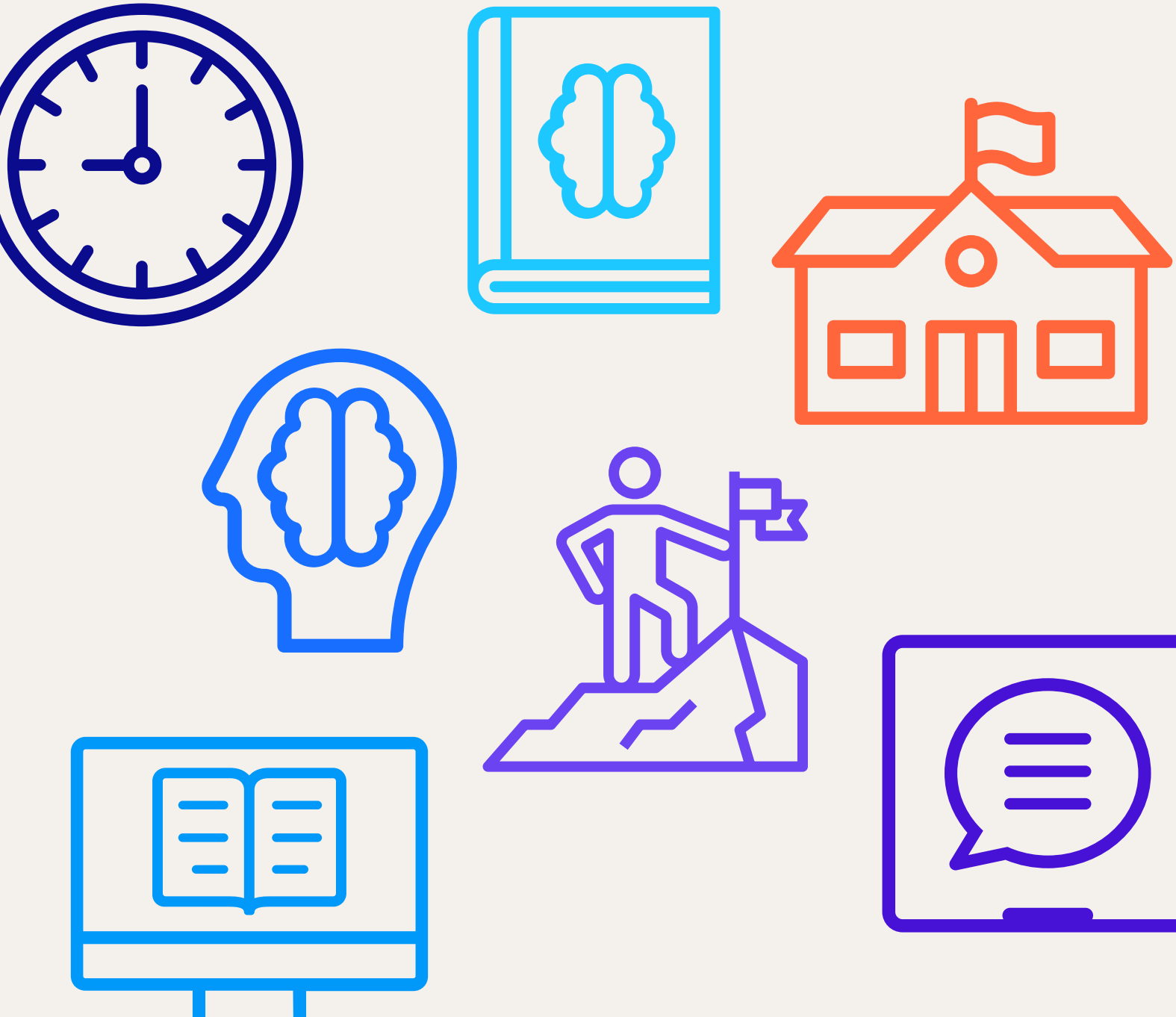
EVIDENCE FOR LEARNING

Guidance Report

All year levels

Metacognition and self-regulated learning



This Guidance Report is based on original content from a report of the same name produced by the Education Endowment Foundation (EEF). The original content has been modified where appropriate for the Australian context.

The authors of the original Guidance Report are Alex Quigley (EEF) Professor Daniel Muijs (previously University of Southampton, now at Ofsted) and Eleanor Stringer (EEF).

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Foreword

Metacognition and self-regulated learning, while not new concepts, are emerging as a focus for educational research within Australian classrooms.

Rated within the Teaching & Learning Toolkit as 'high impact for very low cost, based on extensive evidence'[1] 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.

On a very basic level, it's about students' 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 levels for boosting learning, it's clear that we need to spend more time looking at how to do this well.

There is still conjecture around metacognition and self-regulated learning and that is why we've produced this Guidance Report. Developed by our UK Partner, the Education Endowment Foundation (EEF), and updated for Australian audiences, it offers seven practical, evidence-based recommendations to support school leaders and teachers to develop metacognitive knowledge and skills in their students. This Guidance Report is relevant to teachers and school leaders in primary and secondary schools.

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 Evidence for Learning team

Introduction

What does this guide cover?

This Guidance Report is relevant to the teaching of all students, within any subject area. Most of the examples included are from lower primary to middle secondary, where the research is strongest. It introduces a simplified framework for metacognition and self-regulated learning 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 metacognition and self-regulated learning 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.

Who is this guide for?

This report is applicable to both primary and secondary schools, and some recommendations may be relevant for early childhood educators (you may want to review our Early Childhood Education Toolkit, specifically the strand on self-regulation strategies, for further guidance).[2] This Guidance Report is aimed primarily at school leaders and teachers responsible for staff development. It may also be useful for classroom teachers with an interest in how research can improve their teaching. Further audiences who may find the guidance relevant include school councils, parents, program developers, teacher educators, educational researchers and others who support evidence use in schools.

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 two 'r's', 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 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 student learning. The Teaching & Learning Toolkit – which summarises international evidence – rates 'metacognition and self-regulation' as a high impact, low cost approach to improving the attainment of learners.[1]

"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."

But what do we mean when talking about metacognition and self-regulation? 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.

Self-regulated learning can be broken into three essential components that teachers need to know about to help their students 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 student 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.

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 draw on and possessing the motivation and perseverance to tackle problems and apply these strategies.

What does a self-regulated learner look like?

Zimmerman gives a helpful description of what a successful self-regulated learner looks like.[3]

Effective learners use a number of strategies to help them learn well independently:

- setting specific short-term goals;
- adopting powerful strategies for attaining the goals;
- monitoring performance for signs of progress;
- restructuring one's physical and social context to make it compatible with one's goals;
- managing time-use efficiently;
- self-evaluating one's methods;
- attributing causation to results and adapting future methods.

Summary of recommendations

1

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

- Self-regulated learners are aware of their strengths and weaknesses, and can motivate themselves to engage in, and improve, their learning.
- Developing students' metacognitive knowledge of how they learn – their knowledge of themselves as a learner, or strategies and of tasks – is an effective way of improving student outcomes.
- Teachers should support students to plan, monitor, and evaluate their learning

See page 8

2

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

- Explicit instruction in cognitive and metacognitive strategies can improve students' 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.

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3

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

- Modelling by the teacher is a cornerstone of effective teaching; revealing the thought processes of an expert learning helps to develop students' 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 students to develop their metacognitive and cognitive skills without placing too many demands on their mental resources.

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4

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

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

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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.
- Student-to-student and student-to teacher talk can help 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.

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6

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

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

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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 students' 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.

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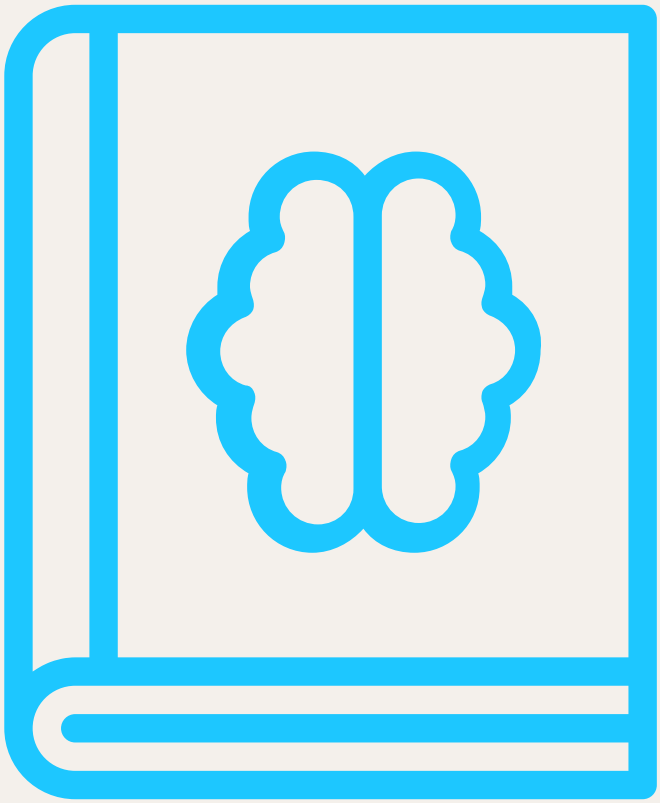
1

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



1 Teachers should acquire the professional understanding and skills to develop their students' 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 students' 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 students 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.

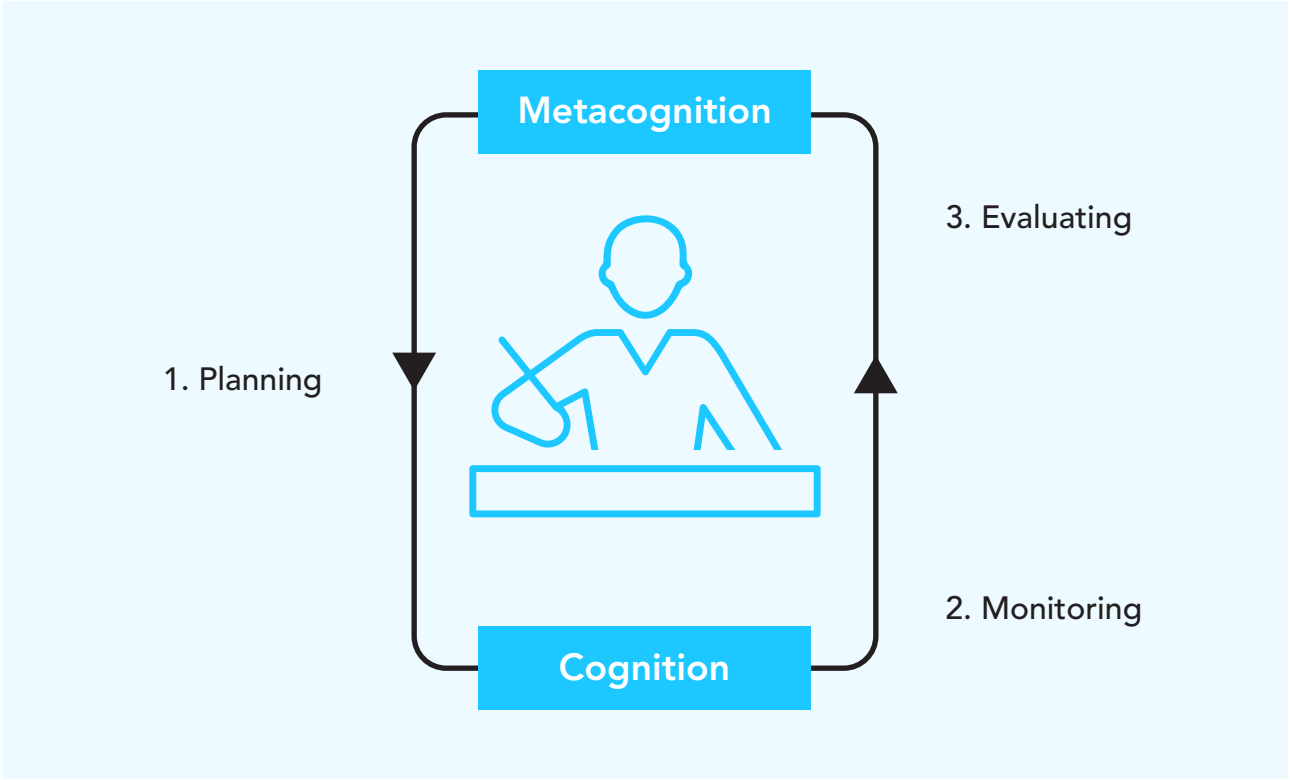


Figure 1: The metacognitive regulation cycle

Misconception 1: Metacognition is only developed in older students

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.[4] They also show greater accuracy on tasks they have chosen to accept than on tasks they would have preferred to opt out of.[5]

There is clear evidence that the level of certainty and self-knowledge remains rather inaccurate until about eight years of age, with children being over-optimistic about their levels of knowledge.[6] 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. This would look quite different for students of different ages, and the sophistication of strategies and knowledge develops as a student develops.

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

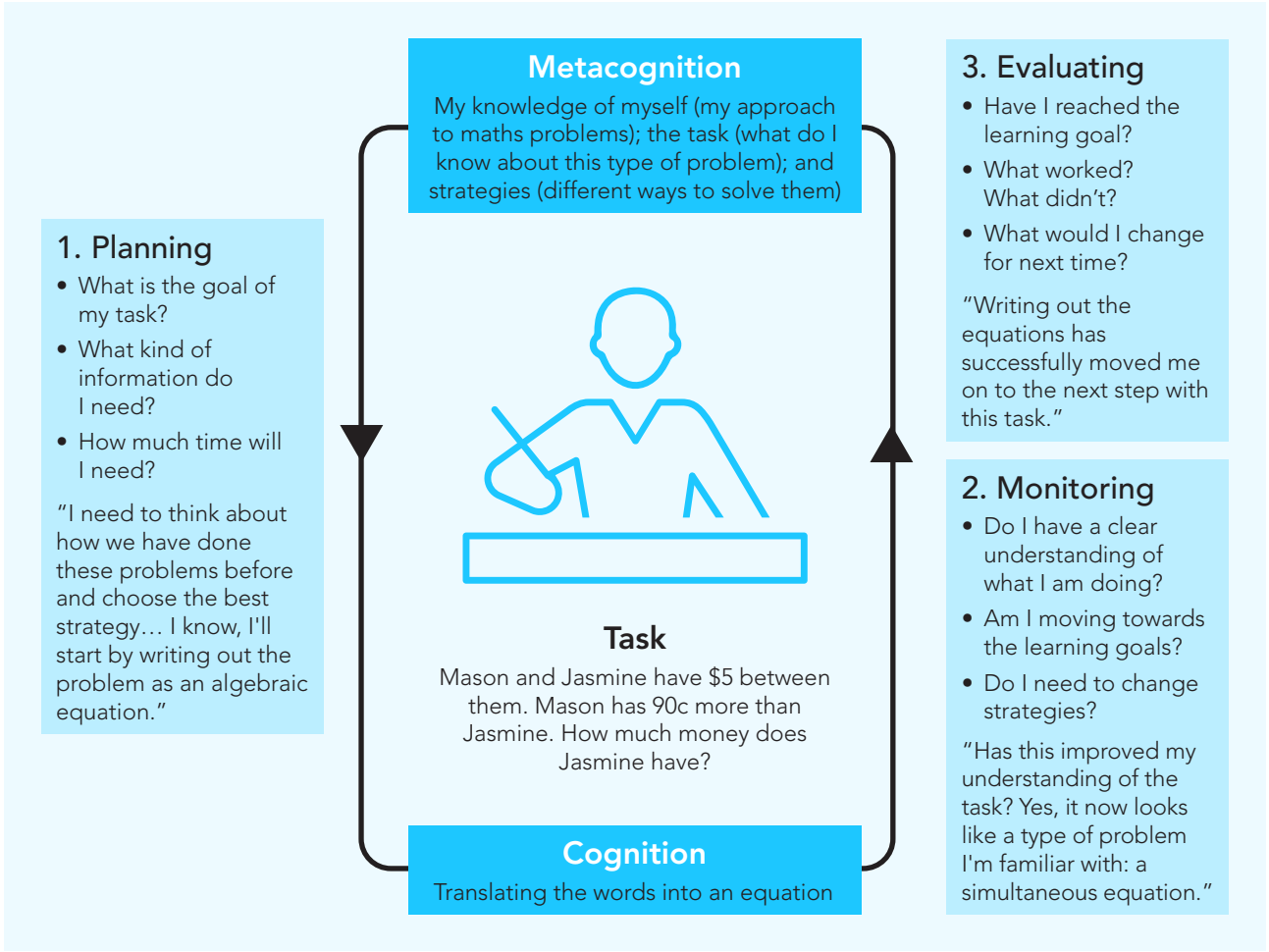


Figure 2: The metacognitive regulation cycle for a learner

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, students will develop differently. The extent to which skills are acquired is in part dependent on the opportunities students 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 students' knowledge and skills. Various studies have shown that self-regulated learning – and in particular metacognition – has a significant impact on students' academic performance, beyond that predicted by prior achievement.[7] This recommendation introduces the key concepts teachers should be aware of; the rest of the guidance focuses on how teachers can improve students' learning by integrating these concepts into their teaching.

2

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

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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 her prescribed text – 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 students 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.[8,9]

'Explicit instruction' does not denote simply 'telling' but describes all the activities that a teacher orchestrates to effect learning in their students. 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:[10]

- **planning** – encouraging students 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 students to assess the progress they are making; this includes the self-testing and self-questioning activities that are necessary to inform how they regulate their 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 student makes. During a lesson, a student 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 students 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?'

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, students 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.

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)[11] to help struggling writers in Years 6 and 7. SRSD provides a clear structure to help students plan, monitor and evaluate their writing. It aims to encourage students 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 students using cognitive strategies like the mnemonic **IPEELL** – **I**ntroductory paragraph, **P**oints, **E**xamples and elaboration, **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 students 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 students in the project to similar students who did not participate – was +0.74 standard deviations, or an estimated nine months' additional progress.[12]

"Some questions for planning aim to activate prior knowledge (resources, previous exemplars) whereas other questions model deploying the right cognitive strategies…"

How should teachers teach metacognitive strategies?

While there may be some benefit to introducing students 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 rather than standalone instruction.

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 science[13] or as a planning tool in history. In a Year 9 history lesson, students are exploring the causes of World War I. 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 students 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 students 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 students verbally contributing their ideas.
6. **Independent practice.** Students complete their own fishbone diagram analysis.
7. **Structured reflection.** The teacher encourages students 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.

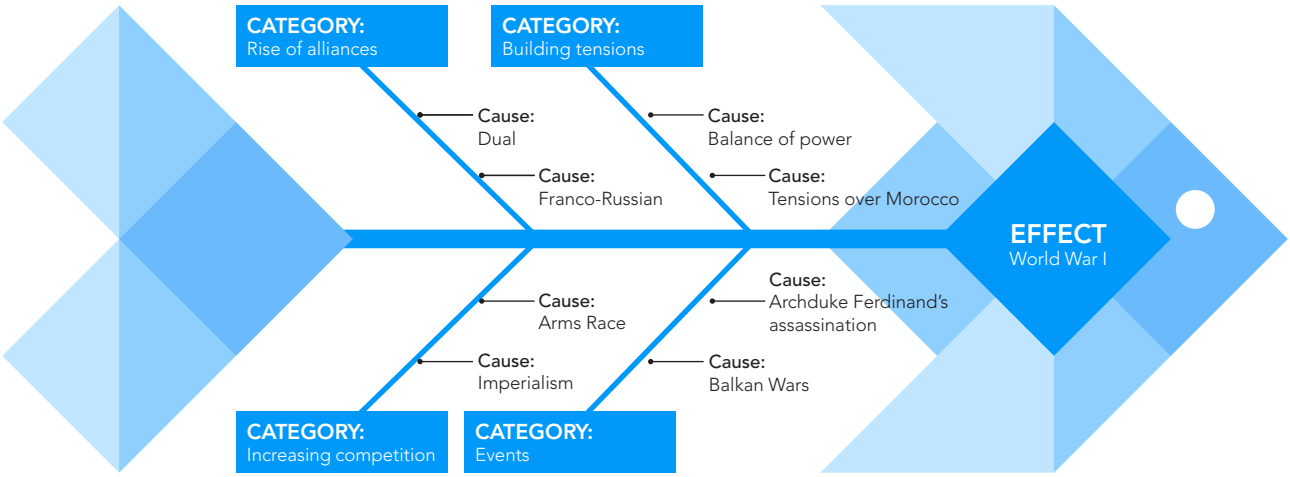


Figure 3: A fishbone diagram, one example of a graphic organiser, used in the Year 9 history lesson.

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 students reading comprehension strategies – metacognitive strategies for improving reading for meaning – can give students the edge, but that the effects of this strategy are limited if the student lacks the required background knowledge of the reading material.[14]

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.[15]

3

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

3 Model your own thinking to help students 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 students 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 students how to perform a forward roll safely in Physical Education (PE), a teacher might talk through her actions as she demonstrates.

"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."

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

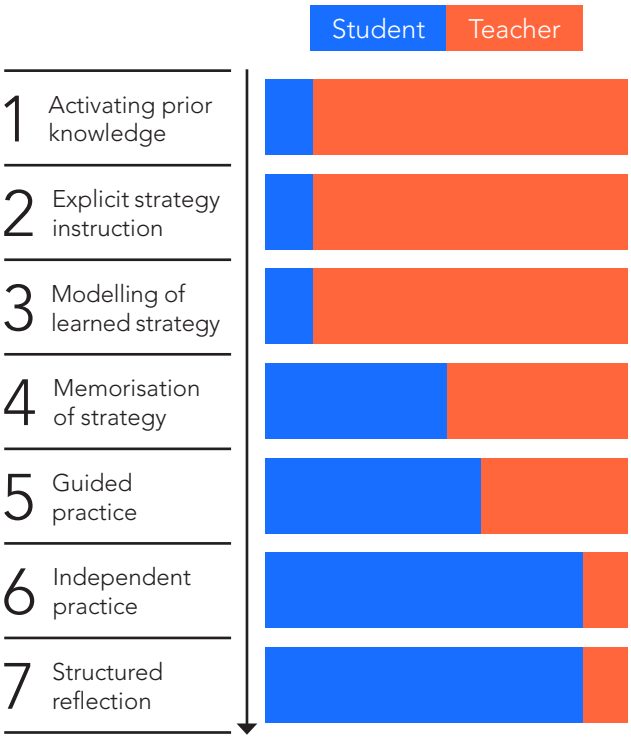
Modelling of this type is rarely planned by teachers as these processes or skills come 'naturally' to them, but that risks these important prompts remaining implicit, which is particularly ineffective for novice learners. To move from novice to expert, our students need to know how an expert athlete, 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'[16] is required so that students 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 students 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 students 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.

To illustrate this, it is helpful to look again at the seven-step model for teaching metacognitive strategies:[17]



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

So, just as a PE teacher might begin by modelling a forward roll, in a maths lesson, a model worked example[18] 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 students to undertake a partially completed equation.

Teachers should be aware that some students 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 students, and not occur concurrently, as task completion may demand all of a student'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.[19]

For example, a student can use metacognitive planning strategies when drafting an 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 students learn. We should look to develop both concurrently and not create false hierarchies where they do not exist.

4

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

4 Set and appropriate level of challenge to develop students' 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 students have to undertake a task that makes them struggle (remember 'deliberate difficulties'), they are more likely (in the future) to be successful in retrieving relevant information from their long-term memory.[16]

A successful student 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. Students, and even animals, opt out of difficult trials; they avoid tests they are unlikely to answer correctly.[20] 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 students make decisions about how to study and how to maintain effort and motivation until the task is complete.[21]

Take homework, for example – an ever-present challenge to students, 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, students will make a judgement on how challenging the homework is. If a given homework is clearly difficult, then a student will need self-efficacy[22] – or self-confidence in their ability to complete a specific task – which is shown to predict the deployment of metacognitive strategies. In motivating students 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. Students 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.[23]

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.[24] In this experiment, the children who successfully delayed eating the first marshmallow 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 homework example above.

Helping students reduce cognitive overload

What is an appropriate level of challenge? This question requires expert knowledge both of a given subject, and of students in the classroom. 'Cognitive load' theory,[25] 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 students 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,[26] or grouping information into more memorable categories or more accessible 'chunks'.[27]

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.

"Cognitive load' theory, 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."

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 students to reflect on their learning – should be carefully placed so as not to distract from the learning at hand. Teachers shouldn't expect students to develop new cognitive and metacognitive skills at the same time.

5

Promote and develop metacognitive talk in the classroom

5 Promote and develop metacognitive talk in the classroom

Metacognitive talk in a Year 4 science lesson[28]

Year 4 students had been constructing branching keys which used yes/no questions to identify animals (see example below). However, the students 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.*

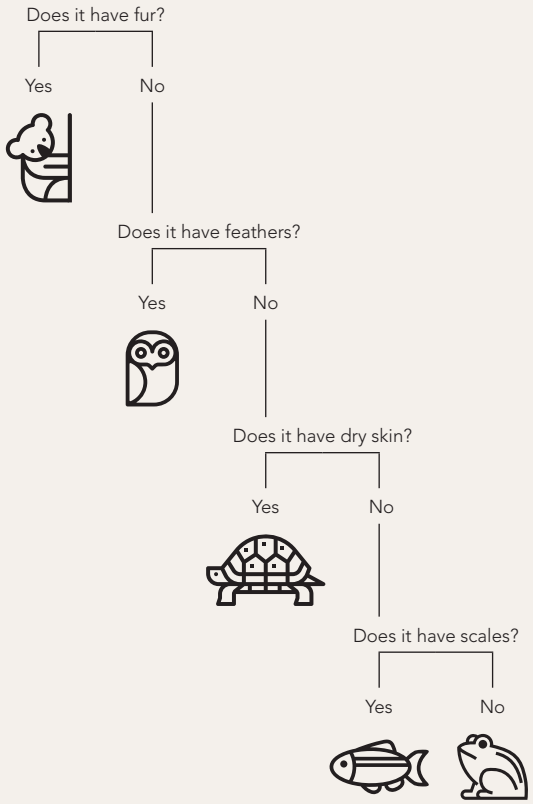
Janiyah: *And the answer might change.*

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 students walked around to look at others' work. The students 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 students with oral feedback, prompting dialogue, and scaffolding productive 'exploratory' talk where appropriate – is an ideal way to share and develop effective learning.[29]

The teacher in the opening example helps students 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 students 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 students 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',[30] for example, emphasises classroom dialogue through which students 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–student 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.[31]

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',[32] 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', 'Think, pair, share' and 'debating' (each strategy having its own clear parameters and rules for responsible dialogue). Such strategies – provided they are sufficiently challenging, build on firm student 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.

* Discussion and dialogue are further defined in the glossary

6

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

6 Explicitly teach students 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 high school assessment preparations.

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 study 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, reflecting on his accuracy and looking to understand his mistakes, before ticking them off his study plan.

Expecting his usual lull after forty-five minutes, Nathan would grab a drink and walk around for a few minutes before getting back to his preparation. At the end of his study session, he would end with the nightly ritual of returning to his study plan to chalk up his strengths and weaknesses.

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 students learn with a degree of autonomy, making active choices to manage and organise their learning, while deploying metacognitive strategies in the process. The study program undertaken by Nathan is a typical example of independent learning.

Supporting students 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 student can assume more and more responsibility as they become more proficient. To revise effectively, students like Nathan need study 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 student subject knowledge, are realistic, and are suitably guided and supported by the teacher.

As explored on page 5, effective learners use a number of strategies to help them learn well independently. According to Zimmerman,[3] these can include:

- setting specific short-term goals (*for example, Nathan executing his study 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 study*);
- managing time-use efficiently (*Nathan giving himself an appropriate break*);
- self-evaluating one's methods (*Nathan checking his study plan at the end of his session*); and
- attributing causation to results and adapting future methods (*Nathan checking his study plan, ticking, or not, appropriately before adapting his study plan*).

** Effective feedback should include feedback on how students monitor, direct and regulate their own learning, in addition to feedback which is task-focused[33]

Motivation and independent study

Students need to manage their motivation so that they are able to stick to learning, and when to employ a new strategy, particularly when there is no teacher to guide independent study. An obvious truth is that our students 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.

Students 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 students 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 students 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'.[34] Like adults, they can suffer from the 'planning fallacy' – underestimating how much time and resource will be required to plan successfully. Improving students' judgements on learning and the effectiveness of particular strategies will likely require further instruction and may include the use of objective feedback from which to calibrate their own judgements.

"Their judgements of learning can make them feel – albeit falsely – like they are learning more successfully when cramming."

Nathan, for example, is an effective metacognitive learner who is deploying a range of effective strategies. More commonly, students 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'.[35] 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 student 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.[34] Teaching tools like 'exam wrappers' (a post-exam student self-evaluation feedback tool) offer teachers and students a way to evaluate and analyse errors, and study patterns, for a given exam. This can help improve students' accuracy of judgement, but should be used in conjunction with strategies that will help students make accurate judgements in between major assessments.

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. Students 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 upper primary art may have significant differences to planning strategies in senior secondary maths. This means that a student 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 students' learning, Dunlosky et al. analysed the techniques that prove most effective, such as 'spaced practice', and those regularly undertaken by students with underwhelming effects, such as rereading and highlighting.[36] The value of different techniques is summarised in Table 1 below.

Table 1: Effectiveness of ten learning techniques

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
	Self-explanation	Explaining how new information is related to known information, or explaining steps taken during problem solving.
Moderate utility	**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.
	Summarisation	Writing summaries (of various lengths) of to-be-learned texts.
	Highlighting	Marking potentially important portions of to-be-learned materials while reading.
	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 of listening.
Low utility	**Rereading**	Restudying text material again after an initial reading.

7

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

7 Schools should support teachers to develop 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.

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 students' self-regulatory skills that have had no impact on student 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 students' 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.

"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."

Key aspects of successful implementation:

1. Sufficient time needs to be built in for the implementation to work and to have an effect on students. Time is needed both to train teachers and to allow them to practise and embed the new methods.
2. High quality professional learning 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, online sources 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 student learning, support from school leadership in the school is key to making that happen effectively and consistently. School 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 student in every lesson gets the best possible learning environment. Their commitment is crucial to implementation effectiveness.

Evidence for Learning's Guidance Report Putting Evidence to Work – A School's Guide to Implementation[37] 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 students, it is crucial that the key principles of effective professional learning*** (PL) are followed to allow teachers to develop their knowledge.

In their overview of research on effective PL for the Teacher Development Trust, Cordingley et al. (2015) identified the following key aspects:[38]

- sufficient time needs to be allocated for PL, preferably at least two terms;
- activities need to be iterative and build on how well approaches are working in the classroom;
- PL needs to build on teachers' starting knowledge and understanding, and explore – and where necessary challenge – existing beliefs and practices;
- PL needs to focus firmly on students' learning;
- internal input from colleagues with understanding of your school context is helpful as it can challenge existing beliefs more easily;

*** The original research referenced Continuing Professional Development (CPD), however we use the term Professional Learning (PL) in line with standard Australian use[39]

- external and internal facilitators need both subject expertise and expertise on PL delivery; and
- peer support is useful to encourage reflection and risk-taking.

Good PL 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.[40] Alongside typical standardised test performance, there are more qualitative assessments that teachers can use. Research indicates that assessment during task performance appears to be more accurate than assessment before or after task performance.[41] Teacher assessments of their students appear moderately accurate.

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

- **traces** – observable metacognitive strategies used by students 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 student 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 students asked to describe how they would use self-regulated learning strategies during it, thus allowing them to access, or not, more context-specific strategies;[40] and
- **talk aloud protocols**[****] – assessments that get students to express their thought processes while doing a particular task (these self-reporting measures, however, may be biased by students' literacy and ability to articulate their thoughts).

Each of these assessment methods have their limitations and biases, so teachers should be cautious in generalising their results.

**** Talk aloud protocols, when not used for formal assessment, can be effectively deployed as a strategy to help students develop their metacognition.

Acting on the evidence

Additional Evidence for Learning 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 students' 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.[15]

The stages of implementation

Foundations for good implementation

- ✓ Treat implementation as a process, not an event. Plan and execute it in stages.
- ✓ Create a leadership environment and school climate that is conducive to good implementation.

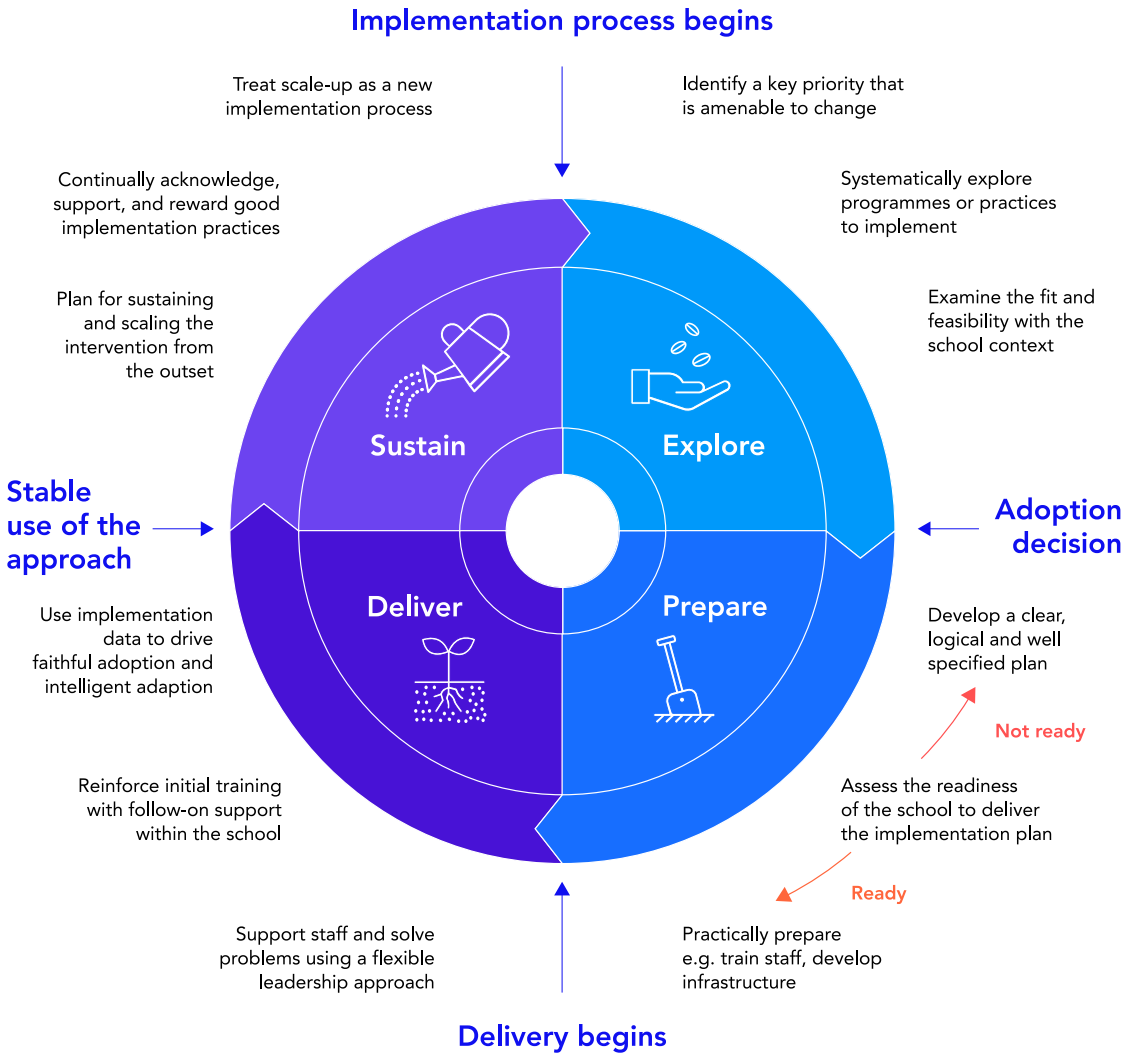


Figure 4: Implementation can be described as a series of stages relating to thinking about, preparing for, delivering, and sustaining change.

Acting on the evidence

We have expressed these questions to prompt reflection, aligned to The Stages of Implementation, detailed on the previous page. These stages are explored further in our Guidance Report Putting Evidence to Work: A School's Guide to Implementation.

Foundations for good implementation

Checklist questions

✓	Have the school leadership team created a clear vision and understanding of the expectation of the change that is desired?
✓	Is there a team responsible for managing the changes?

Explore

Checklist questions

✓	Do you have a base line for what is already being done at your school in relation to metacognition and self-regulated learning?
✓	Have you explored the evidence available and considered its feasibility in your context?

Prepare

Checklist questions

✓	Does the school leadership have a logical plan for implementing the new practices?
✓	Are you able to capture the change in practice that you want to see?
✓	Are staff ready to take on new approaches?

Deliver

Checklist questions

- ✓ Have teachers been involved in professional learning up front with access to ongoing support?
- ✓ Does the professional learning show teachers that development of metacognition should not be an extra task that adds to their workload but is intrinsic to their teaching activities?
- ✓ Are the changes being rolled out gradually, beginning with an initial team to test the new practices at a small scale?
- ✓ Have you used the data collected to evaluate and adapt the practices?

Sustain

Checklist questions

- ✓ Have you achieved the desired outcomes?
- ✓ Do you have a plan to support the scale up of your new practices?

Further reading

Australian Curriculum, Assessment and Reporting Authority (ACARA)

The ACARA general capability – Critical and Creative Thinking – includes explicit links to metacognition within the 'reflecting on thinking and processes' element. The continuum provides guidance around the expected level of progress across the stages of schooling:

australiancurriculum.edu.au/f-10-curriculum/general-capabilities/critical-and-creative-thinking/

Evidence for Learning

Evidence for Learning highlights the international research available on Metacognition and self-regulation as one approach within the Teaching & Learning Toolkit:

evidenceforlearning.org.au/teaching-and-learning-toolkit/metacognition-and-self-regulation/

Evidence for Learning collaborated with Melbourne Graduate School of Education to develop the Australasian research to support the contextualisation of international research:

evidenceforlearning.org.au/the-toolkits/the-teaching-and-learning-toolkit/australasian-research-summaries/meta-cognition-and-self-regulation

The Science of Learning Research Centre (SLRC)

The SLRC brings together neuroscientists, psychologists and education researchers from across the country with the vision to improve learning outcomes at pre-school, primary, secondary and tertiary levels through scientifically-validated learning tools and strategies.

The SLRC have developed the PEN Principles – Psychology, Education and Neuroscience – which are designed for teachers. PEN Principles 1 and 2 relate to the interactions between written text, spoken words and visual images.

slrc.org.au/pen-1-written-text-spoken-word-dont-mix/

slrc.org.au/pen-2-visual-images-spoken-word-mix-well/

How was this guide compiled?

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. The EEF 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).

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Glossary

Term	Definition/working definition
Cognition[41]	Symbolic mental activities and mental representations
Cognitive Load Theory (CLT)[42]	CLT aims to explain how the information processing load induced by learning tasks can affect students' ability to process new information and to construct
Dialogue[43]	Dialogue engages people in building their understanding of an issue, without the pressure to make decisions or be 'right'
Discussion[43]	Discussion is talk that has a purpose – often to make a decision
Evaluation[44]	The process of appraising one's work that has since been completed
Metacognition[45]	Cognition about other cognitions
Metacognitive knowledge[45]	Knowledge about a kind of cognition
Metacognitive monitoring[45]	The assessment of one's current thinking and work on a particular task
Metacognitive control[45]	Regulating some aspect of a cognitive activity
Planning[44]	Recognising the existence of a problem, defining the problem, and deciding on a strategy for solving the problem
Regulation/control[44]	The conscious and non-conscious decisions that one makes based on the output of one's monitoring process
Working memory[46]	The ability we have to hold in mind and mentally manipulate information over short periods of time

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