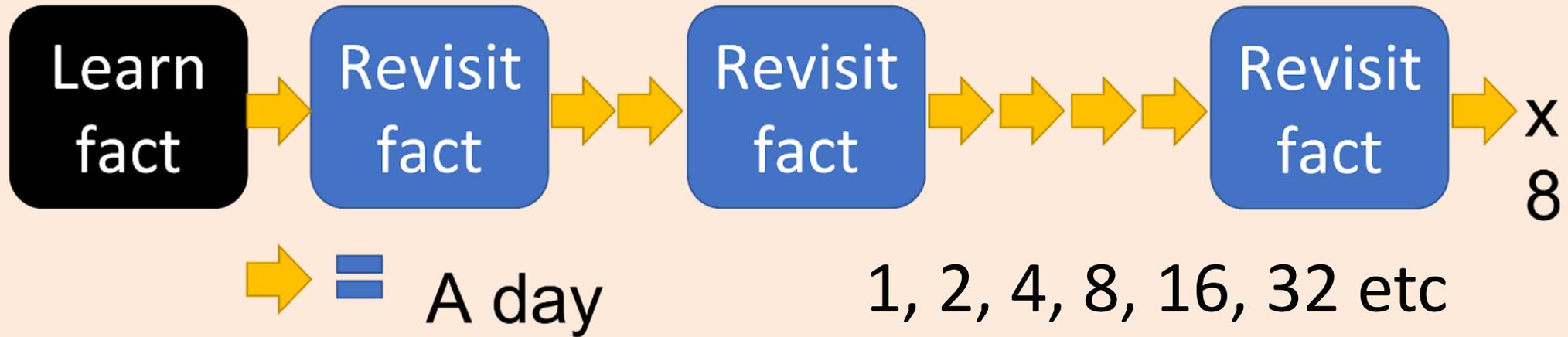
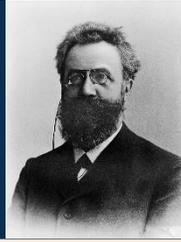
**KS1 KS2**

### Explicitly prompts students to ...

- Distil and summarise the big ideas and concepts as the first step of synthesis
- Connect big ideas and concepts
- Develop expert schema by integrating prior learning about concepts and topics with new learning
- Answer existing inquiry questions and generate new inquiry questions.
- Describe how our thinking about concepts and topics has changed as a result of new learning
- Predict how our new learning about concepts, skills, and topics will be helpful in the future or for the next stage of learning



# Spaced Retrieval



Memory decay can be stopped by spaced retrieval

Ebbinghaus

# Modern Retrieval Practice Theory

Learned knowledge is there in long term memory but it is hard to recall it when we need it. **Retrieving knowledge regularly** helps us remember it

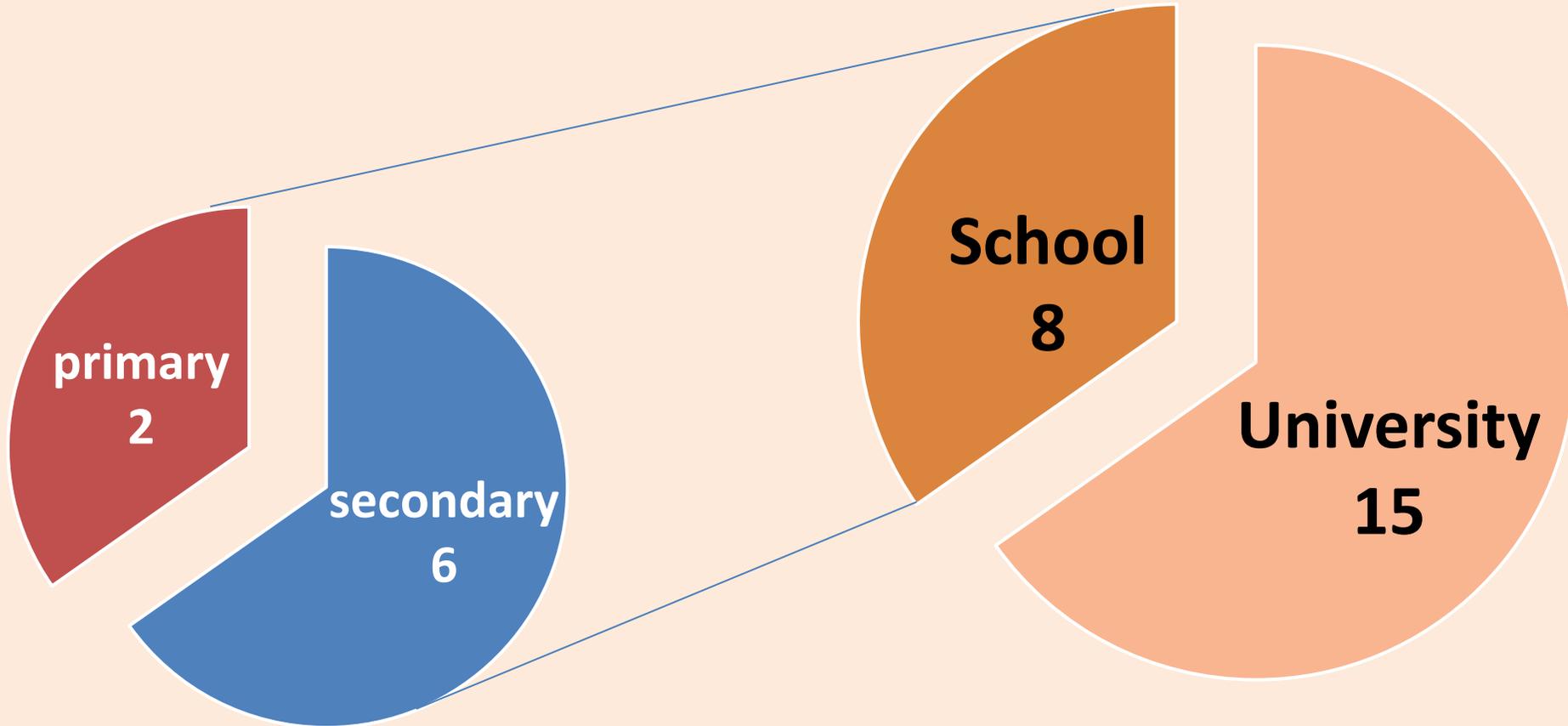
Most efficient method of spaced retrieval is as an **expanding sequence**

Retrieved information becomes easier to retrieve the **more we retrieve it**

Retrieval practice **tests** are more efficient than just rereading information

If pupils are tested on knowledge, they **profit** in memory terms from retrieving it

# Education based research



Moreira (2019)

# Jaeger et al, 3rd grade, Science (UK Year 4) (2015)

Children were asked to read a 321 word passage about the sun which contained key terms they needed to know. The control group just read the passage twice again while the retrieval practice group took a 20 questions quiz where they had to fill in the blanks. No corrective feedback or review was given to pupils before the test. The test was taken seven days later and those that took the retrieval tests achieved higher grades. A nuance to this research is that they identified that this retrieval practice benefitted pupils within the normal range of abilities but not those outside this. Fill in the gap tests are also thought to be better tests of memory than multiple choice tests.

# Goossens et al, Literacy (UK Years 3, 4, 5 & 7) (2016)



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Goossens investigated if remembering the description of words was more beneficial for vocabulary learning through retrieval practice quizzes than copying the description of the word. The experiment took place over 14-21 days. The effectiveness of the project was assessed weekly and in a final test administered after some time (max 11 weeks). No feedback was given to any pupil. In this project retrieval was no more helpful than writing it out and grade 3 (UK Y4) pupils who wrote out the definitions made more progress.

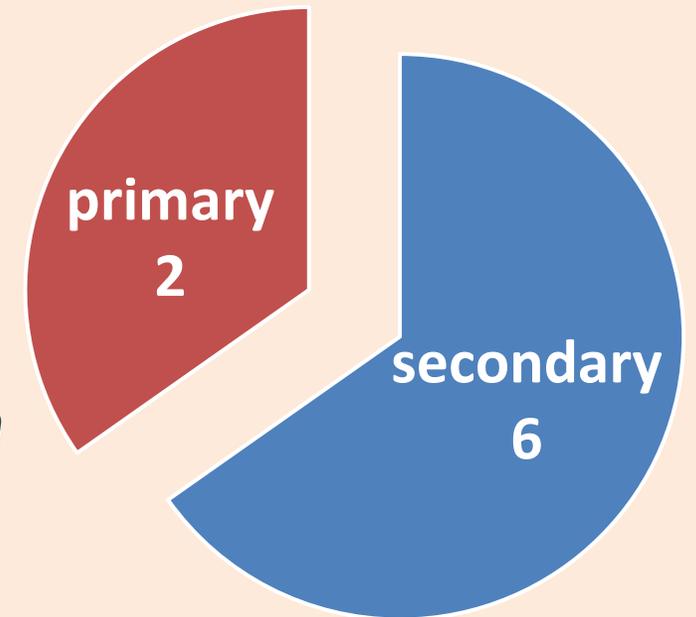
# Education based research findings

Retrieval practice can be used reliably in an educational setting

Beneficial in short- and long-term periods

Short answer tests were **not** beneficial for retrieval purposes in primary settings without comprehensive feedback (*are pupils benefiting from retrieval or good feedback?*)

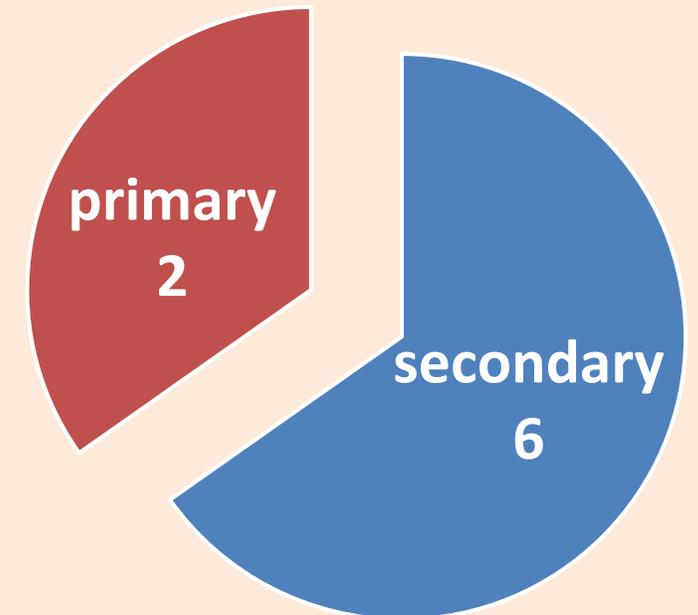
No one examined benefits for pupils of different ability



# Education based research findings

All research compared retrieval practice Vs either no activity or rereading material

Would the same favourable results occur if the alternative control activity was something of a higher order activity?



# RETRIEVAL PRACTICE COMPUTING EXAMPLES

# KSI Example

HIAS MOODLE+ RESOURCE



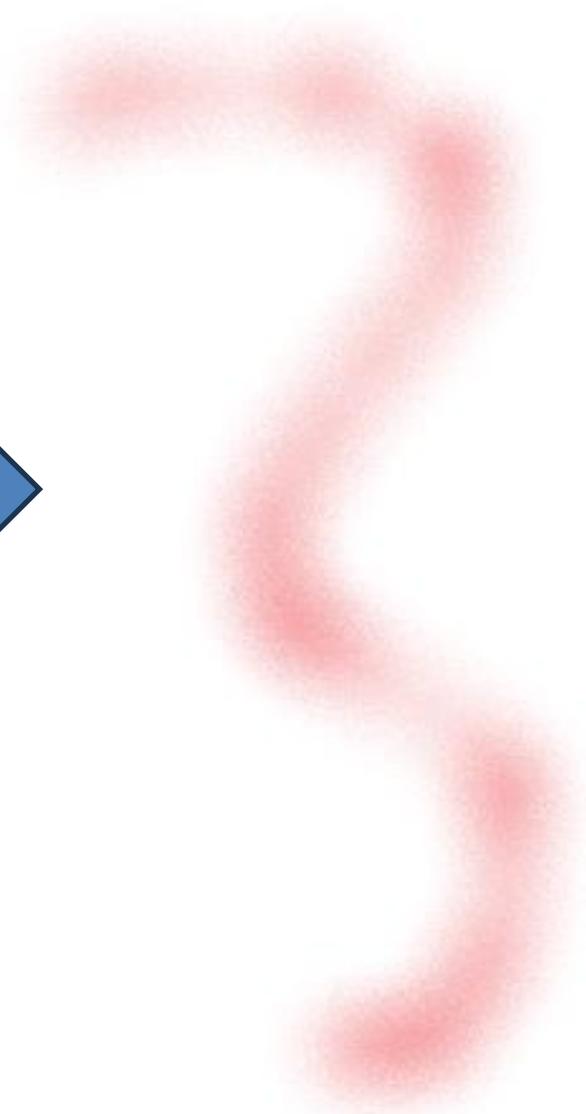
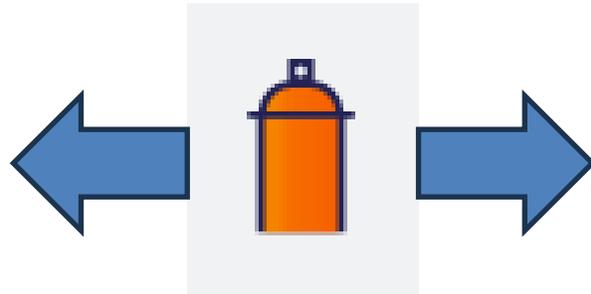
## Vote with your feet



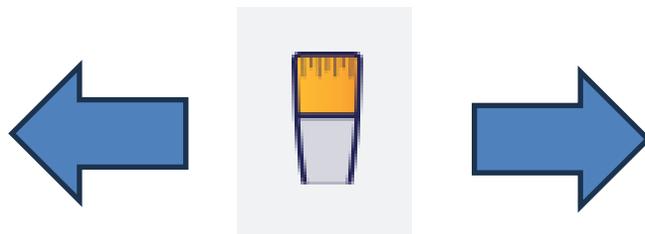
This key makes spaces between words



# What line?



What line?



KSI Example

# KS2 Example

## Presentation Media

**Instructions:** Circle the correct view for each person



I am making notes to go with each slide.



Created by Wilson Joseph  
from the Noun Project



I am presenting my slide show to everyone else.



Created by ic2icon



I am changing my slides.



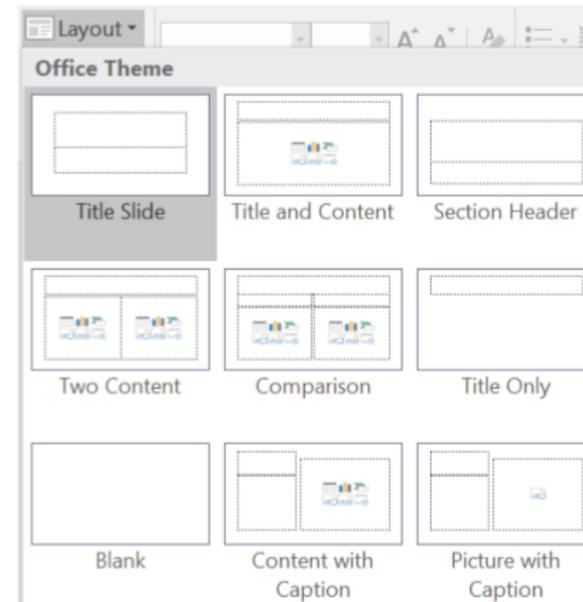
# KS2 Example

## Instructions:

- 1, Read the slide purpose
- 2, Choose a layout
- 3, Explain your choice

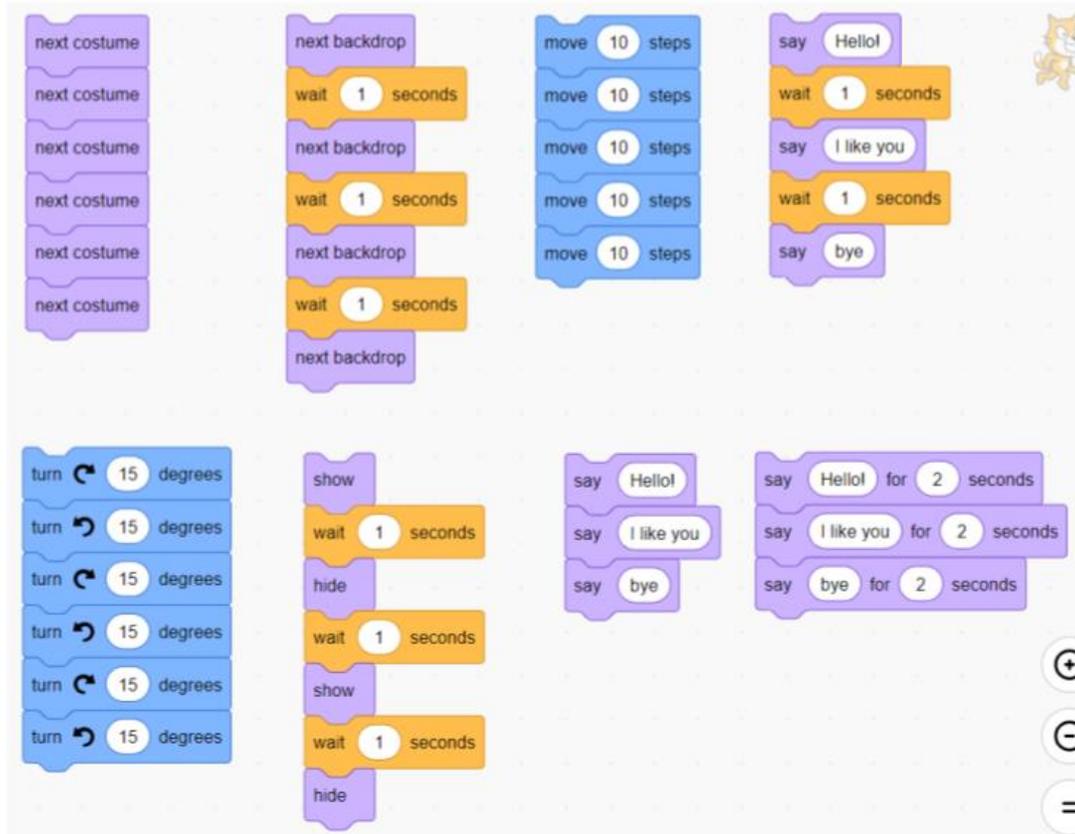
## Presentation Media PP

Slide Purpose	Layout Choice	Reason you chose this layout
Compare two types of cat		
List the types of food a pig eats (text only)		
Explain why Persian cats make great pets in a picture and text		



# KS2 Example

Fast or slow code? F=Fast S=Slow

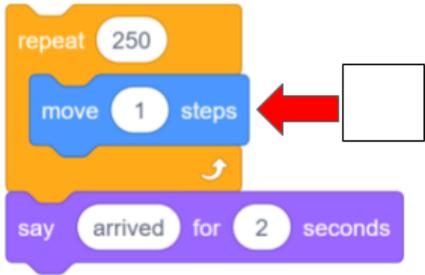


The image shows a Scratch workspace with a cat sprite. There are eight sets of code blocks arranged in two rows of four. Each set contains a different sequence of actions. The top row includes: 1) five 'next costume' blocks; 2) 'next backdrop', 'wait 1 seconds', 'next backdrop', 'wait 1 seconds', 'next backdrop', 'wait 1 seconds', 'next backdrop'; 3) five 'move 10 steps' blocks; 4) 'say Hello!', 'wait 1 seconds', 'say I like you', 'wait 1 seconds', 'say bye'. The bottom row includes: 1) six 'turn 15 degrees' blocks; 2) 'show', 'wait 1 seconds', 'hide', 'wait 1 seconds', 'show', 'wait 1 seconds', 'hide'; 3) 'say Hello!', 'say I like you', 'say bye'; 4) 'say Hello! for 2 seconds', 'say I like you for 2 seconds', 'say bye for 2 seconds'. A small cat icon is visible in the top right of the workspace.

Tick the code that will **NOT** work properly. Can you say why

# KS2 Example

How many times will the action run?

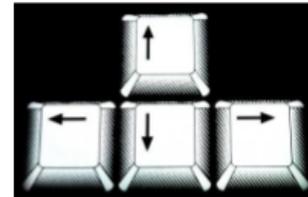
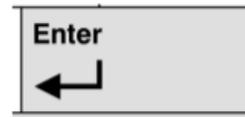
<p>Sing happy birthday Loop three times     Shout hoorah ← <input type="text"/> Sit down Eat birthday cake</p>	<p>Pick up drum stick Loop 10 times     Hit drum ← <input type="text"/> Put down drum stick</p>	<p>Walk forward one step Turn right 90 degrees Walk forward one step Turn left 90 degrees ← <input type="text"/> Walk forward one step Turn right 90 degrees</p>
<p>Stand Loop 100 times     Point up     Jump     Point down     Jump ← <input type="text"/> Sit</p>	 <p>repeat 250     move 1 steps     say arrived for 2 seconds</p>	 <p>play sound dance until done repeat 30     move 1 steps play sound dance until done</p>

# KS2 Example

## Know the key

Instructions: Join the key to its correct function using a line

- key to leave a gap between words
- Key to change lowercase to a capital letter
- Key to delete left ←
- Key to start a new line



key to delete right →

Keys to move around text without using the mouse

# KS2 Example

Write in the formulas in the cells (HINT =, \*, /, +, -)

	A	B	C	D	E	F	G
1			ADD				SUBTRACT
2	57	89			70	45	
3			ADD				MULTIPLY
4	48	38			189	289	
5			Multiply				DIVIDE
6	28	90			189	289	
7							

# KS2 Example

Name these cells

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

What is this called?

What is this called?

What type of data is mostly used in a spreadsheet?

# Unanswered Questions

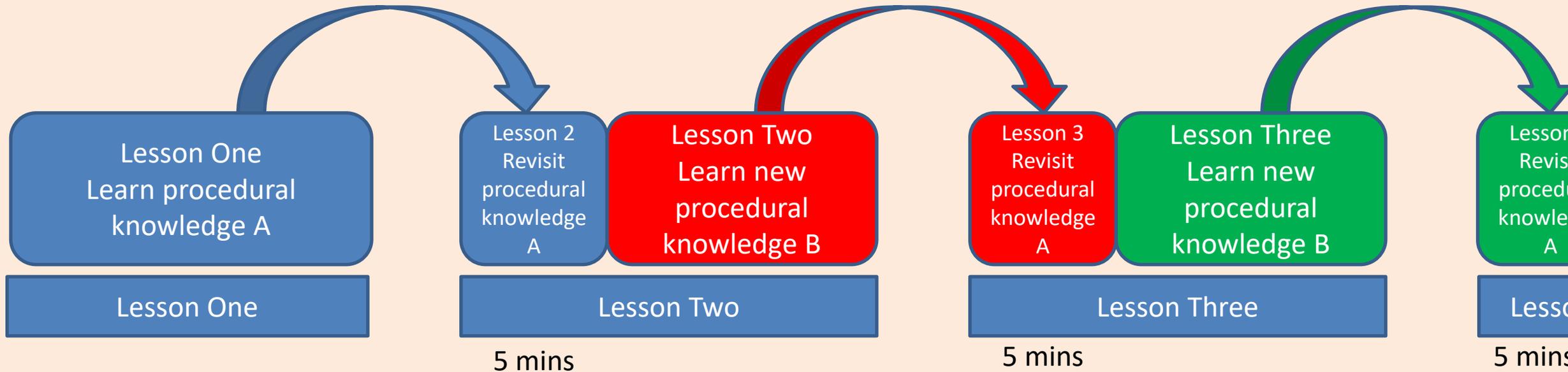
Over how long should we retrieve knowledge in primary? A week, 1/2 term, year, key stage, module?

Are tests the best way to retrieve procedural knowledge (skills)?

Is it a good use of time?

What do you think?

# Retrieving Procedural Knowledge



# Retrieval practice as assessment tool



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Working Below	Working Above
<p><b>Indicators that a pupil is working below</b></p> <p>Unable to complete two or more skills (procedural knowledge). A low score on either assessment activity. Needed lots of extra guided support in most lessons. Can't select when to use the knowledge independently. <b>Low knowledge retention on retrieval practice activities.</b></p>	<p><b>Indicators that a pupil is working above</b></p> <p>A very high score on both assessment activities. Can select when to use knowledge independently. Can explain clearly what they are doing and why. <b>High retention on all retrieval practice activities.</b></p>
<p><b>Names</b></p>	<p><b>Names</b></p>

# Retrieval, whose responsibility?



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- Computing lead?
- Teacher?
- Curriculum planner?

# Applying this to our planning



Take one computing lesson sequence that you use



Briefly share it with a partner



How might you build in retrieval?

**ANY QUESTIONS?**