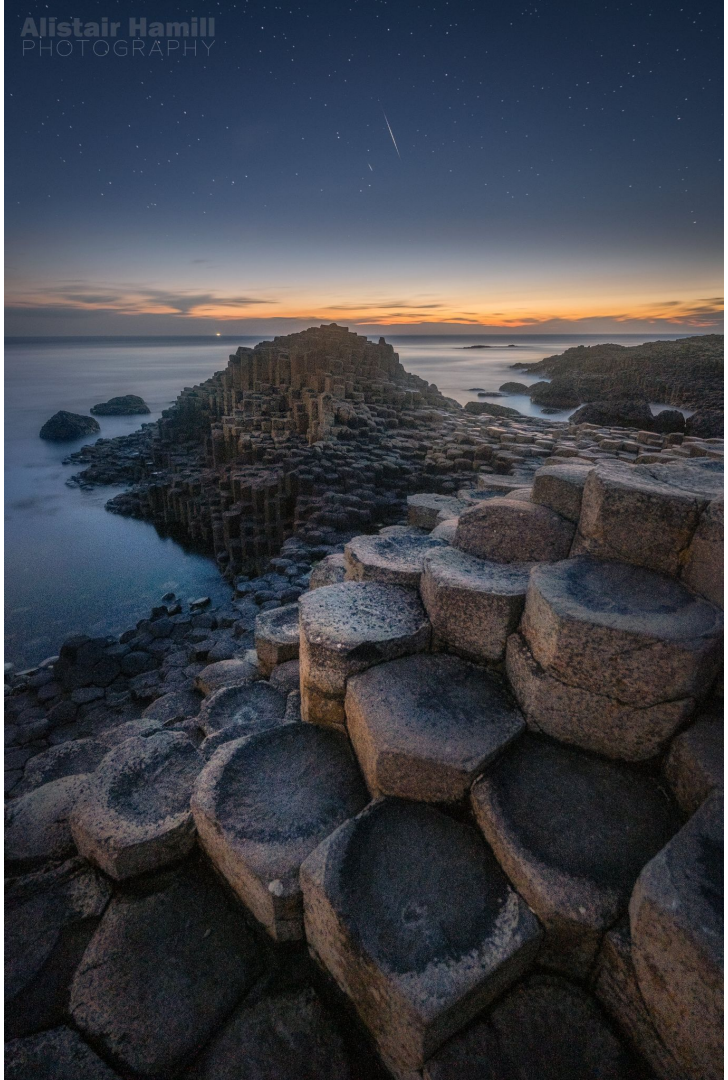
The Meaning Making Classroom

How schema theory can help us help our pupils understand

Alistair Hamill

research ED DUBLIN


Alistair Hamill
PHOTOGRAPHY

What is learning?

What is learning?

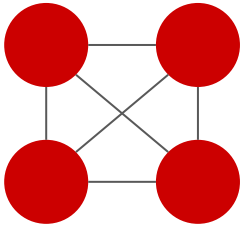
“Learning is a change in the long term memory.”

Kirschner, Sweller and Clark

Schema theory

“A schema is a **network** of information built around **connected** ideas.”

Mark & Zoe Enser

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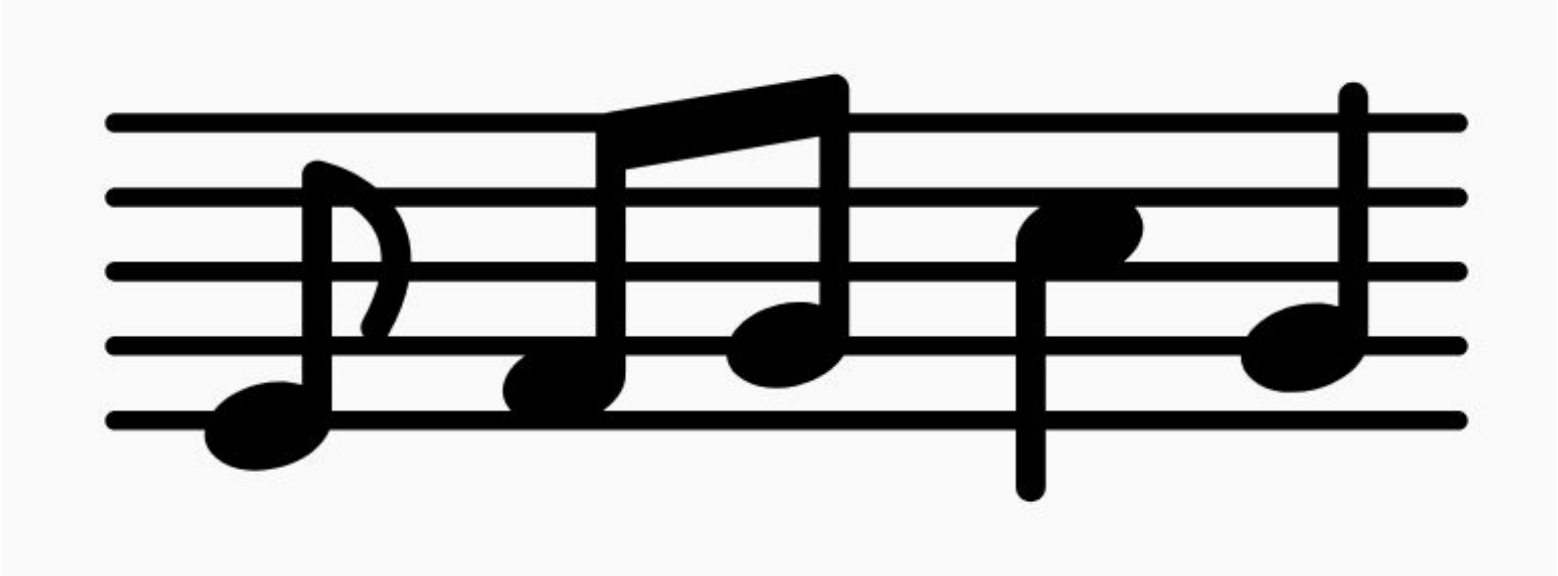
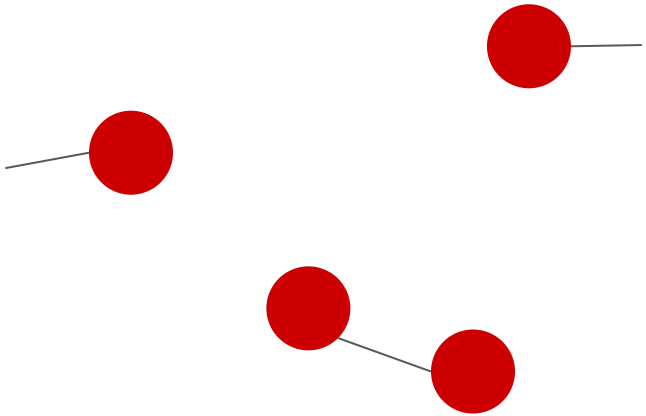
PHOTOGRAPHY




André
Previn
1929-2019



Sunday 18 September 2022

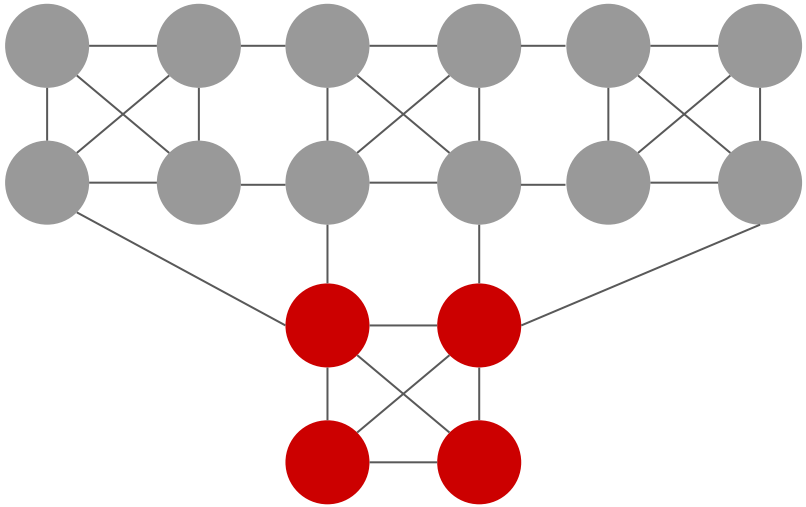
Brentford	0	3	Arsenal	Gtech Community Stadium, **Brentford**
Everton	1	0	West Ham	Goodison Park, **Liverpool**

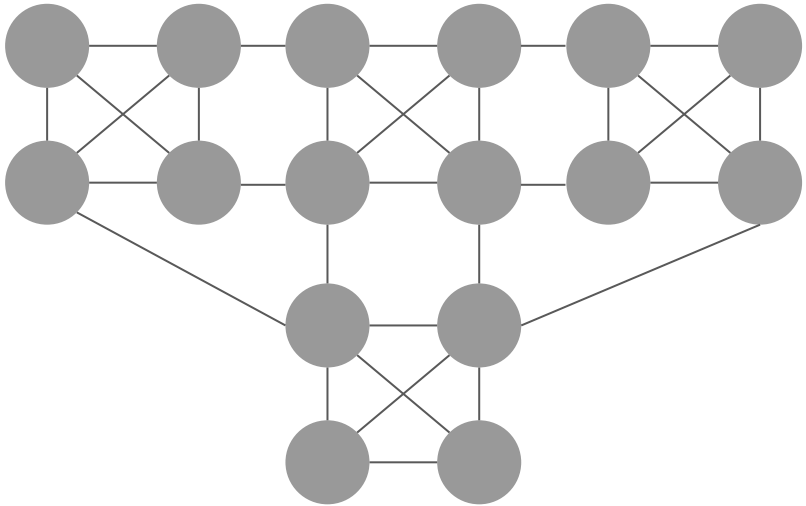
Saturday 17 September 2022

Wolves	0	3	Man City	Molineux Stadium, **Wolverhampton**
Newcastle	1	1	Bournemouth	St. James' Park, **Newcastle**
Spurs	6	2	Leicester	Tottenham Hotspur Stadium, **London**

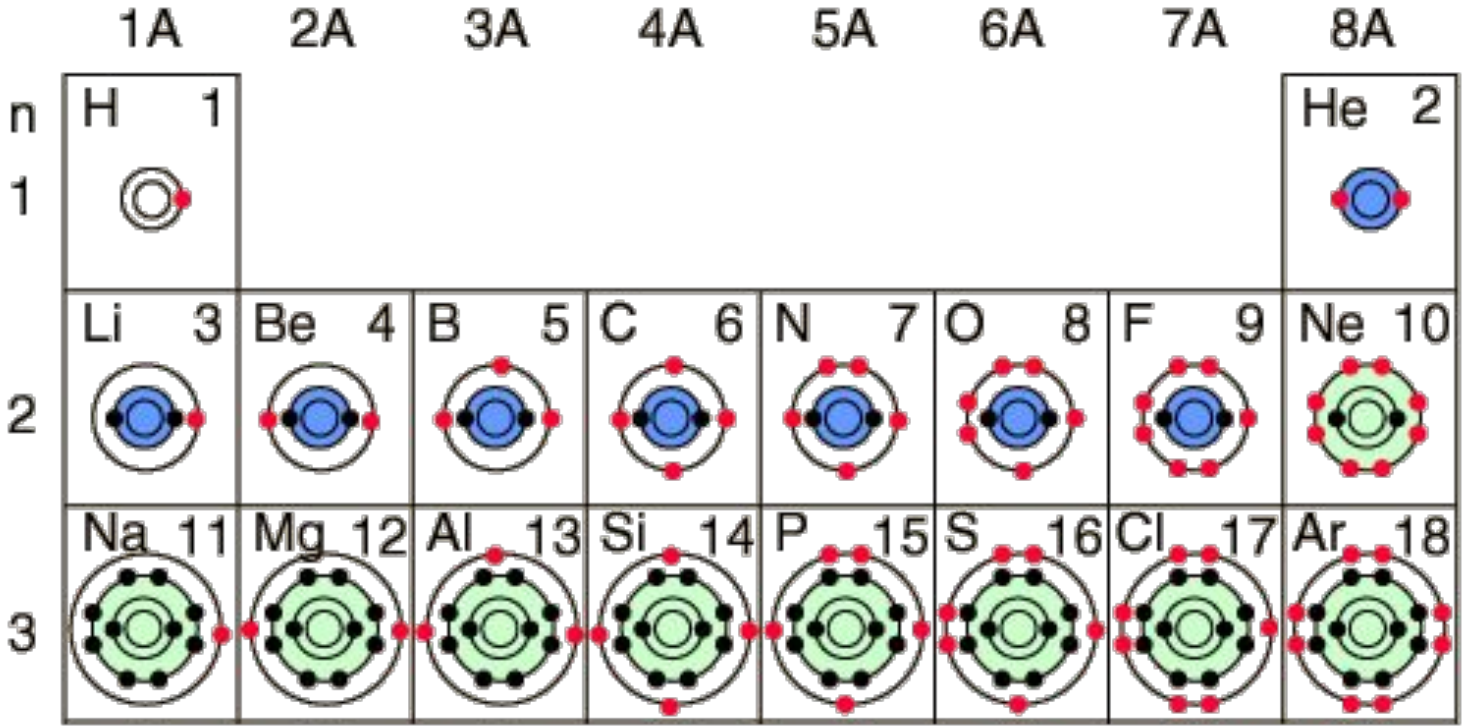
Friday 16 September 2022

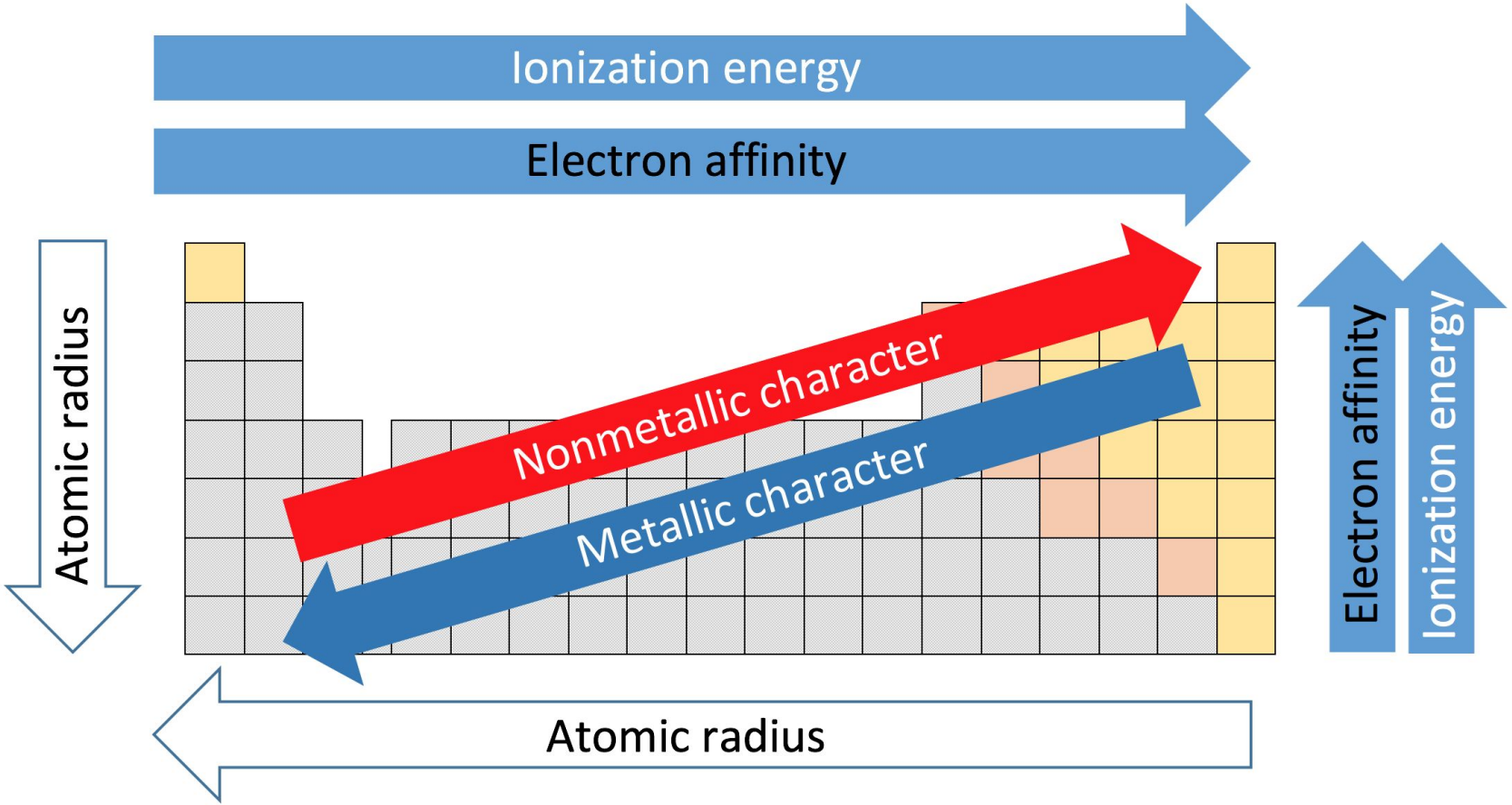
Aston Villa	1	0	Southampton	Villa Park, **Birmingham**
Nott'm Forest	2	3	Fulham	The City Ground, **Nottingham**



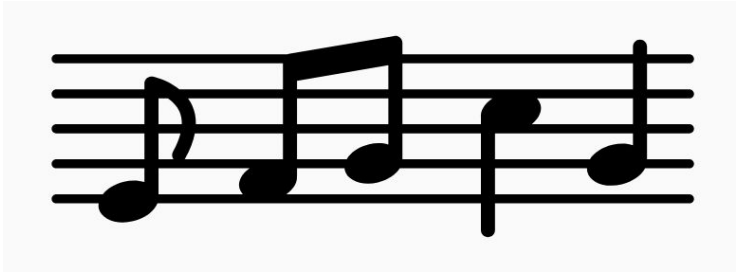


Try learning this...

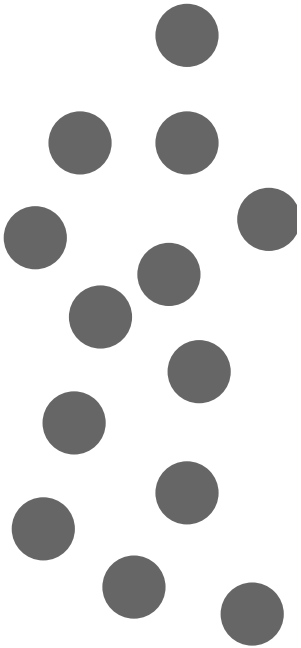



Ionization energy
Electron affinity
Atomic radius
Nonmetallic character
Metallic character
Electron affinity
Ionization energy
Atomic radius

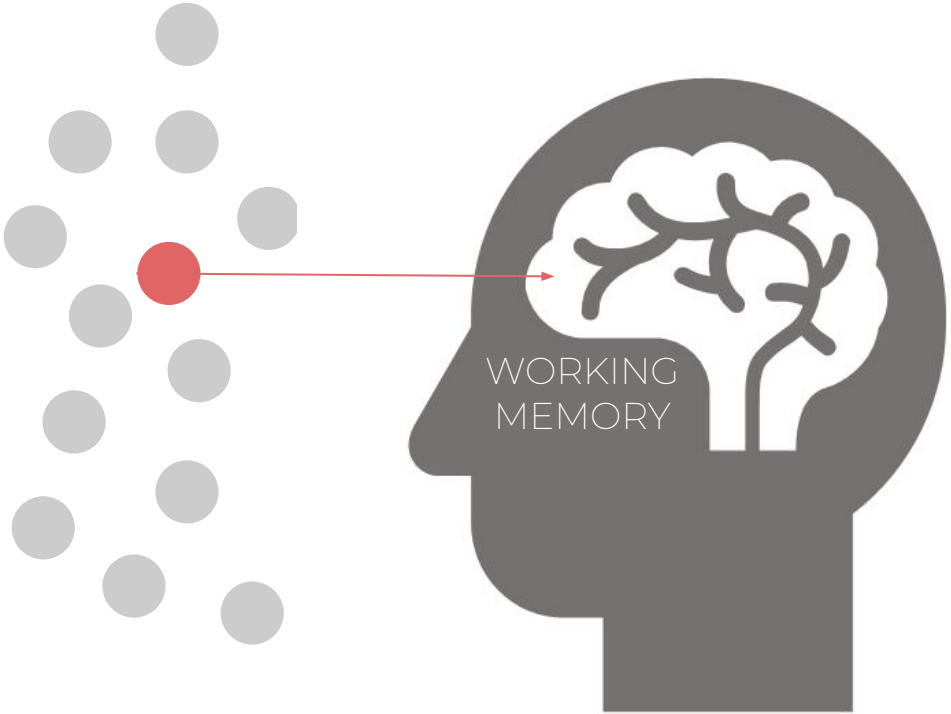
1. We make sense of new knowledge by integrating it into our **knowledge schema** (a structured, well connected body of knowledge).

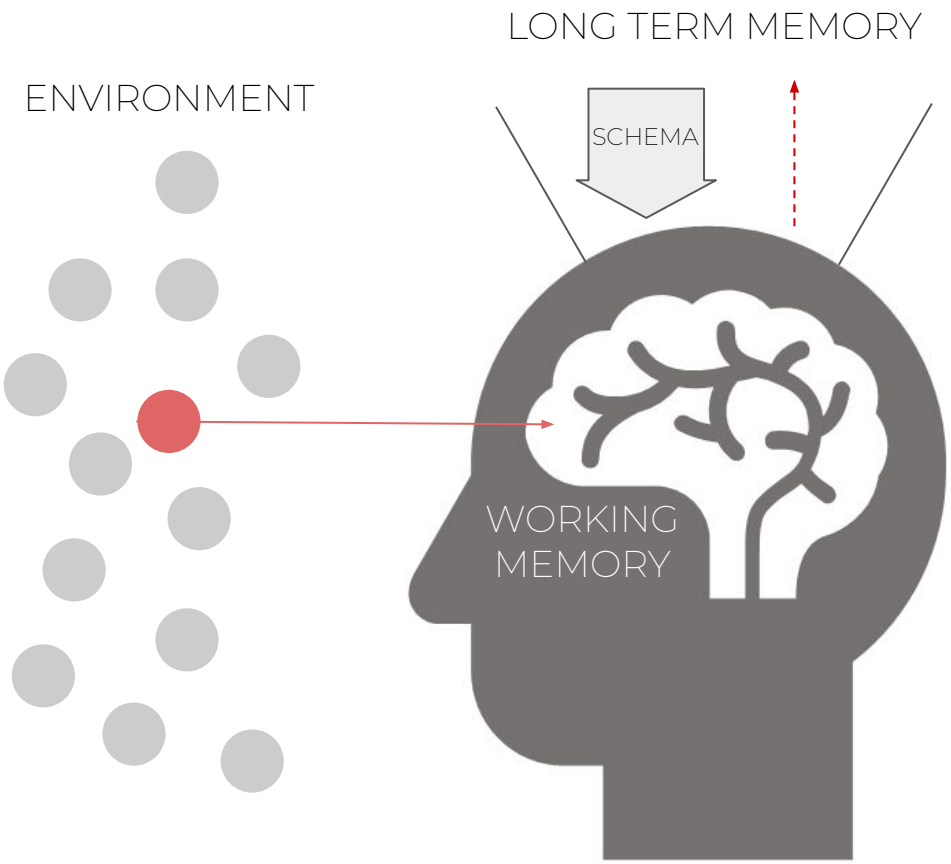


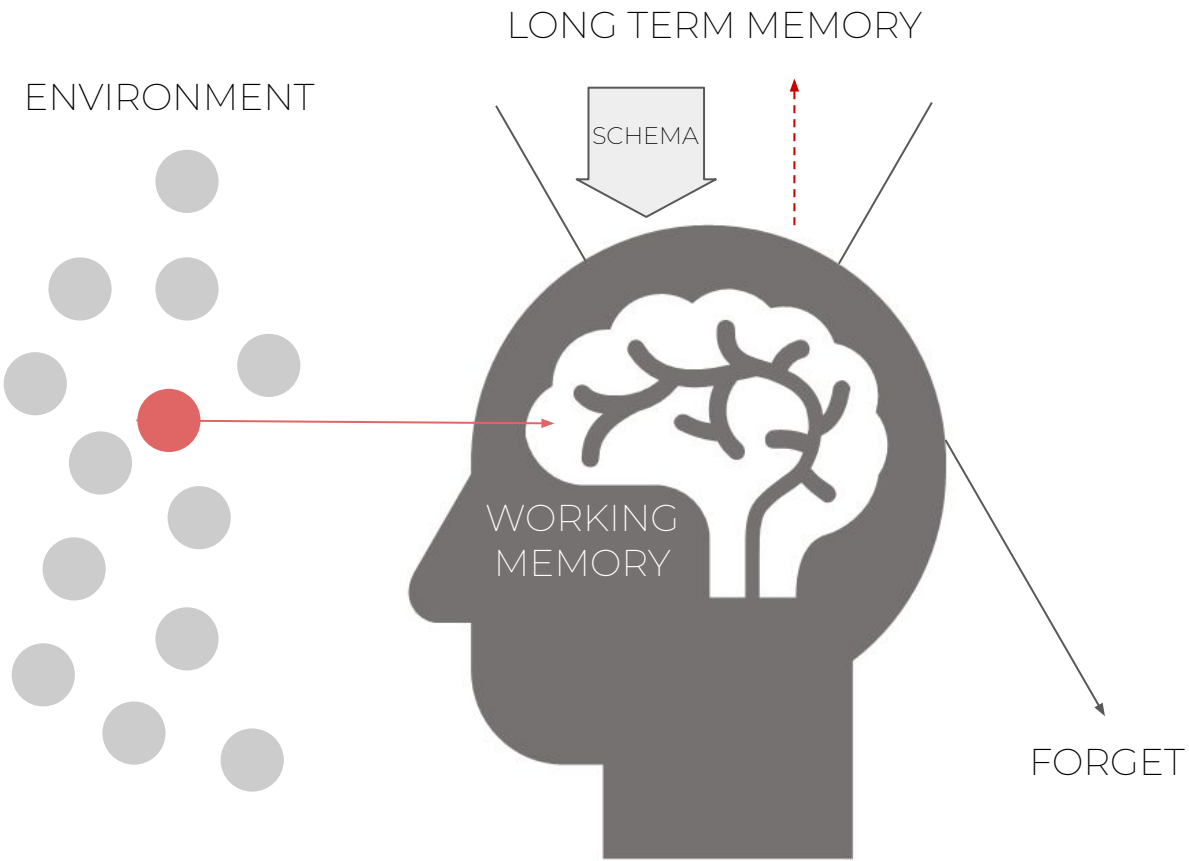
ENVIRONMENT



ENVIRONMENT




LONG TERM MEMORY
ENVIRONMENT
SCHEMA
WORKING
MEMORY


LONG TERM MEMORY
ENVIRONMENT
SCHEMA
WORKING
MEMORY
FORGET

An example

Why do birth rates fall as a country becomes more developed?

Why do birth rates fall in countries over time?

improved medical standards

birth control, financial position, education of women

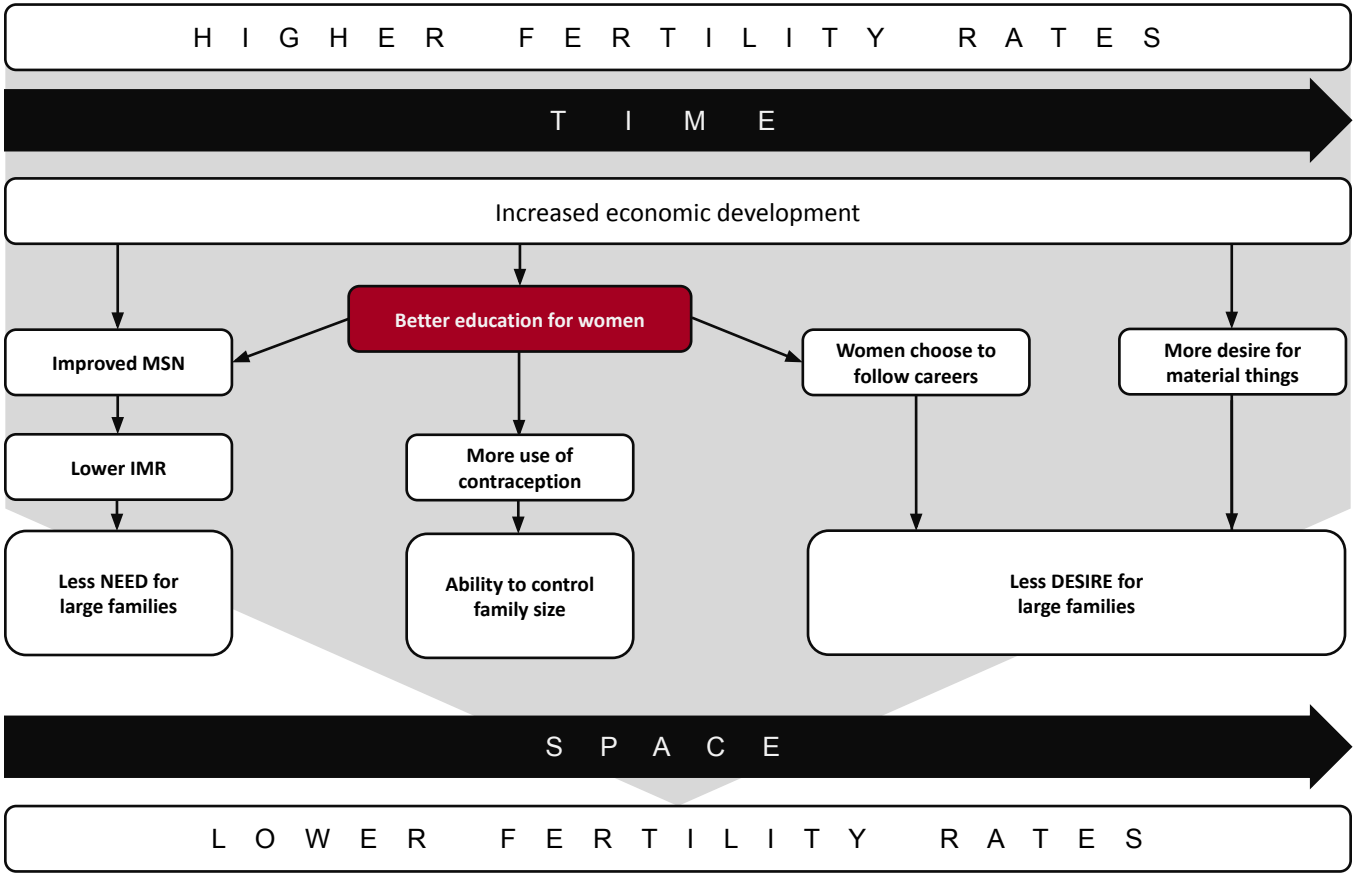
contraception, women educated, social acceptance, careers, child care access, cost of children, gov policies (China)

Diet, Nutrition, Age, Backstreet Abortions, Endometriosis, Physical Problems, Genetics, Medical Health Care, Birth Control,

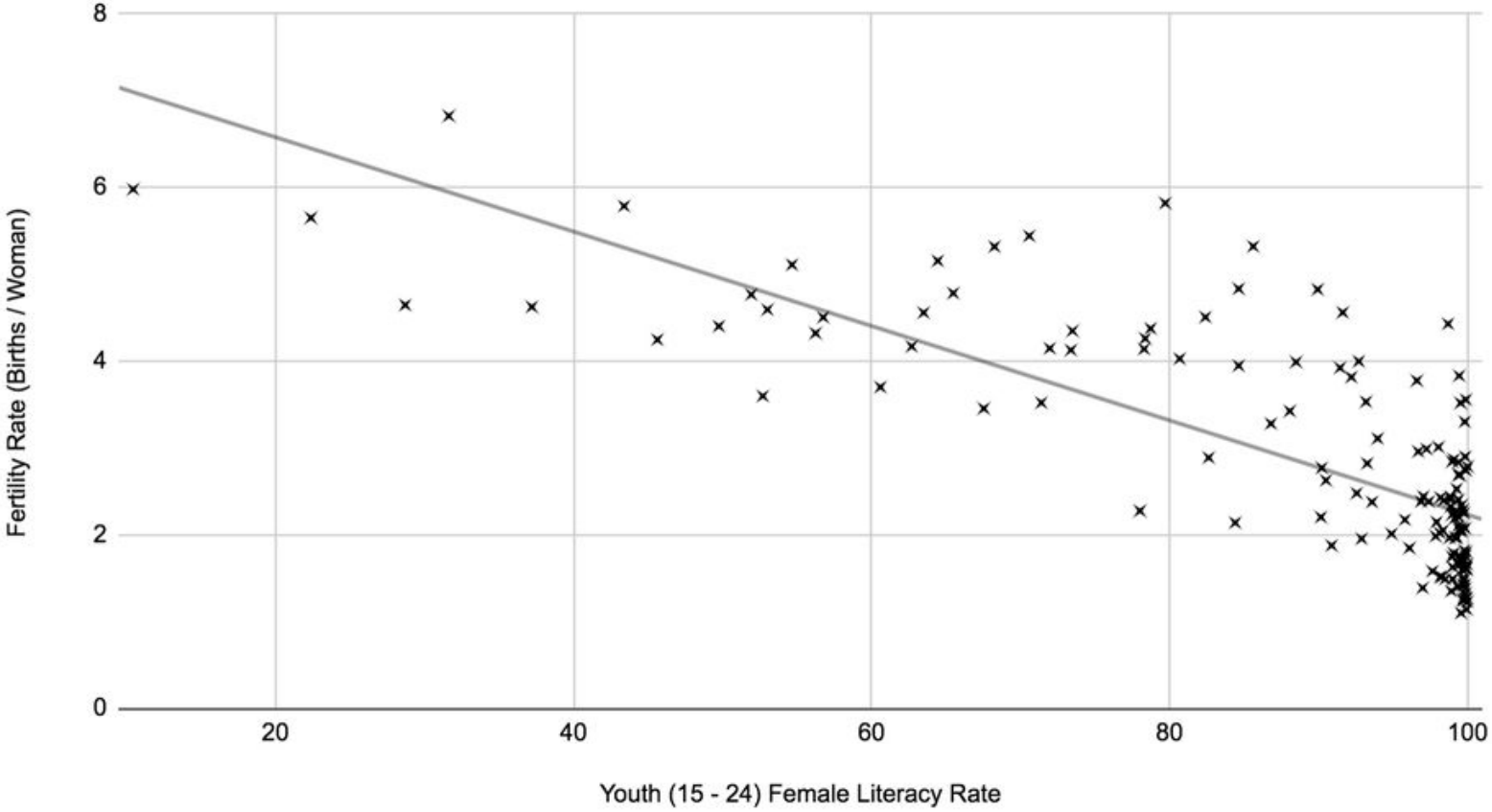
women in work

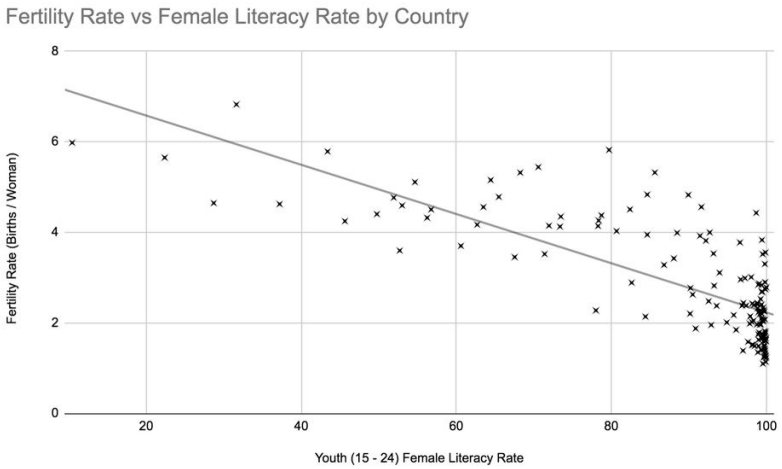
contraceptives, women pursue careers, desire for more material things, changes in culture (smaller families)

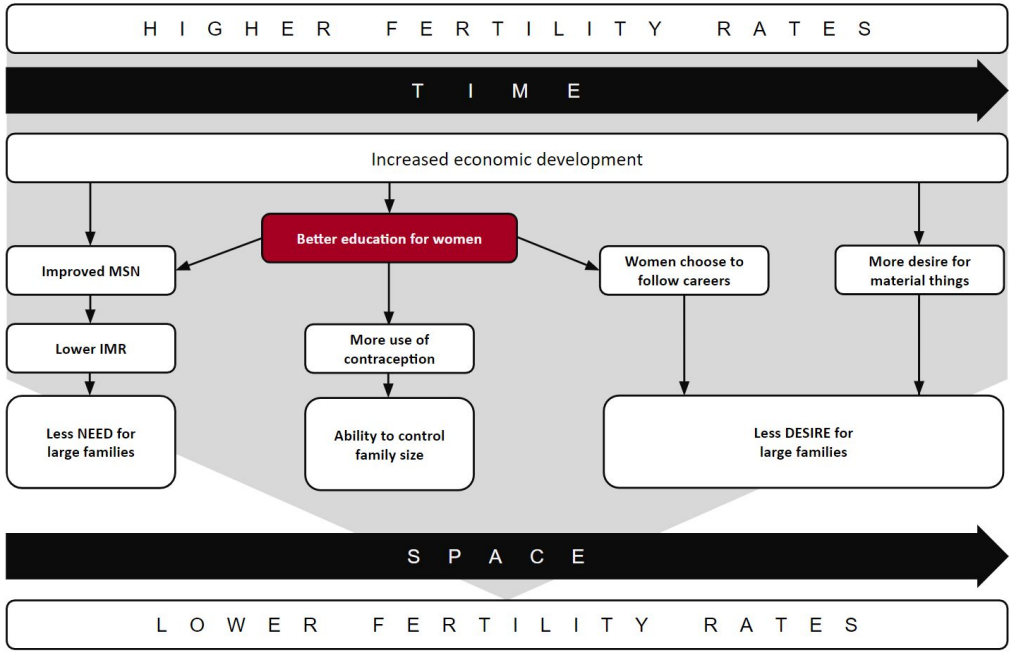
birth control


HIGHER FERTILITY RATES
TIME
Increased economic development
Better education for women
Improved MSN
Lower IMR
Less NEED for large families
More use of contraception
Ability to control family size
Women choose to follow careers
More desire for material things
Less DESIRE for large families
SPACE
LOWER FERTILITY RATES

Fertility Rate vs Female Literacy Rate by Country




Fertility Rate vs Female Literacy Rate by Country
Fertility Rate (Births / Woman)
0
2
4
6
8
20
40
60
80
100
Youth (15 - 24) Female Literacy Rate


H I G H E R F E R T I L I T Y R A T E S
T I M E
Increased economic development
Better education for women
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Less NEED for large families
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Women choose to follow careers
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S P A C E
L O W E R F E R T I L I T Y R A T E S

A John Catt Publication

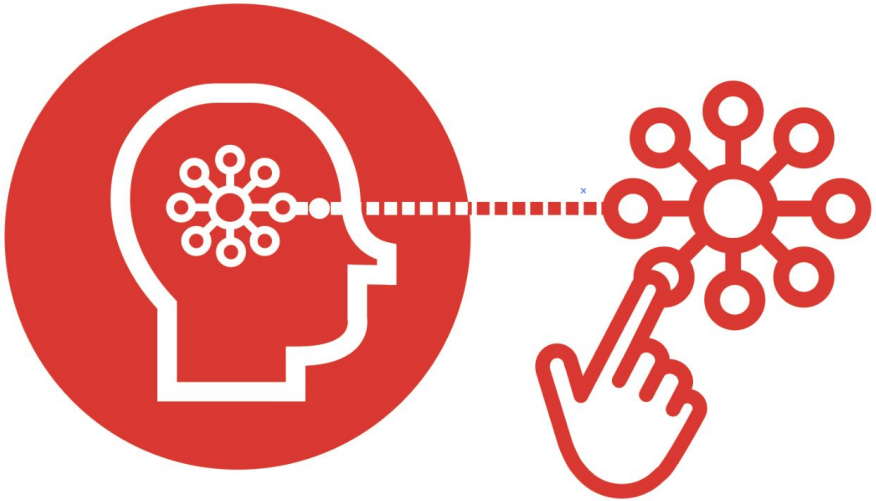
ORGANISE IDEAS

THINKING BY HAND, EXTENDING THE MIND

OLIVER CAVIGLIOLI
& DAVID GOODWIN

WITH 50+ TEACHER CONTRIBUTIONS

AYELLET McDONNELL
BEN NORRIS
BEN RANSON
BRETT KINGSBURY
CATHERINE ACTON
CHARLOTTE HAWTHORNE
CHRISTIAN MOORE ANDERSON
CLARE MADDEN
DAN RODRIGUEZ-CLARK
DAVID KING
DAVID MORGAN
DEEPU ASOK
ELLIOT MORGAN
EMMA SLADE
EVE CAIRNS VOLLANS
FAHEEMAH VACHHIAT
DR FRAZER THORPE
GEORGE VLACHONIKOLIS
HELEN REYNOLDS
JAMIE CLARK
JANCKE DUNN
JJ WILSON
JOE BURKMAR
JOHN ETTY
JOHN HOUGH
JUSTIN WAKEFIELD
KAT HOWARD
KATE JONES
KELLY PEPPIN
LOUISE CASS
LUKE TAYLER
MADELEINE EVANS
MATT STONE
MEGAN BOWS
NICKY BLACKFORD
OLLY LEWIS
PETER RICHARDSON
PETER STOYKO
RACHEL WONG
SAM STEELE
SARAH JONES
SARAH LALLY
SARAH SANDEY
SELINA CHADWICK
SHAUN STEVENSON
SIMON BEALE
SIMON FLYNN
TIM BEATTIE
TOM HANSON
TOM ODDY
TOM SIMS
ZEPH BENNETT



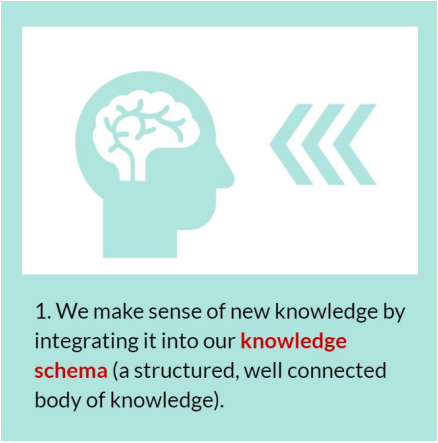
WHY? Theory & Evidence – what's the fuss?

WHAT? Graphic organisers – which are which?

HOW? Construction Instruction – fast track tuition

WHO? Teacher examples, examples, examples

WHEN? Mix it up with other teaching strategies



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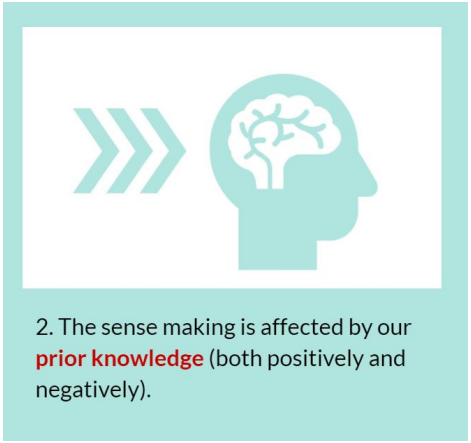

2. The sense making is affected by our **prior knowledge** (both positively and negatively).

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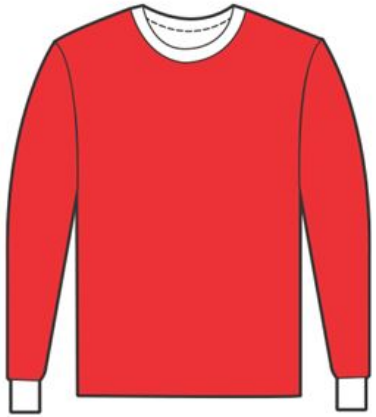
Which two go together?

A



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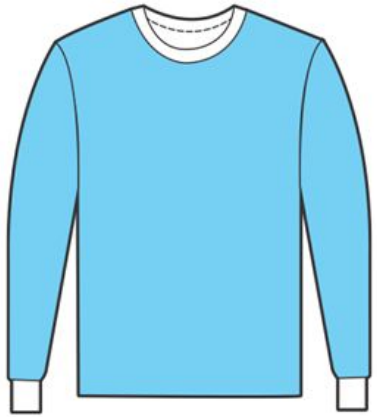
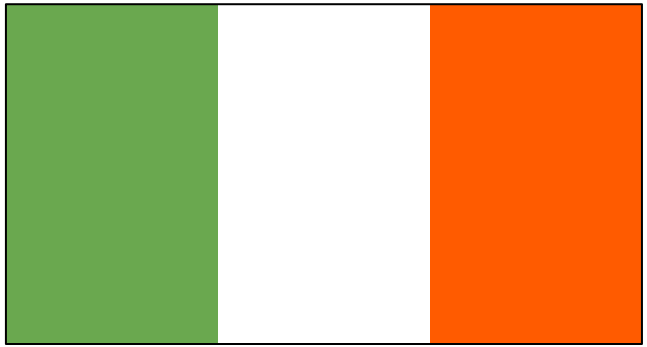
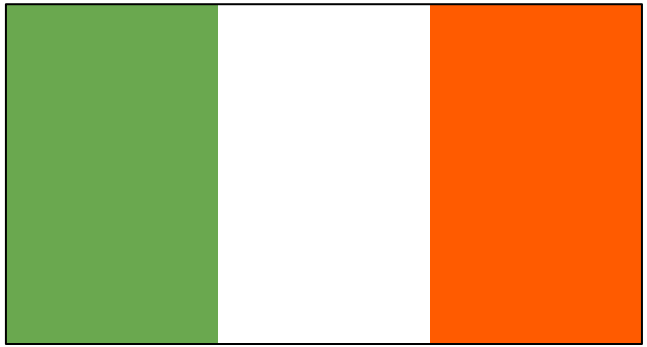
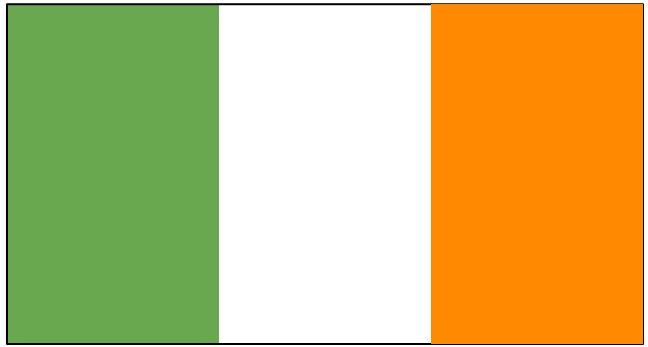


C







NEWSPAPER OF THE YEAR

THE IRISH NEWS

www.irishnews.com THURSDAY MAY 17 2012 70p/€1

JOBS ON Thursday STARTS P43

Captain's armband given to Ambrose

SPORT: Back page

PPS urged to help families

PROSECUTORS have been told to meet victims of serious crimes in cases they have decided not to fight in court. The Criminal Justice Inspectorate (CJI) said the Public Prosecution Service (PPS) still had some way to go to achieve the openness and transparency which would inspire confidence from victims of crime, such as the parents of murdered schoolboy Thomas Devlin, pictured.

Fuller reasons for non-prosecutions need to be given in cases where such decisions are likely to prove contentious, according to the report Telling Them Why released today. P10

Wilson is in denial about cuts

Newton Emerson P20

NEW: Pipe band digest

Gary MacDonald P36

Willie 'sorry' for outburst after a tricolour makes him see red

Simon Doyle
Education Correspondent

Case of mistaken identity as Frazer confuses Italian flag with Irish

A VICTIMS campaigner has apologised following outrageous claims that a Catholic primary school was an IRA training camp.

Willie Frazer asked if the Co Tyrone school was teaching children how to use weapons – after he mistook an Italian flag being flown outside the building for an Irish tricolour.

St Patrick's PS in Donaghmore, near Dungannon, reported the online comments – which included it being labelled, below right, as the "junior headquarters of IRA youth" – to police.

A photograph, above, published on Mr Frazer's Facebook page showed three flagpoles outside St Patrick's flying the flags of Poland, Turkey and Italy as part of a European project.

The first picture, however, was accompanied by a comment asking "this is a school in tyrone flying the irish flag on the school grounds why".

The red of the Italian flag, right,was mistaken for the orange of the Republic's, left.

Flying the flags of Poland, Turkey and Italy as part of a European project.

Mr Frazer is an outspoken critic of republicans and is the founder of the south Armagh victims group Families Acting for Innocent Relatives, which has had its government funding cut.

His Facebook posts attracted comments that called for the school to be stripped of its funding and for the flagpoles to be cut down by chainsaws.

The flags were being flown to mark a visit of teachers from those countries to Co Tyrone.

Principal Dera Cahalane said she was shocked to learn about the content of the Facebook page.

"The comments made are inaccurate. It appears some individual has mistaken the Italian flag for the Irish flag.

The school is currently taking legal advice and are bringing the matter to the PSNI," she said.

Mr Frazer last night apologised.

"It is a genuine mistake but it is understandable how this mistake could have been made. Looking at the photo you would think it is an Irish tricolour," he said.

> Story in full > P6,7
> Editorial > P20

William Frazer THE JUNIOR HEADQUARTERS OF SF/IRA YOUTH,OR IT MAY AS WELL BE.
28 April at 18:46 · Like

The principal of a school described by victims' campaigner Willie Frazer as "the junior headquarters of IRA youth" has called on him to apologise to her directly.

Dera Cahalane of St Patrick's Primary in Donaghmore has contacted the PSNI after the high-profile Protestant victims' campaigner posted controversial remarks about her school after confusing an Italian flag flying outside it for an Irish tricolour.

What is a bank?

What is a bank?

1. We make sense of new knowledge by integrating it into our **knowledge schema** (a structured, well connected body of knowledge).

2. The sense making is affected by our **prior knowledge** (both positively and negatively).

3. Schema building can be unlocked or blocked by **threshold concepts**.

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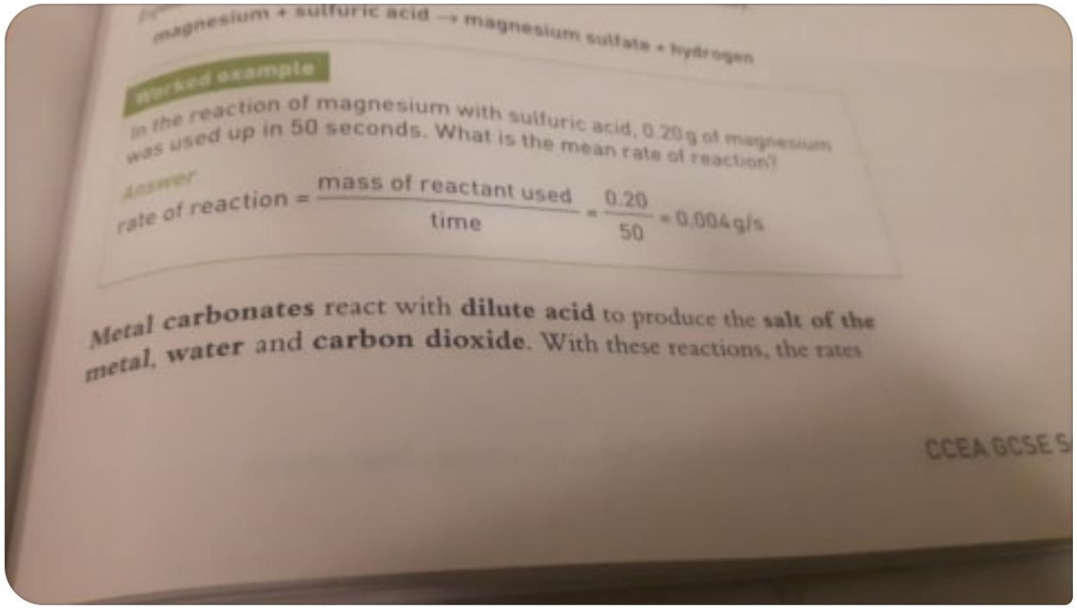
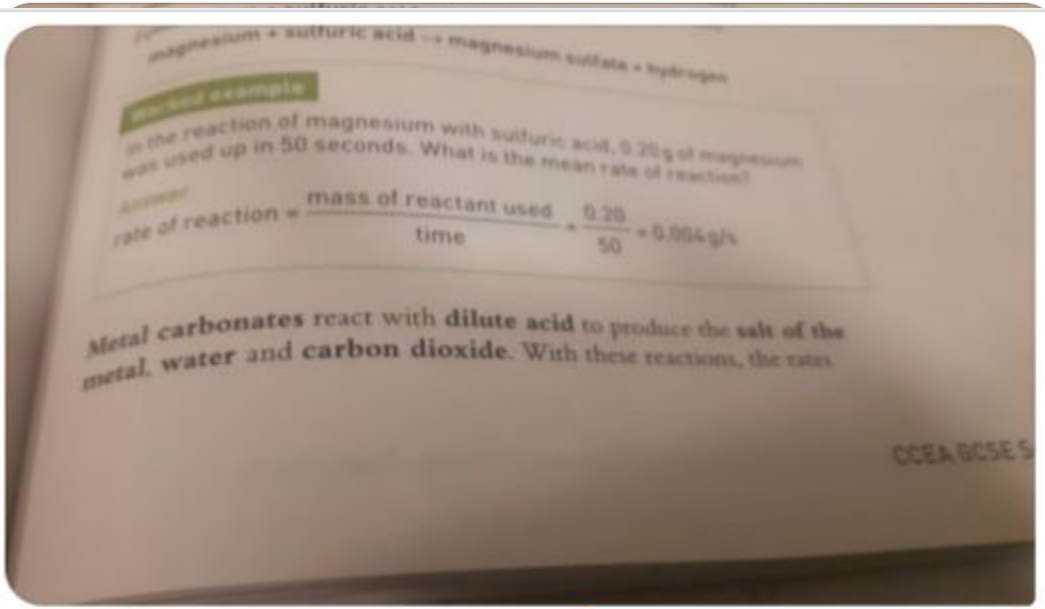
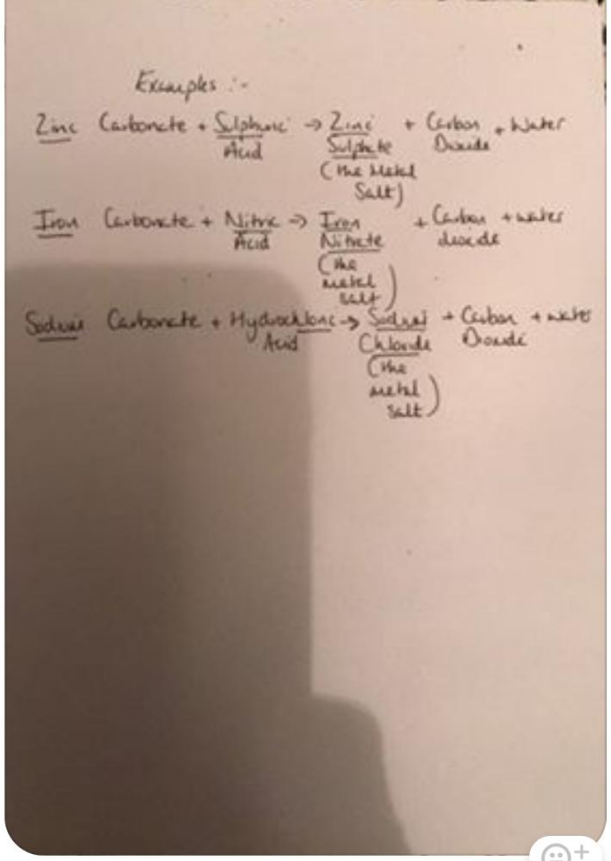


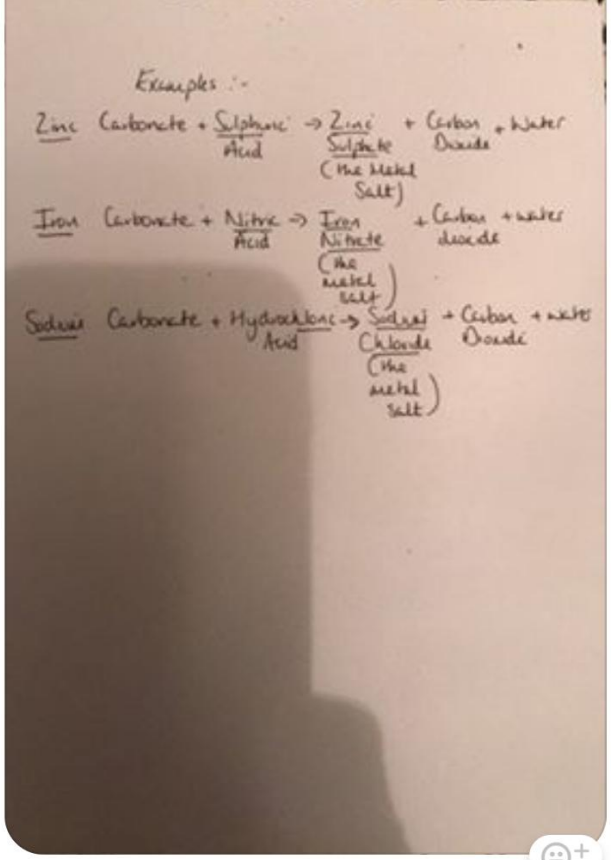
Help! What's the salt of a metal?!



Help! What's the salt of a metal?!

So if the acid was hydrochloric, the metal salt would be a chloride, if the acid was sulphuric, the metal salt would be a sulphate, if the acid was nitric the metal salt would be a nitrate. So, for example, if you added magnesium carbonate to hydrochloric acid, the metal salt formed is MAGNESIUM (the metal part) CHLORIDE (from the acid)


Examples :-
Zinc Carbonate + Sulphuric Acid → Zinc Sulphate (the metal Salt) + Carbon Dioxide + Water
Iron Carbonate + Nitric Acid → Iron Nitrate (the metal salt) + Carbon dioxide + water
Sodium Carbonate + Hydrochloric Acid → Sodium Chloride (the metal salt) + Carbon Dioxide + water



Okay, got it! Conceptually speaking, though, what is a salt in this context?

740.6mm of rain
in 12 hours

Scott Duncan @ScottDuncanWX · Oct 5

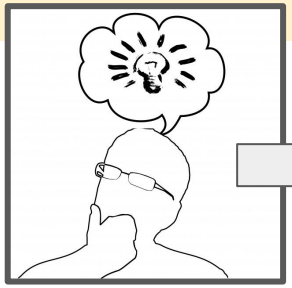
Italy... a new European record.

A whopping 740.6mm (29.2 inches) of **rain** in just 12 hours!

Italy set a new national record for rainfall in 6-hours and then went on to break the European record for 12-hour totals.

Your group (names): Wayne, Kyle, Joanne, Derek

Name	Subject	Threshold concept	How you explain it
Kyle	History	Volksgemeinshaft - Nazi Control of opposition	Linked to something they know already (prior knowledge) - the role of Paramilitaries / drug dealers in NI communities - create fear to speak out for fear of repercussions.
Wayne	French	Forming the negative	Hamburgers: the negative surrounds the verb like the top and bottom of a burger bun surround a burger
Joanne	Music	Tritone What is a tritone?	Scales, Intervals, Semitone (The Simpsons)
Derek	RE	Predestination	Satnav in a car (love it!)



Name	Subject	Threshold concept	How you explain it
Jill Jenks	Physics	Quantum Physics	Onion with lots of layers
Robert Uprichard	Politics/Geog/LLW	Amendment procedure for the US constitution.	Driving lessons - Mirror-signal- manoeuvre
Katie McT	Nutrition	Chemical Structure of Fats	Using familiar terms “mono-brow” one big eyebrow (mono-unsaturated fats contain one double bound)

1. We make sense of new knowledge by integrating it into our **knowledge schema** (a structured, well connected body of knowledge).

2. The sense making is affected by our **prior knowledge** (both positively and negatively).

3. Schema building can be unlocked or blocked by **threshold concepts**.

4. Therefore, the role of diagnostic questioning is to help us as teachers to **discern how effective the schema building process is being for each pupil** in our class.

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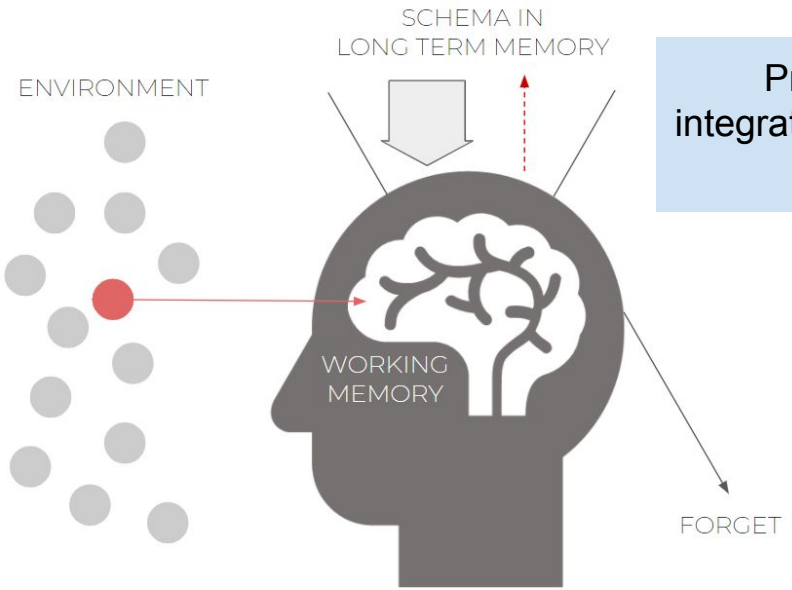
Where can the schema building process go wrong?

Quality of existing schema in pupil

Explanation by teacher

Attention by pupil



Process of schema integration between teacher & pupil

We cannot simply repeat what we hear word for word. Rather, we connect our understanding of the new information to our existing schema and we construct a mental summary (i.e. the gist of what we have heard).

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However, when left on their own, many students make errors in the process of constructing this mental summary. These constructions are not errors so much as attempts by the students to be logical in an area where their background knowledge schema is weak.

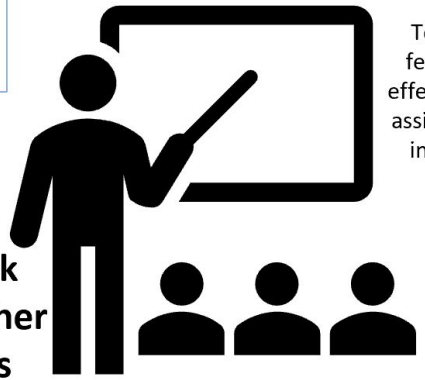
“A class is essentially a room full of highly individual, easily distracted, schema-forming brains grouped in front of us. It is vital that we get as much feedback from our students as we can.”

Tom Sherrington

THE FEED BACK LOOP

Feedback from pupils to teacher

Teacher gathers feedback on how effectively pupils are assimilating content in their schemas



Feedback from teacher to pupils

Teacher then uses this information to clarify, address misconceptions & consolidate effective learning

Feedback Dashboard

- Wide ranging information
- Presented in a timely manner

How do we find out what they know?

How broad is your sample?

It’s a usual scenario, repeated in classrooms everywhere. Teacher asks a question. A few hands shoot up - always the same hands.

The hands that aren't raised instead prop up drooping heads, or twiddle pens.

Those who raise their hands listen in class, engage with the topic and so achieve more highly. The others, often, let their attention drift...

Effective teachers also stopped to check for student understanding. They checked for understanding by:

- asking students to summarise the presentation up to that point or repeat directions or procedures;
- or by asking students whether they agreed or disagreed with other students' answers.

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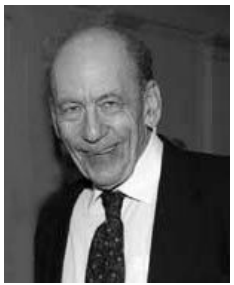
This checking has two purposes:

- answering the questions might cause the students to elaborate on the material they have learned and augment connections to other learning in their long-term memory;
- alerting the teacher to when parts of the material need to be retaught.



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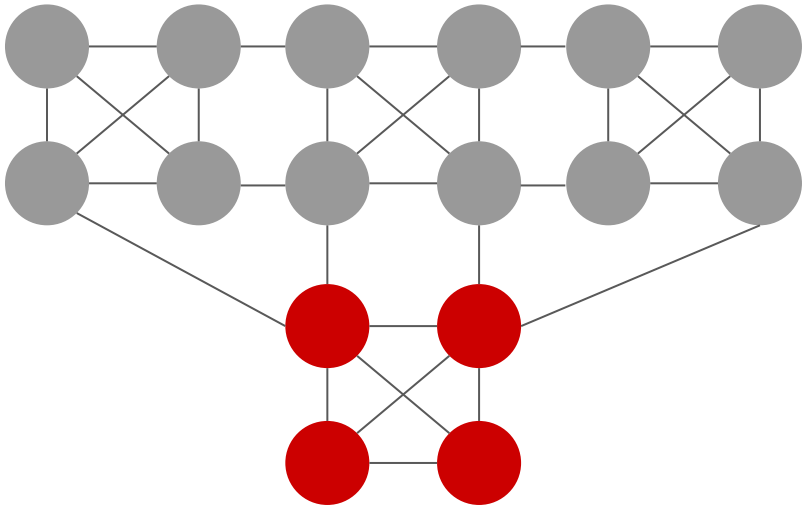
This checking has two purposes:

- answering the questions might cause the students to elaborate on the material they have learned and augment connections to other learning in their long-term memory;
- alerting the teacher to when parts of the material need to be retaught.



Approaches

The approaches are all about the general context you set in your class, the class ethos, if you like. If we need to dialogue with our pupils to check for understanding, what are some of the **default settings** that can help us set the culture where this is the norm?

Reflection 2: Which students in your classes receive **more** of your attention during questioning and why? Which students receive **less** attention and why?

How broad, then, is your typical sample of pupils when deciding whether or not you are ready to move on?

When you ask a question, you get to select who answers. This is a powerful tool for (1) ensuring everyone thinks about the questions you ask, because they **know** that anyone can be selected to answer and (2) for you to be able to sample broadly from your pupils.

This is a good technique to combine with 'No hands up', as it gives the kind of collaborative thinking time that enables pupils to prepare an answer. It works best when it is time bound (often short periods are great 'You have 30 seconds to prepare an answer. Go!') and can be used very extensively throughout lessons.

This involves the use of Google Slides during class (on laptops or phones) to allow you to monitor pupils' work more widely and effectively than simply by circulating around the classroom alone). It has a number of anciliary benefits too. Best used as a semi-regular method so the pupils get used to the procedures ('Go to the link in the learning log, open the DJ and grab a slide.')

This fits in well with a classroom ethos that seeks to sample widely and effectively for pupil understanding and misconceptions. When do you move on in your explanations? And how do you know you've reached that point? C4U is a potent approach to help with this.

Questioning Types

'How did you work that out? Can you explain your reasoning to me, please?'

How happy are we with simply getting the right answer from one pupil? What if they got that right answer 'by accident', so to speak? What if their thinking was flawed to the extent that, given the same issue but in a different context, they wouldn't get the right answer? And what about the other pupils in the class listening in? What do they learn from somone *simply* giving the right answer? What if they can't figure out how to do it either?

Process questions ask pupils to explicitly unpack the thought process that led to their understanding.

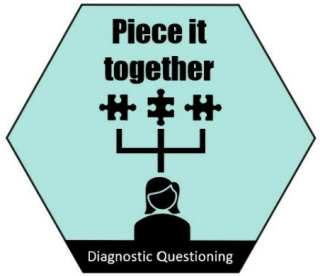
- **Set the context for this by, during your explanations to the class, modelling your thinking process**: this is why the issue of **metacognition** (which we looked at last year) is so helpful. Helping the pupils know *how to* learn in our subject. (NB research suggest that, although there are *general* principles of metacognition, it is *best applied in a subject specific context* - that's why we all need to do it with our classes and why general classes on revision techniques are seldom as effective as we would like them to be).

These are similar to process questions in that you go beyond the one word/one phrase answer.

But the focus here is on more of a dialogic approach, a back and forth between pupil and teacher, perhaps to explore the implications of what they have said, or to look at how it might apply into different contexts.

This approach allows you to explore well the depth to which a pupil understands. If you spread this around the class over time, you can help develop the pupils' ability to articulate their thinking as well as giving you a sense of how deep the class's understanding goes.

- **After their first response, ask a probing question:** 'So, there is a correlation between those two variables. What might explain that correlation? Is there something acting on both of these that help cause them?'
- **Continue the dialogue with this student, nudging their thinking forward.**
- **Perhaps continue this process by asking another pupil to continue.**



When we are bouncing questions around a class, often we will get part of an answer from one pupil, another part from another, and so on, until together we assemble the whole answer.

For us teachers, we are hearing what we want to hear - the complete whole answer - and we, as experts, can assemble all of the elements in our head, fitting all the elements together as one complete whole.

But what about our pupils? Can they do the same thing?

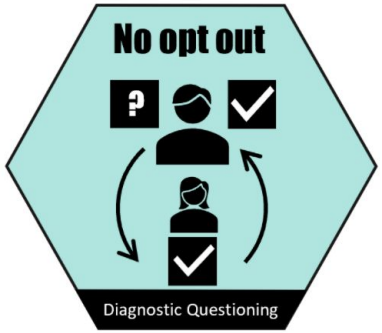
In this method, after assembling the correct answer pupil by pupil, you ask some pupils to repeat the entire answer. Do this a few times and you'll quickly get a sense of how well the pupils have made sense of the entirity of the topic, not just each individual elements.

Remember: a schema is **all the right notes in all the right order.**

When pupils give an answer to a question on something they are unfamiliar with, their first response will often be only partly formed, perhaps expressed in a shallow way. If we simply accept answers like this, we can set low expectations to the pupils that say we are willing to accept responses like this.

But, if we support them, we can help them to reformulate the answer, honing and refining it, to make it a fuller response.

- **Acknowledge their first response**: 'Great start; now, let's see if we can develop it a bit further.'
- **Give them feedback that helps reformulate the answer better**: 'Good, so the graph rises. Now, what can we say about the gradient of the rise?'
- **Ask the pupil to 'say it again better':** (but not using this rather abrupt phrase!!) this allows you to diagnose how well the pupil has begun to internalise the understanding into their schema.



What do you do with the 'I don't know' responses to questions?

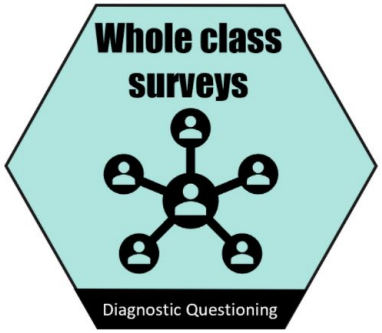
Sometimes, these responses are because pupils haven't taken the thinking time during 'Think, pair, share' and establishing an ethos where you expect them to *think* during TPS is appropriate!

But often these are genuine responses. A pupil, despite their best attempt to think, still doesn't know. You could scaffold follow up questions to help them think better.

But another approach is to go to another pupil for the answer. If we get the right answer, how often do we move on? But what about that original pupil? Having *heard* the answer from someone else, does that mean the *know* the answer?

You can, therefore, come back to them after getting the correct answer and ask them to articulate it.

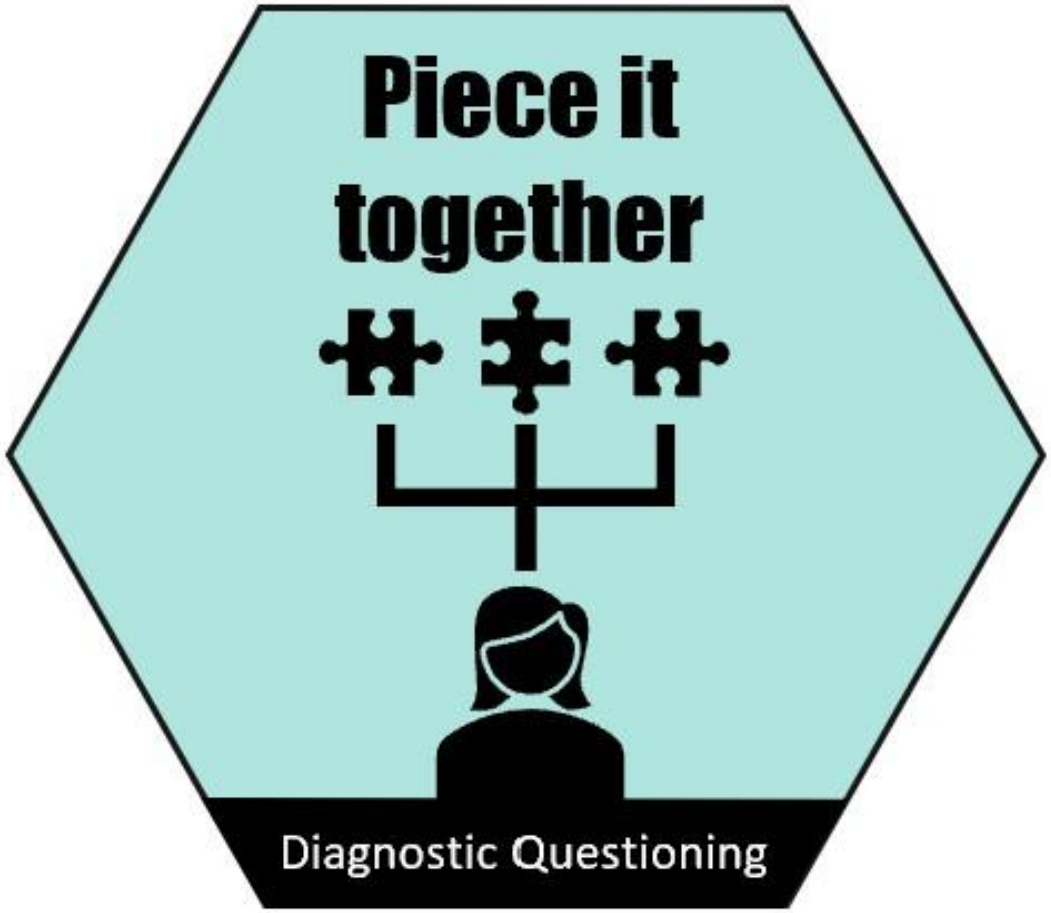
This creates the culture in the classroom that says to pupils: 'It's okay sometimes not to know the answer. I'm going to help you if you don't know; but, having helped you, I may well come back to you and ask you *now* do you know?'

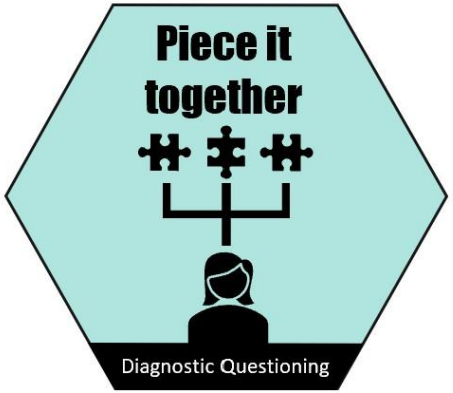


When we were considering sample size, we realised we need to sample broadly. You can frame questions in a more closed fashion to act as **whole class surveys**. That way, you can quickly get a sense from the entire class what their thoughts are.

- **Formulate a closed question that requires pupils to think about and apply the content you have just covered.** 'So, here's a piece of poetry. Is this an example of iambic pentameter?'
- **Either give some thinking time, or some very quick 'think, pair, share' time.**
- **Then use a technique to survey the whole class.** Techniques I often use include *'Sit down if'* (get the whole class to stand up and say 'Sit down if' they think it's one of the two options). Another is *'One, two, three, show'* which is a version of Rock, Paper, Scissors' where pupils can hold up the number of fingers that correspond to a range of answers that you have provided for them to choose from.

You can then follow this up with process or probing questions to explore the thinking behind a pupil's response.


Piece it together
Diagnostic Questioning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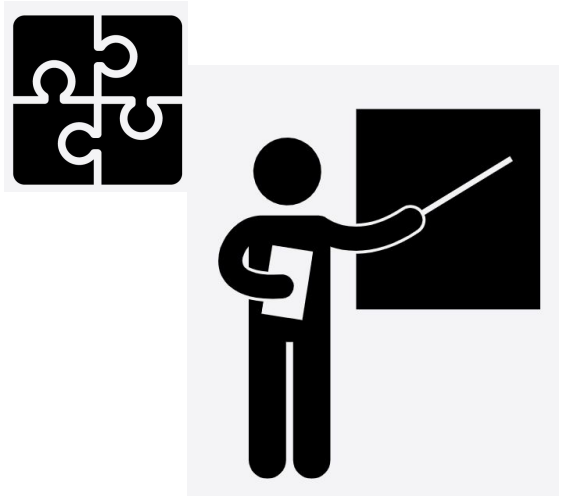
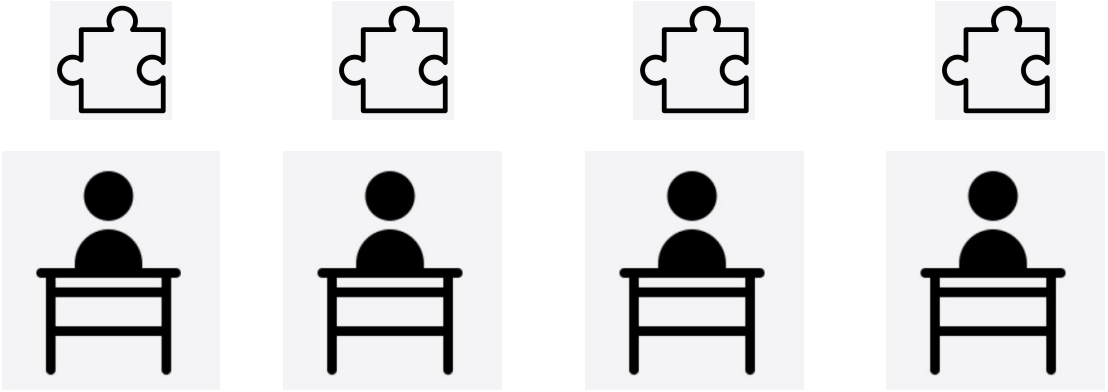
Diagnostic Questioning

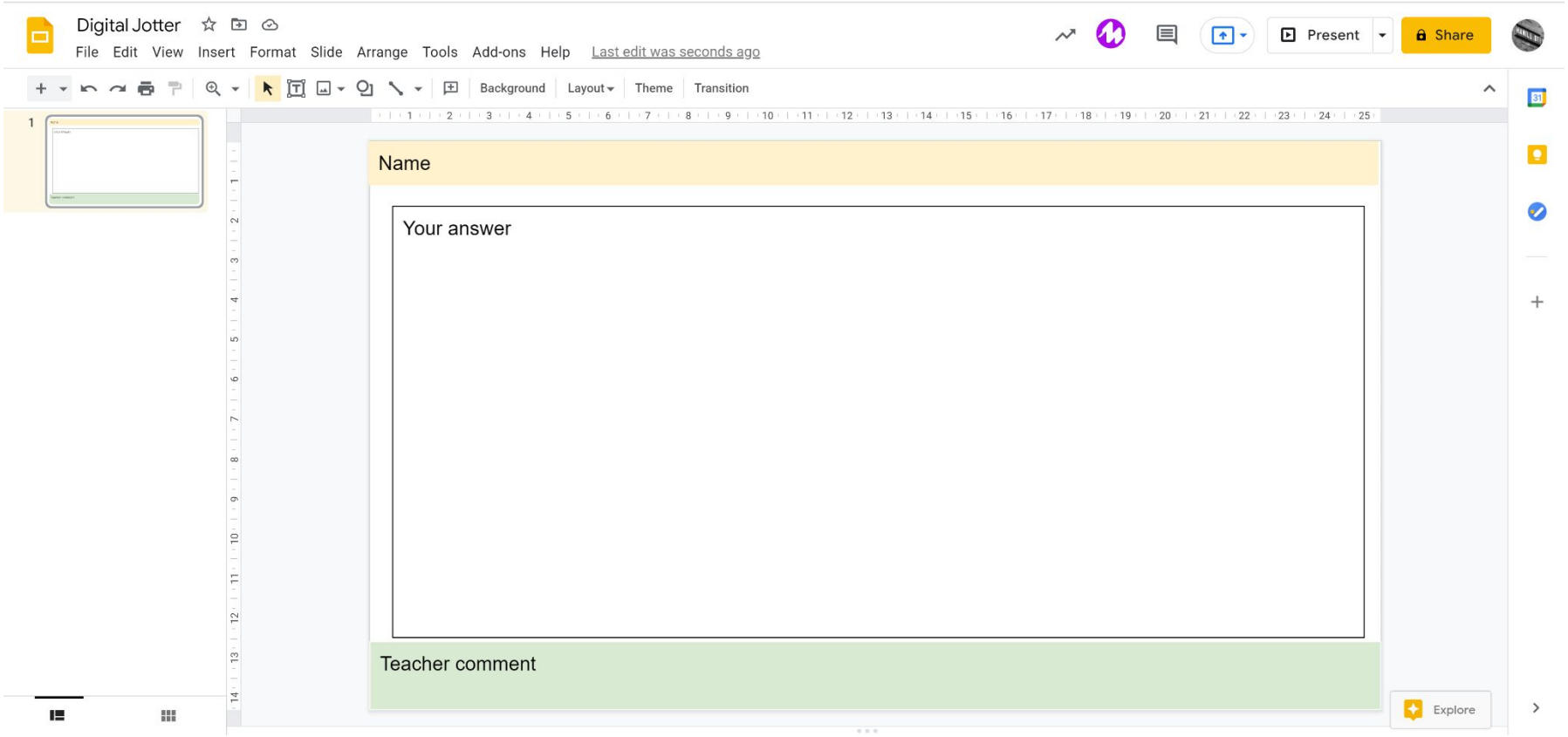


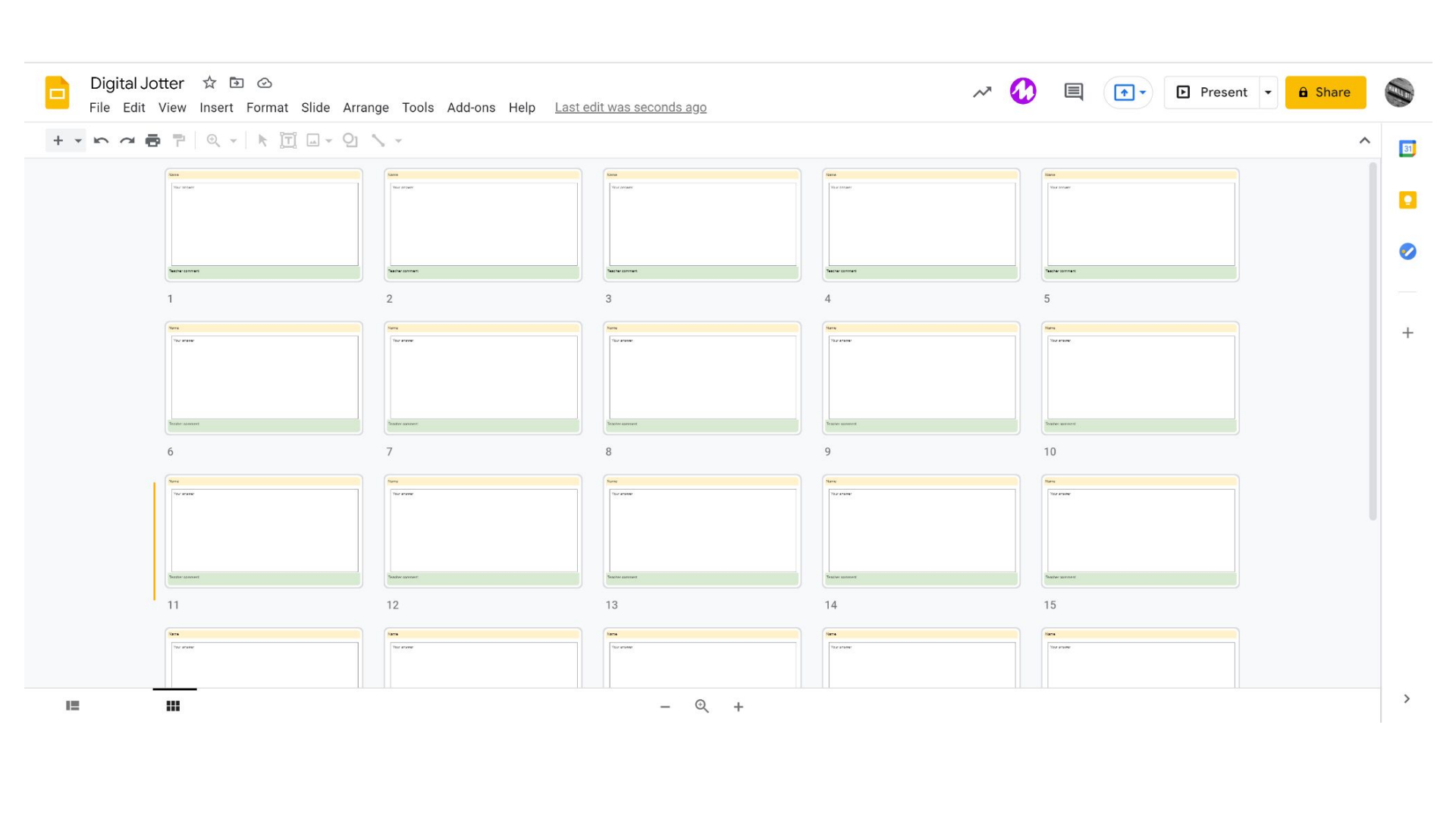


Digital jotter

Diagnostic Questioning

Digital jotter: the set up

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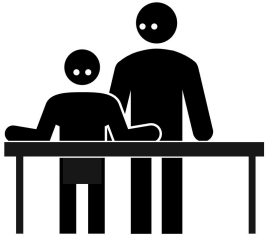
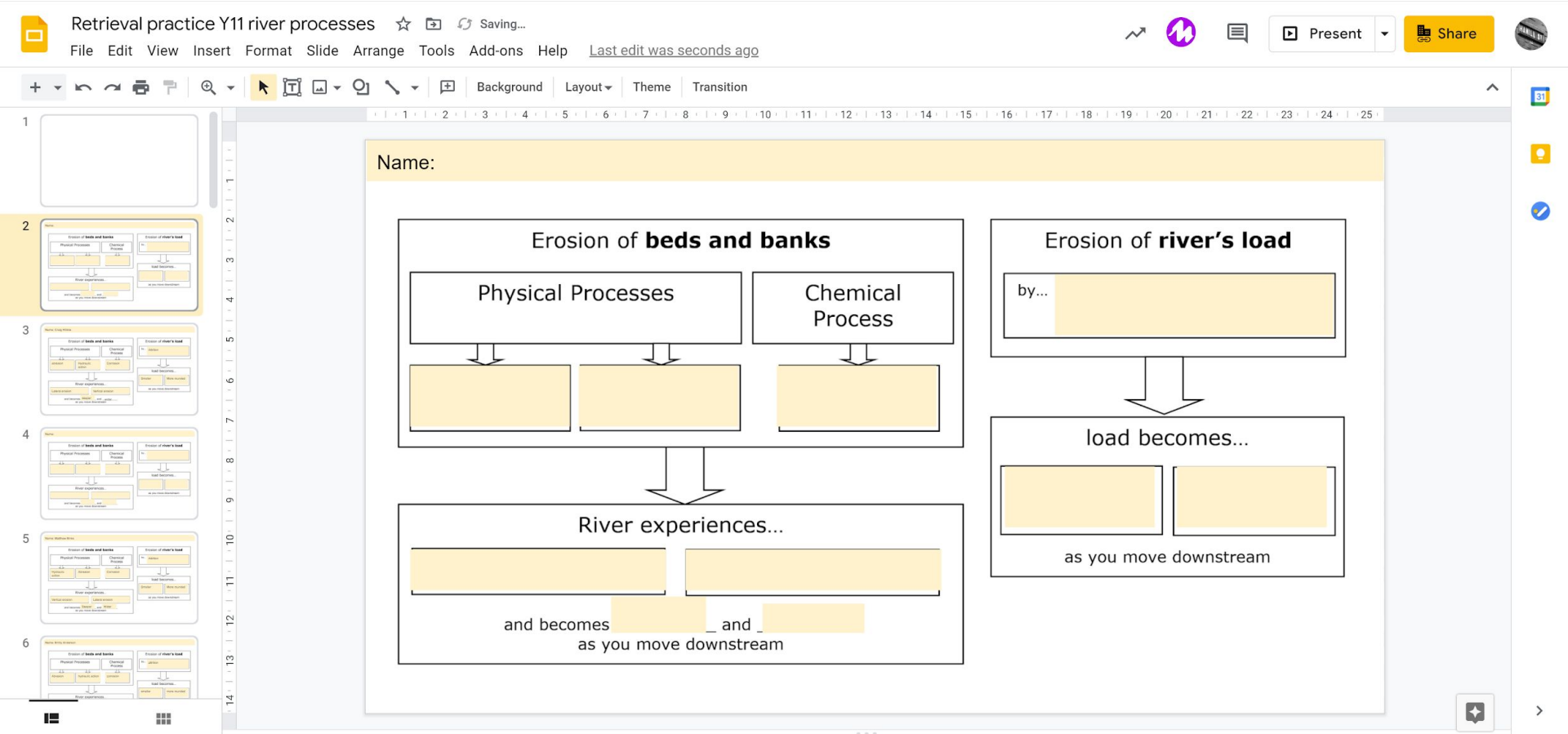


1. Whole class monitoring

Feedback Loop

Examples of use: whole class monitoring



Retrieval practice Y11 river processes

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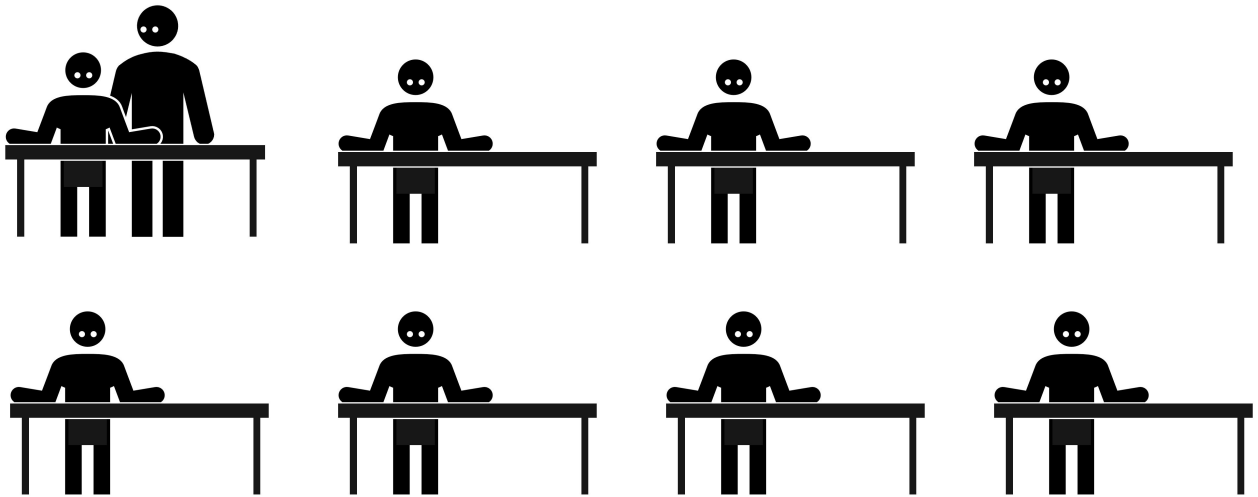

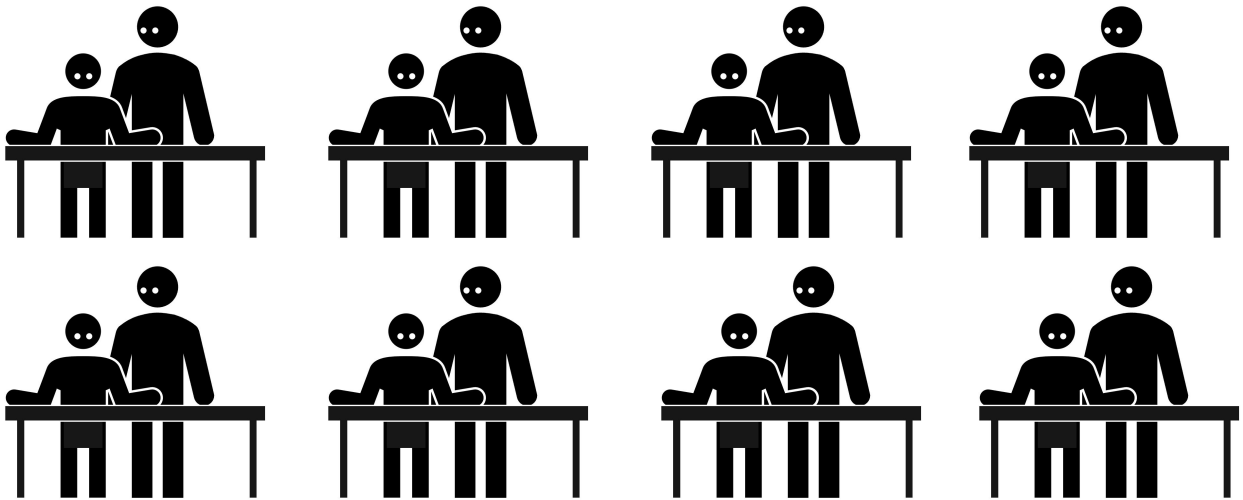

Retrieval practice Y11 river processes

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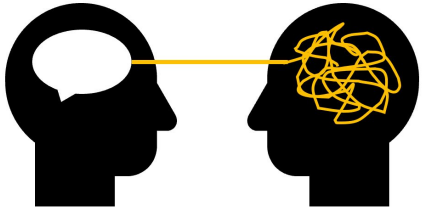
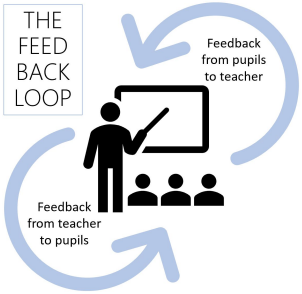
1. Whole class monitoring



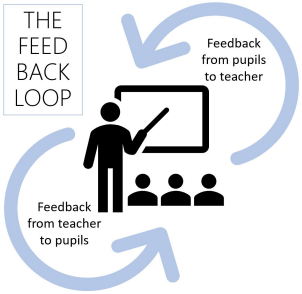
2. Addressing misconceptions

Feedback Loop



We cannot simply repeat what we hear word for word. Rather, we connect our understanding of the new information to our existing schema and we construct a mental summary (i.e. the gist of what we have heard).

Rosenshine

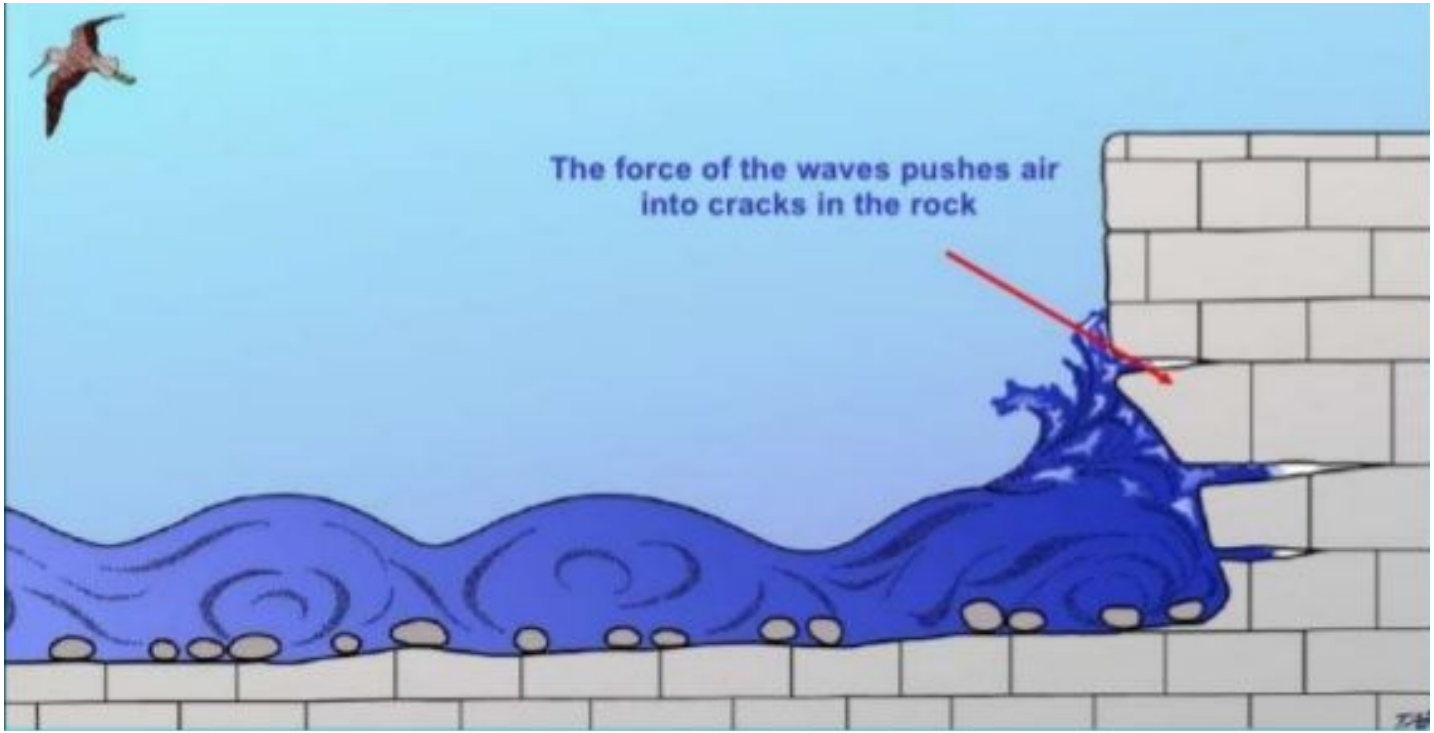


We cannot simply repeat what we hear word for word. Rather, we connect our understanding of the new information to our existing schema and we construct a mental summary (i.e. the gist of what we have heard).

However, when left on their own, many students make errors in the process of constructing this mental summary.

These constructions are not errors so much as attempts by the students to be logical in an area where their background knowledge schema is weak.

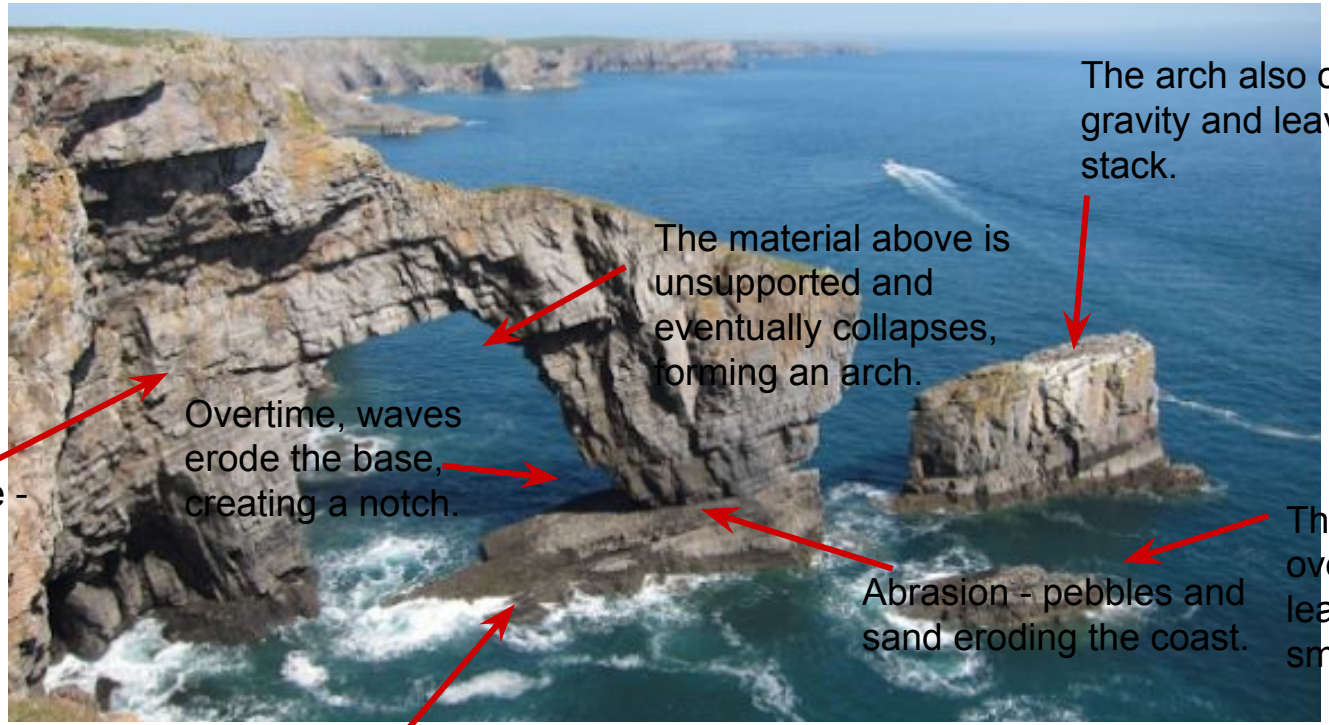
Rosenshine


The force of the waves pushes air
into cracks in the rock

TASK 1: **Annotate** the photograph below using **key terminology** e.g. hydraulic pressure.

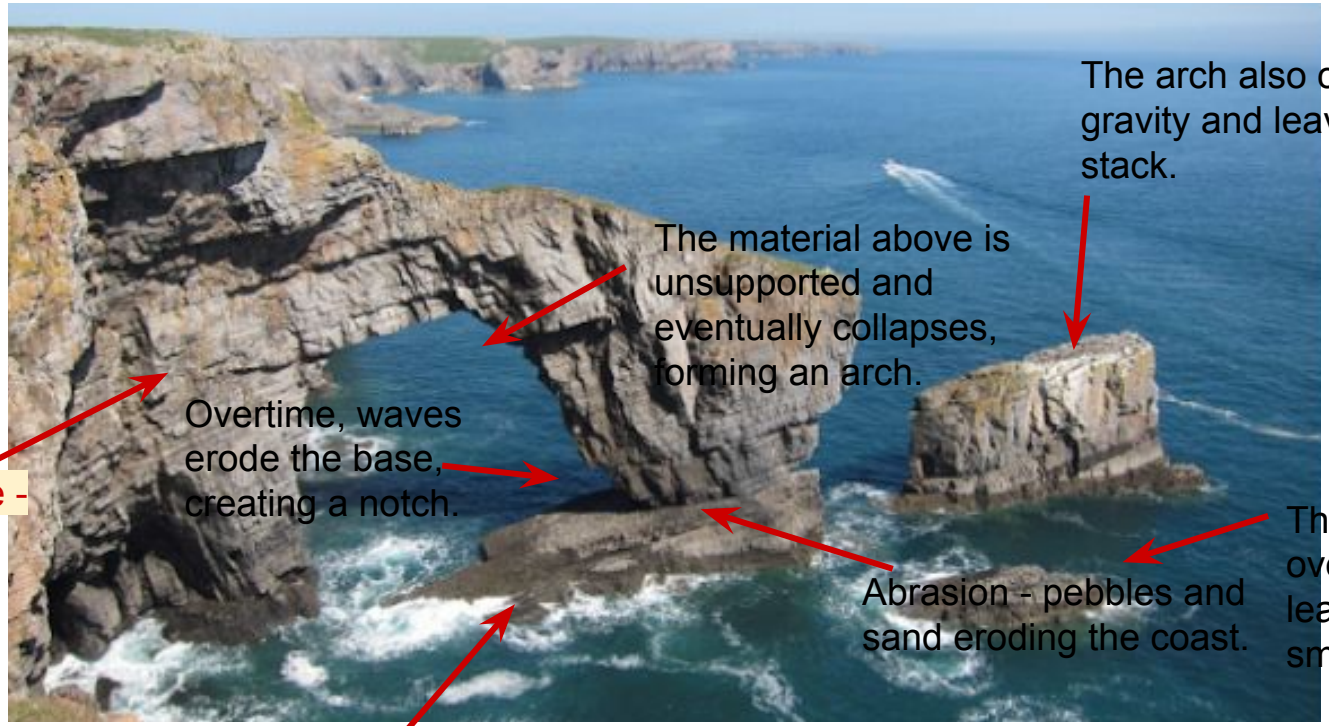
NAME: Lucy

TASK 1: Annotate the photograph below using key terminology e.g. hydraulic pressure.



NAME: Lucy

TASK 1: Annotate the photograph below using key terminology e.g. hydraulic pressure.



The arch also collapses under gravity and leaves behind a stack.

The material above is unsupported and eventually collapses, forming an arch.

Overtime, waves erode the base, creating a notch.

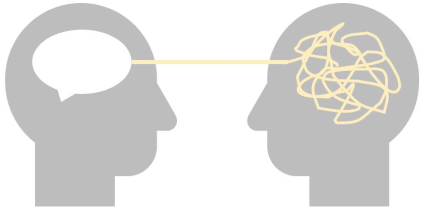
Hydraulic pressure - erodes the cracks and crevices.

Abrasion - pebbles and sand eroding the coast.

The stack erodes overtime and leaves behind a small stump.

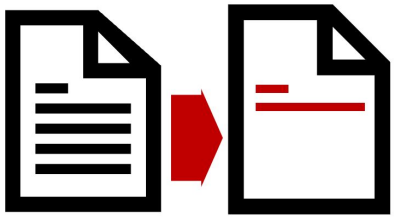
Corrosion - a chemical process that works particularly well on chalk and limestone.

1. Whole class monitoring



2. Addressing misconceptions

3. Modelling effective answers



Examples of use: monitoring extended answers

Y13 A hurricanes DJs

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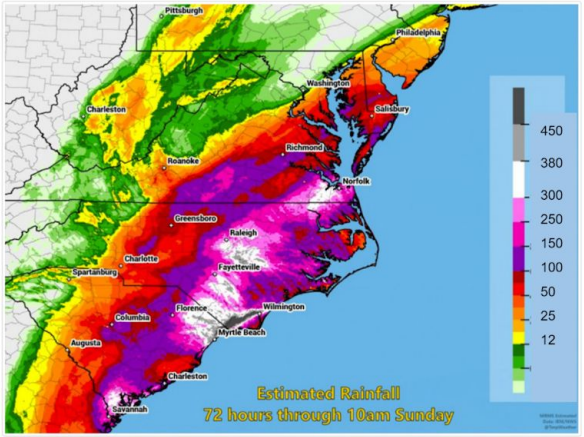
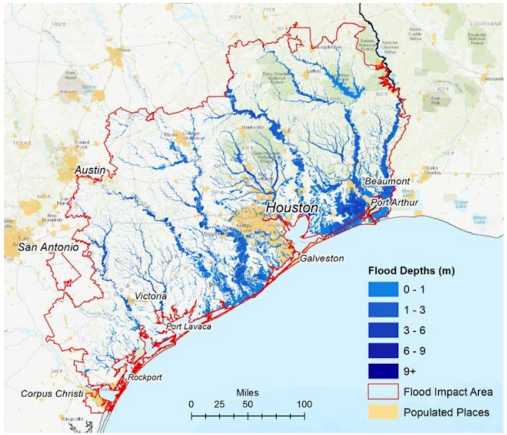
Questions

1. List and briefly discuss the factors that influence hurricane formation
2. List and briefly discuss the hazards associated with hurricanes

3. Describe the **pattern** & **extent** of rainfall in the 72 hour period. (Make reference to annual rainfall totals elsewhere for reference)



4. Describe the **pattern** of flooding, noting how it differs from the pattern of rainfall.



Explore

Y13 A hurricanes DJs

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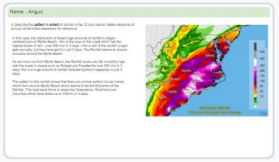
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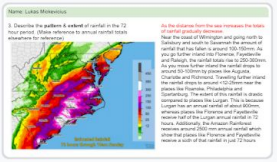
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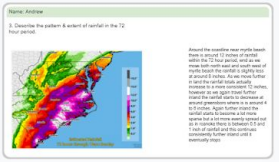
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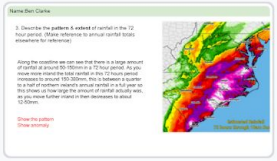
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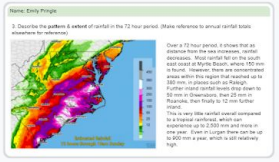
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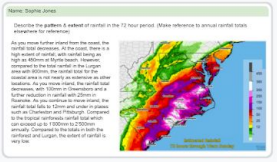
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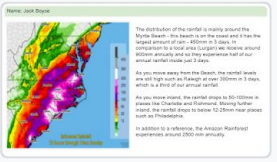
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Deconstructing a model response

Y13 A hurricanes DJs

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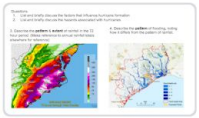

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Messages for Mr Hamill

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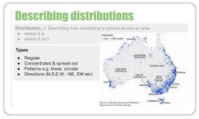


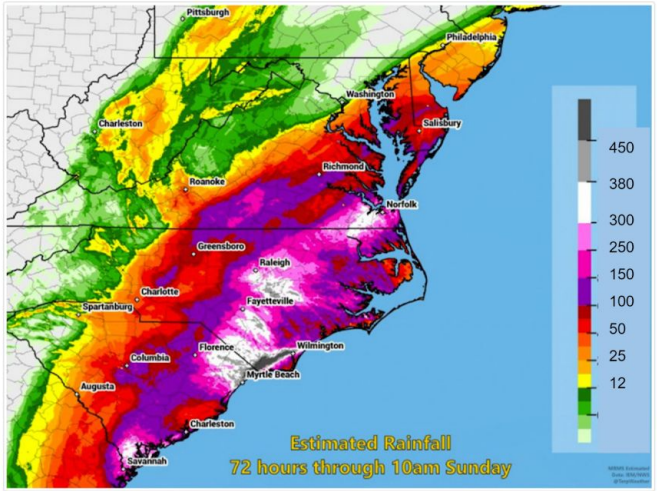
6

Describe the pattern & extent of rainfall in the 72 hour period. (Make reference to annual rainfall totals elsewhere for reference)

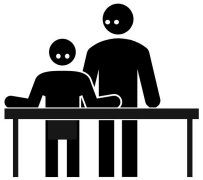
As distance from the sea increases the estimated rainfall over the next 72 hours decreases at a gradual rate.General **trend/pattern** stated

This is seen from how the area closest to the Atlantic which is Myrtle Beach the area sees 450mm of rain in the 72 hours **evidence** stated this is quite a large amount of rain as usual **mid-latitude grasslands** would only have around 400 to 500 mm of rain over the course of the late spring and summer months.Then we see further in land in areas such as florence which sees 200 mm of rain and Columbia which has 100 mm of rain which further shows this pattern of rainfall decrease as distance from the sea increases evidence stated.

Although this is not seen from areas such as Charlestown which is on the coast but sees only 50 mm of rain and Norfolk which sees 300 mm of rain even though being further inland.states the **anomaly**



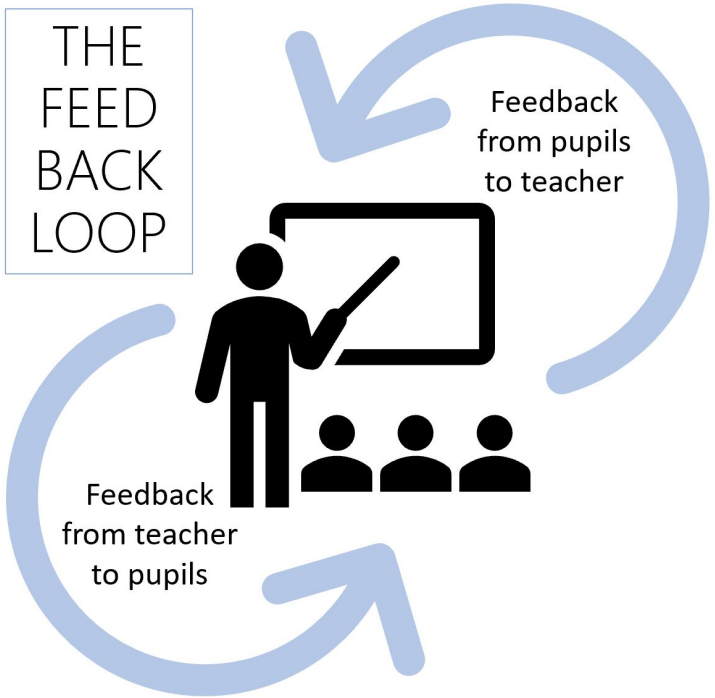
What value do digital jotters add to the feedback loop?



1. Whole class monitoring

2. Addressing misconceptions

3. Modelling effective answers



1. We make sense of new knowledge by integrating it into our **knowledge schema** (a structured, well connected body of knowledge).

"I've been thinking that much greater weight needs to be placed on exploring what our students have actually understood during a teaching sequence: the depth of their understanding relative to the teacher intentions; the students' own sense of their understanding – recognising their own areas of strength and where the gaps lie; their confidence and fluency explaining their understanding.

It's the **curriculum experienced and assimilated by each student that matters** – not the one we have on paper or in our minds. "

Tom Sherrington