The White Hills Park Trust

*A Culture of Excellence*

# Workshop E: Metacognition – Learning That Lasts

Monday 1st July, 2019

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# Aims of this session:

The White Hills Park Trust
*A Culture of Excellence*

- To develop and understand what is meant by metacognition and how this can be achieved
- Review and action plan the processes required to embed examples of Metacognition within the context of your learning environment


THE GREAT BRITISH
BAKE OFF

# How does baking relate to learning?

- Technical challenge - difficult decisions.
- Our learners are faced with problem solving challenges every lesson of every day – how do they overcome them?
- No guidance except a time limit  - so how do they know what to do?
- How do they judge when to take it out & how can they produce the perfect cake without the cookbook?
- Experience, practice, external input, guidance, modelling, low stakes practice, experience of failure, understanding their mistakes, time commitment, understanding why they were successful and then being able to reapply & repeat their learning
- How do our students complete a challenge, problem, question or assessment without your direct input?
- We hope/ know that we have prepared them accordingly

# Challenges & Aims in Education

Do we have the in the time in the classroom to achieve the mastery of learning that is required for our students to be successful?

How can we accelerate this and support students' progress more effectively?

How can we create self-regulated learners so they know how to be successful themselves?

1

Teachers should acquire the professional understanding and skills to develop their pupils' metacognitive knowledge

2

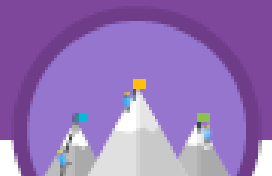
Explicitly teach pupils metacognitive strategies, including how to plan, monitor, and evaluate their learning

3

Model your own thinking to help pupils develop their metacognitive and cognitive skills

4

Set an appropriate level of challenge to develop pupils' self-regulation and metacognition



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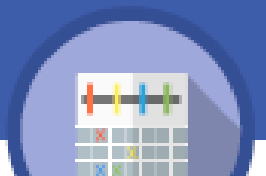
Promote and develop metacognitive talk in the classroom

6

Explicitly teach pupils how to organise and effectively manage their learning independently



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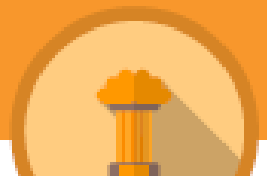
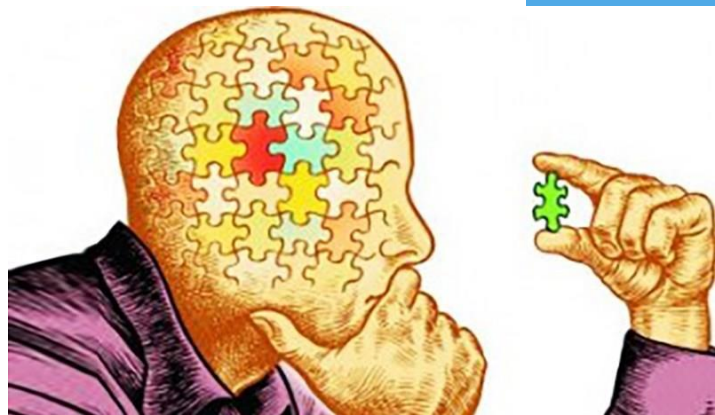
Schools should support teachers to develop knowledge of these approaches and expect them to be applied appropriately



# Jigsaw Task

The EEF summary has 7 key recommendations. As a group sort out the cards into on of the 7 recommendations. There should be 3 cards under each section.

| | | | | | | |
|---|---|---|---|---|---|---|
| Teachers should acquire the professional understanding and skills to develop their pupils' metacognitive knowledge | Explicitly teach pupils metacognitive strategies, including how to plan, monitor, and evaluate their learning | Model your own thinking to help pupils develop their metacognitive and cognitive skills | Set an appropriate level of challenge to develop pupils' self-regulation and metacognition | Promote and develop metacognitive talk in the classroom | Explicitly teach pupils how to organise and effectively manage their learning independently | Schools should support teachers to develop knowledge of these approaches and expect them to be applied appropriately |



# Metacognition & Self-Regulated Learning

- Effective learners have developed repertoires and can overcome challenges and can remain motivated when 'stuck' or when learning something new (working memory)
- The extent to which these skills are developed is in part due to the opportunities students have to develop them outside of school and is likely linked to social circumstances (hence the focus and need to support DA)
- Metacognition is the fabric of successful learning but it can be complex yet subtle
- We need to have an understanding of the metacognitive demands of what we are teaching in order to develop it in our learners
- Not just the answer but the problem solving techniques to understand the answer for themselves and gauge their progress
- It has a significant impact on students' academic performance, beyond that predicted by prior attainment
- We need to help all students develop these repertoires
- How we present the knowledge (reduced load/ spaced/ interleaving/ retrieval) and consequently what we encourage our students to do outside of the classroom can have a big impact

# What are the steps to achieving Metacognition & Self-Regulated Learners?

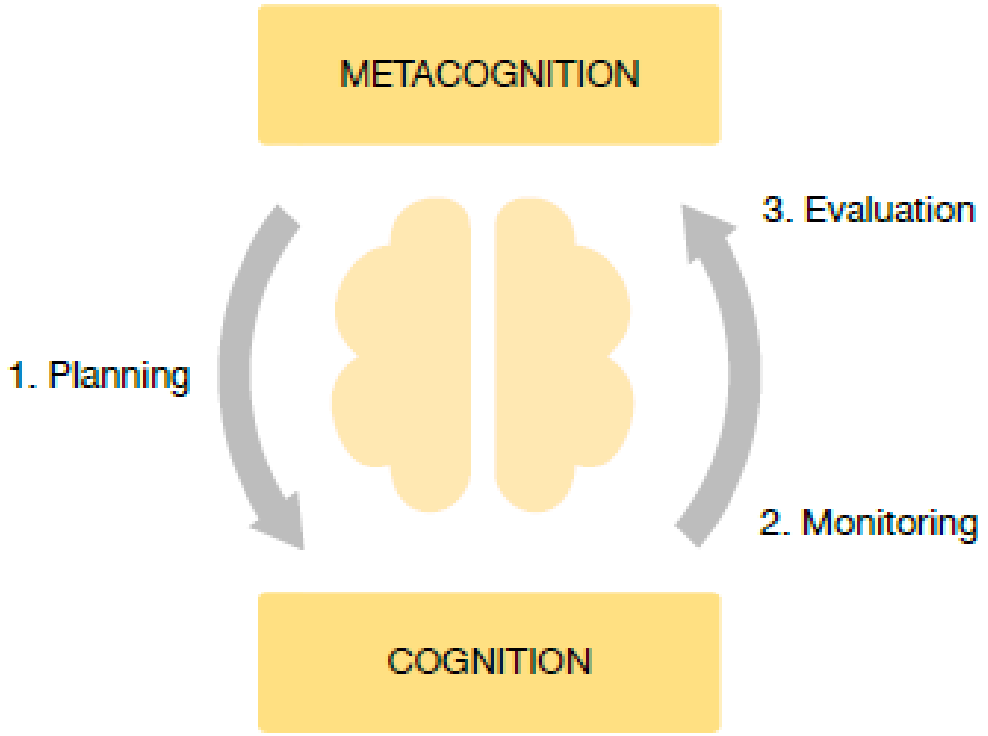
Your learners, as influenced by external factors, will all be at different stages

Teaching staff & individual departments will be at different stages

Reflect on what is learning and how we establish effective long term learning techniques in the classroom (cognition) to then support metacognition

# What is Metacognition and Self-Regulated Learning?

- ***Cognition*** - the mental process involved in knowing, understanding and learning. This is fundamental to ***acquiring knowledge***
- ***Metacognition*** – the strategies used to monitor or control our cognition. Which ***methods of learning are the most effective*** and successful for our learners & why
- ***Motivation*** – the drive and desire to undertake to engage the skills and apply them to learning
- ***It is impossible to be metacognitive without having different cognitive strategies to hand***



# From Intent to Implementation

# What is learning?

**‘Learning is defined as an alteration of long term memory – if nothing has been altered in the long term memory, nothing has been learned.’ (Sweller, 2011)**

# Modelling Example

Modelling by the teacher is a cornerstone of effective teaching; revealing the thought processes of an expert learner helps to develop pupils' metacognitive skills.

# Think – Pair – Share

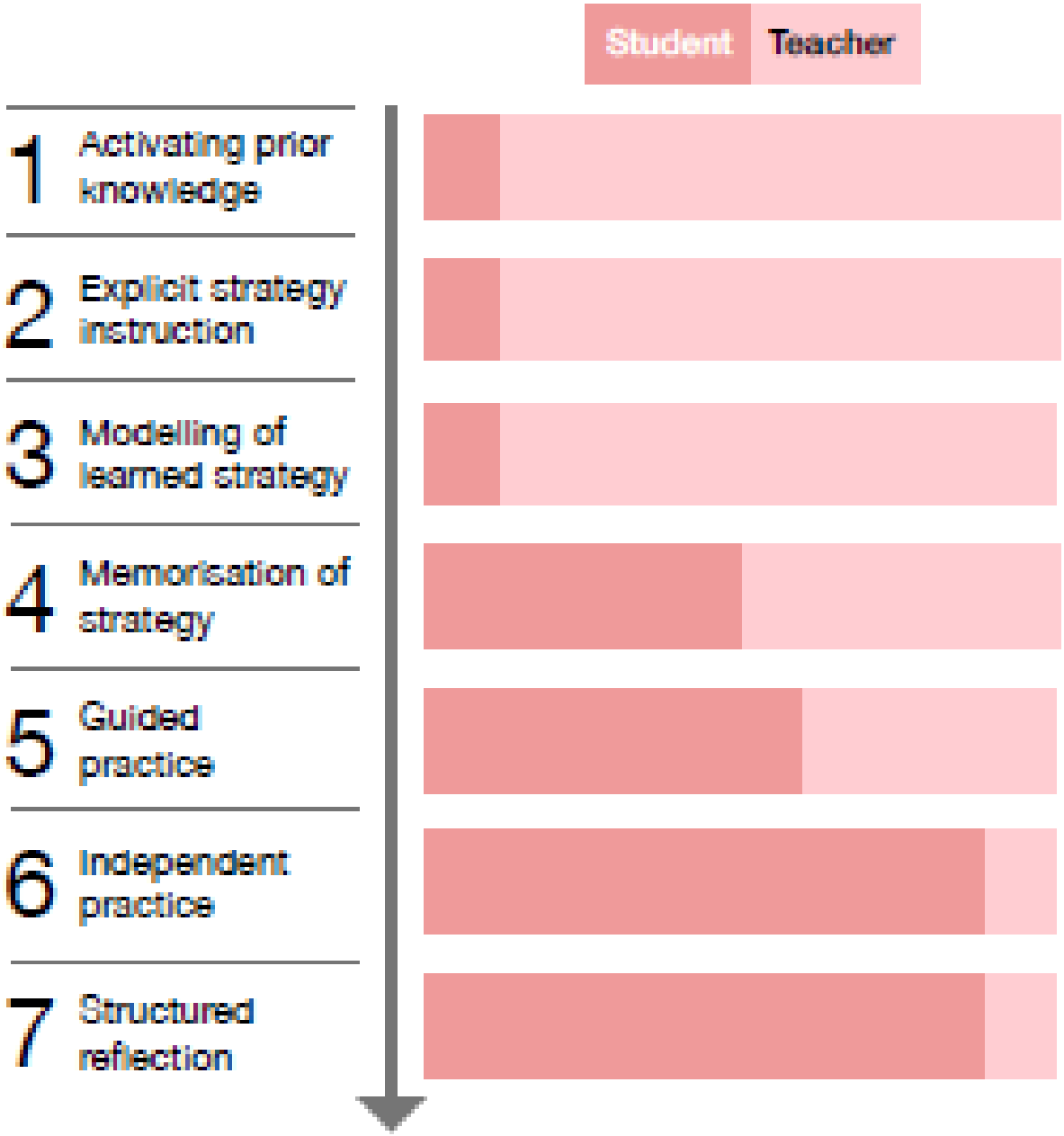

1. What was the last thing you modelled in your classroom?

2. How did you do it? Visual …..verbal ……kinaesthetic?

3. How often do you model answers and explain your thinking process?

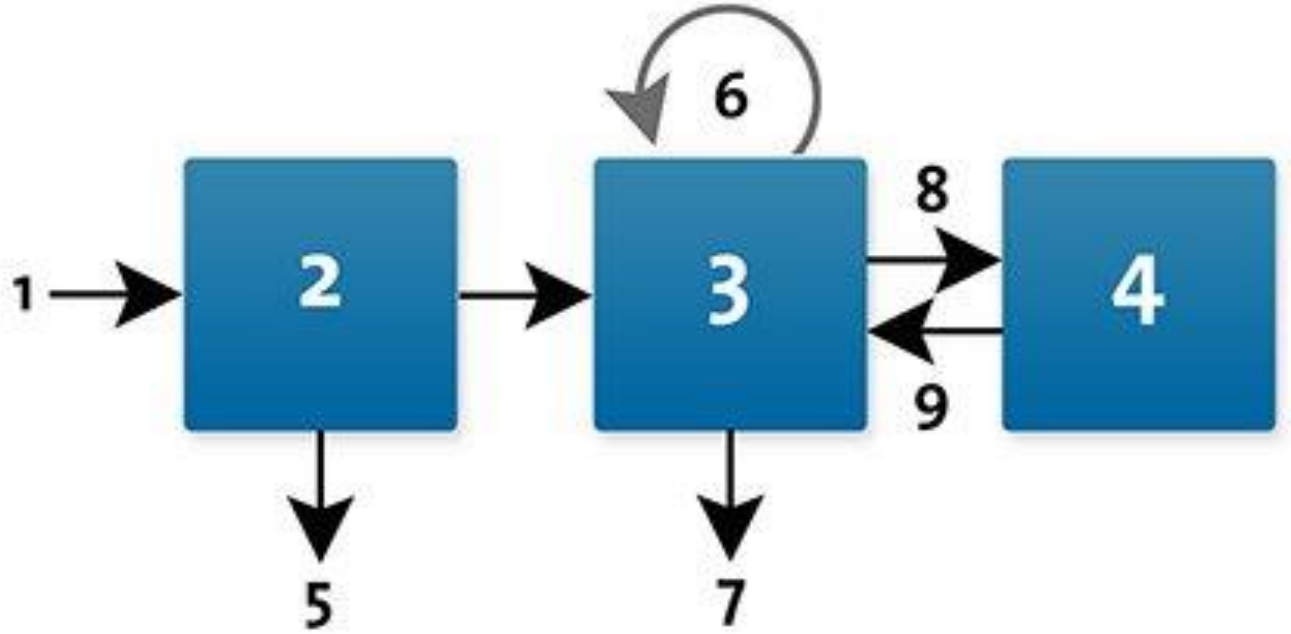
4. Do students find it valuable? How do you know?

5. What do you think are the main barriers that prevent teachers from modelling more frequently in the classroom? How can we overcome this?


Student
Teacher
1 Activating prior knowledge
2 Explicit strategy instruction
3 Modelling of learned strategy
4 Memorisation of strategy
5 Guided practice
6 Independent practice
7 Structured reflection

# Reducing the Cognitive Load

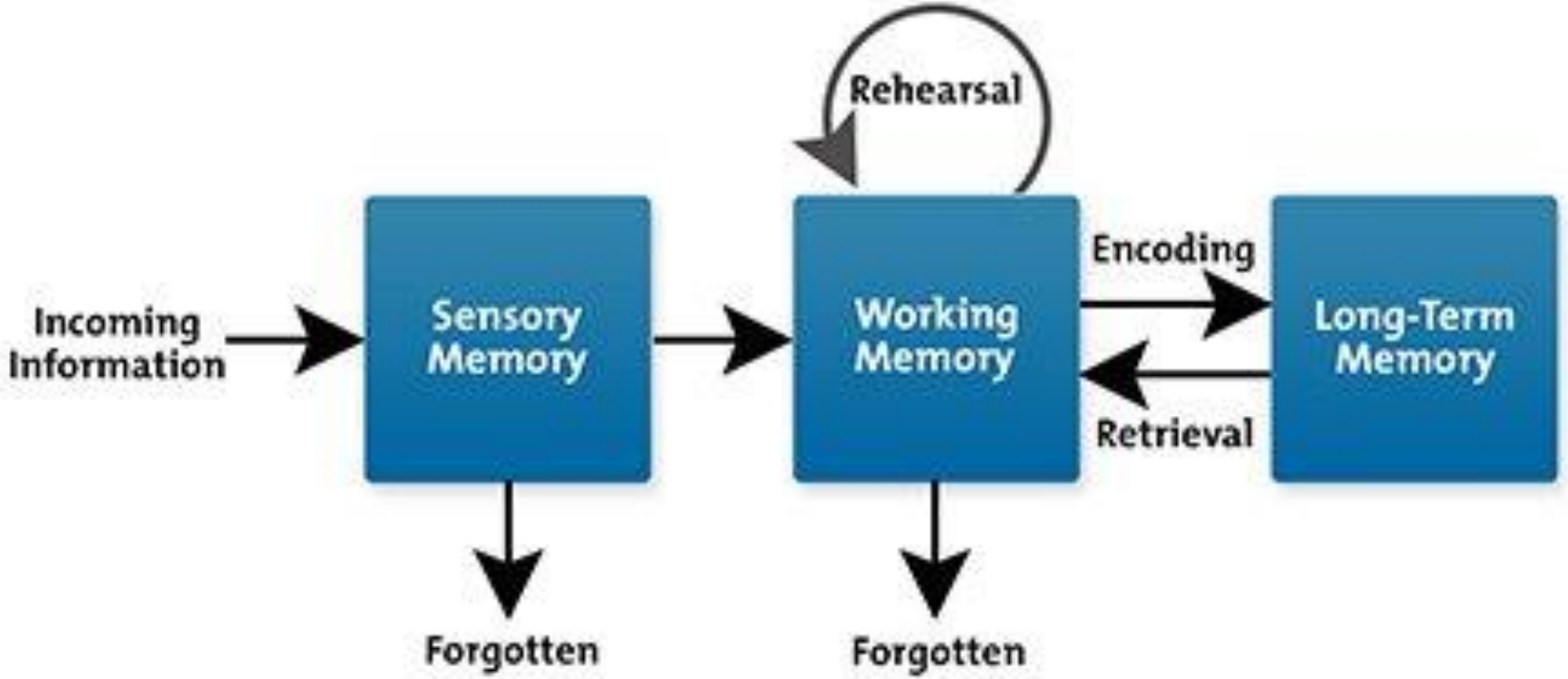
Tasks should not overload pupils' cognitive processes, particularly when they are expected to apply new strategies.




1. Incoming Information
2. Sensory Memory
3. Working Memory
4. Long-Term Memory
5. Forgotten
6. Rehearsal
7. Forgotten
8. Encoding
9. Retrieval

# What was number 7?

7 – Forgotten


Rehearsal
Incoming Information
Sensory Memory
Working Memory
Encoding
Long-Term Memory
Retrieval
Forgotten
Forgotten

# Cognitive Load Theory in Education

- Proven evidence based research - Science of how we learn
- Focus on the most effective ways of committing information to the long term memory
- Considering practical strategies on how we implement and teach for this
- Our teaching and curriculum needs to focus on reducing the cognitive load on students
- Reducing the strain on working memory will allow students to learn better
- Reduce the extraneous load & consider how we present the load as we cannot reduce the overall load
- This should leave more room in working memory to enable retention
- What are the techniques? How do we do this?
- Not just one technique in isolation

# Paired Task

Strategy 1: Tailor lessons according to students' existing knowledge and skill

Strategy 2: Use lots of worked examples to teach students new content or skills

Strategy 3: Gradually increase independent problem-solving as students become more proficient

Strategy 4: Cut out inessential information

Strategy 5: Present all the essential information together

Strategy 6: Simplify complex information by presenting it both orally and visually

Strategy 7: Encourage students to imagine concepts and procedures that they have learnt

For the example you have been issued have a go at reducing the cognitive load.

a) What information would you remove?

b) How could represent the essential information together?

c) Share your example with the rest of the people on your table.

# Develop Pupils Metacognitive Knowledge

Developing pupils' metacognitive knowledge of how they learn—their knowledge of **themselves as a learner**, of strategies, and of **tasks**—is an effective way of improving pupil outcomes.

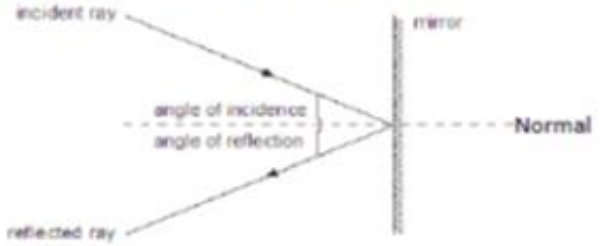
# Knowledge Organisers

## Year 8 Knowledge Organiser - Light and Sound

**KPI 6.2:** Use ray diagrams to show how images are formed – such as mirrors, pinhole cameras and the human eye

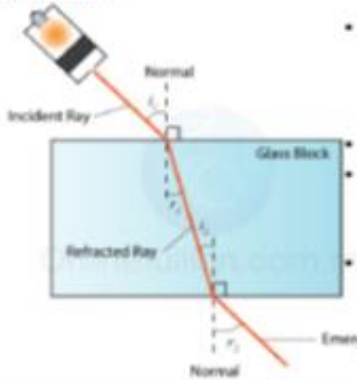
**Reflection**

- Light needs to reflect off an object and into your eye, for you to see it.
- When light is reflected from a mirror, the angle of incidence is equal to the angle of reflection. This is the **law of reflection**.




| Key Terms | Definitions |
|---|---|
| Incident ray | The ray of light that hits the mirror or glass block from the ray box |
| Reflected ray | The ray of light that reflects off the mirror |
| Normal line | Imaginary line at 90 degrees to the mirror or glass block. Used to measure angles. |
| Angle of reflection | The angle between the normal and reflected ray |
| Angle of incidence | The angle between the normal and the incident ray |
| Refraction | When light changes direction as it enters or leaves a different medium (material) |
| Emergent ray | The ray of light that leaves the glass block |
| Focus / focal point | The point where light rays cross |

**Refraction**




- When light travels through a glass block, it slows down when it goes in and speeds up again when it comes back out.
- This causes the light to refract (bend).
- Light bends towards the normal when it goes into glass and bends away from the normal when it comes out
- The two rays outside the block are parallel

**Colours**

There are three primary colours in light: red, green and blue. Light in these colours can be added together to make the secondary colours magenta, cyan and yellow.

## In Groups

Write down as many ways as you can think of to make good use of knowledge organisers in your classroom.

- Highlight and add to notes.
- **Be foxy** - try to write your own questions based on the information.

**Process**

**Assess**

- 10 basic questions set each week in class.

- Turn the questions you get wrong into facts.
- Rewrite these 10 times.

**Repeat**

**Process**

# Fact checker

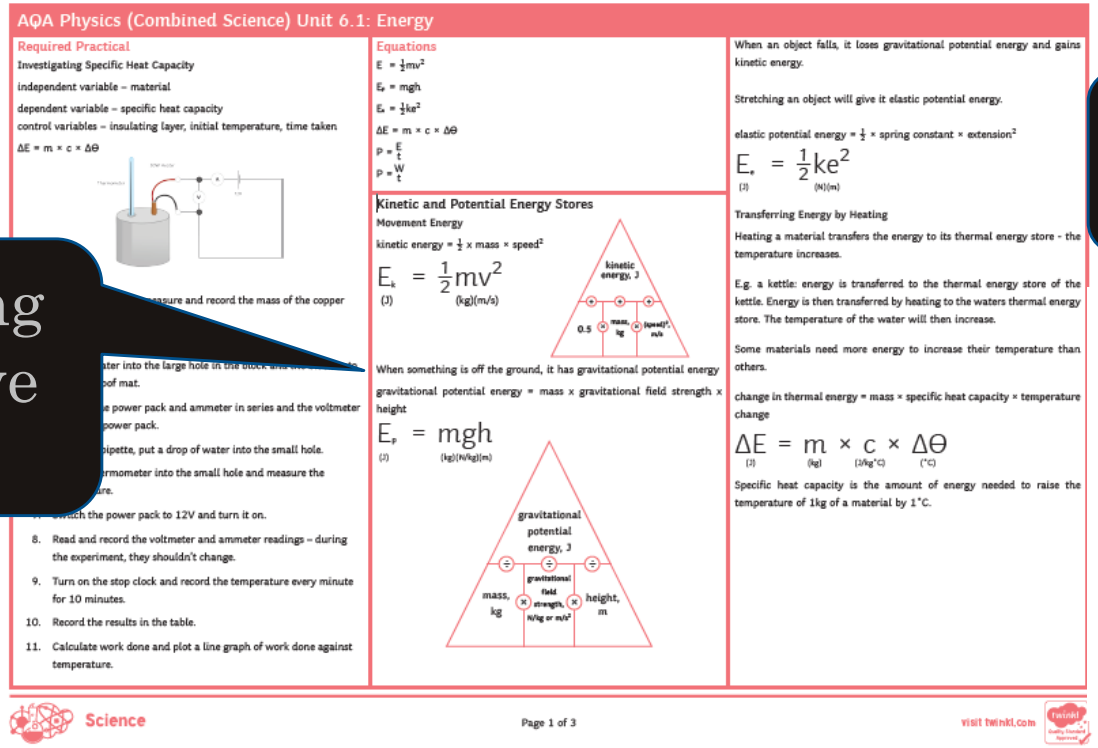
**Homework 1 - Energy**

| Question | Answer |
|---|---|
| 1. Write down the units for gravitational field strength. | |
| 2. Write down the kinetic energy equation. | |
| 3. Complete the sentence: When an object falls it loses ..... ..... energy but gains ..... energy. | |
| 4. What is the independent variable in the specific heat capacity core practical? | |
| 5. How long should you leave the heater on in the core practical? | |
| 6. Name 2 other control variables in the core practical. | |
| 7. Complete the sentence: The ammeter should be placed in ..... but the voltmeter should be placed in ..... | |
| 8. Write down the equation for gravitational potential energy. | |
| 9. What is the unit for specific heat capacity? | |
| 10. Write down both power equations. | |
| **Score/10** | |

# Interleaving

| Page | Content | Week beginning | Score /10 | Fact Check |
|---|---|---|---|---|
| 1 | Energy | 7th Jan | | |
| 4 | Electricity | 14th Jan | | |
| 6 | Particles | 21st Jan | | |
| 8 | Atomic Structure | 28th Jan | | |
| 2 | Energy | 4th Feb | | |
| 5 | Electricity | 11th Feb | | |
| 7 | Particles | 25th Feb | | |
| 9 | Atomic Structure | 4th March | | |
| 3 | Energy | 11th March | | |

# Reducing cognitive load



AQA Physics (Combined Science) Unit 6.1: Energy

Required Practical

Investigating Specific Heat Capacity

independent variable – material

dependent variable – specific heat capacity

control variables – insulating layer, initial temperature, time taken

$\Delta E = m \times c \times \Delta\theta$

8. Read and record the voltmeter and ammeter readings – during the experiment, they shouldn't change.
9. Turn on the stop clock and record the temperature every minute for 10 minutes.
10. Record the results in the table.
11. Calculate work done and plot a line graph of work done against temperature.

Equations

$E = \frac{1}{2}mv^2$

$E_p = mgh$

$E_e = \frac{1}{2}ke^2$

$\Delta E = m \times c \times \Delta\theta$

$P = \frac{E}{t}$

$P = \frac{W}{t}$

Kinetic and Potential Energy Stores

Movement Energy

kinetic energy = ½ x mass x speed²

$E_k = \frac{1}{2}mv^2$ (J) (kg)(m/s)

kinetic energy, J; 0.5; mass, kg; (speed)², m/s

When something is off the ground, it has gravitational potential energy

gravitational potential energy = mass x gravitational field strength x height

$E_p = mgh$ (J) (kg)(N/kg)(m)

gravitational potential energy, J; mass, kg; gravitational field strength, N/kg or m/s²; height, m

When an object falls, it loses gravitational potential energy and gains kinetic energy.

Stretching an object will give it elastic potential energy.

elastic potential energy = ½ × spring constant × extension²

$E_e = \frac{1}{2}ke^2$ (J) (N)(m)

Transferring Energy by Heating

Heating a material transfers the energy to its thermal energy store - the temperature increases.

E.g. a kettle: energy is transferred to the thermal energy store of the kettle. Energy is then transferred by heating to the waters thermal energy store. The temperature of the water will then increase.

Some materials need more energy to increase their temperature than others.

change in thermal energy = mass × specific heat capacity × temperature change

$\Delta E = m \times c \times \Delta\theta$ (J) (kg) (J/kg°C) (°C)

Specific heat capacity is the amount of energy needed to raise the temperature of 1kg of a material by 1°C.

| Year 7 | Half Term | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Topics** | A Cells + B Reproduction | C Particles + D Separating Technique | E Forces F Motion Pressure | G Microbes H Healthy lifestyles | I Acids + Alkalis J Chemical Reactions | K Energy L Space |
| **Core Homework** linked to current learning | Test base questions – e.g. pupil choice from different levels<br>Flipped learning – research based on upcoming topics | | | | | |
| ***LTR*** (10+ weeks post topic) | **Research famous scientist/experiment* | Safety | B Reproduction | D Separating techniques | F Motion/Pressure | H Healthy lifestyles |
| ***Spaced Learning*** 2/3 weeks post topic | A Cells | C Particles | E Forces | G Microbes | I Acids + Alkalis | K Energy |
| The following can be covered in any order as the classroom teacher/s see fit but should fit the model of 1 per half term | | | | | | |
| ***HSW skills*** *PiXL sheets adapted* | Magnification | Methods | Averages and uncertainties | Graph interpretation | Equations | % |
| **Revision Technique**<br><br>Using Knowledge Organisers | Word up | Look cover write check | Mind Map | Test your mind | Flash cards | Pupils favourite technique |
| | **Youtube Mr Garner Knowledge organiser technique of the week**<br>• Look – cover – write – check<br>• Word up<br>• Mind map<br>• Test your mind<br>• Flashcards | | | | | |

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Explicitly teach pupils metacognitive strategies, including how to plan, monitor, and evaluate their learning

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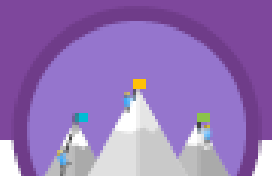

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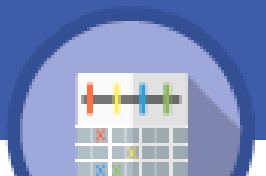

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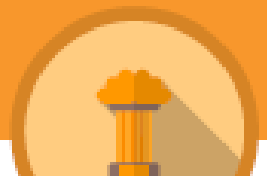

# Intent to Implementation

- If we are to develop the metacognitive abilities of our students, we need to ensure they are equipped with a range of cognitive strategies in order to better develop their knowledge (those who acquire knowledge become better at acquiring it).
- Metacognitive Processes that we are targeting
  - Develop pupils' metacognitive knowledge of how they learn
  - Activating prior knowledge and independent practice
  - Appropriate challenge
  - Do not overload cognitive processes
  - Develop independent learning skills
- These are the building blocks to developing our learners' metacognitive skills
- It is impossible to be metacognitive, without having different cognitive strategies to hand
- We are teaching students how to learn as well as what to learn and then getting them to understand how well they have learnt it and why

# Action Planning & Next Steps

## Key Questions

- Is this a feature in your curriculum currently?
- Do you already deploy these techniques? How?
- Are they used consistently?
- Are the effectiveness of the techniques discussed and evaluated by the students?
- Do students know which cognitive method is the most effective for them and why?
- Do your students know how they have been successful?

## Exit Tickets x 2 post it notes

- On the A3 'Summary Recommendations' Sheet write your name next to 3 bullet points to indicate the next steps of development within your practice or school context.
- On the smaller hand-out highlight the key sections to support you in developing your own school based action plan
- Consider
  - How do you develop this?
  - Where do you start?
  - Which resources need developing?
  - What planning do you need?

# Aims of this session:

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*A Culture of Excellence*

- To develop and understand what is meant by metacognition and how this can be achieved
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