

METACOGNITION AND SELF-REGULATED LEARNING

Guidance Report



Education
Endowment
Foundation

The authors would like to thank the many researchers and practitioners who provided support and feedback on drafts of this guidance. In particular we would like to thank the Advisory Panel and Review Team:

Advisory Panel: Kate Atkins (Rosendale School), Professor Steve Higgins (Durham University), Dr David Whitebread (Cambridge University), Alex Quigley (Huntington School) and Professor Jonathan Sharples (EEF and UCL Institute of Education).

Review team: Professor Daniel Muijs and Dr Christian Bokhove (University of Southampton).

Written by: Alex Quigley (Huntington School), Professor Daniel Muijs (previously University of Southampton, now at Ofsted) and Eleanor Stringer (Education Endowment Foundation).

CONTENTS

Foreword		4
Introduction		5
Summary of recommendations		6
What are metacognition and self-regulated learning?		8
Recommendation 1	Teachers should acquire the professional understanding and skills to develop their pupils' metacognitive knowledge	10
Recommendation 2	Explicitly teach pupils metacognitive strategies, including how to plan, monitor, and evaluate their learning	12
Recommendation 3	Model your own thinking to help pupils develop their metacognitive and cognitive skills	16
Recommendation 4	Set an appropriate level of challenge to develop pupils' self-regulation and metacognition	18
Recommendation 5	Promote and develop metacognitive talk in the classroom	20
Recommendation 6	Explicitly teach pupils how to organise, and effectively manage, their learning independently	22
Recommendation 7	Schools should support teachers to develop their knowledge of these approaches and expect them to be applied appropriately	26
References		28
How was this guidance compiled?		30

FOREWORD



When we launched the Sutton Trust-EEF Teaching and Learning Toolkit in 2011, we designed it particularly with busy teachers and senior leaders in mind. Our aim was to bridge the gap between educational research and classroom practice, presenting our accumulated understanding of ‘what works’ in a practical and accessible way.

But there was one particular bit of education jargon we couldn’t avoid: ‘metacognition and self-regulation’. Rated by the Toolkit as ‘high impact for very low cost, based on extensive evidence’ it can nonetheless seem an elusive topic. And with good reason.

Beyond a simple definition of ‘thinking about thinking’ or ‘learning to learn’, it can be hard to describe what metacognition means in the classroom.

“We hope this report brings some clarity and guidance to an area of teaching and learning that holds so much promise but that can be difficult to implement.”

On a very basic level, it’s about pupils’ ability to monitor, direct, and review their learning. Effective metacognitive strategies get learners to think about their own learning more explicitly, usually by teaching them to set goals, and monitor and evaluate their own academic progress.

Teaching metacognition is easier said than done; there’s certainly no simple method or trick. We know that learners develop some metacognitive knowledge

and skills naturally, and most teachers support metacognition in their teaching without realising it. That said, it can be difficult to give concrete examples of what metacognitive knowledge and skills actually look like. But with a large body of international evidence telling us that when properly embedded these approaches are

powerful levers for boosting learning, it’s clear that we need to spend time looking at how to do this well.

Teachers want to know more too. Since we launched the Teaching and Learning Toolkit, the strand on metacognition and self-regulation has consistently ranked as one of our most popular and has been accessed over 120,000 times.

This is why we’ve produced this report. It offers seven practical, evidence-based recommendations to support teachers to develop metacognitive knowledge and skills in their pupils. The guidance is relevant to early years practitioners, teachers, and senior leaders in primary and secondary schools, as well as those in post-16 settings.

To develop the recommendations, we reviewed the best available international research and consulted experts, teachers, and academics to arrive at key principles for effective teaching. Each recommendation is accompanied by specific examples designed to bring the work alive for teachers.

We hope this report brings some clarity and guidance to an area of teaching and learning that holds so much promise but that can be difficult to implement. The EEF and its partners, particularly our network of Research Schools, will be producing a range of supporting resources, tools, and training to help you implement the recommendations in your classrooms.

A handwritten signature in black ink, appearing to read 'K Collins', with a long horizontal stroke underneath.

Sir Kevan Collins

Chief Executive
Education Endowment Foundation

What does this guidance cover?

This guidance report is relevant to the teaching of all students, within any subject area. Most of the examples included are from Key Stages 1 to 4, where the research is strongest. It introduces a simplified framework for self-regulated learning and metacognition.

In due course, we will publish a more detailed research review exploring the subject in more depth; this is an area of academic discussion that may be of interest to some teachers. Here, however, we have simplified the frameworks to allow for ease of understanding and use in real-world settings—we focus on what the evidence says about what teachers can do to develop these skills. Often the research evidence is generic and hard to interpret; by giving specific examples we have tried to bring the work alive for teachers (but this means they are less directly supported by strong evidence).

This guidance draws on a review of the evidence about self-regulated learning and metacognition led by Professor Daniel Muijs and Dr Christian Bokhove (University of Southampton). It is not a new study in itself, but rather is intended as an accessible overview of existing research with clear, actionable guidance. More information about the review and the process is at the end of the report. Some key references are included here; for those wishing to explore the subject in more depth, the forthcoming review will contain a more comprehensive reference section.

Who is this guidance for?

This guidance is applicable to both primary and secondary schools, and some recommendations may be relevant for early years education (you may want to

review our Early Years Toolkit, specifically the strand on *self-regulation strategies*, for further guidance).¹ It is aimed primarily at senior leaders and teachers responsible for staff development. It may also be useful for class teachers with an interest in how research can improve their teaching. Further audiences who may find the guidance relevant include governors, parents, programme developers, and educational researchers.

Acting on the guidance

Additional EEF resources to support the implementation of the recommendations made in this report are in the process of development. As well as these resources, our other guidance reports can support the implementation of specific recommendations. The subject-specific reports, such as those on literacy, maths, and science, can be used in conjunction with this report to support pupils' attainment in these subjects. The more general guidance, such as *Putting Evidence to Work—A School's Guide to Implementation*, can also support teachers and senior staff to apply the recommendations in a school.²

You may also want to seek support from our national network of Research Schools, a collaboration between the EEF and the Institute for Effective Education. Research Schools aim to lead the way in the use of evidence-based teaching, building affiliations with large numbers of schools in their region, and supporting the use of evidence at scale.

“Often the research evidence is generic and hard to interpret; by giving specific examples we have tried to bring the work alive for teachers.”

SUMMARY OF RECOMMENDATIONS

Sections are colour coded for ease of reference

Find this info on:

1

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



- Self-regulated learners are aware of their strengths and weaknesses, and can motivate themselves to engage in, and improve, their learning.
- 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.
- Teachers should support pupils to **plan, monitor**, and **evaluate** their learning.

Page 12

2

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



- Explicit instruction in cognitive and metacognitive strategies can improve pupils' learning.
- While concepts like 'plan, monitor, evaluate' can be introduced generically, the strategies are mostly applied in relation to specific content and tasks, and are therefore best taught this way.
- A series of steps—beginning with **activating prior knowledge** and leading to **independent practice** before ending in **structured reflection**—can be applied to different subjects, ages and contents.

Page 14

3

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



- Modelling by the teacher is a cornerstone of effective teaching; revealing the thought processes of an expert learner helps to develop pupils' metacognitive skills.
- Teachers should verbalise their metacognitive thinking (*'What do I know about problems like this? What ways of solving them have I used before?'*) as they approach and work through a task.
- Scaffolded tasks, like worked examples, allow pupils to develop their metacognitive and cognitive skills without placing too many demands on their mental resources.

Page 18

4

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



- Challenge is crucial to allow pupils to develop and progress their knowledge of tasks, strategies, and of themselves as learners.
- However, challenge needs to be at an appropriate level.
- Pupils must have the motivation to accept the challenge.
- Tasks should not overload pupils' cognitive processes, particularly when they are expected to apply new strategies.

Page 20

5

Promote and develop metacognitive talk in the classroom



- As well as explicit instruction and modelling, classroom dialogue can be used to develop metacognitive skills.
- Pupil-to-pupil and pupil-teacher talk can help to build knowledge and understanding of cognitive and metacognitive strategies.
- However, dialogue needs to be purposeful, with teachers guiding and supporting the conversation to ensure it is challenging and builds on prior subject knowledge.

Page 22

6

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



- Teachers should explicitly support pupils to develop independent learning skills.
- Carefully designed **guided practice**, with support gradually withdrawn as the pupil becomes proficient, can allow pupils to develop skills and strategies before applying them in **independent practice**.
- Pupils will need timely, effective feedback and strategies to be able to judge accurately how effectively they are learning.
- Teachers should also support pupils' motivation to undertake the learning tasks.

Page 24

7

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



- Develop teachers' knowledge and understanding through high quality professional development and resources.
- Senior leaders should provide teachers with time and support to make sure approaches are implemented consistently.
- Teachers can use tools such as 'traces' and observation to assess pupils' use of self-regulated learning skills.
- Metacognition shouldn't be an 'extra' task for teachers to do but should be built into their teaching activities.

Page 28

WHAT ARE METACOGNITION AND SELF-REGULATED LEARNING?

Freya fiddled with her pencil case. Every Friday, she would experience a quiet dread when facing the weekly spelling test. This week, though, she felt more confident than before. After a couple of weeks characterised by annoying mistakes, she had worked hard in readiness for this week's test. She had devised two of her own mnemonics and she had practised her 'le' ending words, as well as 'surprise' with an 'r', repeatedly.

As Mr Thomas began the spelling test, Freya listened hard. She knew that sometimes she would feel a little pressure when her teacher moved quickly onto the next spelling, but that this week she would listen carefully and remember what she had practised.

One or two words were no doubt tricky, but Freya had weighed up her options each time and she was utterly confident of her success. Before Mr Thomas had a chance to cycle through the correct spellings, Freya sat up straight, with a smile lighting up her face, fuelled by quiet satisfaction. She had already thought about her new spelling routine and how she would stick to it next week too.

This spelling test anecdote is a familiar scene that is played out in classrooms across the country. The

“Self-regulation is about the extent to which learners like Freya are aware of their strengths and weaknesses and the strategies they use to learn.”

actions and thoughts of Freya as she is learning her spelling, inside and outside of the classroom, is simply the typical stuff of everyday learning and school. And yet, despite much of her thinking and strategies remaining hidden and implicit in the classroom, her success is instructive. Freya exhibits the thoughts and actions of a successful self-regulated learner and she deploys crucial metacognitive strategies.

Why does this matter? Well, there is a strong body of research

from psychology and education demonstrating the importance of metacognition and self-regulation to effective pupil learning. The Sutton Trust-EEF Teaching and Learning Toolkit—which summarises international evidence—rates ‘metacognition and self-regulation’ as a high impact, low cost approach to improving the attainment of disadvantaged learners.³

But what is it? Essentially, self-regulation is about the extent to which learners like Freya are aware of their strengths and weaknesses and the strategies they use to learn. It describes how they can motivate themselves to engage in learning and develop strategies to enhance their learning and to improve. It will look different for learners of different ages, and for different tasks, but teachers will recognise these characteristics in their most effective learners.

What does a self-regulated learner look like?

Zimmerman gives a helpful description of what a successful self-regulated learner looks like:⁴

‘These learners are proactive in their efforts to learn because they are aware of their strengths and limitations and because they are guided by personally set goals and task-related strategies, such as using an arithmetic addition strategy to check the accuracy of solutions to subtraction problems. These learners monitor their behavior in terms of their goals and self-reflect on their increasing effectiveness. This enhances their self-satisfaction and motivation to continue to improve their methods of learning.’

Self-regulated learning can be broken into three essential components that teachers need to know about to help their pupils to develop into successful learners:

- **Cognition** is the mental process involved in knowing, understanding, and learning. By *cognitive strategies*, we mean skills like memorisation techniques or subject-specific strategies like making different marks with a brush or using different methods to solve equations in maths. This is the bread and butter of good teaching; cognitive strategies are fundamental to acquiring knowledge and completing learning tasks.
- **Metacognition** is about the ways learners monitor and purposefully direct their learning. For example, having decided that a particular cognitive strategy for memorisation is likely to be successful, a pupil then monitors whether it has indeed been successful and then deliberately changes (or not) their memorisation method based on that evidence. By *metacognitive strategies*, we mean the strategies we use to monitor or control our cognition, such as checking that our memorisation technique was accurate or selecting the most appropriate cognitive strategy for the task we are undertaking.

- **Motivation** is about our willingness to engage our metacognitive and cognitive skills and apply them to learning. *Motivational strategies* will include convincing oneself to undertake a tricky revision task now—affecting our current well-being—as a way of improving our future well-being in the test tomorrow.

Cognition, metacognition, and motivation all interact in complex ways during the learning process. For Freya, she deployed *cognitive strategies*, like using mnemonics and doing some self-testing practice at home. She used *metacognitive strategies* to plan her spelling practice, recognising why using a mnemonic was the right tool for the job, while monitoring her own difficulties with time pressures during the test. Finally, Freya mustered the *motivational strategies* to engage in repeated practice and to persevere during a pressured challenge.

“It is impossible to be metacognitive without having different cognitive strategies to hand.”

Metacognition is the focus of this guidance report, but that does not mean cognition and motivation are any less important. In fact, it is impossible to be metacognitive without having different cognitive strategies to hand and possessing the motivation and perseverance to tackle problems and apply these strategies.



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

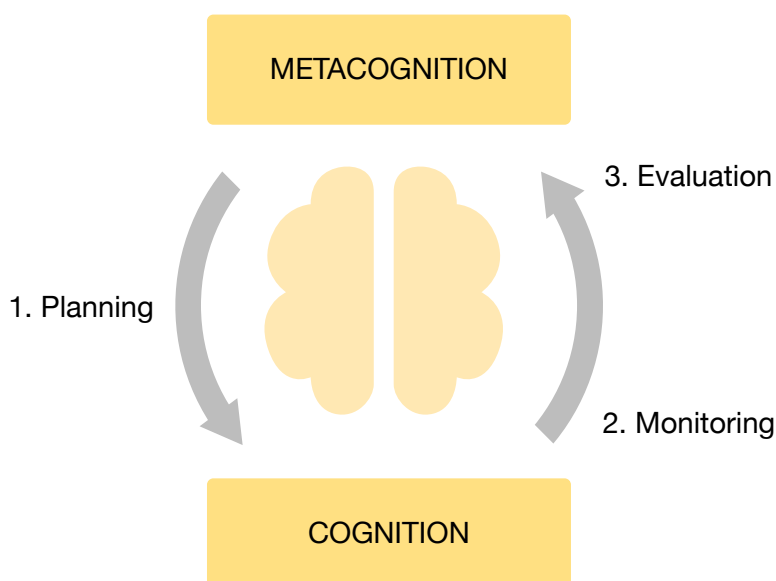


Self-regulated learners are aware of their strengths and weaknesses, and can motivate themselves to engage in, and improve, their learning. At the heart of this is metacognition. This term is increasingly well known in schools, but beyond a simple definition of 'thinking about thinking', teachers can quickly run out of classroom examples to describe it accurately. Understanding what we mean is the first step in helping teachers to improve pupils' metacognition.

We approach any learning task or opportunity with some metacognitive knowledge about:

- our own abilities and attitudes (*knowledge of ourselves as a learner*);
- what strategies are effective and available (*knowledge of strategies*); and
- this particular type of activity (*knowledge of the task*).

When undertaking a learning task, we start with this knowledge, then apply and adapt it. This is metacognitive regulation. It is about **planning** how to undertake a task, working on it while **monitoring** the strategy to check progress, then **evaluating** the overall success. The diagram opposite represents the metacognitive regulation cycle.



This is not a one-off process of discrete steps, but an ongoing cycle. As you progress through the task applying your metacognitive and cognitive skills, you update your *metacognitive knowledge* (of yourself, strategies, and tasks), as well as updating your subject knowledge and skills.

The **cycle of plan, monitor, evaluate** and the different aspects of metacognitive knowledge (**learner, strategies, task**) are recurrent themes throughout this guidance. Teachers should consider these when setting learning tasks and supporting pupils to complete them. In an expert learner, these processes are unconscious and automatic. In novice learners, however, it can be valuable to make them explicit.

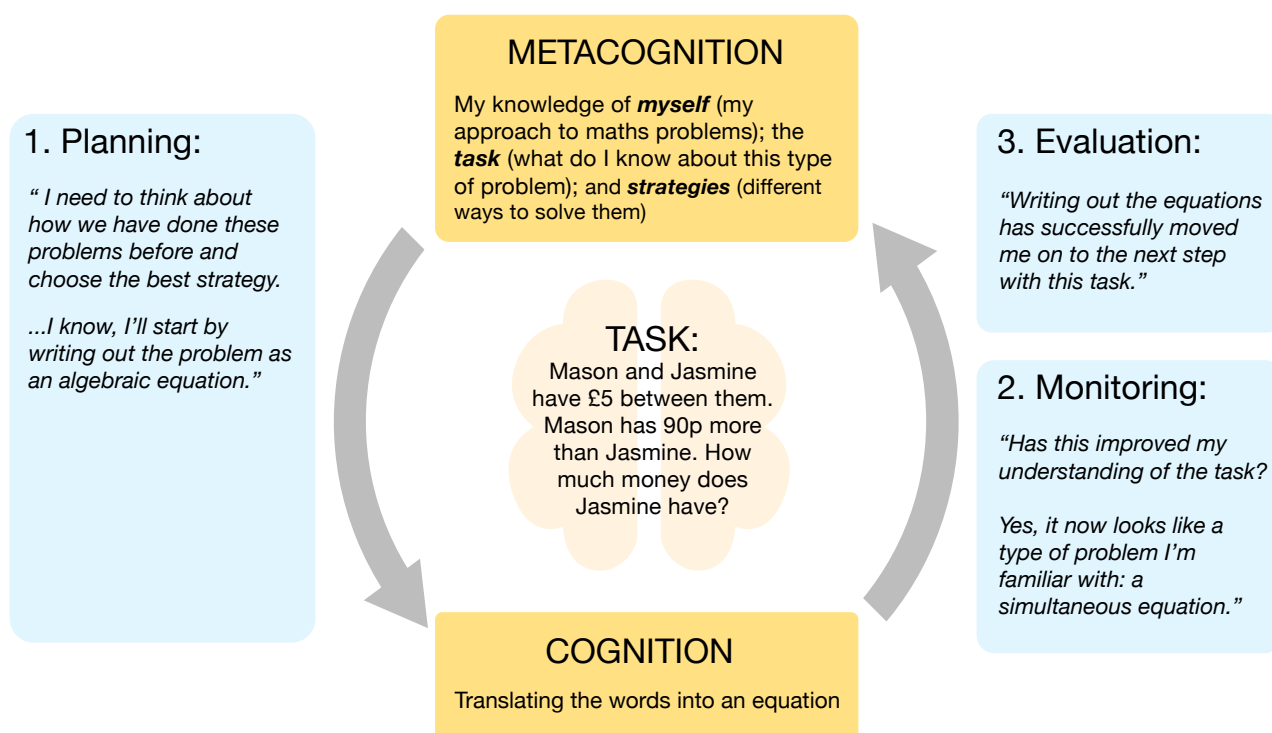
Misconception 1: Metacognition is only developed in older pupils.

A common misconception is that metacognition is only developed effectively in mature young adults and not young children. We know from research, however, that children as young as three have been able to engage in a wide range of metacognitive and self-regulatory behaviours, such as setting themselves goals and checking their understanding.⁶ They also show greater accuracy on tasks they have chosen to accept than on tasks they would have preferred to opt out of.⁷

There is clear evidence that the level of security and self-knowledge remains rather inaccurate until about eight years of age, with children being over-optimistic about their levels of knowledge.⁸ However, although older children typically exhibit a broader repertoire of metacognitive strategies, the evidence suggests that younger children do typically develop metacognitive knowledge, even at a very early age.



To use an example to make the cycle more concrete, imagine a learner, John, is set a maths question to answer:



In this example, John starts with some knowledge of the *task* (word problems in maths are often solved by expressing them as equations) and of *strategies* (how to turn sentences into an equation). His knowledge of the task then develops as it emerges from being a word problem into a simultaneous equation. He would then continue through this cycle if he has the *strategies* for solving simultaneous equations. He could then *evaluate* his overall success by substituting his answers into the word problem and checking they are correct. If this was wrong, he could attempt other strategies and once more update his metacognitive knowledge.

Most learners will go through many of these thinking processes to some extent when trying to solve a problem or tackle a task in the classroom. The most effective learners will have developed a repertoire of different cognitive and metacognitive strategies and be able to effectively use and apply these in a timely fashion. They will self-regulate and find ways to motivate themselves when they get stuck. Over time, this can further increase their motivation as they

become more confident in undertaking new tasks and challenges.

As with other aspects of knowledge and skills, pupils will develop differently. The extent to which skills are acquired is in part dependent on the opportunities pupils receive to develop them outside of school and in the home, which is likely (though not necessarily) to be correlated with social background.

Metacognition is part of the fabric of successful learning, but it can prove both complex and subtle. It is ever-present in the classroom, but unless teachers have a strong understanding of the metacognitive demands of the topics they are teaching, they may miss opportunities to develop pupils’ knowledge and skills. Various studies have shown that self-regulated learning—and in particular metacognition—has a significant impact on pupils’ academic performance, beyond that predicted by prior achievement.⁵ This recommendation introduces the key concepts teachers should be aware of; the rest of the guidance focuses on how teachers can improve pupils’ learning by integrating these concepts into their teaching.

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



Amy's geography teacher has asked the class to prepare a short presentation about rainforest ecosystems. To plan this, Amy reflects on how she learned best on the last topic—using the school textbooks—and decides to read the relevant chapter before drafting her presentation points. However, when reading it she decides that the chapter does not really improve her understanding. She starts to panic as she was relying on this.

Then Amy remembers a geography website her teacher mentioned. She adapts her strategy and searches the website. This provides a more useful overview and she uses the information to summarise some interesting facts. She reflects on the experience and decides that next time she will gather a range of resources before starting to research a topic rather than relying on one source.

While all children like Amy develop metacognition to some extent—and this will continue to develop further as they mature—the extent to which this happens differs significantly between learners; most will not spontaneously develop all the strategies they need or would find useful and therefore require explicit instruction in key metacognitive strategies. There is some evidence to suggest that disadvantaged pupils are less likely to use such strategies and are, therefore, most likely to benefit from the whole range of approaches to supporting metacognitive and self-regulatory skills, including explicit teaching.^{9,10}

'Explicit instruction' does not denote simply 'telling' but describes all the activities that a teacher orchestrates to effect learning in their pupils. It is not to be confused with a lecturing approach but combines explicit teacher input with interactive questioning and feedback. It is important to provide explicit instruction in metacognitive regulation strategies, in particular:¹¹

- **planning**—encouraging pupils to think about the goal of their learning (set by the teacher, or themselves) and to consider how they will approach the task; this includes ensuring they understand the goal, activate relevant prior knowledge about the task, select appropriate strategies, and consider how to allocate their effort;
- **monitoring**—emphasising the need, while undertaking the learning task, for pupils to assess the progress they are making; this includes the self-testing and self-questioning activities that are necessary to control learning, and making changes to their chosen strategies; and

- **evaluating**—appraising the effectiveness of their plan and its implementation.

This framework can seem clunky and only relevant to discrete, demanding tasks for older learners. In fact, the underlying skills are relevant to most learning choices a pupil makes. During a lesson, a pupil must decide how much effort to put into listening to the teacher's explanation of a new topic (planning); while listening, they can consider whether they are understanding the teacher (monitoring) and what to do if they don't (planning a good question to ask and evaluating if they now have understood the explanation successfully and are ready to move on).

Teachers can explicitly teach these skills by prompting pupils with examples of the things they should be considering at each stage of a learning task. For example, a common activity in art is to draw or paint a self-portrait. Effective teacher questioning while modelling a self-portrait can aid the development of metacognitive reflection:

Planning:

'What resources do I need to carry out a self-portrait?'

'Have I done a self-portrait before and was it successful?'

'What have I learned from the examples we looked at earlier?'

'Where do I start and what viewpoint will I use?'

'Do I need a line guide to keep my features in proportion?'

Case study: Using self-regulation to improve writing

An EEF-funded project aimed to use memorable experiences and an approach called ‘**Self-Regulated Strategy Development**’ (SRSD)¹² to help struggling writers in Years 6 and 7. SRSD provides a clear structure to help pupils plan, monitor and evaluate their writing. It aims to encourage pupils to take ownership of their work and can be used to teach most genres of writing, including narrative writing.

Led by the Calderdale Excellence Project, this project had a focus on pupils using cognitive strategies like the mnemonic IPEELL—**I**ntroductory paragraph, **P**oints, **E**xamples and **e**laboration, **E**nd, **L**inks (such as connectives and openers), and **L**anguage (for example, ‘wow’ words, genre specific vocabulary, punctuation, and self-scoring). The approach explicitly teaches the writing process while encouraging pupils to take ownership of their progress with monitoring and evaluation strategies.

Overall, the project appeared to have a large positive impact on writing outcomes in the independently evaluated efficacy trial. The overall effect size for writing—comparing the progress of pupils in the project to similar pupils who did not participate—was +0.74 standard deviations, or an estimated nine months’ additional progress.¹³

Monitoring:

‘Am I doing well?’

‘Do I need any different techniques to improve my self-portrait?’

‘Are all of my facial features in proportion?’

‘Am I finding this challenging?’

‘Is there anything I need to stop and change to improve my self-portrait?’

Evaluation:

‘How did I do?’

‘Did my line guide strategy work?’

‘Was it the right viewpoint to choose?’

‘How would I do a better self-portrait next time?’

‘Are there other perspectives, viewpoints or techniques I would like to try?’

You can see—through this worked example of a teacher posing metacognitive questions—that some questions for **planning** aim to activate prior knowledge (resources, previous exemplars) whereas other questions model deploying the right cognitive strategies (viewpoint, line guides). The **monitoring** questions emphasise both general progress (proportion, editing) alongside checking general motivation (meeting goals and dealing with challenge). Finally, the **evaluation** questions concentrate upon the success of the cognitive strategies (line guide, viewpoint, comparison with other techniques) and on what can be taken forward from the learning.

As discussed, these prompts must accompany instruction in the relevant specific cognitive strategies. In this example, pupils will only be able to consider these questions and approaches if they understand the importance of perspective and the different techniques. The next section gives an example of applying it with a particular strategy.

“Some questions for planning aim to activate prior knowledge, whereas other questions model deploying the right cognitive strategies...”

How should teachers teach metacognitive strategies?

While there may be some benefit to introducing pupils to the general importance of planning, monitoring, and evaluating, the particular strategies are often quite subject- or task-specific, and the evidence suggests that they are best taught through subject content.

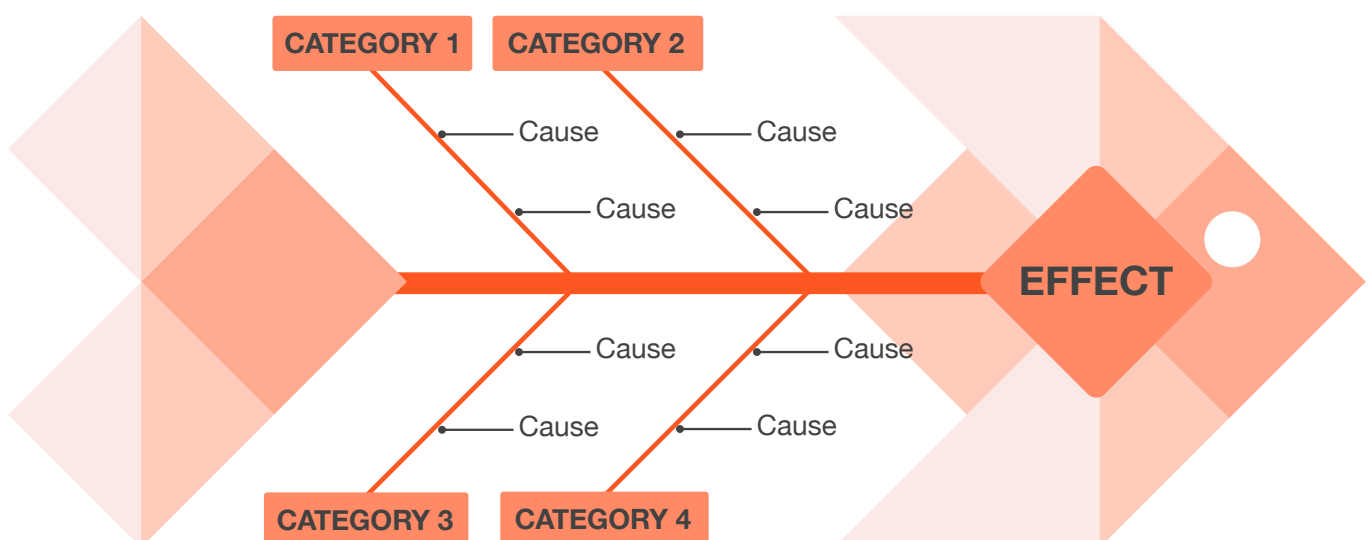
The following seven-step model for explicitly teaching metacognitive strategies can be applied to learning different subject content at different phases and ages. It involves:

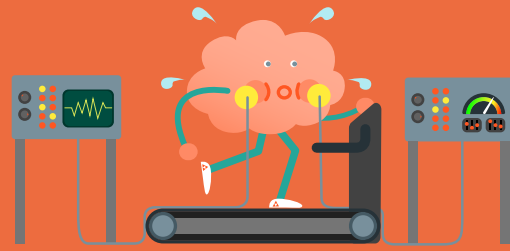
1. **Activating prior knowledge;**
2. **Explicit strategy instruction;**
3. **Modelling of learned strategy;**
4. **Memorisation of strategy;**
5. **Guided practice;**
6. **Independent practice; and**
7. **Structured reflection.**

Let's consider a worked example of the seven-step model. Graphic organisers can function successfully in many different ways, such as an effective note-taking strategy in science¹⁴ or as a planning tool in history. In a Year 9 history lesson, pupils are exploring the causes of World War One. To cohere the complex subject knowledge into a planning tool that organises their ideas, the teacher introduces a *fishbone diagram* (a commonly used graphic organiser):

1. **Activating prior knowledge.** The teacher discusses with pupils the different causes that led to World War One while making notes on the whiteboard.
2. **Explicit strategy instruction.** The teacher then explains how the fishbone diagram will help organise their ideas, with the emphasis on the cognitive strategy of using a 'cause and effect model' in history that will help them to organise and plan a better written response.
3. **Modelling of learned strategy.** The teacher uses the initial notes on the causes of the war to model one part of the fishbone diagram.
4. **Memorisation of learned strategy.** The teacher tests if pupils have understood and memorised the key aspects of the fishbone strategy, and its main purpose, through questions and discussion.
5. **Guided practice.** The teacher models one further fishbone cause with the whole group, with pupils verbally contributing their ideas.
6. **Independent practice.** Pupils complete their own fishbone diagram analysis.
7. **Structured reflection.** The teacher encourages pupils to reflect on how appropriate the model was, how successfully they applied it, and how they might use it in the future.

This approach allows the teacher to develop solid knowledge and understanding which then forms the basis of increasingly independent practice as the teacher changes their guidance and gradually withdraws the scaffolding.





Misconception 2: Metacognition is a general skill that can be separated from subject knowledge

This is perhaps the most common misconception about metacognition. The clue is in the word: without cognition, there is no metacognition.

Contrary to the misconception, metacognition is specific to the task being undertaken and stronger where learners have a thorough grounding in subject knowledge. It is, for example, very hard to have knowledge about how one can learn in a subject without solid subject knowledge. For example, Willingham and Lovette note that teaching pupils reading comprehension strategies—metacognitive strategies for improving reading for meaning—can give pupils the edge, but that the effects of this strategy are limited if the pupil lacks the required background knowledge of the reading material.¹⁵

While some of the metacognitive strategies in this guidance can be described generically, they can only be improved through practice—and this means applying them to specific tasks. Other EEF guidance reports, such as those on literacy and mathematics, provide more detailed subject-specific guidance for teachers.¹⁶



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



A tailor will teach an apprentice by allowing them to work alongside them watching their movements and techniques closely, modelling their craft. Teachers in all subjects do the same – reveal their expert subject knowledge and skill to their novice learners.

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.

Teacher modelling

Teachers can model their thinking as they approach a task to reveal the reflections of an effective learner. In Recommendation 2, we gave the example of a teacher posing questions about how to plan, monitor, and evaluate while approaching a self-portrait task—an example of teachers making such strategies explicit. Similarly, teachers can outline their thinking about their knowledge; for example, while teaching young pupils how to perform a forward roll safely in PE, a teacher might talk through her actions as she demonstrates:

these are very young children, they may not even know what a forward roll is supposed to look like, so the teacher might perform one without talking it through first). It is also more effective when pupils are engaged in the task being modelled and have the opportunity to practise it immediately after the demonstration.

Modelling of this type is rarely planned by teachers as these processes or skills come ‘naturally’ to them, but that risks these important prompts remaining implicit, which is particularly ineffective for novice pupils. To move from novice to expert, our pupils need to know how an expert athlete, artist, historian, or scientist habitually thinks and acts. We need to make these largely implicit processes explicit to our novice learners.

There is some evidence, at least in terms of metacognition, that such scaffolding should not be too specific as this may inhibit reflection. Some **‘deliberate difficulty’**¹⁷ is required so that pupils have gaps where they have to think for themselves and monitor their learning with increasing independence. Reinforcing the value of the processes modelled by engaging the pupils in reflecting on how successful they were at the end of the activity, or lesson, is also important.

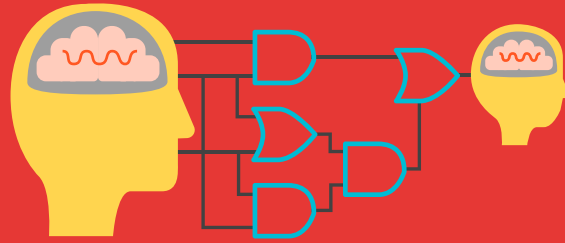
Removing the scaffolding

Ultimately, the purpose of modelling is to help novice pupils become more capable of learning independently and thinking metacognitively. The modelling process involves teachers making gradual changes in support. Initially, scaffolding such as direct modelling and support from the teacher, is necessary, but as guided practice moves to independent practice, teacher input will change to monitoring and intervening only when necessary. Practice and independent work help to develop cognitive and metacognitive knowledge. Over time, such thinking becomes habitual – acting as ‘internal scaffolding’ that will support future learning.

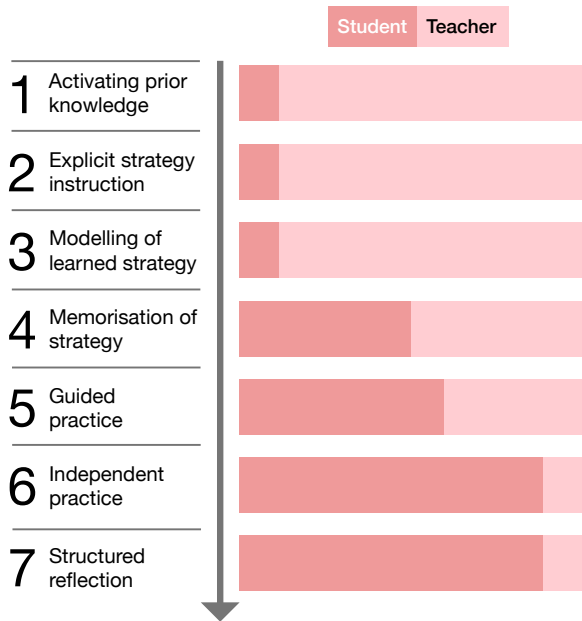
“The most effective teachers—like a master craftsman working with his novice apprentice—are aware of their expertise and of how to reveal their skills to learners.”

‘I don’t want to hurt my neck and want to do this neatly. So first, to protect my neck, I need to tuck my chin to chest like this. Then when I start to roll, I remember not to roll onto my head. Instead, look how I’m going to roll onto my back and shoulders. This also means my back is round, so I can smoothly roll like this. Now, who can remember what I did first to protect my neck?’

Such modelling is only effective if the pupils have access to relevant knowledge (in this example, if



To illustrate this, it is helpful to look again at the seven-step model for teaching metacognitive strategies:¹⁸



So, just as a PE teacher might begin by modelling a forward roll, in a maths lesson, a model worked example¹⁹ of a given task or problem can be used. For example, a teacher first shares a completed worked example of adding fractions before looking more closely at the steps involved in working out the solution. After the step-by-step modelling, the teacher gradually removes the scaffold, getting pupils to undertake a partially completed equation.

“It may be that metacognitive reflection needs to follow the completion of the task for novice pupils, and not occur concurrently.”

Teachers should be aware that some pupils may find it hard to articulate their thoughts while doing a task, and doing so may interfere with their ability to complete the task successfully. It may be that metacognitive reflection needs to follow the completion of the task for novice pupils, and not occur concurrently, as task completion may demand all of a pupil’s mental resources.

Misconception 3: Metacognition represents ‘higher order’ thinking and is therefore more important than mere cognition or subject knowledge

We know that metacognition is the knowledge of cognition and the strategies to regulate and control it. However, it would be a mistake to see metacognition as somehow ‘higher order’, hierarchically, over cognitive activities such as remembering knowledge (Bloom’s taxonomy is sometimes misinterpreted as being a hierarchy that privileges ‘evaluation’ over ‘knowledge’). As has been pointed out, it is very hard to have metacognitive knowledge about how competent you are in a given subject domain, or how best you can learn, without sound subject knowledge.²⁰

For example, a student can use metacognitive planning strategies when drafting a GCSE essay about Shakespeare. But without an understanding of Shakespeare’s plays, language, and the relevant social context, the essay will not be successful. We cannot adequately deploy metacognitive strategies for monitoring and evaluating our essay-writing if we do not first understand the components of a successful essay and have a knowledge of Shakespeare’s world.

Metacognition and cognition display a complex interplay as pupils learn. We should look to develop both concurrently and not create false hierarchies where they do not exist.

4

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



Challenge is key to developing self-regulation and metacognition: if learners are not challenged, they will not develop new and useful strategies; nor will they reflect deeply on the content they are engaging with, or on their learning strategies, or stretch their understanding of themselves. Put simply, and somewhat paradoxically, if pupils have to undertake a task that makes them struggle (remember 'deliberate difficulties'), they are more likely (in the future) to recall information from such tasks from their long-term memory.²¹

A successful pupil will regularly engage in metacognitive reflection, asking questions of themselves as they learn and take on challenging tasks, such as:

Knowledge of task:

- Is this task too challenging for me?
- What are the most difficult aspects of this task?
- How much time should I devote to this task?
- Are there easy bits I can get 'done'?

Knowledge of self:

- Is this task asking for subject knowledge I can remember?
- Do I understand the concept(s) that underpins this task?
- Am I motivated to stick at this tricky task?
- What can I do to keep myself focused?

Knowledge of strategies:

- Are my notes effective for understanding this task?
- Do I need to ask the teacher for help?
- What strategies can I deploy if I am stuck?
- What can I do to ensure I remember what I've learned?

A successful metacognitive learner will ask such questions, either consciously or as an unconscious process, and typically exhibit an awareness of the degree of challenge in what they are learning. However, challenge needs to be set at an appropriate level, otherwise one or both of the following may occur:

- the learner will not accept the challenge; or
- the learner will suffer cognitive overload.

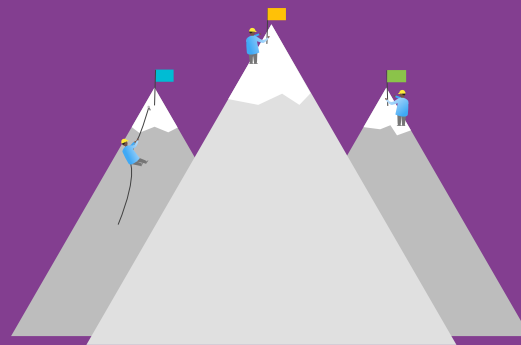
Accepted challenge and motivation

As we know, motivation is one of the essential components of self-regulated learning. Pupils, and even animals, opt out of difficult trials; they avoid tests they are unlikely to answer correctly.²² Where learners are being challenged it is important to ensure they feel emotionally supported as well as being motivated to persevere. Metacognition, then, is of special importance when pupils make decisions about how to study and how to maintain effort and motivation until the task is complete.²³

Take homework, for example—an ever-present challenge to pupils, teachers, and parents alike. It is paramount to pitch homework at the right level of challenge, especially as the control and monitoring offered by the teacher in the classroom is absent. Metacognitive strategies are required to preserve self-motivation in this undertaking.

First, pupils will make a judgement on how challenging the homework is to them. If a given homework is clearly difficult, then a pupil will need **self-efficacy**²⁴—or self-confidence in their ability to complete a given task—which is shown to predict the deployment of metacognitive strategies. In motivating pupils to persevere at challenging tasks, it is important to reward effort rather than absolute levels of achievement; to give feedback about personal progress, and to avoid social comparison.

One obvious factor that has been found to relate to more effective use of metacognitive strategies, and sticking to tasks like homework, is the ability to delay gratification. Pupils who are better able to delay



gratification in favour of studying, or undertaking homework, are also better at planning and regulating their learning, and vice versa.²⁵

In Walter Mischel's famous '**marshmallow test**', young children were given the challenge of delaying their gratification by being offered the choice of one small reward—the marshmallow—or wait for 15 minutes to gain a larger reward of two marshmallows.²⁶ In this experiment, the children deployed a range of metacognitive strategies such as not looking at the marshmallow, or closing their eyes and thinking of something completely different. It is such strategies that teachers can support children to deploy in a range of contexts, such as the aforementioned homework example.

Helping pupils reduce cognitive overload

What is an appropriate level of challenge? This question requires expert knowledge both of a given subject, and of pupils in the classroom. '**Cognitive load theory**,²⁷ developed by John Sweller out of the study of problem solving, offers a handy model to understand the '*Goldilocks degree of challenge*': not too hard, not too easy, but just right.

Put simply, 'cognitive load' is the amount of information our working memory can hold at any one time. The **working memory** is where we process information and is key to learning. The capacity of the working memory is limited. We can, however, support pupils to maximise their working memory with a range of apt metacognitive strategies. For example, we can rehearse the components of a complex task (such as the worked examples already mentioned) so that it becomes automated, thus freeing up working memory capacity. Or we

might suggest creating stories from information to be remembered,²⁸ or grouping information into more memorable categories or more accessible '**chunks**'.²⁹

Understanding cognitive load in relation to self-regulation and metacognition has a number of consequences. First, where we can draw on existing knowledge from the long-term memory, we increase capacity; this is one reason why knowledge matters and why learners need to be taught to first try and activate prior knowledge. Second, we need to make sure that learning activities don't overburden working memory; we need to teach strategies to cope with demanding tasks—for example, using diagrams, notes, and other external aids, talking through the problem out loud, or breaking the task down into simpler steps.

In terms of developing self-regulated learning and metacognition, this means we need to make sure that we don't give too much information at the same time (when delivering explicit instruction), and do not expect the learner to take on too much challenge when doing guided practice and independent work. The use of **structured planning templates, teacher modelling, worked examples, and breaking down activities into steps** can help achieve this.

It also means that any metacognitive teaching tasks—like asking pupils to reflect on their learning—should be carefully placed so as not to distract from the learning at hand. Teachers shouldn't expect pupils to develop new cognitive and metacognitive skills at the same time.

“ ‘Cognitive load’ theory offers a handy model to understand the ‘Goldilocks degree of challenge’: not too hard, not too easy, but just right.”

5 Promote and develop metacognitive talk in the classroom.



Metacognitive talk in a Year 4 science lesson³⁰

Year 4 pupils had been constructing branching keys which used yes/no questions to identify animals (see example below). However, the pupils had found this harder to do than expected, so the teacher devoted part of the next science lesson to talking about this work.

Ms Marshall: *How confident do you feel about making keys? Lots of us found this hard to do last time, let's try to work out what was tricky about making keys.*

Calvin: *The questions.*

Ms Marshall: *What was tricky about the questions?*

Calvin: *Making new ones.*

Amelie: *Thinking of a different question each time.*

Abdul: *And it had to be a yes/no question.*

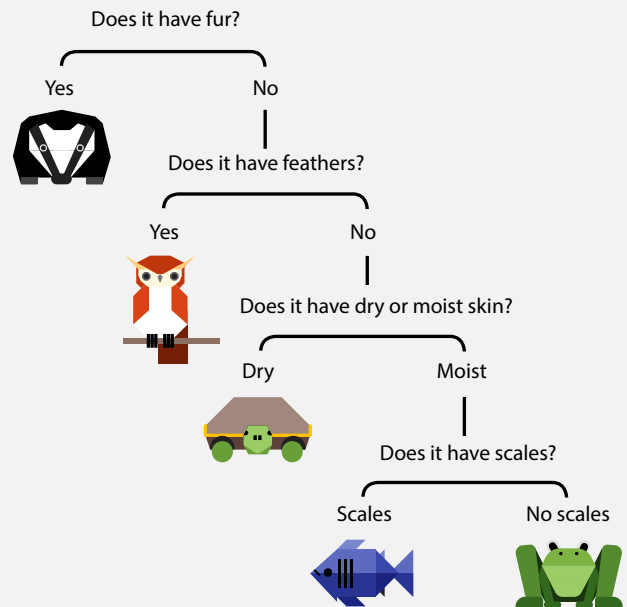
Janiyah: *And the answer might change.*

Ms Marshall: *How might the answer change?*

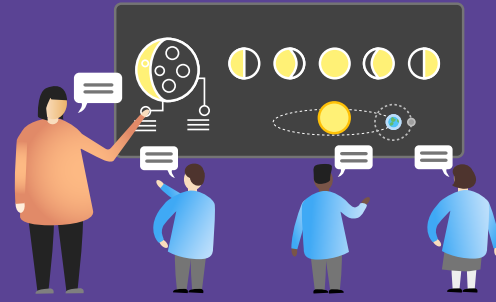
Janiyah: *Because it depends, sometimes the animal might live in the water, sometimes they might go on land.*

Elliott: *And you can't ask someone about their favourite, because everyone has a different favourite.*

Ms Marshall: *Oh yes, so we only want the questions to have one answer, and it has to be a yes or a no. Perhaps we need to make a list of questions to help us get started. Questions which will divide the animals in half each time...*



After creating a class list of questions, the teacher asked the children to consider how confident they felt and then used this to create mixed groups of three. They worked in these groups to create branching keys with post-it notes, pausing for a mini-plenary where pupils walked around to look at others' work. The pupils discussed the features of the questions and keys which worked well, then returned to their own keys to improve them.



Teachers asking challenging questions—guiding pupils with oral feedback, prompting dialogue, and scaffolding productive ‘exploratory’ talk where appropriate—is an ideal way to share and develop effective learning.³¹

The teacher in the opening example helps pupils to understand how to construct a branching key—the cognitive strategies needed. She also encourages them to discuss what they found hard, and to think in advance about what could go wrong. All the time, she is guiding and probing thinking, getting pupils to listen actively and respond. It is the stuff of great teaching, but too often, if we do not name the strategies, such expert development of metacognitive talk can remain implicit and hidden.

Interactions with others are one way to test one’s own metacognitive strategies and knowledge, so both peers and teachers have a role to play here. As you can see from the example above, classroom talk can build knowledge and understanding. In this example, the pupils share both their awareness of strategies (knowledge of strategies) and of how hard they have found the task in the past (knowledge of tasks).

A number of classroom interventions that aim to develop the quality of classroom talk can also be effective ways of improving and practising learners’ metacognitive skills. As devised by Robin Alexander, ‘**Dialogic teaching**’,³² for example, emphasises classroom dialogue through which pupils learn to reason, discuss, argue, and explain. A key element of the dialogic approach is to encourage a higher quality of teacher talk by going beyond the closed ‘teacher question–pupil response–teacher feedback’ sequence. Importantly, in this and other successful interventions, dialogue needs to be purposeful and not just conversation, with teachers using questions to elicit further thought.

Types of classroom talk

Professor Robin Alexander’s most recent account of dialogic teaching identifies six basic talk repertoires for effective teaching and learning (talk settings, everyday talk, learning talk, teaching talk, questioning, and extending). Use of the repertoires is guided by five principles or criteria that highlight what is essential to make talk engaging and cognitively productive. For example, talk should be cumulative and purposeful.³³

The most relevant repertoires for developing metacognitive skills are **learning talk** and **teaching talk**. Learning talk includes narrating, questioning, and discussing; teaching talk includes instruction, exposition, and dialogue.

Alexander observes that all ‘have their place’,³⁴ but that **discussion** and **dialogue** are both the most potent and the least common and therefore need to be given much greater prominence because they are most likely to open up the ‘learning talk’ and move it beyond the mere giving of closed answers.

Common teaching strategies to better organise and structure classroom talk and dialogue include ‘**Socratic talk**’, ‘**talk partners**’, and ‘**debating**’ (each strategy having its own clear parameters and rules for responsible dialogue). Such strategies—provided they are sufficiently challenging, build on firm pupil subject knowledge, are realistic, and suitably guided and supported by the teacher—can help develop self-regulation and metacognition. We should take care, however, not to focus on dialogue simply as an end in itself without it being wedded to these necessary conditions.

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



Nathan knew that to revise properly he would need a technology ‘black out’. With a little help from his father, Nathan made his bedroom more like an office than a games room during his GCSE revision.

Each evening at seven o’clock, just after dinner, Nathan would switch off his phone and go upstairs to revise. First, he’d check his revision plan and get out what he needed before steeling himself to do some hard work. Strategy number one was always a quick flashcard challenge, mixing up his cards from his different subjects, before testing himself. Then Nathan would test himself on different topics, with past questions or simply seeing what he could recall with a blank piece of paper, before ticking them off his revision plan.

Expecting his usual lull after forty-five minutes, Nathan would grab a drink and a biscuit (or three) before getting back to his revision. At the end of his revision session, he would end with the nightly ritual of returning to his revision plan to chalk up his victories and losses.

The aim of the skills and approaches discussed in the rest of this report is to develop learners that are able to manage their learning independently. The phrase ‘independent learning’, rather like metacognition, is commonly used in schools, but

perhaps our understanding is not so commonly shared. Put simply, independent learning is when pupils learn with a degree of autonomy, making active choices to manage and organise their learning, while deploying metacognitive strategies in the process. The GCSE revision undertaken by Nathan is a typical example of independent learning.

Supporting pupils like Nathan to self-regulate—providing them

with timely feedback and helping them to plan, monitor, and evaluate their progress—forms the basis for successful, independent learning.

Research emphasises the need for *guided practice*, in which the teacher provides support, prompts, and scaffolding, particularly during the initial stages of practice. The pupil can assume more and more responsibility as they become more proficient. To revise effectively, pupils like Nathan need revision approaches clearly modelled for them—vital cognitive strategies such as using self-testing flashcards—before they gain independent expertise.

Independent practice can play an important role in developing self-regulation and metacognition provided that tasks are sufficiently challenging, build on firm pupil subject knowledge, are realistic, and are suitably guided and supported by the teacher.

“The aim of the skills and approaches discussed in the rest of this report is to develop learners that are able to manage their learning independently.”

Effective learners use a number of strategies to help them learn well independently. According to Zimmerman,³⁵ these can include:

- setting specific short-term goals (*for example, Nathan executing his revision plan*);
- adopting powerful strategies for attaining the goals (*Nathan's self-testing using flashcards*);
- monitoring performance for signs of progress (*Nathan monitoring his progress by answering past questions*);
- restructuring one's physical and social context to make it compatible with one's goals (*Nathan changing his bedroom so it was fit for revision and learning*);
- managing time-use efficiently (*Nathan giving himself an appropriate break*);
- self-evaluating one's methods (*Nathan checking his revision plan at the end of his session*); and
- attributing causation to results and adapting future methods (*Nathan checking his revision plan, ticking, or not, appropriately before adapting his revision plan*).

Motivation and independent study

Pupils need to manage their motivation so that they are able to stick to learning, particularly when there is no teacher to guide independent study. An obvious truth is that our pupils often have to make tricky choices when learning independently, such as doing their homework tasks over giving in to more immediate gratifications. Of course, this requires self-control, which is itself a metacognitive process.

Pupils therefore need to regulate their motivational investment in learning activities, not least in light of the fact that they are often confronted with a choice between immediately-rewarding activities and activities that may seem less so but that support longer term learning goals (thus the need to 'delay gratification' as discussed in the previous recommendation). For example, Nathan, as he undertakes his revision, may likely have the urge to contact his friends by phone rather than revise!

Our pupils need to be able to balance short term—or *proximal*—goals, with longer term learning goals and rewards—their *distal* goals. These are, again, not necessarily strategies that children spontaneously develop, so they will need to be taught. Whether this should happen through direct instruction or other methods, such as modelling, is debatable.



Accuracy of judgements

One issue that pupils often have with independent learning is their **accuracy of judgement**. They tend not to have very realistic views of how well they have learned something, or which strategy has been effective. Consequently, they can make unrealistic

'judgements of learning'.³⁶

Like adults, they can suffer from the **'planning fallacy'**—underestimating how much time and resource will be required to plan successfully. Improving pupils' judgements on learning and the effectiveness of particular strategies will likely require further instruction.

Nathan, for example, revising his GCSEs, is an effective metacognitive learner who

is deploying a range of effective strategies. More commonly, pupils are unaware of the benefits of certain type of study, such as the benefit of **spaced practice** (where practice is broken up into a number of short sessions, over a longer period of time) compared to **massed practice** (when individuals practise a task continuously without rest)—more commonly known as 'cramming'.³⁷ Their judgements of learning can make them feel—albeit falsely—like they are learning more successfully when cramming.

Explicit teaching can help alleviate this issue of pupil over-confidence. For example, one experimental study found that direct instruction on the benefits of spaced practice decreased underestimation, while this was not the case for simply providing feedback.³⁸ Teaching tools like **'exam wrappers'** (a post-exam student self-evaluation feedback tool) offer teachers and pupils a way to evaluate and analyse errors, and revision patterns, for a given exam. This can help improve pupils' accuracy of judgement.

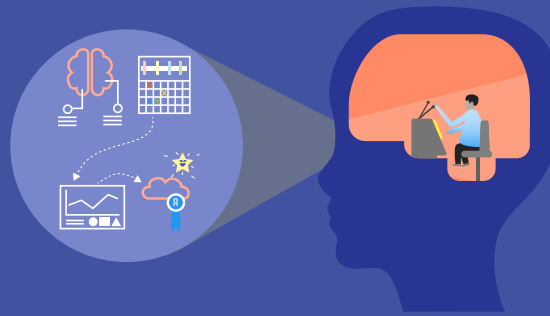
“Their judgements of learning can make them feel—albeit falsely—like they are learning more successfully when cramming.”

Misconception 4: You can easily teach metacognitive knowledge and strategies in discrete 'thinking skills' lessons

There is little evidence of the benefit of teaching metacognitive approaches in 'learning to learn' or 'thinking skills' sessions. Pupils find it hard to transfer these generic tips to specific tasks.

Self-regulated learning and metacognition have often been found to be context-dependent, so how you best plan in Key Stage 2 art may have significant differences to planning strategies in GCSE maths. This means that a pupil who shows strong self-regulated learning and metacognitive competence in one task or subject domain may be weak in another, and metacognitive strategies may or may not be effective, depending on the specific task, subject, or problem tackled. This does not, however, mean that metacognitive knowledge and skills will automatically develop through content knowledge teaching.

That being said, over time, metacognition can become more generic, and older metacognitive learners can possess an array of strategies that they then judiciously apply across a range of contexts and to a range of tasks. This maturation also includes the development of a growing understanding of when to use what strategies, or when good strategies may be missing in the learner's repertoire.



In a recent and extensive study on pupils' learning, Dunlosky et al. analysed the techniques that prove most effective, such as 'spaced practice', and those regularly

undertaken by pupils with underwhelming effects, such as rereading and highlighting.³⁹ The value of different techniques is summarised in Table 1 below.

Table 1: Effectiveness of ten learning techniques, from Dunlosky et al (2013) ³⁹

High utility	Practice testing	Self-testing or taking practice tests on material to be learned.
	Distributed ('spaced') practice	Implementing a schedule of practice that spreads out activities over time.
	Elaborative interrogation	Generating an explanation for why an explicitly stated fact or concept is true.
Moderate utility	Self-explanation	Explaining how new information is related to known information, or explaining steps taken during problem solving.
	Interleaved practice	Implementing a schedule of practice that mixes different kinds of problems, or a schedule of study that mixes different kinds of material, within a single study session.
	Summarization	Writing summaries (of various lengths) of to-be-learned texts.
	Highlighting	Marking potentially important portions of to-be-learned materials while reading.
Low utility	Keyword mnemonic	Using keywords and mental imagery to associate verbal materials.
	Imagery use for text learning	Attempting to form mental images of text materials while reading or listening.
	Rereading	Restudying text material again after an initial reading.

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



There is no shortage of interesting research evidence or advice on teaching and learning for school teachers and leaders. Even so, it is widely accepted that teachers often lack the time, tools, and training to implement new strategies and to translate research evidence into action.

“As with any changes to classroom practice and pedagogy, teachers will need a lot of support, training, and time to practise in order to implement them.”

Metacognition and self-regulation are no exception to this problem. Despite strong evidence that they are important, there are also many examples of interventions designed to improve pupils’ self-regulatory skills that have had no impact on pupil outcomes. Sometimes this is due to a distinct lack of understanding of what metacognition is; this, in turn leads to misconceptions and often weak implementation. As with any changes to classroom practice and

pedagogy, teachers will need a lot of support, training, and time to practise in order to implement them. It is important that supporting pupils’ metacognition and self-regulation skills isn’t seen as something ‘extra’ for teachers to do, but an effective pedagogy that can be used to support their normal classroom practice.

Key aspects of successful implementation:

- 1. Sufficient time** needs to be built in for the implementation to work and to have an effect on pupils. Time is needed both to train teachers and to allow them to practise and embed the new methods.
- 2. High quality professional development** for teachers is key to any successful intervention. The teachers are the people who are going to make the difference in their classrooms, with the particular challenge of integrating metacognition to specific subject domains or specific phases, so the focus should be on supporting them to do this.

- 3. Teachers need to be provided with high quality tools**, such as textbooks and resources, and **support**, such as on-going mentoring and coaching.
- 4. While what happens in the classroom is what will ultimately make the difference to pupil learning, support from senior leadership** in the school is key to making that happen effectively and consistently. Senior leaders need, for example, to support all the steps outlined above, and make sure approaches are implemented consistently and coherently across the school so every pupil in every lesson gets the best possible learning environment. Their commitment is crucial to implementation effectiveness.

The EEF’s *Putting Evidence to Work—A School’s Guide to Implementation*⁴⁰ describes the implementation journey in more detail.

Support teachers with high quality continuous professional development

Given the challenge of developing self-regulated learning and metacognition in pupils, it is crucial that the key principles of effective continuing professional development (CPD) are followed to allow teachers to develop their knowledge.

In their overview of research on effective CPD for the Teacher Development Trust, Cordingley et al. (2015) identified the following key aspects:⁴¹

- sufficient time needs to be devoted to CPD, preferably at least two terms;
- activities need to be iterative and build on how well approaches are working in the classroom;
- CPD needs to build on teachers’ starting knowledge and understanding, and explore—and where necessary challenge—existing beliefs and practices;



- CPD needs to focus firmly on pupils' learning;
- internal input is helpful as it can challenge existing beliefs more easily;
- external and internal facilitators need both subject expertise and expertise on CPD delivery; and
- peer support is useful to encourage reflection and risk-taking.

Good CPD will show teachers that development of metacognition should not be an 'extra' task that adds to their workload but is intrinsic to their teaching activities.

Assessing the impact of self-regulation and metacognition interventions

It is widely recognised that the reliable assessment of self-regulated learning and metacognition is challenging. Nevertheless, assessment is crucial to guide practice in the classroom.

The development of measures of self-regulation and metacognition has followed changes in our knowledge and understanding of the processes involved. Thus, as it has become clearer that self-regulated learning and metacognition are subject- and task-specific, generic instruments have largely been replaced by subject- or task-specific ones.⁴² Alongside typical standardised test performance, there are more qualitative assessments that teachers can use.

Typical assessments of metacognition that can be used in the classroom by teachers include:

- **traces**—observable metacognitive strategies used by pupils while completing a task, such as underlining a passage or making notes;
- **observation**—observing learners while they are completing a task, and estimating their use of

metacognition directly, allows teachers to take non-verbal behaviours and social interactions into account; recording measures like **'time-on-task'** or **homework completion rates** can also let teachers make inferences about self-regulated learning;

- **self-report questionnaires**—perhaps the most common assessment strategy is retrospective pupil self-reporting in the form of questionnaires (a note of caution should attend this method: recalling metacognitive strategies accurately is a difficult challenge for learners);
- **structured interviews**—though challenging to implement, interviews can take the form of a hypothetical learning scenario, with pupils asked to describe how they would use self-regulated learning strategies during it, thus allowing them to access, or not, more context-specific strategies;⁴³ and
- **talk aloud protocols**—assessments that get pupils to express their thought processes while doing a particular task (these self-reporting measures, however, may be biased by pupils' literacy and ability to articulate their thoughts).

Research indicates that assessment during task performance appears to be more predictive and accurate than assessment before or after task performance.⁴⁴ Teacher assessments of their pupils appear moderately accurate.

However, each of these assessment methods have their limitations and biases, so teachers should be circumspect in generalising their results.

“Good CPD will show teachers that development of metacognition should not be an 'extra' task that adds to their workload but is intrinsic to their teaching activities.”

REFERENCES

1. <https://educationendowmentfoundation.org.uk/evidence-summaries/early-years-toolkit/self-regulation-strategies/>
2. <https://educationendowmentfoundation.org.uk/tools/guidance-reports/>
3. <https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/>
4. Zimmerman, B. J. (2010) 'Becoming a Self-Regulated Learner: An Overview', *Theory into Practice*, 41 (2).
5. Hacker, D. J., Dunlosky, J. and Graesser, A. C. (2009) *Handbook of Metacognition in Education*, New York and London: Routledge.
6. Whitebread, D. & Coltman, P. (2010) 'Aspects of pedagogy supporting metacognition and self-regulation in mathematical learning of young children: evidence from an observational study', *ZDM Mathematics Education*, 42 (2), 163-178 <https://doi.org/10.1007/s11858-009-0233-1>
7. Bernard, S., Proust, J. and Clement, F. (2015) 'Procedural Metacognition and False Belief Understanding in 3- to 5-Year-Old Children', *PLOS One*, 10 (10): e0141321. doi:10.1371/journal.pone.0141321
8. Clark, I. and Dumas, G. (2016) 'The Regulation of Task Performance: A Trans-Disciplinary Review', *Frontiers in Psychology*, 6, p. 1862.
9. Callan, G. L., Marchant, G. J., Finch, W. H. and German, R. L. (2016) 'Metacognition, Strategies, Achievement, and Demographics: Relationships Across Countries', *Educational Sciences – Theory and Practise*, 16 (5), pp. 1485–1502.
10. Pappas S., Ginsburg H. P. and Jiang M. (2003) 'SES differences in young children's metacognition in the context of mathematical problem solving', *Cognitive Development*, 18 (3), pp. 431–450.
11. <https://cambridge-community.org.uk/professional-development/gswmeta/index.html>
12. Mason, L. H. (2013) 'Teaching Students Who Struggle With Learning to Think Before, While, and After Reading: Effects of Self-Regulated Strategy Development Instruction', *Reading & Writing Quarterly*, 29:2, pp. 124–144.
13. Torgerson, D., Torgerson, C., Ainsworth, H., Buckley, H., Heaps, C., Hewitt, C. and Mitchell, N. (2014) 'Improving Writing Quality. Evaluation report and executive summary', London: Education Endowment Foundation.
14. Robinson, D. H., Katayama, A. D., Beth, A., Odom, S., Hsieh, Y-P. and Vanderveen, A. (2010) 'Increasing Text Comprehension and Graphic Note Taking Using a Partial Graphic Organizer', *The Journal of Educational Research*, 100:2, pp. 103-111, 10.3200/JOER.100.2.103-111
15. Willingham, D. and Lovette, G. (2014) 'Can Reading Comprehension be taught?', *Teachers College Record*. Accessible online: http://www.danielwillingham.com/uploads/5/0/0/7/5007325/willingham&lovette_2014_can_reading_comprehension_be_taught.pdf
16. <https://educationendowmentfoundation.org.uk/tools/guidance-reports/>
17. Bjork, E. L. and Bjork, R. A. (2011) 'Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning', in M. A. Gernsbacher, R. W. Pew, L. M. Hough and J. R. Pomerantz (Eds.), *Psychology and the real world: Essays illustrating fundamental contributions to society* (2nd edition). (pp. 59-68). New York: Worth.
18. Adapted from Graham, S., Bollinger, A., Booth Olson, C., D'Aoust, C., MacArthur, C., McCutchen, D., & Olinghouse, N. (2012). "Teaching Elementary School Students to Be Effective Writers": A practice guide (NCEE 2012- 4058). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/writing_pg_062612.pdf
19. Sweller, J. (2006) 'The worked example effect and human cognition', *Learning and Instruction*, 16 (2), pp. 165–169.
20. Pressley, M. and Harris, K. R. (2006) 'Cognitive strategy instruction: from basic research to classroom instruction', in P. A. Alexander and P. Winne (eds), *Handbook of Educational Psychology* (2nd edn), Mahwah, NJ: Erlbaum (pp. 265–286).
21. Bjork, E. L. and Bjork, R. A. (2011) (op. cit.).

22. Kornell, N. (2009) 'Metacognition in animals and humans', *Current Directions in Psychological Science*, 18 (1).
23. Kornell, N. and Bjork, R. A. (2007) 'The promise and perils of self-regulated study', *Psychonomic Bulletin and Review*, 14, p. 219.
24. Gutman, L. and Schoon, I. (2013) 'The impact of non-cognitive skills on outcomes for young people: Literature review', Education Endowment Foundation.
25. Bembenutty, H. and Karabenick, S. (2004) 'Inherent Association Between Academic Delay of Gratification, Future Time Perspective, and Self-Regulated Learning', *Educational Psychology Review*, 16 (1), pp. 35–57.
26. Mischel, W., Ebbesen, E. B. and Raskoff Zeiss, A. (1972) 'Cognitive and attentional mechanisms in delay of gratification', *Journal of Personality and Social Psychology*, 21 (2), pp. 204–218. doi:10.1037/h0032198. ISSN 0022-3514. PMID 5010404.
27. Sweller, J. (1988) 'Cognitive load during problem solving: Effects on learning', *Cognitive Science*, 12, pp. 257–285.
28. McNamara, D. S. and Scott, J. L. (2001) 'Working memory capacity and strategy use', *Memory and Cognition*, 29, pp. 10–17.
29. Neath, I. and Surprenant, A. M. (2003) in Taflinger M. (ed.), *Human Memory* (2nd edn), Canada: Vicki Knight.
30. Adapted from the Teacher Assessment in Primary Science (TAPS) project: <https://pstt.org.uk/resources/curriculum-materials/assessment>
31. Mercer, N. & Dawes, L. (2008) The value of Exploratory Talk. In Mercer, N. & Hodgkinson, S. (2008) (eds) *Exploring Talk in School*. London: Sage.
32. Alexander, R. J. (2017) *Towards Dialogic Teaching: rethinking classroom talk* (5th edn), Dialogos.
33. Alexander R. J. (2017) 'Developing Dialogue: process, trial, outcomes', paper for the 17th international conference of EARLI, Finland. <http://www.robinalexander.org.uk/wp-content/uploads/2017/08/EARLI-2017-paper-170825.pdf>
34. Alexander, R. J. (2008), *Essays on Pedagogy*, Routledge.
35. Op. cit, Zimmerman (2010).
36. Logan J.M., Castel A.D., Haber S. & Viehman E.J. (2012). Metacognition and the spacing effect: The role of repetition, feedback, and instruction on judgments of learning for massed and spaced rehearsal. *Metacognition and Learning*, 7(3), 175-195.
37. Carpenter, S. K., Cepeda, N. J., Rohrer, D., Kang, S. H. K and Pashler, H. (2012) 'Using Spacing to Enhance Diverse Forms of Learning: Review of Recent Research and Implications for Instruction', *Educational Psychology Review*, 24, pp. 369–378.
38. Logan J. M., Castel A. D., Haber S. and Viehman, E. J. (2012) 'Metacognition and the spacing effect: The role of repetition, feedback, and instruction on judgments of learning for massed and spaced rehearsal', *Metacognition and Learning*, 7 (3), pp. 175–95.
39. Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J. and Willingham, D. T. (2013) 'Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology', *Psychological Science in the Public Interest*, 14 (1), pp. 4–58.
40. <https://educationendowmentfoundation.org.uk/tools/guidance-reports/a-schools-guide-to-implementation/>
41. Cordingley, P. Higgins, S. Greany, T. Buckler, N. Coles-Jordan, D. Crisp, B. Saunders, L. Coe, R (2015) *Developing Great Teaching—Lessons from the international reviews into effective professional development*. Teacher Development Trust.
42. Dent, A. and Koenka, A. (2016) 'The Relation Between Self-Regulated Learning and Academic Achievement Across Childhood and Adolescence: A Meta-Analysis', *Educational Psychology Review*, 28 (4), pp. 425–474.
43. Dent, A. and Koenka, A. (2016) (Op. Cit.).
44. Veenman, M. V. J., Van Hout-Wolters, H. A. M. and Afflerbach, P. (2006) 'Metacognition and learning: conceptual and methodological considerations', *Metacognition and Learning*, 1 (1), pp. 3–14.

HOW WAS THIS GUIDANCE COMPILED?

This guidance report was written by Alex Quigley (Huntington School), Professor Daniel Muijs (previously University of Southampton, now at Ofsted) and Eleanor Stringer (Education Endowment Foundation). It draws on the best available evidence regarding the development of metacognition and self-regulated learning, based on a review conducted by Professor Daniel Muijs and Dr Christian Bokhove (University of Southampton).

The guidance report was created over three stages:

- 1. Scoping.** The EEF consulted with a number of teachers and academics about the scope of the report. We then appointed an advisory panel and the review team, and agreed research questions for the review.
- 2. Evidence review.** The review team conducted searches for the best available international evidence, using a range of databases, and a systematic methodology to classify strength of evidence.
- 3. Writing recommendations.** The EEF worked with the advisory panel and reviewers to draft the guidance report and recommendations. The final report was written by Alex Quigley, Professor Daniel Muijs and Eleanor Stringer, with input and feedback from many others.

The advisory panel consisted of Kate Atkins (Rosendale School), Professor Steve Higgins (Durham University), Dr David Whitebread (Cambridge University) and Professor Jonathan Sharples (EEF and UCL Institute of Education). We would like to thank them for the support, challenge, and input they provided throughout the three stages.

We would like to thank the researchers and practitioners who were involved in providing support and feedback on drafts of this guidance. These include Dylan Wiliam, Robin Alexander, Sarah Earle (Bath Spa University), Simon Cox (Blackpool Research School), Rebecca Pentney (East Cambridgeshire and Fenland Research School), Russell Spink (Stoke-on-Trent Research School), and many others.

Production and artwork by Percipio
<https://percipio.london/>



Education
Endowment
Foundation

Education Endowment Foundation
5th Floor, Millbank Tower
21-24 Millbank
London
SW1P 4QP

www.educationendowmentfoundation.org.uk

 @EducEndowFoundn

 Facebook.com/EducEndowFoundn