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Attention, Working Memory and Cognitive Load Theory

Fran Haynes - Assistant Director of Durrington Research School

1. Cognitive load theory.
2. Retrieval practice.
3. Classroom strategies.
4. Strategies during remote teaching and learning.

Write down everything you already know about cognitive load theory and retrieval practice.

1. Recap on Cognitive Load Theory

Memory Myths

Myth 1: *We only use 10% of our brain.*	**Myth 2:** *We are more likely to remember something if we discover it for ourselves.*	**Myth 3:** *Men and women learn differently.*
Myth 4: *We learn better when teaching is tailored towards our preferred learning style.*	**Myth 5:** *Your brain is a muscle that can be trained.*	

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Memory Myths

Myth 6: *We do not need to remember facts now we have the internet.*	**Myth 7:** *Performance is always a sign of learning.*	**Myth 8:** *Rereading notes and highlighting are effective revision strategies.*
Myth 9: *We are good judges of how much we will remember.*	**Myth 10:** *Forgetting is the enemy of memory.*	

Memory Myths

Myth 11: *Memorable lessons should always contain unique and unexpected experiences.*	**Myth 12:** *Stories are only for English lessons.*	
Myth 13: *Learning is visible.*	**Myth 14:** *Cramming is an effective revision strategy.*	**Myth 15:** *We can always trust our memory.*

Dylan Wiliam
@dylanwiliam

I've come to the conclusion Sweller's Cognitive Load Theory is the single most important thing for teachers to know bit.ly/2kouLOq

♡ 650 7:16 PM - Jan 26, 2017

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Understanding cognitive load theory helps us to improve our approaches to …

- teacher talk/student attention
- writing
- task and activity design
- classroom displays
- slideshow design
- lesson resourcing
- lesson pacing

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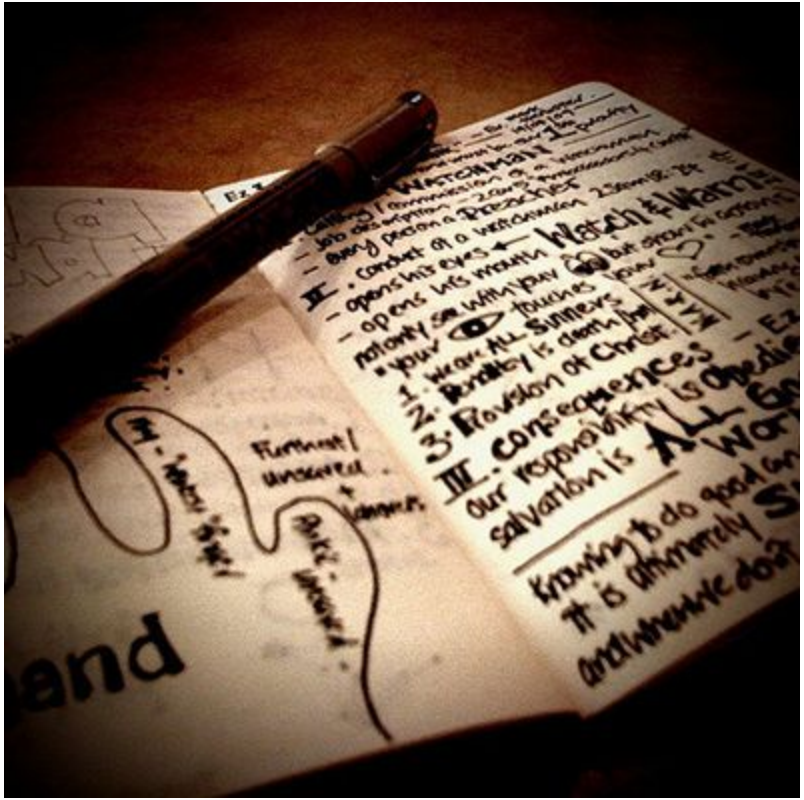
Long-term memory and working memory

Long-term memory - a huge storehouse of vocabulary, concepts and procedures

Working memory – the limited space in which we think and process information



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Long-term memory and working memory

Willingham (2009), p28

Long-term memory and working memory

Environment

Willingham (2009), p28

Long-term memory and working memory

Environment → Working memory (site of awareness & thinking)

Willingham (2009), p28

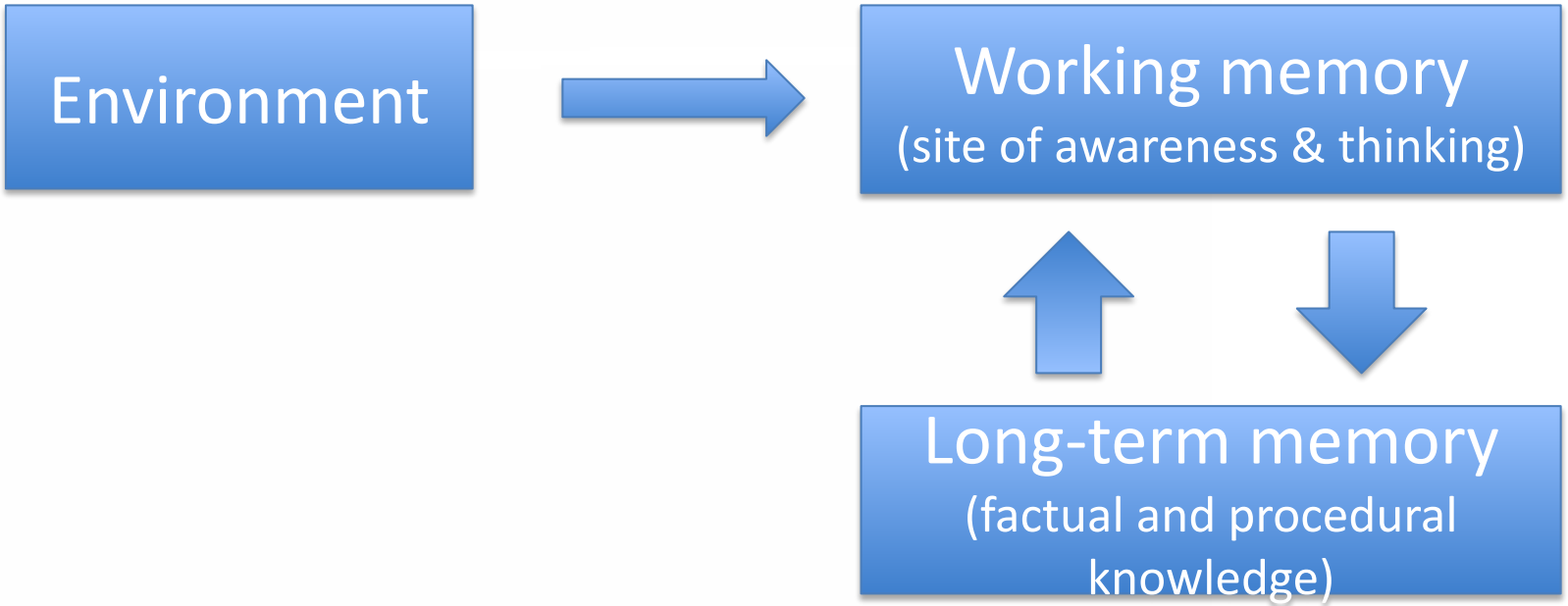
Long-term memory and working memory

Environment → Working memory (site of awareness & thinking)

Long-term memory (factual and procedural knowledge)

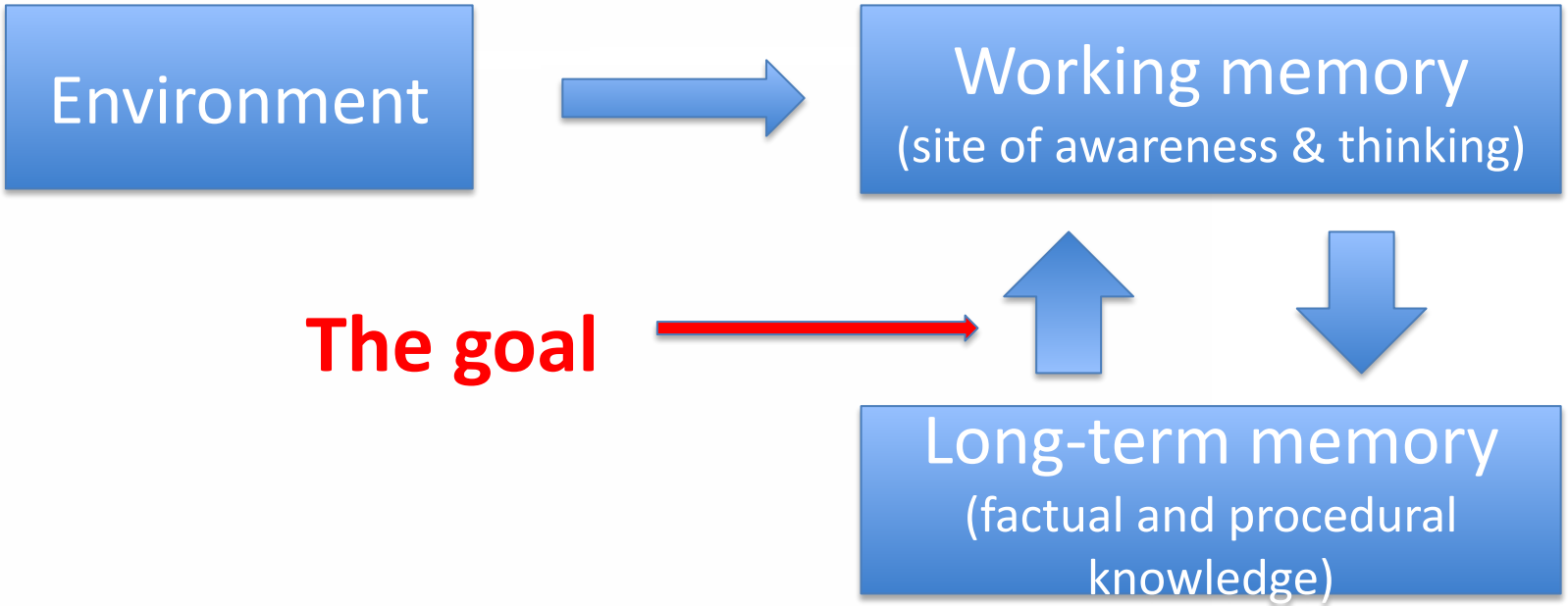
Willingham (2009), p28

Long-term memory and working memory



Willingham (2009), p28

Long-term memory and working memory



Willingham (2009), p28

Working memory limitations

- 30 second duration
- Small number of elements
- Magic number four

Demonstration 1: Remember this number

07929843635

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Demonstration 2: Read this and listen to me at the same time

Oh! But he was a tight-fisted hand at the grindstone, Scrooge! a squeezing, wrenching, grasping, scraping, clutching, covetous, old sinner! Hard and sharp as flint, from which no steel had ever struck out generous fire; secret, and self-contained, and solitary as an oyster. The cold within him froze his old features, nipped his pointed nose, shrivelled his cheek, stiffened his gait; made his eyes red, his thin lips blue; and spoke out shrewdly in his grating voice. A frosty rime was on his head, and on his eyebrows, and his wiry chin. He carried his own low temperature always about with him; he iced his office in the dog-days; and didn't thaw it one degree at Christmas.

Demonstration 3: Remember these letters:

BCB

VTI

NNC

SHN

Demonstration 3: Remember these letters:

BBC

ITV

CNN

NHS

Differences between children

"Differences in working memory capacity between different children of the same age can be very large indeed. For example, in a typical class of 30 children aged 7 to 8 years, we would expect at least three of them to have the working memory capacities of the average 4-year-old child and three others to have the capacities of the average 11-year-old child, which is quite close to adult levels."

Gaverscole & Alloway (2007)

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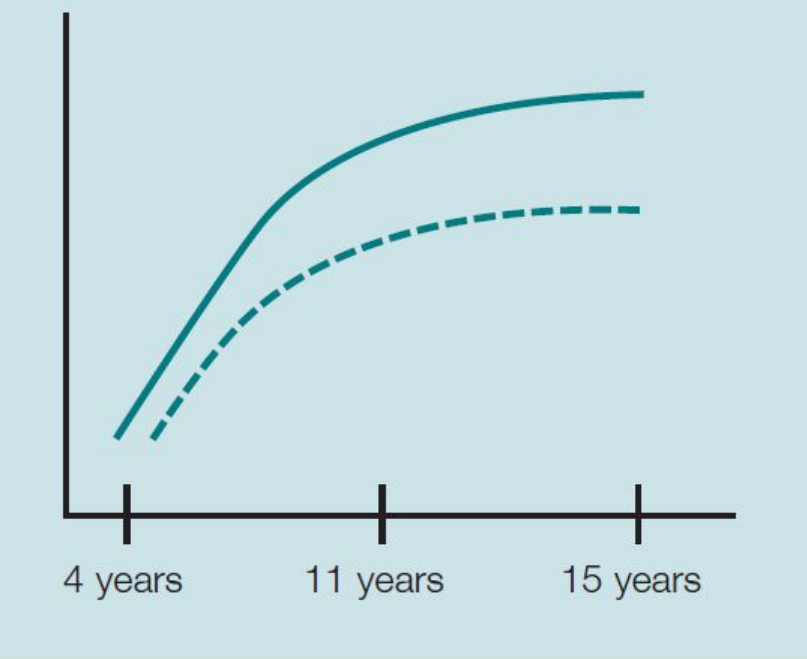
Changes in working memory capacity



Gaverscole & Alloway (2007)

Cognitive Load Theory (John Sweller)

intrinsic load

+

extraneous load

+

germane load

=

total cognitive load

Cognitive Load Theory (John Sweller)

intrinsic load (inherent challenge)

+

Cognitive Load Theory (John Sweller)

intrinsic load (inherent challenge)

+

extraneous load (unnecessary information)

+

germane load (productive thinking)

=

desirable difficulty

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Cognitive Load Theory (John Sweller)

intrinsic load (inherent challenge)

+

extraneous load (unnecessary information)

+

germane load (productive thinking)

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Cognitive Load Theory - John Sweller, late 1980s

intrinsic load (inherent challenge)

+

extraneous load (unnecessary information)

+

germane load (productive thinking)

=

total cognitive load

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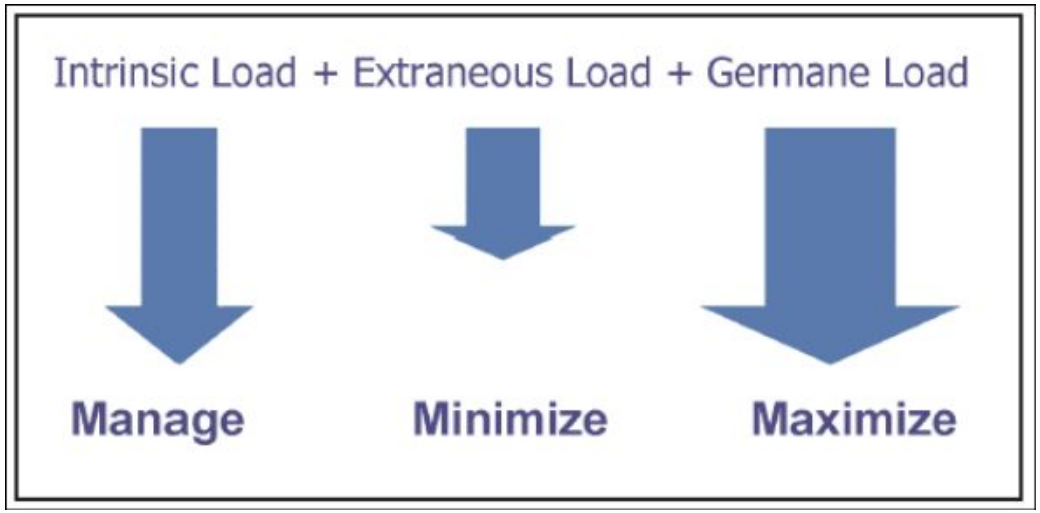
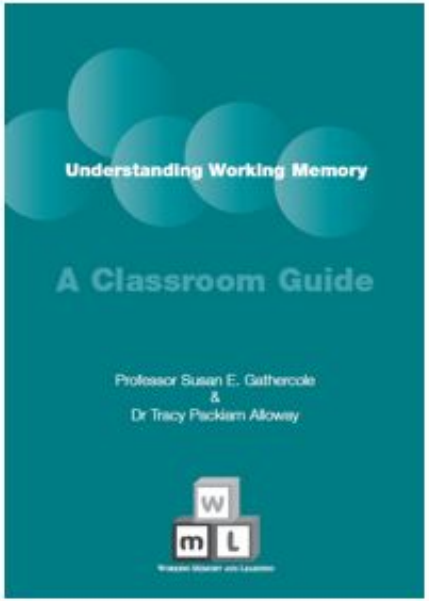
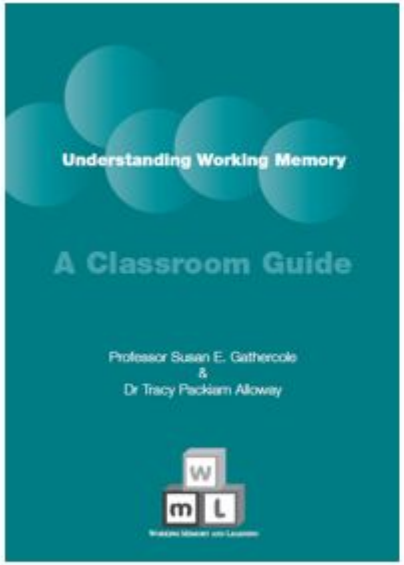

Intrinsic Load + Extraneous Load + Germane Load
Manage
Minimize
Maximize



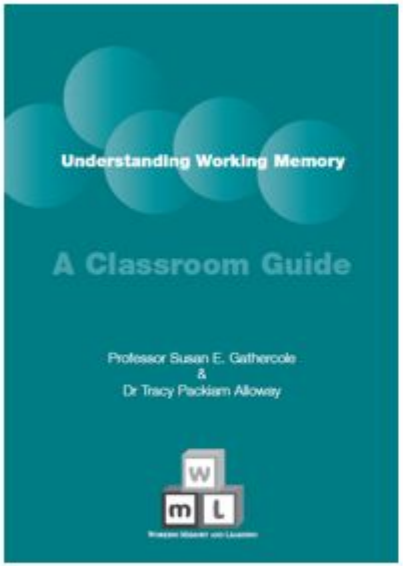
1. **Recognise working memory failures**

- **incomplete recall**;
- **failing to follow instructions**, including remembering only the part of a sequence of instructions;
- **place-keeping errors** – for example, repeating and/or skipping letters and words during sentence writing;
- **task abandonment** – the child gives up a task completely.



2. Monitor the child

- repeat information;
- break down tasks;
- encourage child to request information.



3. Evaluate the working memory demands of activities

- *Put your sheets on the green table, arrow cards in the packet, put your pencil away, and come and sit on the carpet.*

- *To blow up parliament, Guy Fawkes had 36 barrels of gunpowder.*

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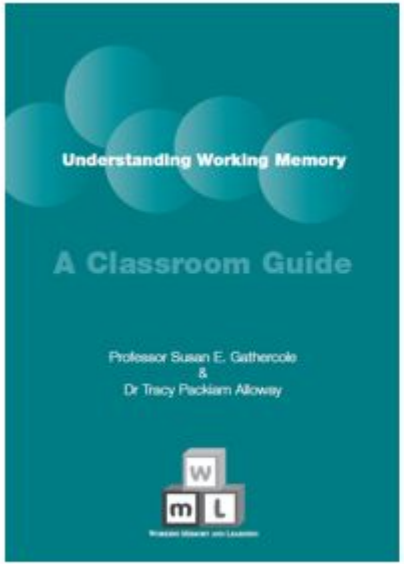

4. Frequently repeat important information

- *Classroom management instructions*
- *Task specific instructions*
- *Detailed content*

Think of a time when a pupil was struggling to remember something in your lesson.

Using what you now know about cognitive load theory, why might this have been the case?

2. Retrieval Practice

The Critical Importance of Retrieval for Learning

Article *in* Science · March 2008

DOI: 10.1126/science.1152408 · Source: PubMed

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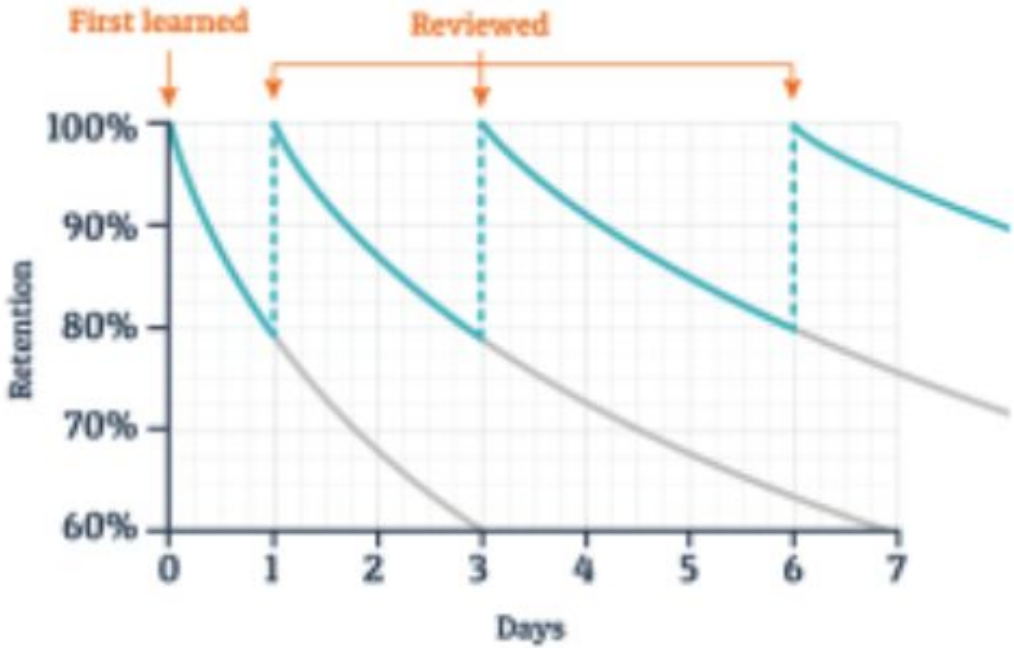
Typical Forgetting Curve for Newly Learned Information



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Write down everything you know about cognitive load theory and retrieval practice.

Recent research has shown that retrieval is critical for robust, durable, long-term learning.

Every time a memory is retrieved, that memory becomes more accessible in the future.

Retrieval also helps us create coherent and integrated mental representations of complex concepts, the kind of deep learning necessary to solve new problems and draw new inferences.

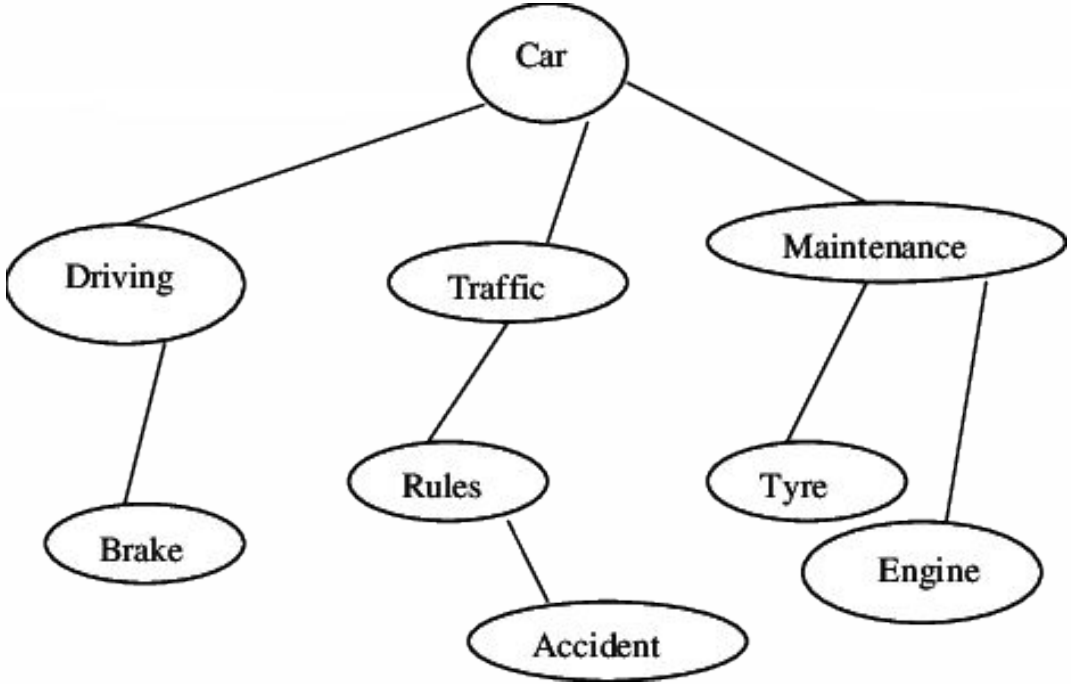
Write down as much as you can about...

frog

armadillo

Think about something that you know a lot about.

- When you thought about the words, facts and information stored in your long-term memory were brought to mind.
- This is called **schema activation**.
- **Schemata** are the mental models you have of any subject and are made up of a web of everything you have ever learned about that subject.


Car
Driving
Traffic
Maintenance
Brake
Rules
Tyre
Engine
Accident

- As teachers, we want to build schemata in our pupils' minds about specific subjects.
- Over time, we want to increase the sophistication of these schemata so that our pupils can think more critically and coherently.
- As schemata grow, or as the web becomes larger and tighter, it is easier to capture new knowledge. **Knowledge begets knowledge.**
- In other words, the more pupils learn about a particular subject, the bigger their web to catch new pieces of information.

Retrieval practice can strengthen your schema…

- Recalling prior knowledge and applying it to a new context builds schemata.

- Knowledge is stored more easily in your long-term memory if it is linked to knowledge that is already stored there.

Demonstration 3: Remember these letters:

BBC

ITV

CNN

NHS

Think of a time when a pupil was struggling to remember something in your lesson.

Using what you now know about cognitive load theory, why might this have been the case?

Spaced Practice

Spaced practice (or ‘spacing’ or ‘distributed practice’) involves repeatedly coming back to information that we are learning in various short sessions, spaced out over time, rather than cramming in a long intense period

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What are the implications of schemata, retrieval practice and spaced practice on curriculum design?

How make this look in your school?

3. Practical Strategies

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How do we overcome barriers to working memory?

1. Outsource it through scaffolding.

2. Practise to automaticity.

3. Centralise the development of long-term memory through curriculum planning.

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Strategies to Manage Cognitive Load

1. Short bursts

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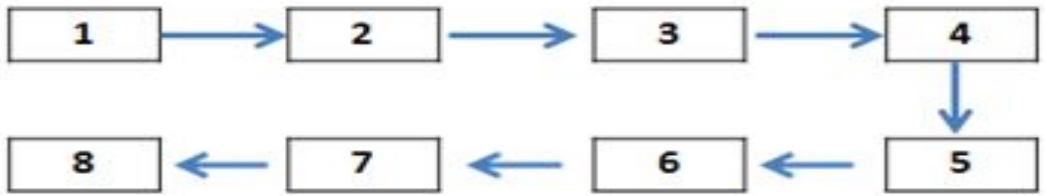
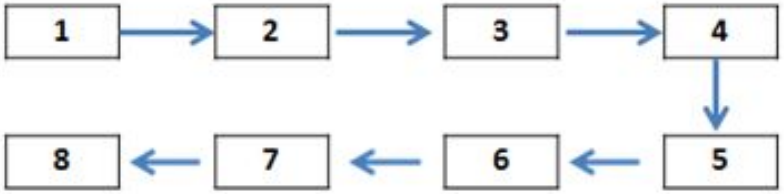
1. Short bursts



1. Short bursts



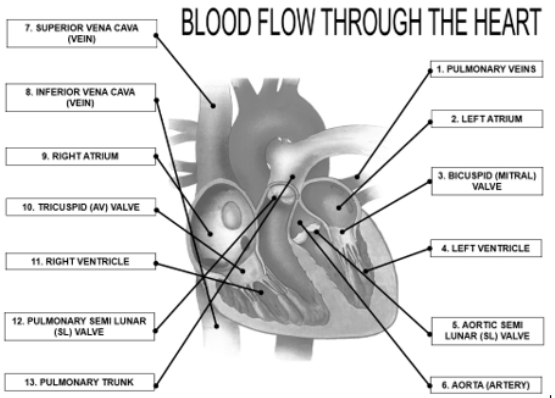
1	2	3	4
5	6	7	8

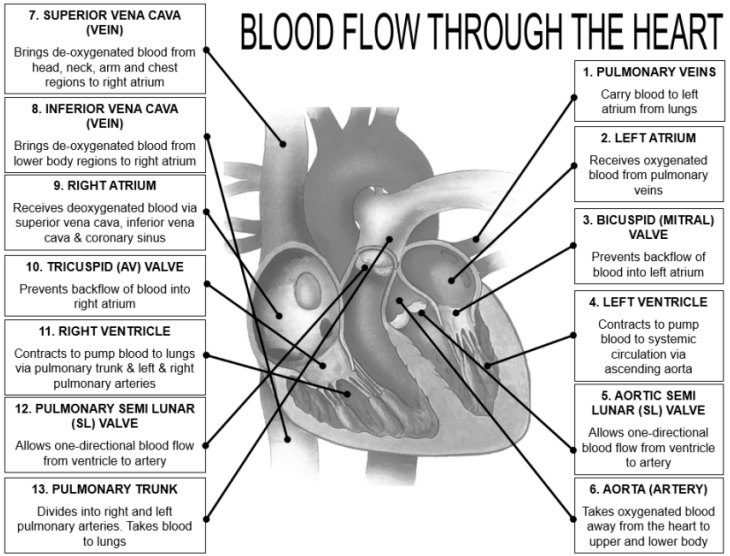
2. Avoid split attention

- Integrate labels
- Arrows
- Colour-coding
- Physical proximity – resources and classroom

BLOOD FLOW THROUGH THE HEART

1. **PULMONARY VEINS**: Carry blood to left atrium from lungs
2. **LEFT ATRIUM:** Receives oxygenated blood from pulmonary veins
3. **BICUSPID (MITRAL) VALVE:** Prevents backflow of blood into left atrium
4. **LEFT VENTRICLE:** Contracts to pump blood to systemic circulation via ascending aorta
5. **AORTIC SEMI LUNAR (SL) VALVE:** Allows one-directional blood flow from ventricle to artery
6. **AORTA (ARTERY):** Takes oxygenated blood away from the heart to upper and lower body
7. **SUPERIOR VENA CAVA:** Brings de-oxygenated blood from head, neck, arm and chest regions to right atrium
8. **INFERIOR VENA CAVA (VEIN):** Brings de-oxygenated blood from lower body regions to right atrium
9. **RIGHT ATRIUM:** Receives deoxygenated blood via superior vena cava, inferior vena cava & coronary sinus
10. **TRICUSPID (AV) VALVE:** Prevents backflow of blood into right atrium
11. **RIGHT VENTRICLE:** Contracts to pump blood to lungs via pulmonary trunk & left & right pulmonary arteries
12. **PULMONARY SEMI LUNAR (SL) VALVE:** Allows one-directional blood flow from ventricle to artery
13. **PULMONARY TRUNK:** Divides into right and left pulmonary arteries. Takes blood to lungs





Source: https://furtheredagogy.wordpress.com/2018/07/13/principle-to-practice-the-split-attention-effect/

3. Reduce redundant information

- Remove superfluous images and text from PowerPoints and other resources.
- Listening or reading (not both)
- Speaking over the top of students whilst they are working.
- Lean feedback.

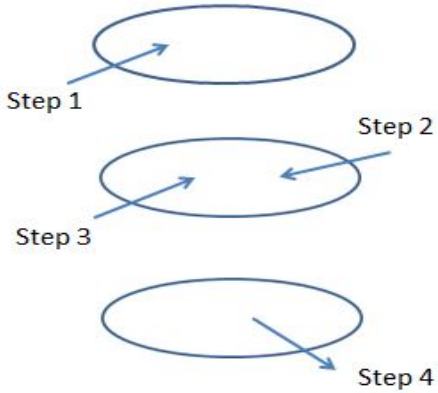
4. Limit distraction

- Silent when working independently on cognitively challenging tasks.
- Reduce noise from outside
- Stimulating wall display?
- Reduce movement in lessons

5. Permanent working-memory supports

- Hand-out notes
- Wall displays – prompts, vocabulary, etc
- Note taking
- All on one page
- Lesson routines
- Danger of reliance – fade out support.

6. Worked example effect

Worked example	Student practice
Problem/task _____  	Problem/task _____

Example and Question

Example 1

Solve $2x - 3 = 1$ for x

Add 3 to both sides

$$2x - 3 + 3 = 1 + 3$$
$$2x = 4$$

Divide both sides by 2

$$\frac{2x}{2} = \frac{4}{2}$$

$$x = 2$$

Question 1

Solve $3x - 2 = 7$ for x

Writing a talk or speech

21. Your school have decided to stop all school trips.
You have been asked to give a talk to the school governors encouraging the school to change its mind.

Your talk should include one or more of the following:

- the benefits of school trips
- the types of school trips available
- the consequences of banning school trips

Write what you would say. [20]

1. Identify purpose, audience and text type (PAT)

2. Five point plan
(four and a spare)

- **Point 1** - *personal stories of trips – Worsley Museum, Natural History, New York*
- **Point 2** – *benefits – independence, resilience, environment*
- **Point 3** – *consequences – 1% children choosing other schools*
- **Point 4** – *counter-argument – negative effects on teachers (argue against this)*
- **Point 5** – *many families cannot afford to take children on holiday – trips provide these experiences*

3. Connect with the audience (tell them why)

4. First Reason (2+ ideas or pieces of evidence)

5. Second reason (2+ ideas or pieces of evidence)

6. Third reason (2+ ideas or pieces of evidence)

7. Counter argument and rebuttal (state opposite argument and destroy!)

8. Call to action (what do you want your audience to do?)

9. Polite farewell

Good afternoon, My name is Sam Smith and I am a Year 11 student at our wonderful school. Like many others in the student body, I fully respect the work you do as governors to support and improve our school. However, today I am here to encourage you to reconsider your recent decision to ban school trips. refer to no

If I look back over my eleven years in compulsory education, my most vivid and cherished memories come from the wonderful trips I have been lucky to go on. In year 1, we tottled down to Worthley Museum to learn about the Victorians. In Year 5, we travelled by coach to London to admire the wonder of life at The National History Museum. And in year 11, we were fortunate enough to visit the inspirational art galleries of New York. These experiences have sparked within me an unquenchable thirst for history, biology and art – the three subjects I will study at A-Level. Perhaps you could take a moment to reflect on the school trips you went on yourselves as children. Would you be sat in the seats you are now if you had not had those experiences? emotive language

For me, school trips have made education interesting. However, there are plenty of other benefits too. Residential trips mean that we spend time away from our family and friends, which helps us to build the skills of independence and resilience. Furthermore, geography field trips expose us to the awe-inspiring natural beauty of beaches, rivers and mountains. Indeed, some of my closest friends have learnt to love the environment on these trips and have pledged to lead green lives in the future. If you go through with this proposal, all this will be lost. triplet

Unfortunately, there will be other consequences too. Year 8 students and their parents will be less likely to choose our wonderful school, and will instead opt to send their children to other local schools. Like me, many parents and members of the local community believe that school is about much more than exam results; it is about the development of character and personality too. anaphora

I appreciate that school trips take students and teachers away from the classroom. I appreciate that school trips require an awful lot of planning and preparation. However, if you want a school of happy, interested and well-rounded young people, then I urge you to reverse your decision as soon as possible.

Thank you for taking the time to listen. Do you have any questions? ask for questions

(413)

Question: You have been asked to give a talk in assembly to your year group about why everyone should donate money to charity. Write what you would say.

Check list	
1. Identify purpose, audience and text type (PAT)	
2. Five point plan (four and a spare)	
3. Connect with the audience (tell them why)	
4. First reason (2+ ideas or pieces of evidence)	
5. Second reason (2+ ideas or pieces of evidence)	
6. Third reason (2+ ideas or pieces of evidence)	
7. Counter argument and rebuttal (state opposite argument and destroy!)	
8. Call to action (what do you want your audience to do?)	
9. Polite farewell	
10. Edit your writing with a ruler	

Point 1 _____
Point 2 _____
Point 3 _____
Point 4 _____
Point 5 _____

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Dual-coding theory

Two formats – words and visuals.

Present them together – the ***contiguity principle*** (see Meyer and Anderson, 1992)

Explain visuals in your own words.

Draw visuals to go with new learning.

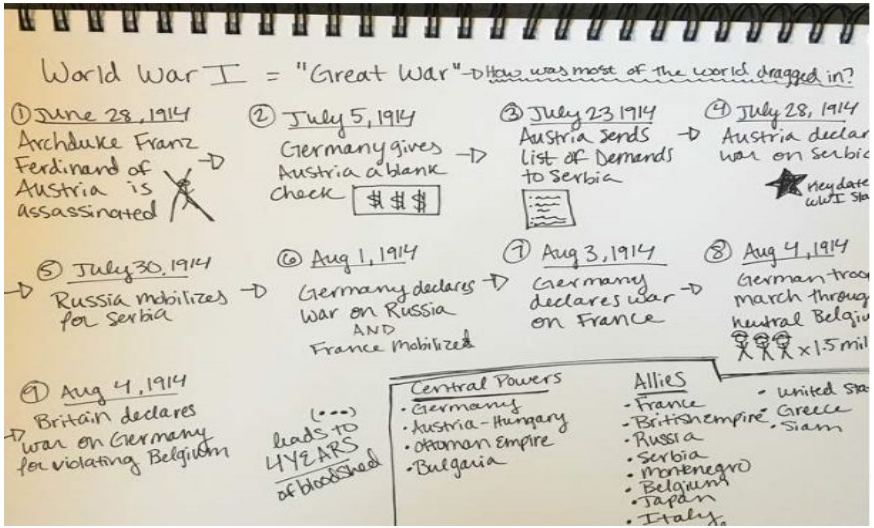
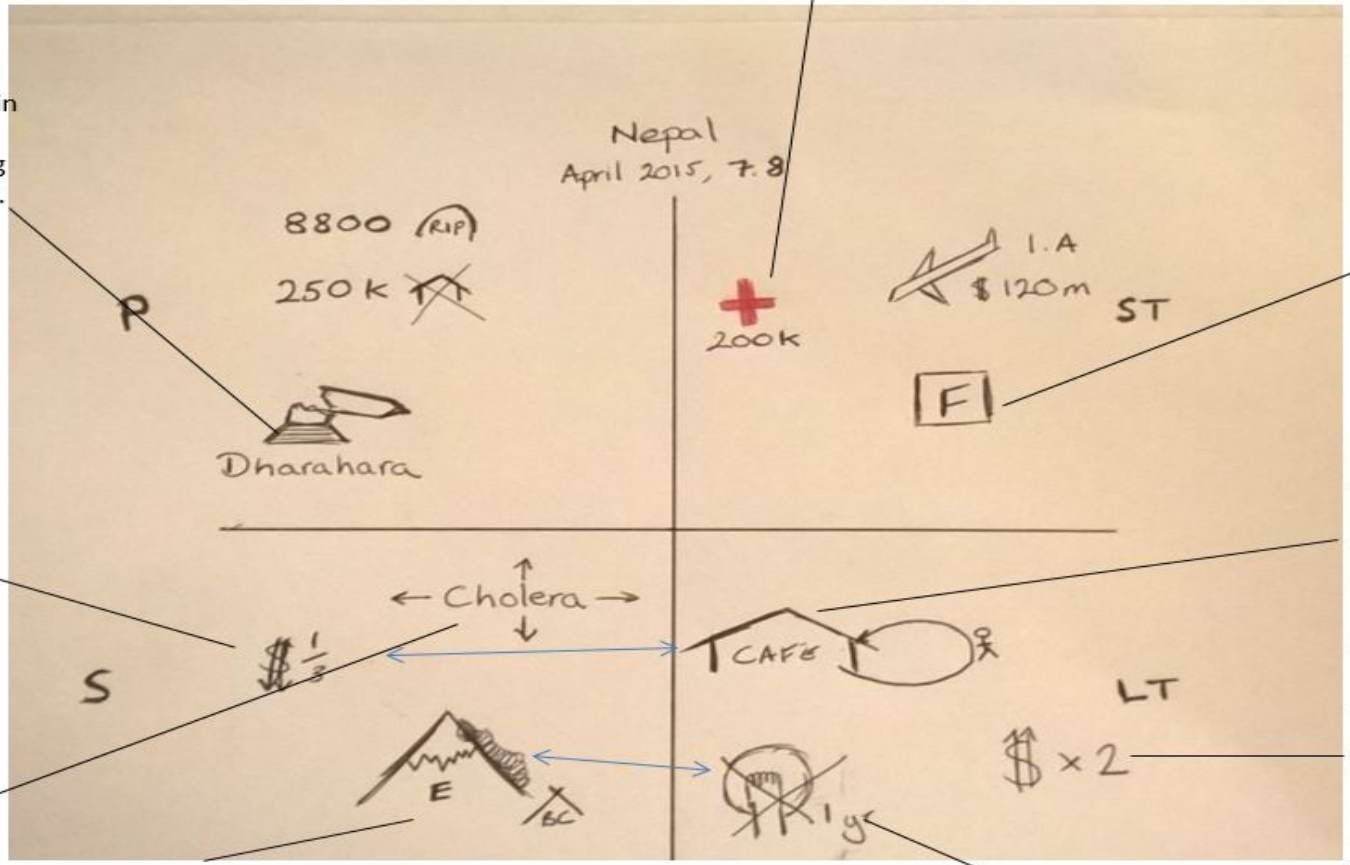


Image from 'Learning Scientists' blog

Geography example



200,000 people put in temporary shelter by Red Cross

Facebook created a check-in page that allowed people to log that they were okay- more beneficial to rich people and visitors.

The landmark Dharahara tower in Kathmandu collapsed trapping 200 people inside.

In an attempt to overcome the loss of tourism Nepalese business owners focused their efforts on attracting local people to their cafes and bars.

Nepal suffered a 33% decrease in tourism following the earthquake.

Visitor fees to tourists attractions were doubled to make up for the loss of visitors and pay for rebuilding of them.

A lack of clean water resulted in the spread of diseases such as cholera.

Avalanches on Mt Everest destroyed base camp and ended the climbing seasons – result in a huge financial loss

Many parts of Nepal were still without power a yea after the earthquake

The Expertise Reversal Effect - Kalyuga et al (2003)

The more a learner knows about a topic, the less effective reducing cognitive load becomes.

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Strategies for Retrieval Practice

Flashcards

- **Students need support on how to make and use, and lots of guided practice.**
  - Number them
  - Leave a pause between asking the question and checking
  - Keep practising even when you think you know it all (overlearn)
  - Do not make separate piles
  - Mix them up
  - Space their use.

The Strategies in Practice

Flashcards

Question	Answer
6 x 7	42

The Strategies in Practice

Flashcards

Set 1	Concept	Explanation
Set 2	Instruction	• Draw this concept • Give a concrete example • When is this likely to happen? • What is the opposite? • What is similar to this concept from another subject?

Use the learning strategies to create instructions.

Other Methods of Retrieval Practice

- **Quizzing. In particular, start the lesson with three groups of questions:**
  - Questions from last lesson
  - Questions from last term
  - Questions from last year.

- **Practise explaining something from a previous lesson in pairs.**

- **Produce a timeline or writing plan about a process, e.g. a character in a story or science experiment.**

- **On a blank piece of paper, write down everything you know about a topic...**

Write down everything you know about cognitive load theory and retrieval practice.

Strategies to Build Schemata

Knowledge Organisers

What might they look like?

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What knowledge goes on the organiser?

Declarative knowledge

- Facts, dates, vocabulary, conceptual ideas, theories, laws, propositions, principles etc.

- Declarative means **what** you can state (declare).

Procedural knowledge

- Processes, procedures, methods, applications, performances etc.

- Procedural is **how** you do something.

Declarative Knowledge

1. Illnesses and diseases
2. Symptoms
3. Properties and effects of medicines
4. Patient's history
5. Where to refer for further treatment

Procedural Knowledge

1. Diagnosis
   - questions to ask and how
   - strategies to deal with patients' reactions
   - recommendations
2. Bedside manner

1. The KOs are divided into different sections. Each section is given a heading.

2. Facts and ideas are numbered.

3. The facts are brief – explanation and elaboration is provided in class.

4. Diagrams and images can be useful **if they add to the schema**.

Minibeasts | Year One | Summer 2

Minibeast Habitats

Where do minibeasts live?

1	rivers
2	houses
3	lakes
4	woodland
5	marshes
6	ponds,
7	hedgerows
8	grasslands
9	heathland
10	seashores

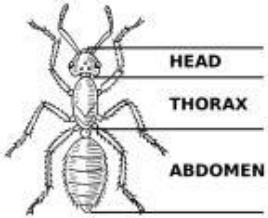
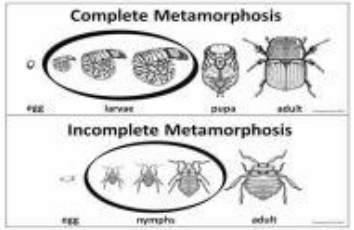


Diagram of an insect's three part body.

Types of Minibeasts

What are the main types of minibeast?

1	Insects	Ants, beetles, butterflies, dragonflies	
2	Arachnids	Spiders, mites, scorpions	
3	Molluscs	Snails, slugs, mussels, octopuses	
4	Crustaceans	Crabs, lobsters, woodlice	



Vocabulary

1	abdomen	The bottom part of an arthropod's body.
2	antennae	The 'feelers' attached to some arthropods' heads.
3	arachnids	An animal with a two part body and eight legs.
4	arthropods	An animal that has an exoskeleton, segmented body, a segmented body, and jointed legs.
5	crustaceans	An animal with an exoskeleton
6	exoskeleton	A hard shell covering the outside of the body.
7	insects	An animal that has a three part body, six legs, and usually wings.
8	invertebrates	An animal that doesn't have a spine or a backbone.
9	molluscs	An animal with a soft unsegmented body, and often a hard shell.
10	thorax	The middle part of an arthropod's body, which the legs and wings are attached to.

Apollo 11 Mission to the Moon | Year Two | Spring 2

Timeline

1	April 12th 1961	Russian cosmonaut Yuri Gagarin becomes the first person to go to space.
2	May 25th 1961	President John F Kennedy says that America will send someone to the moon before 1970.
3	July 16th 1969	Saturn V rocket launches from Cape Kennedy space base, Florida.
4	July 20th 1969	The lunar module lands successfully on the moon, in the Sea of Tranquillity.
5	July 21st 1969	Armstrong and Aldrin conduct surface operations (missions).
6	July 21st 1969	Part of the lunar module leaves the moon and joins with the command module.
7	July 24th 1969	The command module arrives back on earth, landing in the Pacific Ocean.
8	July 24th 1969	President Nixon personally congratulates the crew in quarantine.
9	August 13th 1969	Celebration parades across America.
10	November 16th 2011	Crew of Apollo 11 awarded the Congressional Medal of Honour

Crew

1	Neil Armstrong	Commander
2	Michael Collins	Command Module Pilot
3	Edwin "Buzz" E. Aldrin, Jr.	Lunar Module Pilot

Important Quotations

1	*"We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard."* - President John F Kennedy, 1961
2	*"The Eagle has landed."* - Neil Armstrong, landing on the moon.
3	*"That's one small step for man, one giant leap for mankind."* - Neil Armstrong, as he took the first step on the moon.
4	*Here men from the planet Earth first set foot upon the Moon, July 1969 A.D. We came in peace for all mankind.* - Plaque left on the moon.

Interesting Facts

1	The Saturn V rocket reached a total speed of 6,164 mph.
2	The moon is 384,400 km or 238,900 miles from Earth.
3	The strength of gravity on the moon is only around 16% compared to Earth.

Vocabulary

1	**Apollo 11**	The name given to the overall mission to land on the moon.
2	**Crew**	The team who are taking part in the mission
3	**Command Module**	The spacecraft that orbited the moon, and took the crew back to earth.
4	**Gravity**	The invisible force that pulls objects together. The bigger the object, the stronger the pull (more gravity).
5	**Lunar Module**	The spacecraft that actually landed on the moon. (Luna is Latin for the moon).
6	**NASA**	An American organisation which explores space. NASA stands for the National Aeronautics and Space Administration
7	**Saturn V**	The huge rocket that sent the astronauts into space.
8	**Sea of Tranquillity**	A large, dark area of the moon, in which the astronauts landed.
9	**Space Race**	The USA and the USSR (now Russia) were racing to be the first country to put man on the moon.
10	**Pacific Ocean**	The largest ocean in the world, in between Asia and America.

Knowledge Organisers

‘Active Ingredients’

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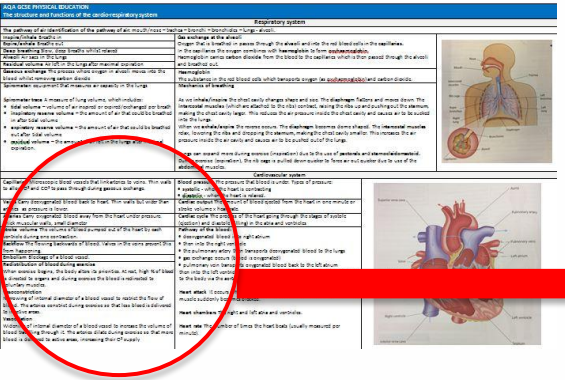
Knowledge Organisers: Criteria

1. Every knowledge organiser includes tier 2 and tier 3 vocabulary linked to the unit of work.



Capillaries Microscopic blood vessels that link arteries to veins. Thin walls to allow O^2 and CO^2 to pass through during gaseous exchange.

Veins Carry deoxygenated blood back to heart. Thin walls but wider than arteries as pressure is lower.

Arteries Carry oxygenated blood away from the heart under pressure. Thick muscular walls, small diameter

Stroke volume The volume of blood pumped out of the heart by each ventricle during one contraction.

Backflow The flowing backwards of blood. Valves in the veins prevent this from happening.

Embolism Blockage of a blood vessel.

Redistribution of blood during exercise
When exercise begins, the body alters its priorities. At rest, high % of blood is directed to organs and during exercise the blood is redirected to voluntary muscles.

Vasoconstriction
Narrowing of internal diameter of a blood vessel to restrict the flow of blood. The arteries constrict during exercise so that less blood is delivered to inactive areas.

Vasodilation
Widening of internal diameter of a blood vessel to increase the volume of blood travelling through it. The arteries dilate during exercise so that more blood is delivered to active areas, increasing their O^2 supply

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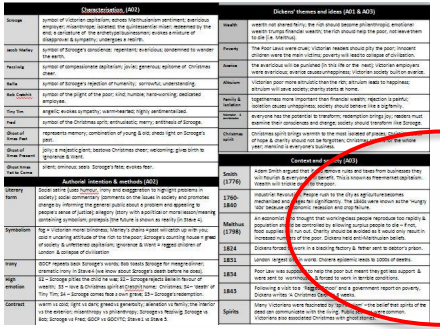
Knowledge Organisers: Criteria

2. The content of knowledge organisers include knowledge that builds cultural capital as well as knowledge required for exam specifications.



Context and society (A03)	
Smith (1776)	Adam Smith argued that if you remove rules and taxes from businesses they will flourish & everyone will benefit. This is known as free-market capitalism. Wealth will trickle down to the poor.
1760-1840	Industrial Revolution. People rush to the city as agriculture becomes mechanized and wages fall significantly. The 1840s were known as the 'Hungry '40s' because of economic recession and crop failure.
Malthus (1798)	An economist who thought that working-class people reproduce too rapidly & population should be controlled by allowing surplus people to die – if not, food supplies will run out. Charity should be avoided as it would only result in increased numbers of the poor. Dickens held anti-Malthusian beliefs.
1824	Dickens forced to work in a blacking factory & father sent to debtor's prison.
1831	London largest city in world. Cholera epidemic leads to 1000s of deaths.
1834	Poor Law was supposed to help the poor but meant they got less support & were sent to workhouses & forced to work in terrible conditions.
1843	Following a visit to a 'Ragged School' and a government report on poverty, Dickens writes 'A Christmas Carol' in 6 weeks.
Spirits	Many Victorians were fascinated by 'spiritualism' – the belief that spirits of the dead can communicate with the living. Public séances were common. Victorians also associated Christmas with ghost stories.

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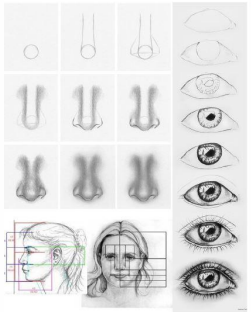
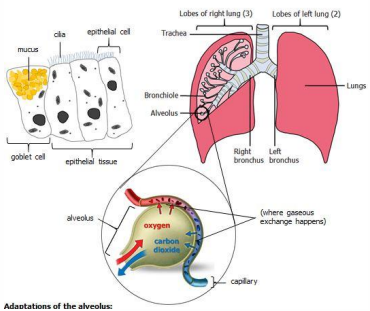
Knowledge Organisers: Criteria

3. Knowledge can be written or visually presented.



1 Cardiac myocyte	A **specialised cell**. Makes up the **walls** of the **heart**. **Contracts** to **pump blood** around our bodies. **Involuntary myocyte**.
2 Involuntary muscle	A **muscle** that **contracts automatically**. We **do not consciously** tell these muscles to **contract**.
3 Myocyte	A **specialised cell**. The **scientific term** for **muscle cell**.
4 Skeletal myocyte	A **specialised cell**. **Contracts** to **move** our **joints**. **Voluntary myocyte**.
5 Smooth myocyte	A **specialised cell**. Makes up the **walls** of **internal organs**. **Contracts** to keep **organs working**. **Involuntary myocyte**.
6 Specialised cell	Cells may be **specialised** for a **particular job**. Their **structure** will **help** them to carry this **job** out.
7 Voluntary muscle	We **consciously** tell these muscles to **contract**.



1	I love **to do** my homeworks	J'adore **faire** mes devoirs
2	whilst **listening** of the music.	en **écoutant** de la musique.
3	**It's necessary that** I do my homeworks	**Il faut que** je fasse mes devoirs
4	before **going out**.	avant de **sortir.**
5	**Although I am** English	**Bien que je sois** anglais
6	**I speak** French.	**je parle** français.

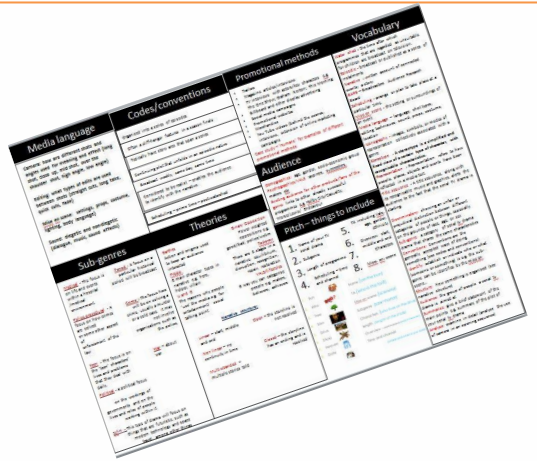
Knowledge Organisers: Criteria

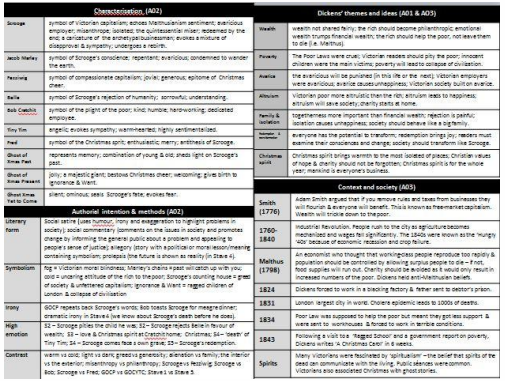
4. The knowledge organiser makes it easy for students to self-quiz.

1 Aphelion	**Furthest from** the **Sun** in its **orbit**.
2 Atmosphere	The **layer** of **clouds** and **greenhouse gases** that are **around some planets**.
3 Asteroid	An **irregularly shaped object** made of **rock left over** from the **birth** of our **Solar System**. These objects **orbit** the **Sun**. Asteroids are **smaller** than **planets**.
4 Asteroid belt	**Millions** of **asteroids** found **between** the **inner** and **outer planets**.
5 Astronomy	A **science**. **Investigates** the **stars**, **planets** and other objects in **space**.
6 Axis	An **imaginary line** through the **middle** of a **planet**. The planet **rotates around** the **axis**.
7 Comet	An **object** made of **ice** which **orbits** the **Sun**, mainly **beyond Neptune**. Can **melt** as they **pass** the **Sun**. This causes a huge **tail** of **gas** and **dust** to **form**. **Smaller** than **planets**.
8 Constellation	A named '**shape**', which is made by **grouping stars** together into a **pattern**.
9 Copernicus, Nicolaus	**Polish astronomer** born in **1473**. Accused of **heresy** because he believed in a **heliocentric Solar System**.
10 Daytime	The **part** of **Earth** which is **facing** the **Sun** is experiencing **daytime**.

Knowledge Organisers: Criteria

5. The knowledge on each organiser is that which will enable automaticity or fluency within a subject, **or makes a schema visible and explicit**.
6. Knowledge organisers need to be suitable and useful for each subject.





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Minibeasts | Year One | Summer 2

Minibeast Habitats

Where do minibeasts live?

1	rivers
2	houses
3	lakes
4	woodland
5	marshes
6	ponds,
7	hedgerows
8	grasslands
9	heathland
10	seashores

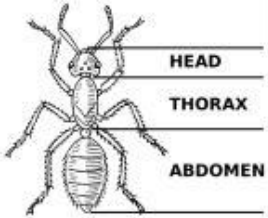
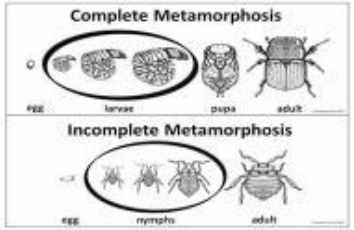


Diagram of an insect's three part body.

Types of Minibeasts

What are the main types of minibeast?

1	Insects	Ants, beetles, butterflies, dragonflies	
2	Arachnids	Spiders, mites, scorpions	
3	Molluscs	Snails, slugs, mussels, octopuses	
4	Crustaceans	Crabs, lobsters, woodlice	



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Retrieval Practice: Quizzing

- Pupils memorise the information on a knowledge organiser and then complete a quiz (a section at a time).
- This helps to build cumulative quizzing over time.
- Students cover up sections and quiz themselves or each other.
- Students make flashcards using the numbered points.
- Students write out or verbally describe a KO from memory.

Managing Cognitive Load: Scaffolding Responses

- Use KOs for scaffolding, i.e. have them in front of students as they respond to a task. Take away gradually.
- Students have access at home to support for more demanding homework.
- Same KO for all students but perhaps differentiate delivery.

Research Evidence

- No robust research evidence that supports (or challenges) the use of knowledge organisers.
- No guidelines for best practice.
- No concrete ideas for how to put them to use.
- **Knowledge organisers need to be the *schemata* for the curriculum and evidence-informed pedagogy that is right for your school or department.**
- **Knowledge organisers as an isolated tool are probably not the way forward.**

4. Strategies During Remote Teaching and Learning

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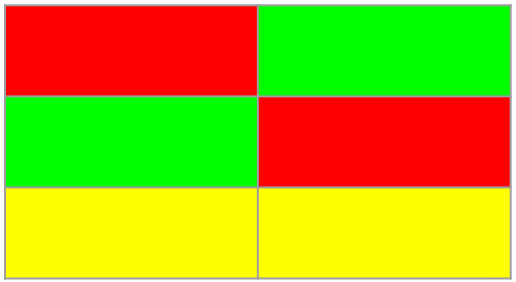
1. Reduce your expectations of curriculum coverage



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2. Short bursts for video and online lessons

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3. Avoid split attention

- **Keep all resources and tasks in the same document where possible.**

- **Avoid asking pupils to have to find too many resources or click on too many links.**

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3. Reduce redundant information

- **Do not read (either live or in video) and ask students to read a screen at the same time.**

  Listening or reading (not both)

- **Give lean feedback for online work - one goal at a time for pupils to think about.**

4. Limit distraction

- **Tell pupils how to do this at home:**
  - Turn off your phones and other devices
  - Find a quiet place to work if you can.
  - Let people know you are in a lesson.

5. Support working memory through creating remote learning routines

Use a similar structure in all lessons:

- Start with a retrieval quiz
- Explanation and modelling
- Practise
- Self monitoring using a checklist

6. Support pupils to self regulate

“Make sure you have a pen, pencil and piece of paper before we start.”

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