Welcome!

SHOTTON HALL
RESEARCH SCHOOL

If I asked you to distil great science teaching into 3 must-do's, what would they be?

Turn to your neighbour, introduce yourself and tell them.

Education Endowment Foundation

- **The EEF is an independent grant-making charity dedicated to breaking the link between family income and educational achievement.**
    - o Founded in 2011 by the Sutton Trust, in partnership with Impetus PEF.
    - o Established with a £125m grant from the UK Department for Education.
    - o Focuses on children aged 3-18.
- In 2014 the EEF's focus was extended to the early years.
- Since 2011 the EEF has awarded £90 million to fund 153 projects working with over 10,000 schools across England.

Why use research and evidence?

Helps teachers and leaders make more informed decisions about what to do (and what to stop doing!) to improve outcomes (*“best bets”*).

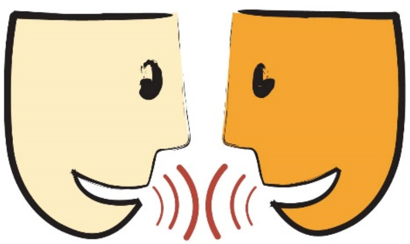
Research evidence *supplements* expertise *it does not supplant it.*

Science Matters!

1. There is an attainment and participation gap in science in England, with disadvantaged pupils doing less well and a lower proportion continuing their study post-16
2. A quality science education can support social mobility
3. Science qualifications open the doors to many rewarding and interesting careers
4. Scientific literacy is critically important for being an informed citizen and engaging with the world
5. It's an efficient way to bolster a school's performance on Progress 8 - double science counts as two slots and triple science counts as three slots in the Progress 8 measure.

Improving secondary science

3 Modelling:
Use models to support understanding



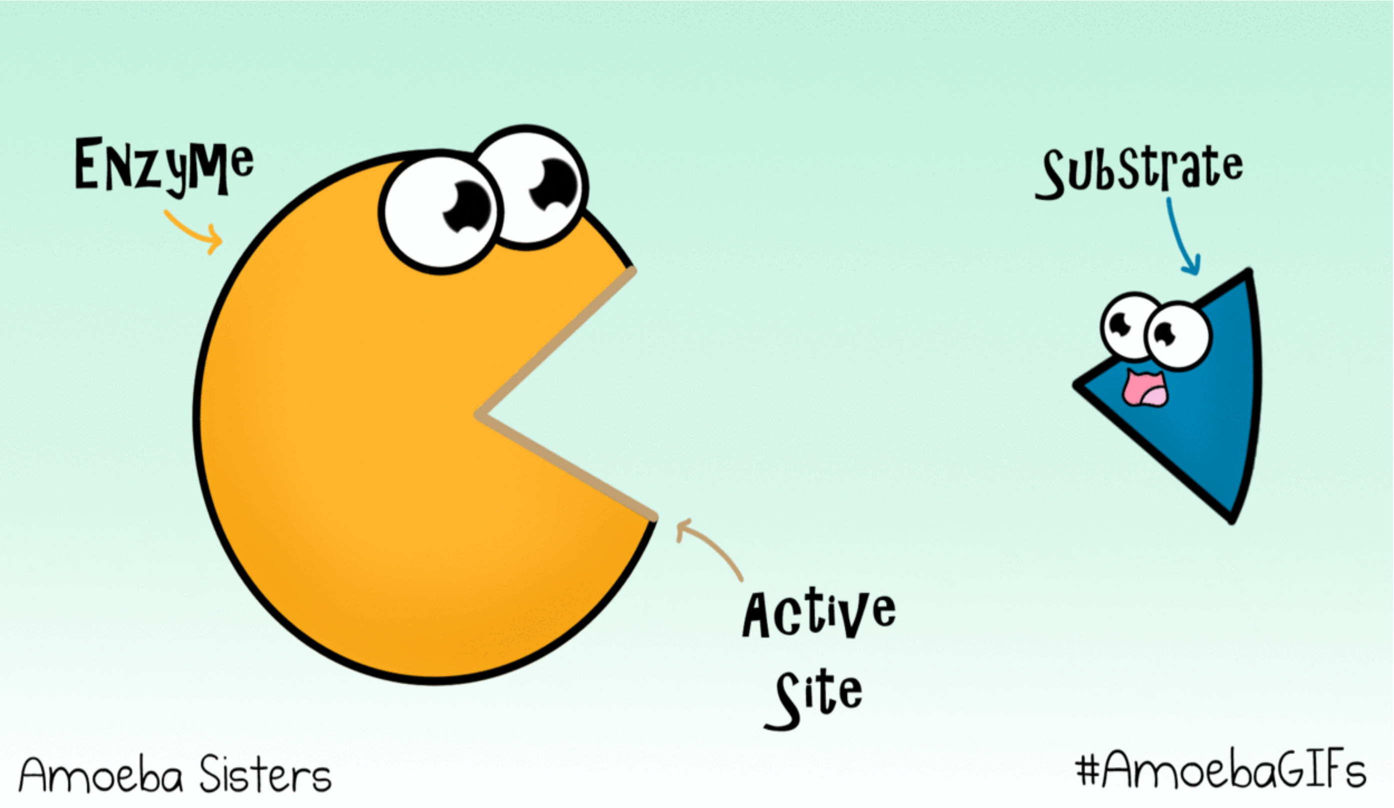
Discussion

Why use models?

When are models particularly helpful?

‘All teachers use modelling to some extent. The most effective teachers- like a master craftsman working with their novice apprentice- are aware of their expertise and of how to reveal their skills to learners and how to assess whether their pupils have understood them; they are metacognitive about their teaching.’

Models – be careful of misconceptions




How
Many?

TYPES OF MODELLING

Live mock

Three worked examples

Planning a response

Deconstruction

Partial worked examples

Different approaches to modelling:

- Full worked examples

- **Guided practice**

- Partially completed practice

Modelling is a metacognitive strategy:

"Without cognition there is no metacognition."

When you model, you are asking students to think about how the **content knowledge** embedded in their memory is **applied**.

You also need to show them, as the **expert**, how to do it. This includes making your thought processes **explicit: verbalising** why you are doing what you are doing.

Key Lessons:

- After modelling, students need time set aside for **deliberate practice:** they need the opportunity to practice retrieving knowledge and applying it in different contexts/situations in order to LEARN.

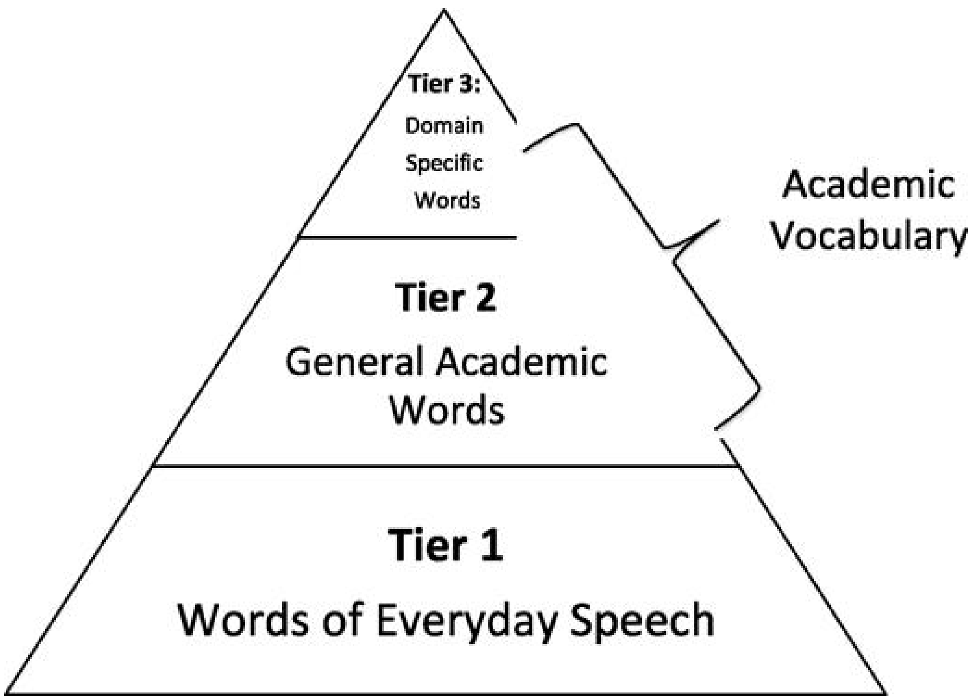
- In the early stages of knowledge application, they may need to have certain resources available to assist retrieval/lesson the strain on the working memory. However, they shouldn't become overly-reliant, hence the need for retrieval activities.

Task:

- Complete the planning chart for the something you could model in an upcoming lesson.

6 Language of Science: Develop scientific vocabulary and support pupils to read and write about science

Developing vocabulary – which are the words to focus on?



Tricky words in science – words with alternative everyday meanings	
Incident	Complex
Spontaneous	Relevant
Valid	Composition
Emit	Random

‘Biology is not plants and animals. It is language about plants and animals … Astronomy is not planets and stars. It is a way of talking about planets and stars,’ wrote Neil Postman in *Teaching as a Conserving Activity*(1979).

The structure of words

Morphology is the study of the different parts of a word: prefix, root, suffix.

Prefix – appears at the beginning of the word, eg hypo- (below), hyper- (above), cyclo- (ring), poly- (many), endo- (within), exo- (outside of).

Root – words that have a meaning standing alone. They often form the longest part of a word. Science vocabulary often has Greek or Latin roots, eg chloro (green), iso (equal), allo (other), com (together)

Suffix – appears at the end of the word and provides additional information, eg -ane (saturated hydrocarbon), -phillic (love, affection), -phobic (hate, fear), -lysis (decompose, breakdown).

Help students to get to grips with new words by breaking them down into their constituent parts. Point out links between new words and vocabulary that is already familiar. Support students to see how the words themselves link to the concepts they describe.

1.Explore your key term

- Find out what your students know about the word already.

2. Explore the key term further

- Show the links between words and their composite parts.

Select your key term

3. Explain what the word means

- Introduce the correct definition that students will need for their exams/assessments.

4. Consolidate the word

- Get students using the word in sentences.

1. What does the word reflection mean to you? Where have you come across this word before?

2. Looking more into the word reflect

Etymology
Flect = genuflect = deflect

Reflection

4. Write an explanation of why you can see yourself in a mirror.
You should use the idea of reflection in your answer.

3. The definition of reflection and ray diagram to show this.

1. What does the word transmission mean to you?
Where have you come across this word before?

2. Looking more into the word transmission

Etymology
Trans = transatlantic mission – going somewhere

Transmission

4. Now give two examples of where light is transmitted. They could be examples from school at home or in one of your hobbies.

3. The definition of transmission.

1. What is a lens?
Where have you come across this word before?

2. Looking more into the word lens

Can you think of any words which contain the word letters ‘len’?

Lens

4. Now draw a simple ray diagram to show how a lens works.

3. Describe in your own words what a lens is and what it does.

1. Where have you come across the word incident before? What does it mean to you? Can you use the word incident in a sentence?

2. Looking more into the word incident

Can you think of any words which have the same meaning as incident?

Etymology

Incidence/ Incident

3. What does incident mean in physics? Let's draw a simple ray diagram to show the incident beam.

4. Which of the following is the correct use of the words incident and incidence?

The angle of incidence is equal to the angle of reflection.

There was an incident on the roads when someone got injured.

The light beam is incident to the mirror.

1. What does the word conservation mean to you?
Where have you come across this word before?

2. Definition of the word conservation.

Can you think of any words which are similar to conservation?
Conserve = jam

Conservation

4. Which of the following are correct uses of the words conservation and conserve?

We need to conserve the rainforests as they provide habitats for thousands of species.

York Minster is currently being conserved because the old brick are being replaced.

In a chemical reaction mass is not lost or gained – it remains the same and is conserved.

I had a conservation with my friends at lunch about the football at the weekend.

3. Draw a simple diagram(s)
to describe the word ‘conservation’
AND ‘conservation of mass’.

1. What does the word displacement mean to you? Where have you come across this word before?

2. Explore displacement.

Dis and placement.

Can you think of any similar words to displacement?

Displacement

4. Can you explain why this is a displacement reaction?

Calcium + copper chloride → calcium chloride + copper

3. Definition of displacement.

1. What does the word extraction mean to you? Where have you come across this word before?

2. Explore extraction.

Ex and traction

Can you think of any synonyms for extraction?
What is the opposite of extraction?

Extraction

4. Describe the process of extracting a metal from its ore.
You should include a word equation as part of your answer.

3. Definition of extraction.

Improving students' understanding through writing

Making extended writing accessible through oracy

Overcoming the activation energy of the blank page

Everyone needs an editor

Education in chemistry, The royal society of chemistry (2019)

Characteristics of science vocabulary

Characteristic #1: A definition of a tier three word is only useful **after** you have learnt what the word means.

Characteristic #2: Tier three words are not really concrete, even if they seem to be.

Characteristic #3: Tier three words gain meaning from context.

Characteristic #4: We typically choose tier three words independently of texts.

Education in chemistry, The royal society of chemistry (2019)

Characteristic #1: A definition of a tier three word is only useful **after** you have learnt what the word means.

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Here is a definition:

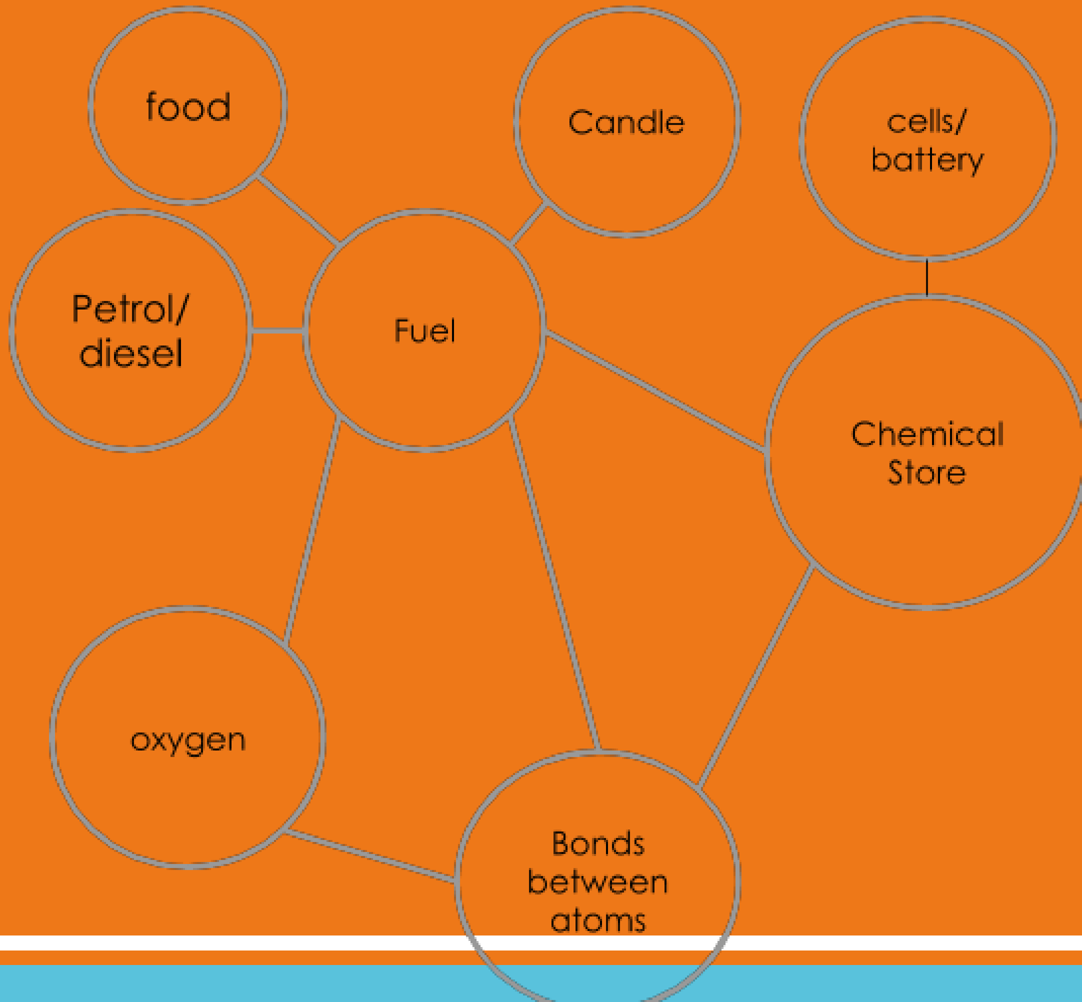
Chemical energy is energy stored in substances. This energy is released by your body when you digest food, and by cars when fuel is burnt. Wood, paper, apples, petrol and batteries all contain chemical energy.

Characteristic #2: Tier three words are not really concrete, even if they seem to be.

You are teaching year 7 pupils lab equipment. You hold up a beaker. You say, “This is a beaker.” You quiz them. They tell you it’s a beaker. Beaker is a tier 3 word because it is a technical term.

It is possible to have a very shallow, concrete understanding of many tier three words: words like *beaker*, *Bunsen burner, push and pull.*

Characteristic #3: Tier three words gain meaning from context.



Characteristic #4: We typically choose tier three words independently of texts.

Many of the blog and books about vocabulary focus on tier two words. Teachers identify which tier two words to teach based on the text they are reading.

Tier three words are usually chosen independently of texts – their choice is often not down to the teacher, but planned at the time of writing the course. For example, any electricity course is likely to include the tier three words: current, potential difference, cell and conductor.

Thank you for listening!

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