

Metacognition: Adaptive Teaching For SEN Students

Who Am I?

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- Former Head of Maths/Pastoral Lead/MAT Lead
- Metacognitive researcher and author
- Full time training provider and consultant



Session Aims

- The rationale for metacognition
- A (re-cap) of metacognitive theory
- The myth of SEN students and metacognition
- Metacognitive strategies for the classroom

Ponder...

What are your current views on metacognition?

Why Metacognition?

- Greatest positive attainment impact of any intervention (EEF)
- OFSTED suggested area of focus for high-quality CPD
- Benefits ALL students (regardless of: socio-economic status; prior attainment; sex; behaviour; SEN status; age)
- Free for schools to implement

Why Metacognition? More...

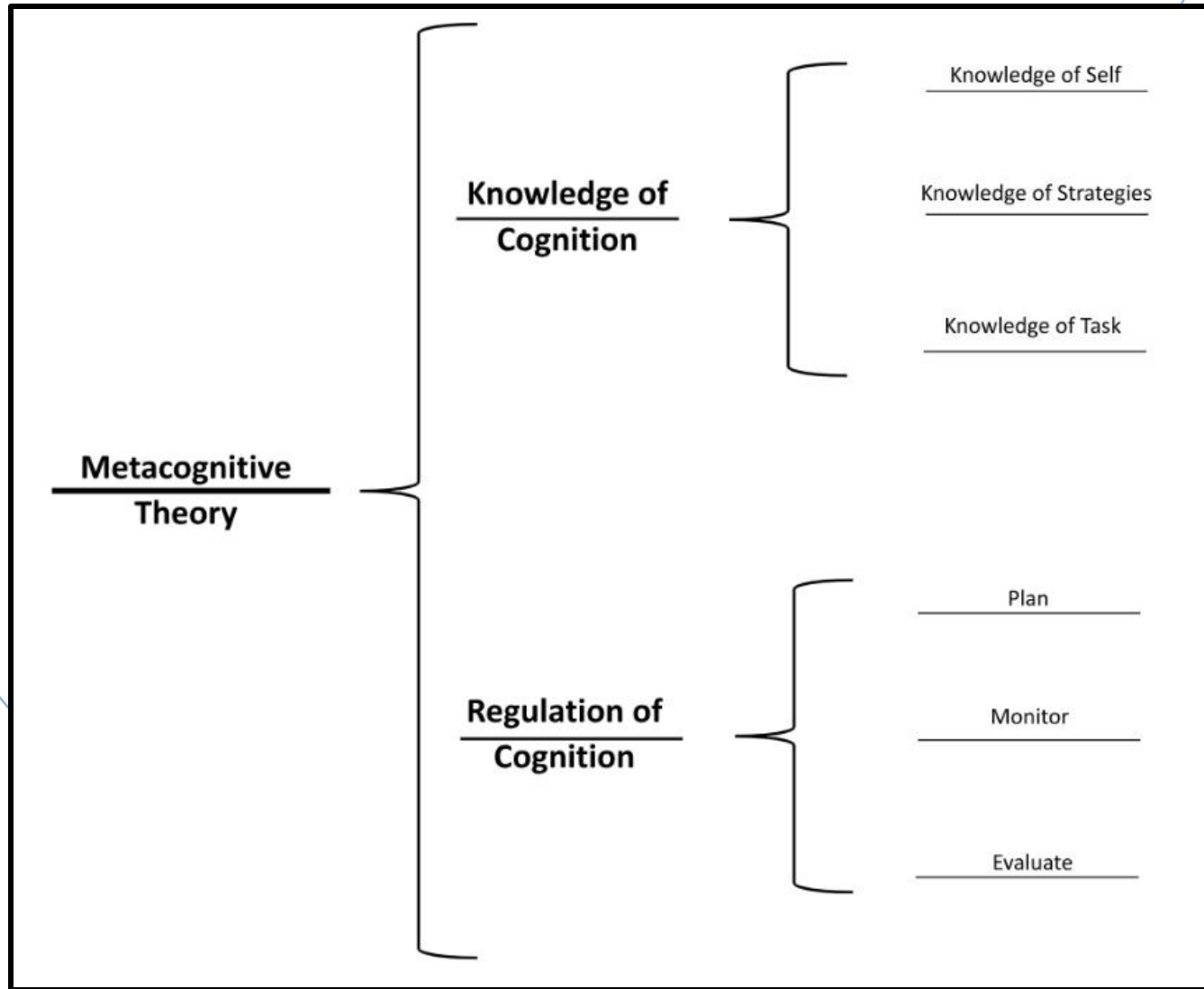
- Works across phases (i.e. can be a focus for all)
- Develops problem solving skills
- Improve skill transference across contexts
- Improves students self-regulatory abilities
- Improves revision skills

What Is Metacognition?

- Flavell: 'I am being metacognitive if I notice that I am having more trouble learning A than B; if it strikes me that I should double check C before accepting it as fact'
- Burns: '[Metacognition is] the little voice inside your head that constantly evaluates and informs your decisions.'
- *Let us consider the process to plan and deliver a lesson...*

Why Is It So Difficult?

- It's invisible
- There are complexities to the theory
- It is reliant on cognition and motivation (i.e. it is not a standalone strategy or pedagogy)



*Knowledge Vs
Regulation*

Knowledge Of Cognition

- Knowledge of task – knowledge of requirements to meet to fulfill task criteria
- Knowledge of self – knowledge of... knowledge
- Knowledge of strategies – knowledge of methods available to attempt a cognitive task

Regulation Of Cognition

- Planning – an approach for the task
- Monitoring – staying on track for successful task completion
- Evaluation – review of the efficiency and effectiveness of approach and outcomes

Some Other 'Must Knows'

- Metacognition hinges upon cognition
 - Metacognitive abilities can vary with cognitive changes (topics; subject areas)
- Metacognitive abilities are not dichotomous
 - There are four 'levels' (Perkins 1992)

Ponder...

Do you have any questions on the theory so far?

The SEN Myth Of Metacognition

Metacognition is not for students with SEN

THE SEN MYTH OF METACOGNITION

Is it because...?

- Metacognition is too complicated?
- Too many steps/stages or fear of overload?
- Don't believe they're capable?

The Strategies

- Selected strategies which suit science and are easily adaptable
- *Not* chosen 'easy' strategies
- This is not an exhaustive list of metacognitive ideas!
- All strategies include the fundamentals of the strategy and an example

Ask questions, chip in, discuss... as we go!

Worksheet Graphics

What?

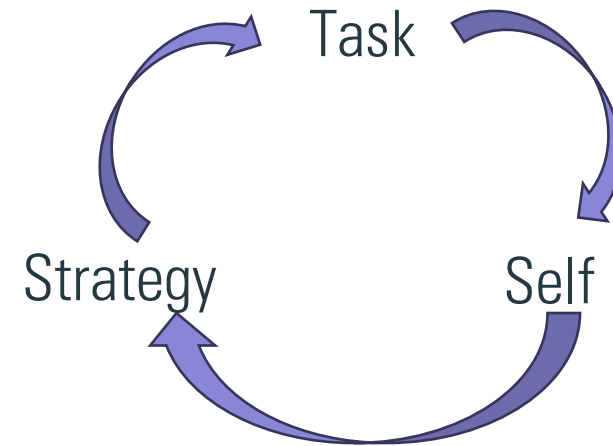
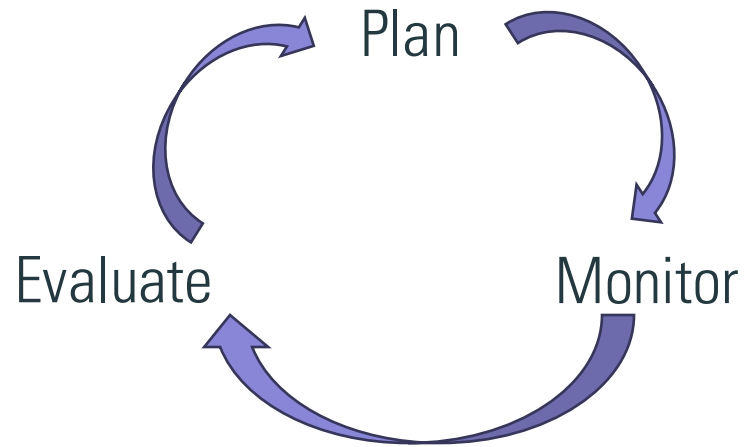
- Place a graphic of one (or both) of the cycles on PPT slides, worksheets, books etc.

Why?

- Ensures consideration of key metacognitive stages.
- Useful as a visual scaffold to refer back to.

NOTE - a static graphic will not help; it needs to be incorporated into the lesson/teaching

Example



Explicit Justifications

What?

- Justify the choices that you make during modelling
 - Explaining where (relevant) you take a different possible pathway (use of a key word; strategy; use of prior knowledge)

Why?

- Ensures students learn from our experiences rather than trial & improvement 100 times over.
- Aim to lead to a greater depth of understanding.

Example

I would utilise a bar chart to graph this data. This is because the data is discrete, not continuous, so a line graph is not suitable. There is not a total amount so I cannot use a pie chart.

**Water Temperatures
at Various Depths**

Water Depth (meters)	Temperature (°C)
50	18
75	15
100	12
150	5
200	4

Method Comparison

What?

- Model two (or more) methods appropriate for task completion.
 - Discuss the relative strengths, weaknesses and utility of different methods.

Why?

- Students develop awareness of these strengths, weaknesses, utility to support their own learning

Note - potentially better once students have a better awareness of content and strategies available to them (cognitive load).

Note - not appropriate where there is no reasonable alternative approach.

Example

Describe the similarities and differences between an animal cell and a plant cell.

- List out the characteristics of animal cells, then plant cells, then compare.
- List out a characteristic of an animal cell, then instantly compare it to a plant cell, then consider the next characteristic.

Visualiser

What?

- Opportunity to model in live time.

Why?

- Draw emphasis to particular areas, including layout.
- Work 'looks like' a students (PPT doesn't).

Example

For example, when completing calculations of energy requirements in a healthy daily diet.

Model Scaffold Use

What?

- Scaffolds used to bridge gaps between current levels and desired level.
- Focus here is on training students *what* scaffolds that they have available to them, *how* to use them and *why* they are helpful.

Why?

- High quality feedback supports student in identify and improving on target areas.
- Improved independent learners

Example

For example...

- Calculator
- (Annotated) periodic table
- Key word bank
- Formula sheets
- Knowledge organisers

Knowledge of Grid

What?

- Knowledge of grid is a planning tool to get students to think about...
 - Knowledge of task
 - Knowledge of self
 - Knowledge of strategies
- These are the fundamentals of *any* cognitive activity

Why?

- Student forced to attend to these factors
- Places emphasis and priority on these areas (and moves it away from just doing the task)

Example

Magnesium oxide is a compound formed from the metal magnesium and the non-metal oxygen.

Describe what happens when a magnesium atom reacts with an oxygen atom.

You should refer to electrons in your answer.

[4 marks]

Knowledge of Task	Knowledge of Self	Knowledge of Strategies
Explain magnesium atom and oxygen atom reaction Need to refer to electrons 4 marks – 4 points	Magnesium + oxygen make magnesium oxide Heat Light But electrons????	Make 4 points Explain outcomes Link to electrons

Key Word Quizzing

What?

- Explicitly teach students the key (command) words
 - Improve comprehension
 - Reduce question load
- Could be incorporated into teacher modelling and questioning
- Can be incorporated into a retrieval starter or homework tasks

Why?

- Increase comprehension abilities
- Reduce cognitive load of questions

Example

Last lesson

Last week

Last month

Last term

Define...

Content Checklists

What?

- Produce a list of the content that needs to be included in a successful task response.
- Teacher or TA led, or group/pair/individually produced.

Why?

- Reduce cognitive load during task completion
- Increase likelihood that all content is included within task response.

Example

(BBC Bitesize): "State the law of conservation of mass, and explain why some reactions may appear to involve a change of mass (6)"

Checklist...

- In reaction, no atoms lost/made
- Mass products = mass reactants
- Mass looks like increase
- As solid reactant joins air (gas)
- Mass looks like decrease
- Products = gas = disappear

Flow Maps

What?

- As part of planning for task, produce a flow map for the stages to work through
 - Provides a 'monitoring' scaffold

Why?

- Reduced cognitive load allowing focus on accuracy and writing quality
- Support students planning abilities and forces students to slow down

Example

A cube with sides of length 5cm, weighs 50g.
What is its density, in kg/m^3 ?

Convert cm to m



Convert g to kg



Write our density formula



Substitute in values



Calculate

Answering Directed Questions

What?

- Provide structured (metacognitive) questions to students to support their (self) evaluation

Why?

- Place a metacognitive focus on evaluation
- Provide a clear structure to evaluation

Comprehension

- What are the key words in the question? How do you know?
- What must be included within my answer? How do you know?
- If I have been provided with a table or graph, why may this be significant?
- Why have I been provided with an image?
- How does the number of marks available for this question link to the structure of answer that I need to provide?

Connection

- When have you seen a question or task like this before?
- What did you do well on when we had the similar task? Why did it go well?
- What did you struggle with when we had a similar task? Why do you think you struggled?
- What support may you need to be more successful this time around? Why will that help?
- What strategies did you use last time, and how well did they work? How do you know?

Strategies

- What are the strategies available to us?
- When would we usually use strategy x ?
- What are the strengths and weaknesses of this strategy?
- Will this strategy always work, or is there a safer option?
- Did you consider how effective that strategy was last time that you used it?

Evaluation

- How successful were you in that task? How do you know?
- What went well in that task? How do you know?
- Where might you need greater support next time, and how will that help?
- What will you do differently next time?
- What will you do the same next time?

Plan

- What strategies are you going to use to plan your response? Why are you going to use that strategy?
- What are the key criteria of the task you have been given? How do you know?
- Do you need any additional support before completing the task? How will that help you?

Monitor

- How will you know that you are moving in a positive direction?
- How are you going to keep yourself within the time limit?
- What are the warning signs that you might be looking out for?

Evaluate

- How will you know that you have met the task success criteria?
- How are you going to improve next time?
- What support might you need to be more successful next time, and how will this help?

Knowledge of self

- What content do you know about this area?
- How do you know that content is relevant?
- What gaps do you have in your understanding? How are you going to address those gaps?

Knowledge of task

- What is the task asking of you? How do you know?
- What are the key criteria for you to include?
- Have you seen a task like this previously, and if so, how did you tackle that task (were you successful, unsuccessful, how, why and so on)

Knowledge of strategies

- How could you go about approaching this task?
- How confident are you with each strategy?
- Which strategy is probably most suitable for this task? How do you know?

Good, Better, Best Answers

What?

- Provide students with 3 answers to a given question.
- Similar in levels (e.g. 7-; 8- or 5+; 7-)
- Focus on drawing out subtleties of the best answer; aspects which are strong in one (even if not the best overall answer).

Why?

- Illuminate your expertise
- Illuminate task requirements and examiner expectations
- Drawing attentions to subtlety

Example

Define the structure and bonding of a diamond:

- A diamond is a covalent structure with carbon atoms joined to others in a covalent bond. It's a tetrahedral network with no spare electrons.
- A giant structure with carbon atoms joined to four others in strong covalent bonds. It has spare electrons in a regular tetrahedral network.
- A diamond is a giant covalent structure with carbon atoms joined to four other carbon atoms in strong covalent bonds. It has no free electrons and the carbon atoms are in a network structure.

Learning Diaries

Why?

- Record down areas of strength and improvement from a task/lesson/post-assessment
- Can be recorded within standard book or a separate tracker

Why?

- Ensures that areas for development are not forgotten
- Removes guess work around strengths and weaknesses
- Supports effective independent study and revision

Example

Topics of Strength	Topics Requiring Improvement

STAY IN TOUCH!

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Newsletter, books and feedback links...



Ponder...

Any final questions?