1
Metacognitive theory

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The why

The fact that you have picked up this book probably means you already know that metacognition is incredibly powerful. However, it is still crucial that we consider all of the benefits of metacognition. Firstly, there may be some benefits that you are not currently aware of. Secondly, and perhaps more importantly, when implementing a metacognitive curriculum, it is imperative that your staff understand 'the why'. The better that the staff understand the rationale for a change, the more likely that they are to be on board with said change. So, let's begin.

The first reason why metacognition needs to be a focus is due to the evidence presented by the Education Endowment Foundation (EEF). The EEF is an organisation which reviews research literature around a vast number of teaching theories and pedagogies. Their report on metacognition (Education Endowment Foundation, 2019), which summarised over 1500 papers, determined that metacognition was the most powerful teaching practice that we could introduce into our schools. This means that metacognition is more important, arguably, than anything else that we can do in school. The EEF report determined that effective metacognitive teaching could lead to an eight-month uplift in student attainment. If we think about this, eight months is almost equivalent to a whole school year. Though it would be hard to argue that metacognitive teaching will lead to a year's improvement for every student, one thing is clear: metacognitive teaching will lead to improved outcomes for our students.

There is a second key education organisation which also supports the development of metacognition in schools: Ofsted. Love them or loathe them, Ofsted have recently made changes to ensure that what they demand of schools is embedded within high quality research and evidence. One of the changes that they have made is to their expectations of teacher professional development, which now details that metacognition would be a key component of high-quality professional development (Ofsted, 2019). We, of course, do not want to make changes just to tick a box, but where these changes ensure that we are in line with evidence, we ought to be making them. When we have got two significant organisations, Ofsted and the EEF, who agree on the power of metacognition and of metacognitive development in our students, we need to sit up and listen. Metacognition is powerful and ought to be a focus.

Beyond these organisations is the actual literature. I've been fortunate, for the purposes of these books and university research, to have been able to engage with much of this. What is clear in this literature is how metacognition really does benefit all students. Research shows us, that regardless of an individual's socioeconomic background or their demographics, metacognitive improvements lead to improved school attainment. Furthermore, an individual's prior attainment does not limit the benefits of metacognitive teaching. Whether an individual is previously high attaining, lower attaining, or somewhere in the middle, improved metacognitive skills lead to improved outcomes. Moreover, SEN students can also benefit from metacognitive teaching. So long as the metacognitive teaching is developed in an effective and adaptive manner, these students will also benefit. It also doesn't matter about an individual's sex or their behaviour profile. Intriguingly, students with poorer levels of behaviour can also benefit from metacognitive development. Improved metacognitive skills, improves access to work, and thus allows an individual to be more academically successful. We know that behaviour can often be caused by an inability to access work. Therefore, improved metacognitive skills, allowing students to access the work better can in turn lead to improved behaviour. Overall, the literature shows that all of our students can benefit from improved infinitive cognitive teaching. This is exactly the sort of pedagogy that we should spend time working on. Something that will improve the outcomes for all of our students.

Another key consideration of metacognition is the cost. or rather the fact that it doesn't cost anything. All too often in education we find an approach that can help, but that has a price tag which is prohibitive for schools. Fortunately, this is not true of metacognition. There is no programme to buy, textbooks to source, or subscription to pay. Apart from the cost of time, there are no financial costs which stop a school from prioritising this area as one for staff and students to developing.

You may think that we are done there. But we are not! Another advantage of metacognition is that it works across all phases. Metacognitive development is not limited to teenagers, and in fact can be found developing in students as young as two or three years old. It will become clearer later on in the chapter, but as soon as an individual starts showing cognitive action, metacognitive development can follow. This therefore means that regardless of the age of student that you work with, metacognitive development can be one of your top priorities. Also means that any work done in one key stage can be developed at the next key stage regardless of whether the student is staying at the same school, or moving to a new one.

Importantly for this book, metacognition is also shown to work across the curriculum. Sometimes it may seem easier to develop in maths and science, but later on this book will show you how it can be developed in every curriculum area. The main benefit here, is that metacognition can be a whole school focus. There is nothing worse than implementing a new idea across a whole school, that just doesn't suit every curriculum area. We are fortunate, that in this scenario, metacognition can, and should, be developed across every curriculum area.

More specifically, metacognition is also shown to improve an individual's ability to problem solve. Once again, just why this occurs will become clearer later on in this chapter. However, in a time where our curriculum demands more and better problem solving from our students, a way for us to improve our students' problem solving abilities is crucial. Building from this, skill transference also improves where an individual has improved metacognitive abilities. This is again an area that we desperately want our students to improve in. We need our students to be able to draw on learning from other topics and other subjects, and be able to accurately select knowledge and skills to complement different subject areas. Without developing metacognitive skills, this is very, very difficult.

The development of metacognition is also a sure-fire way to improve an individual's self-regulatory abilities. It is perhaps important at this point, to address the misconception that metacognition and self-regulation are the same full. We can think of self-regulation as an umbrella, that includes the regulation of all academic, social, and emotional behaviours. In practice, self-regulation is how an individual controls their emotions and responses across a range of different situations. Metacognition is only a small part of this, where an individual will be controlling their response to an academic task. Therefore, as metacognition is a subset of self-regulation, where metacognitive abilities improve, self-regulation abilities must also improve.

The penultimate benefit of metacognition is that of increased revision effectiveness. We are all too familiar with the students who choose ineffective ways of revising, or focus on the incorrect things to be revising (or perhaps both). Perhaps students choose the easiest topics to revise, or the ones which require the least writing whatever it may be we know that our students are typically not as effective at revising as we would hope. Where individuals have improved metacognitive skills, they are more likely to revise the correct topic areas (that is, areas which are most likely to come up on the assessment or have been accurately identified by the individual as areas that they need to improve), and choose the most effective ways to revise. That is, active revision, not passive.

Which brings us to our final benefit of metacognition: that it complements any other teaching professional development that you are doing. For example, if you are already focussing on modelling, questioning, or feedback, for example, then metacognition can be tied into this. We know that teachers are short for time, and we know that there is never enough time for the reflection and professional development that we are wanting to do. Therefore, the fact that metacognition can dovetail with other areas of focus for schools, like those just mentioned, is a huge benefit, especially for leaders.

The how

Having established a clear rationale for metacognition, we now need to move on to understanding exactly what it is. To begin, we will consider two alternate definitions, one by the American psychologist John H. Flavell, and the other my own.

Flavell wrote in 1976:

> 'I am being metacognitive if I notice that I am having more trouble learning A than B; if it strikes me that I should double check C before accepting it as fact.' (Flavell, 1976, p. 232.)

And I wrote, in 2023:

> '[Metacognition is] the little voice inside your head that constantly evaluates and informs your decisions.' (Burns, 2023, p. 6.)

These definitions focus in on two specific considerations. The first is that metacognition is in relation to cognition. Where there is no cognition, we cannot be metacognitive. Additionally, metacognition is the evaluation of our cognition rather than the fundamental cognitive action or piece of knowledge. The second point of consideration is that the process of metacognition is forever ongoing. Metacognition is the process of planning, monitoring and evaluating our actions, considering what went well and what didn't, considering our specific cognitive knowledge and so much more.

The reason that metacognition can be so hard to understand, is that it is invisible. Whereas cognition and motivation are visible; that is, we can see when a student does a piece of work or completes a physical task, we are not able to see their conscious and subconscious consideration and evaluation of their own cognition. That is, we cannot see their metacognition. It should also probably be noted that metacognitive theory can be quite hard to get your head around. Neither of the above definitions provide us with a perfectly clear understanding of what metacognition actually is. The remainder of this chapter will explore the theory in depth, and so by the end you will have a clear understanding, but this does not take away from the difficulty in wrapping your head around this theory.

Which brings us on nicely to the breakdown of metacognitive theory, our knowledge of cognition, and our regulation of cognition. These two areas, both equally as important as each other (despite the latter area of regulation being far more widely known), are then both themselves split down into three subsequent areas, as shown in the diagram below.

Let us begin with developing our understanding of knowledge of cognition – the part of metacognition which is in relation to how we determine our own levels of knowledge. Instantly, it hopefully appears obvious why this area is just as important as our regulation of cognition. If we are not able to effectively determine what knowledge we do, and do not have, and the approaches that we can take for problems, then we are going to be in a pickle, even if our ability to regulate our cognition is superb.

We begin with an individual's knowledge of task. This refers to an individual's understanding of *exactly* what they need to be doing. This includes things such as time limit, the format that a response or project should be given in, as well as the

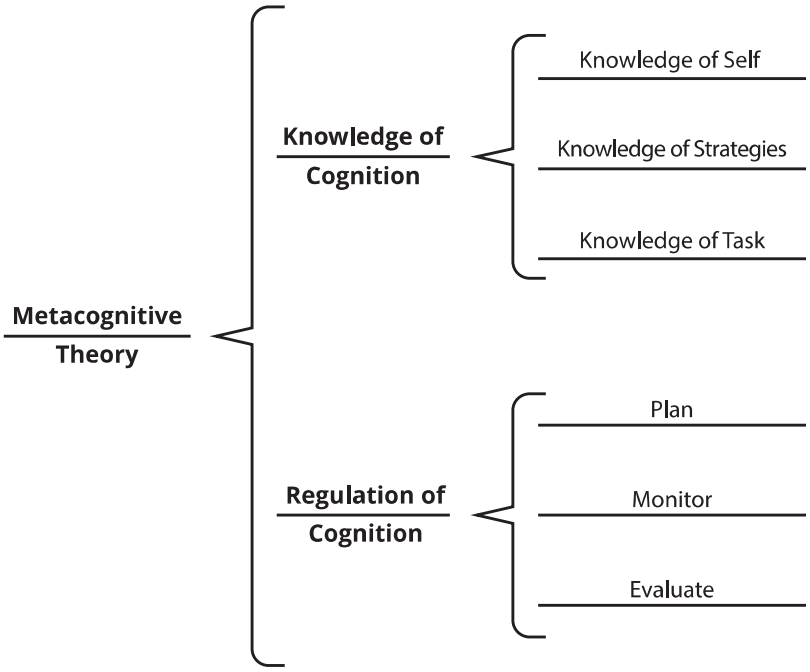

Figure 1.1 Brace map of the six foundations of metacognitive theory

determining success criteria (e.g., 'I need to make six points to get all six marks'). Positively, all students will always have an understanding of task. Negatively, this may not always be an accurate understanding of task. Comprehension is a messy thing, in which all individuals will have their own idea of what it is they ought to be doing, but this can be different to what they really ought to be doing. Without an accurate understanding of task, then an individual will not be producing an effective response to the problem at hand. We therefore have our work cut out, as without an effective knowledge of task, nothing else *really* matters.

Moving on from this, we begin to consider our knowledge of self. This part of metacognition refers to the knowledge that we know that we have, that is relevant for the task at hand, that we can draw upon. The crucial bit here is *knowledge that is relevant*. For example, it is great that a student has swathes of knowledge around elements, bonds and chemical formulas, but if they are unable to select the correct knowledge to answer the question 'define covalent bonding', then their knowledge of self is weak. Individuals need to be able to isolate and effectively determine the relevant knowledge that they have at their disposal for the task at hand.

Thirdly, we come on to an individual's knowledge of strategies. This area of metacognition is far more straightforward. Given a task or problem, we typically have more than one way of doing it. Each approach will have its strengths, but also its own weaknesses, and suitability to different problems. This part of metacognition places emphasis on choosing the most appropriate strategy for the task at hand. Where we do not choose the most suitable strategy, we risk anything from taking longer to completing the task than we otherwise would have done, all the way through to not being able to complete the task due to the choice of an ineffective strategy. One example of this area in metacognition would be knowledge of the different types of making a cup of tea (which, at a basic level, could be considering whether to brew the tea straight in a mug or in a teapot).

This is all quite theory heavy, so let us now consider what this would look like for us in our day-to-day jobs. Regardless of the age group that we work with, or the subject that we teach, we will have all had to produce reports for students at some point in time. Let us walk through the knowledge of cognition stages for this process:

Knowledge of Task

- Do I need to write a report for all students, just one particular class, or just one particular subject area?
- Do I need to give written feedback, a grade/score, or both?
- What system am I using to do this?
- How long do I have to do it?
- Do I need to work with any other teachers in order to do this?
- How long is this task going to take to do?
- What does an effective or good report look like?

Knowledge of self

- Do I have all the data that I need in order to write these reports?
- Am I confident with the grade prediction model that the school uses?
- Do I know about personal circumstances which may impact what I say in the report card for some students?
- What do I know about the student who only joined the class three weeks ago?
- Do I know how to use the system that we have been told we must put reports on?

Knowledge of strategies

- Am I going to plan to do all of these reports in one go, or am I going to break them up?
- Would it be better to write in individual statements or should I just use the pre-populated statements on the system?
- Which method of grade prediction should I use?
- Should I cross-reference all of my grades with colleague x?

Having now developed an understanding of knowledge of cognition, we move on to consider regulation of cognition – the more widely known and understood part of metacognitive theory. This area, as shown on the brace map (Figure 1.1), is broken down into planning, monitoring, and evaluation, all far more straightforward areas to understand – obvious, perhaps?

Planning is the approach that a student will take to a task. It may include a consideration of time planning, considering how to go about a task, as well as considering what they need to include in their response. This can sometimes take a written form, but very often will be a mental, and somewhat invisible, process. Intriguingly, effectively planning is typically made up of the three sub-sections of knowledge of cognition. We would often claim that effective planning would include consideration of a task's requirements (knowledge of task), the knowledge that we need to include in it (knowledge of self), as well as the way in which we will approach the task (knowledge of strategies). These metacognitive cycles link together very nicely!

The second part of cognitive regulation is that of monitoring. I like to think of this as the tricky middle bit between planning and evaluation, where we are looking to do some level of immediate evaluation on our progress so far, to ensure that we have the best resulting answer or product. This is difficult, for two reasons. Firstly, monitoring breaks our natural flow state. We need to stop from the 'doing', and instead consider what is going well, if we need to make changes, if we have sufficient time, and so forth. This comes at a time where we typically want to keep our head down and just keep going with the work until we get to the end. This is worse where we are more in a 'flow state'. Secondly, monitoring is especially difficult when we consider the sunk-cost fallacy. This fallacy suggests that where we invest, in effect, blood, sweat, and tears, we will keep going on in the same way, even if we know it is not as efficient as changing tac or even starting again, because, well, because we are human, and human nature is somewhat 'pig-headed'. Despite all of this, the importance of monitoring should not be underestimated, as it means that changes can be made to an individual's work in live time, rather than at the point of evaluation (or even feedback), where it is often too late to make changes to that just completed task.

The final area of consideration is of course evaluation. This is perhaps the most obvious of the three areas, where an individual will consider the task that they have just completed, and review it in relation to the success criteria. Did they include all of the points as required? Did they get the correct final answer? Did they include the required method? Did they manage to finish the task within the time allotted? All of these questions should be asked by the individual of themselves, and the determined responses should, for an effective learner, then be fed back into their future planning, in order to make improvements to their future work. Once again, regulation of cognition is a cycle, where evaluation feeds back to planning, planning feeds into monitoring, and so forth!

Once again, let us now try to contextualise this part of metacognitive theory too, consider the process of planning, delivering, and evaluating a lesson.

Planning

- What is it that I will be teaching students?
- What resources do I need?
- What teaching strategies/approaches am I going to utilise?
- What misconceptions do I need to address?
- Is the seating plan fine as it is?

Monitoring

- Have students understood what they need to?
- Is my use of the TA effective?
- Are students ready to move on to the next task or do they need further support?
- Are my current teaching models effective or do I need to model alternative options?
- Which students do I really need to be working with?

Evaluation

- Did students learn what I needed them to learn?
- Where do I need to begin the next lesson from?
- How would I teach that lesson again?
- What misconceptions arose that I wasn't aware of?
- Do I need to make future changes to the seating plan (etc.)?

Of course, there are a number of additional questions that you would be asking yourself, and numerous other things that you would be planning, but this certainly helps to place some 'meat on the bones' of metacognitive theory.

At this point, metacognitive theory in its entirety has been explored. However, it is worth dwelling on two further points – the myths of metacognition and the fear of implementation.

Firstly, there are some misconceptions around which students that metacognition is suitable for, which I addressed in detail in my first book *Inspiring Deep Learning with Metacognition*. It is worth considering them again though, in case you come up against them while implementing metacognition in your own settings and with your metacognitive curriculum work. These myths are:

- Metacognition is only for high-attaining students.
- Metacognition is only for older students.
- Metacognition is not for SEN students.
- Metacognition is better in girls than boys.

You will hopefully see, how through the exploration of the rationale for metacognition earlier on in this chapter, that these are all myths. All students can access metacognitive strategies and develop their metacognitive abilities. Perhaps it is sometimes easier with students who are not struggling with the cognition, and perhaps it is sometimes easier with individuals who have already developed their metacognition further. However, if

we do not take the opportunities that we have to improve metacognitive skills in our young people, then they will never actually develop their metacognitive abilities. If we have young people in our classes, then we need to be providing them with opportunities to actively consider, and improve, their metacognitive abilities.

A final point now needs to be made, in reference to previous implementation of metacognition, through the guise of learning to learn in the 2000s and 2010s across UK schools. Typically, this didn't go well, not due to the underlying research base, but the way that it was done. Exactly what went wrong, and how we can avoid that, is explored in the coming chapters, but it is worth addressing that the learning to learn programme, and furthering metacognitive skills in our student and developing a curriculum with opportunity to develop these skills are completely different things. Developing a curriculum, based upon subject specific knowledge, that provides opportunity for metacognitive development through it, is a world away from the learning to learn programme. This may be a concern that you hold, or one that you come up against when making changes in your own educational context.

With the rationale for metacognition established, theory understood, and myths addressed, it is now time for us to consider metacognition and the curriculum. How do we develop it? How do we ensure that it is successful? How do we even decide what we need to focus on? Let us now address these questions.

References

Ben-David, A., and Zohar, A. (2009). Contribution of meta-strategic knowledge to scientific inquiry learning. *International Journal of Science Education*, *31*(12), pp. 1657–1682.

Brown, A. L., and DeLoache, J. S. (1978). Skills, plans, and self-regulation. In R. S.Siegler (Ed.), *Children's thinking: What develops?* (pp. 3–35). Hillsdale, NJ: Lawrence Erlbaum.

Burns, N. (2023). *Inspiring Deep Learning With Metacognition: A Guide for Secondary Teaching*. London: SAGE Publications.

Burns, N. (2024). *Teaching Hacks: Fixing Everyday Classroom Issues With Metacognition*. London: SAGE Publications.

Callan, G. L., Marchant, G. J., Finch, W. H., & German, R. L. (2016) Metacognition, strategies, achievement, and demographics: Relationships across countries. *Educational Sciences: Theory and Practice*, *16*(5), pp. 1487–1502.

Education Endowment Foundation. (2019). *Metacognition and Self-Regulated Learning: Guidance Report*. London: Education Endowment Foundation.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The Nature of Intelligence* (pp. 231–236). Hillsdale, NJ: Erlbaum.

Flavell, J. H., Miller, P. H., & Miller, S. A. (2002). *Cognitive development* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Kramarski, B., Mevarech, Z. R., & Arami, M. (2002). The effects of metacognitive instruction on solving mathematical authentic tasks. *Educational Studies in Mathematics*, *49*(2), pp. 225–250.

Kuhn, D. (1989). Children and adults as intuitive scientists. *Psychological Review*, *96*(4), pp. 674–689.

Mevarech, Z. R. (1999). Effects of metacognitive training embedded in cooperative settings on mathematical problem solving. *The Journal of Educational Research*, *92*(4), pp. 195–205.

Mevarech, Z. R., and Amrany, C. (2008). Immediate and delayed effects of meta-cognitive instruction on regulation of cognition and mathematics achievement. *Metacognition and Learning*, *3*(2), pp. 147–157.

Mevarech, Z. R., and Kramarski, B. (1997). IMPROVE: A multidimensional method for teaching mathematics in heterogeneous classrooms. *American Educational Research Journal*, *34*(2), pp. 365–394.

Ofsted. (2019). *Research for the Education Inspection Framework*. London: Ofsted.

Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science*, *26*(1–2), pp. 113–125.

Teong, S. K. (2003). The effect of metacognitive training on mathematical word-problem solving. *Journal of Computer Assisted Learning*, *19*(1), pp. 46–55.

Toth, J. P., Daniels, K. A., & Solinger, L. A. (2000). Age-related differences in the accuracy of judgments of learning: The role of encoding strategies. *Psychology and Aging*, *15*(1), pp. 64–75.

Willingham, D. T. (2011). Ask the cognitive scientist: Can teachers increase students' self-control?. *American Educator*, *35*(2), pp. 22–27.

Zohar, A., and Ben-David, A. (2008). Explicit teaching of meta-strategic knowledge in authentic classroom situations. *Metacognition and Learning*, *3*(1), pp. 59–82.