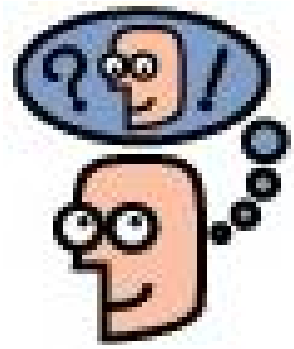
Special Education Support Service

‘Equality of Challenge Initiative’

SPECIAL EDUCATION SUPPORT SERVICE

building on ability

Metacognition for the classroom and beyond: Differentiation and support for learners



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Introduction

Every so often an idea in education “comes of age”; its relevance to learning becomes apparent and it endures beyond policy and research trends. Metacognition is not a new phenomenon – we have had the capacity to think about our own thinking long before we gave it a name – but in the past 30 years a sustained programme of research has focussed on this cognitive process, and while we still have much to learn, the positive impacts that metacognitive skills can have for the learner are well-documented.

Why are metacognitive skills so desirable in our learners? Pupils with good metacognitive skills are flexible in their approaches to learning. They possess a number of strategies to best cope with the information they need to interact with, and can assess which ones to use at the most appropriate times. Engagement with metacognitive learning techniques encourages pupils to see learning as a process, and one in which they can have input. The learner is at the centre of the activity, directing it, rather than standing on the sidelines. Ideally in this way, pupils begin to see how they can take control of their own learning and be agents of their own success.

This pilot resource is part of the ‘Equality of Challenge’ initiative that the Special Education Support Service (SESS) is undertaking in collaboration with a number of post primary schools, and in which the schools are exploring provision for students with exceptional abilities. The strategies that are outlined in this booklet have been primarily designed for use with pupils who have been identified as having special educational needs. However, metacognitive skills training is beneficial to all learners and many of the techniques and strategies are also applicable to whole-class teaching and pupils of all abilities.

Some basic examples of how each of the techniques can be used are provided – no doubt teachers participating in the Equality of Challenge initiative will find many ways to extend and develop them to best fit their teaching, pupils and the

organisational contexts in their schools. We hope that practices and examples explored in these schools will be included in the second edition of this resource.

Improving metacognitive skills is not a “magic bullet” to solve all the problems encountered by a diverse range of learners in our educational system. Nor it is a quick fix; helping pupils to become more metacognitively aware in the way they approach activities is a slow process. However, it is an approach to learning how to learn; a toolkit of strategies that will be of relevance not only in school but beyond in work and everyday life.

The Special Education Support Service wished to acknowledge to work of Dr. Sarah McElwee, University of Oxford, in the preparation of this resource.

Special Education Support Service, September 2009

1. Section 1: A brief introduction to metacognition

1.1 What is metacognition?

The simplest definition of metacognition is just "thinking about thinking" - a notion that disguises much more complicated concepts that have kept scientists, philosophers, and educators puzzling for hundreds of years. Puzzles such as "How can we truly think about our own thinking", when the brain that is doing the thinking is also the thing that is being thought about?!

Philosophical puzzles aside, metacognition can most usefully be thought of as ***knowledge and understanding of what we know and how we think***, including the ***ability to regulate our thinking*** as we work on a task. While cognitive skills are necessary to perform a task, metacognitive skills allow us to understand how the task was performed (Garner, 1987)[1].

What is cognition?

Cognition is the scientific term referring to the mental processes involved in gaining knowledge and comprehension, including thinking, knowing, remembering, judging, and problem solving.

What is metacognition?

Metacognition is knowledge and understanding of our own cognitive processes and abilities and those of others, as well as regulation of these processes.

[1] Garner, R. (1987). Metacognition and reading comprehension. Norwood, NJ: Ablex.

The umbrella term “metacognition” can be divided into two separate, but inter-related parts: **Metacognitive Knowledge** and **Self-regulation**.

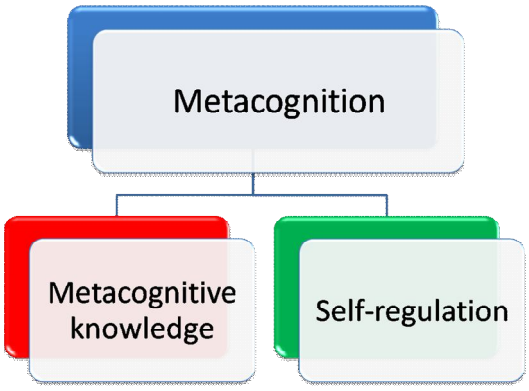


Figure 1.1 - Simple diagram of metacognitive concepts

Metacognitive knowledge is knowledge that we hold about our own thinking, and the thinking of other people. We are usually able to report metacognitive knowledge if we are asked about our own thinking and it includes things like:

- Understanding that having a strategy might help you to solve a problem more efficiently, or that having an essay plan may help to keep your argument on track.
- Knowing that it is more difficult to concentrate in a room that is noisy than one which is quiet.
- Knowing that you are good at remembering people’s faces but not their names, while your friend is good with names, not faces.

There are three types of metacognitive knowledge that each play a role in learning and problem-solving:

- **Declarative knowledge**: “knowing what” – knowledge of one’s own learning processes, and about strategies for learning
- **Procedural knowledge**: “knowing how” – knowing what skills and strategies to use and how to apply them
- **Conditional knowledge**: “knowing when” – knowledge about why and when various learning strategies should be used

Self-regulation on the other hand, refers to a set of activities that help learners to control their learning. Research has shown that metacognitive regulation supports performance in a number of ways, including understanding where to direct attention, using strategies more reliably and efficiently, and developing awareness of difficulties with comprehension. At the heart of self-regulation are three essential skills:

- Planning
- Monitoring
- Evaluation

Planning involves working out how a task might be approached before you do it. For example you might make predictions before reading, select a strategy before tackling a problem, or allocate time or other resources before commencing work.

Monitoring refers to the pupil's on-task awareness of progress, comprehension and overall performance. Stopping every so often to self-test and check for understanding is a good example of monitoring. Monitoring ability is slow to develop and even adults find it difficult, but it can be improved with training and practice.

Evaluation requires the student to review the outcomes and efficiency of the learning experience. Evaluation includes revisiting goals and conclusions, deciding how to improve next time, and examining learning from another person's perspective to diagnose problems.

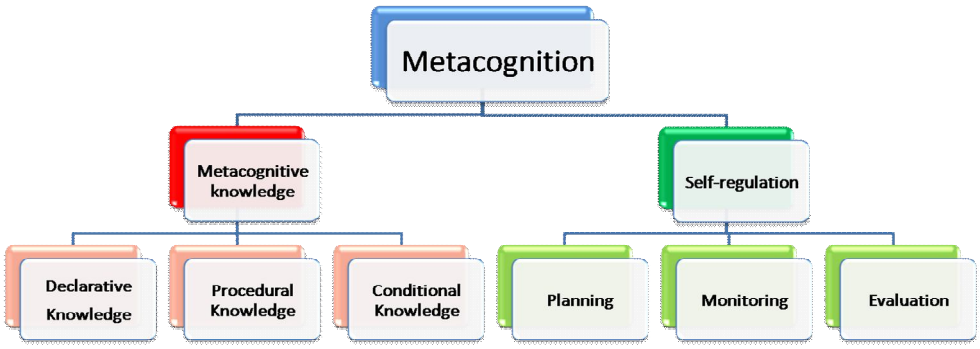


Figure 1.2 - Expanded diagram of metacognition

These two components of metacognition – metacognitive knowledge and regulation of cognition – are related. Research suggests that good metacognitive knowledge (such as information about which strategies might be useful at a given time, and why) helps pupils to regulate their own thinking, for example, when it comes to monitoring their progress of a task. Essentially, knowing about metacognition and its potential benefits greatly supports pupils in applying it to learning situations.

Further, metacognitive skills are applicable to all subjects of the curriculum, and can be transferred from subject-to-subject. Metacognitive skills practiced in geography can be equally useful in science, Irish, or business studies. Students may need to be reminded to use them in different contexts from those they first encountered them, but the skills are portable nonetheless.

Knowing about metacognition and its potential benefits greatly supports pupils in applying it to learning situations.

1.2 Why is knowledge of metacognition important for the teacher?

It makes sense that an awareness and understanding of *how* we learn could impact upon the *way* in which we learn. For more than a century educationalists have been suggesting that paying conscious attention to the learning process could influence how we acquire knowledge and understanding. Thirty years of research in this area indicates that awareness and application of metacognitive skills supports learning for pupils.

Metacognitive strategies are rarely taught explicitly to students. We expect pupils to learn the material from the curriculum that we present to them, but we do not always invest the same time in teaching them *how* to learn. Factual information fades fairly quickly once a pupil leaves school – over 60% of it disappears within 2-3 years if it is not in constant use[2]. However, throughout any further education or working career, an individual will constantly be faced with new problems to solve, new information to make sense of and new tasks to complete. In equipping pupils with the knowledge of how to learn we can set them up for these future challenges.

We all strive to find ways to keep our pupils engaged and to make them an active part of the learning process. Teaching metacognitive skills to students gives them the key to understanding their own learning. It shows them ways to take responsibility for the way in which they learn, rather than expecting to be a passive recipient waiting for the next transmission of information.

Developing metacognitive skills are also an important aspect of formative assessment or Assessment for Learning[3]. In order to maximise the benefits of learning experiences, pupils must be able to evaluate their own performance, isolate steps that they can take to help them to improve and work in a collaborative way with their teachers to decide on next steps. A knowledge of metacognition on the parts of both the teacher and pupil is an important factor in

[2] Bahrick, H.P. (1984) Semantic memory content in permastore: fifty years of memory for Spanish learned in school. *Journal of Experimental Psychology: General,* 113, 1, 1-37.
[3] NCCA (2007). Assessment in the Primary School Curriculum. Dublin:NCCA

facilitating the Assessment for Learning process. Assessment for learning is discussed more fully below.

Factual information fades fairly quickly. However, throughout any further education or working career, an individual will constantly be faced with new problems to solve, new information to make sense of and new tasks to complete. In equipping pupils with the knowledge of *how to learn* we can set them up for these future challenges.

1.3 Why are metacognitive skills important for the learner?

Metacognitive skills are tools that empower the learner. Pupils very often fail to see learning as cycle that involves revisiting previous work to see where it can improved, acknowledging the value of mistakes, and planning improvements on this basis. Instead, research shows that they are inclined to attribute successes to good luck and failures to lack of ability[4]. Such faulty beliefs serve to make some students helpless, believing that there is little they can do affect the outcome of the "lottery" of good grades. By showing a learner that they can be in control of how they study, how they organise their work, and how they reflect upon it, we encourage them to take responsibility for learning and demonstrate that it is an active process reduce the "mystery" that some pupils imagine shrouds the learning process. Learning doesn't just "happen" if you sit in a classroom for long enough or read the same page enough times.

The self-regulatory skills of planning, monitoring and evaluating are crucial for the student if they are to experience learning in the holistic manner intended in the learning cycle.

[4] Dweck, C. S. (2002). Messages that motivate: How praise molds students' beliefs, motivation, and performance (in surprising ways). In J. Aronson (Ed.), *Improving academic achievement: Impact of psychological factors on education* (pp. 61-87). Orlando, FL: Academic Press.

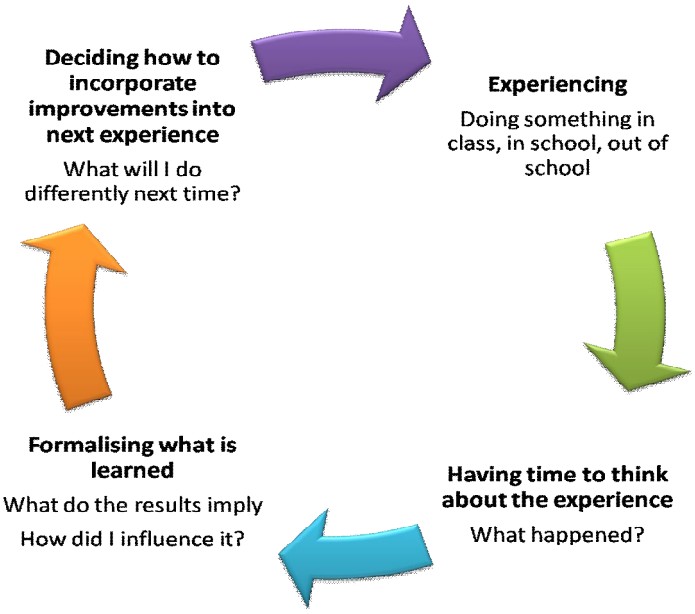


Figure 1.3 - The Learning cycle (adapted from Kolb, 1984)[5]

Metacognitive skills are also important for the learner as they encourage self-reflection. Training in metacognitive skills, collaborative reflection on work that involves more that just a single grade score, and practice at asking and answering questions that stimulate higher-order thinking are all activities that may help to move students beyond this helplessness to see themselves as agents in their own learning.

[5] Kolb, D.A. (1984). Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall.

1.4 How do metacognitive skills relate to Assessment for Learning?

> *Where the classroom culture focuses on rewards, 'gold stars', grades or place-in-the-class ranking…pupils look for the ways to obtain the best marks rather than at the needs of their learning which these marks ought to reflect….[W]here they have any choice, pupils avoid difficult tasks. They also spend time and energy looking for clues to the 'right answer'. Many are reluctant to ask questions out of fear of failure. Pupils who encounter difficulties and poor results are led to believe that they lack ability, and this belief leads them to attribute their difficulties to a defect in themselves about which they cannot do a great deal. So they 'retire hurt', avoid investing effort in learning which could only lead to disappointment.*
>
> *From "Inside the Black Box" (Black & William, 2001)*[6]

Assessment is the process of **gathering, recording, interpreting, using,** and **reporting** information over time about a child's progress and achievement in developing knowledge, skills and attitudes.

In guidelines issued in 2007, the NCCA make a distinction between Assessment of Learning (AoL) and Assessment for Learning (AfL)[7]. AoL comprises the traditional form of assessment that generally involves assessing the pupil's performance at the end of a unit of work, or after a period of time, such as at the end of term, or end of year. Very often the only feedback given on assessment performance is a score or grade. While this information can be very useful to the teacher in planning how to progress with the individual pupil and the class as a whole, the benefit to the pupil of a score or grade alone, without supporting information on how to improve and progress, may be rather limited. On the other hand Assessment for Learning (AfL) emphasises the role that the child can play in his/her own learning by involving the child in deciding learning outcomes, helping them to identify progress, highlighting challenges, and reflecting on ways

[6] Black, P., & Wiliam, D. (1998b). *Inside the Black Box: Raising standards through classroom assessment.* London: School of Education, King's College.
[7] NCCA (2007). Assessment in the Primary School Curriculum. Dublin:NCCA

to improve in the future. The ethos of AfL is an understanding that the pupil measures their progress against previous attainments rather than against other pupils. AfL is a collaborative process between the teacher and student and is at the heart of supporting the learning cycle described in the section above. Metacognitive skills are key in supporting pupil's own monitoring and evaluation of their work, in choosing where to improve and what to do to reach their targets.

1.5 How can metacognitive skills training benefit learners with SEN and exceptionally able learners?

While metacognitive skills training can benefit pupils at all levels of ability, it can have specific benefits for learners who have special educational needs or those who are exceptionally able.

Not all students with learning difficulties will have a lower than expected IQ. However where this may be the case, a number of research studies over the past ten years have shown that metacognition and intelligence (typically measured as IQ scores) are related concepts but are not the same thing. The development of metacognitive skills does not depend strongly on IQ and metacognitive skills make a contribution to problem-solving performance that is independent of what we would expect IQ to explain. This means that there are a number of implications for the learners with SEN and exceptional ability.

1.5.1 Learners with SEN.

Research suggests that learners with SEN possess less metacognitive knowledge about learning and problem-solving, and are typically less proficient at self-regulatory aspects of metacognition. Porter (2002)[8] suggests that pupils with intellectual disabilities may be less aware of how their minds work, have less knowledge about learning strategies, and although they can learn strategies, they are less likely to independently apply and monitor them.

Over time, as learners grow more experienced, they tend to develop their own theories of metacognition and begin to understand why regulating their thinking might be important. Learners with special educational needs may not reach this

[8] Porter, L. (2002). *Educating young children with special needs.* Crows Nest, Australia: Allen & Unwin

stage without support. Pupils whose special educational needs affect their ability to organise information, stay focused on task, or comprehend information in context may benefit from metacognitive skills training that explicitly shows them how to look for the bigger picture, and how to prompt or cue themselves to monitor their progress.

Research on problem-solving performance in children with learning disabilities indicates that children with high metacognitive skills did better than those with poorer metacognitive skills.[9]

> **"Efficient learners use metacognitive strategies, but students with learning disabilities tend to lack the skills to direct their own learning. However, once they learn the metacognitive strategies that efficient learners use, students with learning disabilities can apply them in many situations."**
>
> **(Lerner and Kline, 2006, p 184)[10]**

Which aspects of metacognition do pupils with SEN find difficult?[11]

1. **Recognising task requirements**

Central to the process of efficient learning is fully understanding what it is you have to do, as further efforts will be based on those perceived demands. Pupils with SEN can have difficulty focusing on the specifics of a learning task and often interpret it as they see it, rather than according to instructions given. Furthermore, inadequate conception of what an activity is *for* can also make understanding what is being asked opaque. For example, research shows that pupils with dyslexia, and other poor readers, are often less aware of the aim of extracting meaning from text and more concerned with reading accurately or

[9] Swanson, H. L., Christie, L., & Rubadeau, R. J. (1993). The relationship between metacognition and analogical reasoning in mentally retarded, learning disabled, average and gifted children. *Learning Disabilities Research, 8*, 70-81

[10] Lerner, J., & Kline, F. (2006). *Learning disabilities and related disorders: Characteristics and teaching strategies (10th Ed).* Boston, MA: Houghton Mifflin Company.

[11] Butler, D.L. (1998). Metacognition and learning disabilities. In B.Y.L. Wong (Ed.), Learning about learning disabilities (2nd ed., pp. 277-307). Toronto: Academic Press.

decoding; this focus tends to obscure engagement with the main ideas of the text. In writing, pupils with SEN tend to concentrate on lower-level processes, such as idea generation and spelling, rather than communicating coherent ideas and presenting rounded arguments.

How can metacognitive strategy training help:

- ✓ Giving explicit instructions clearly communicating expectations is vital, guiding pupils to interpret a task appropriately
- ✓ Cue pupils to actively analyse task requirements for themselves. Establish this as part of a routine every time an exercise is set. Work with pupils to break down the task into steps, and to recognise areas of uncertainty where they need further clarification before they begin.

2. Selecting and implementing strategies

Once task demands have been analysed and the requirements noted, efficient learners will select strategies in order to accomplish their goals. However, pupils with SEN may not have a broad repertoire of learning strategies to apply and frequently select inappropriate strategies that don't match the task demands. For example, pupils with learning difficulties may differ from other pupils in their awareness of strategies to help regulate the process of writing a piece of extended prose – many defer to external criteria to judge when a piece is finished such as length of the sheet of paper, word limits, or the number of paragraphs they have written rather than assessing whether the arguments have been fully communicated. Pupils with SEN may be less able to coordinate their strategies for dealing with text to a given task – for example, proficient readers may be aware of the distinction between skimming a piece, and reading it closely for studying, whereas less able readers are unlikely to modify their reading based on the situation. In mathematics, pupils with SEN are more inclined to focus on computation than building up a representation of the problem and what they are being asked to do.

How can metacognitive strategy training help:

- ✓ Pupils can be supported in identifying the different types of strategies that are open to them and selecting the most appropriate for the task
- ✓ Planning is especially important – deciding criteria for how a task will be approached, the order in which stages will be tackled, and how completion will be judged.

3. Monitoring and adjusting performance

Effective learners keep track of their learning processes and note the times when strategy use was successful. Learners who are good at monitoring as they work essentially have "debugging" strategies to halt their progress when they spot a problem with their comprehension, solutions etc. By contrast, pupils with SEN are less likely to assess their progress accurately, or to fix problems that crop up. This can be linked back to an inadequate task understanding – it makes sense that any of us would be less efficient at monitoring ourselves if we were unsure of what we were doing in the first place. It may also arise from a lack of awareness of their own knowledge or from failing to self-question to check understanding.

How can metacognitive strategy training help:

- ✓ Develop awareness of the process of learning/problem-solving including the importance of keeping track
- ✓ Helping pupils to "stand back" from a problem and assess what to do next.

Pupils whose special needs affect their ability to organise information, stay focused on task, or comprehend information in context may benefit from metacognitive skills training that explicitly shows them how to look for the bigger picture, and how to prompt or cue themselves to monitor their progress.

Learners with Dyslexia

Students with dyslexia often have a mismatch between their level of ability and attainments in reading, writing and comprehension. These students may also have difficulty in sequencing (i.e. arranging information in order), copying notes from the board and recalling the names of objects, problems with coordination and speed of reading. Pupils with reading difficulties (whether assessed as having dyslexia or not) can become so bogged down with the mechanics of reading that comprehension and understanding of the text is limited. Pupils with dyslexia may also have difficulty organising both personal belongings in readiness for learning and their cognitive activities such as higher-order thinking.

In explaining the necessity for metacognitive skills training for pupils with dyslexia, this quote from Goldup and Ostler describes the challenges:

> *The dyslexic child's disorganisation…undermines his ability to keep track of books, pencils and pieces of paper….It lurks unseen and plays havoc with his thinking, planning, hypothesising and testing, and even with his storage and retrieval processes, all of which need help, through support and strategies if he is to succeed.*
>
> Goldup & Ostler, 2000, p.319.[12]

Other Examples of Special Educational Need

A number of other Special Educational Needs can impact upon learners in ways that make the development of metacognitive awareness desirable. Just two examples are provided here to illustrate, although there are many more.

Students with Autistic Spectrum Disorder (ASD) may have difficulty with thinking flexibly, and find it difficult to manage time and complete work. They may have a tendency to compartmentalise their thinking, for example viewing completion of a task as unrelated to its presentation. Pupils with Developmental Coordination Disorder or Developmental Verbal Dyspraxia again may have difficulty with organisational skills, both in terms of personal conduct and presentation of school

[12] Goldup, W. & Osler, C. (2000). The dyslexic child at home and school. In J. Townend and J. Turner (Eds.) *Dyslexia in Practice: A guide for teachers.* London: Springer, pp 311-340

work. Skill development in terms of monitoring both academic tasks and emotional states may be beneficial for these particular learners, as well as practice at planning a task before beginning and evaluating at the end.

Learners with working memory problems

Learners with SEN may in some cases have a working memory capacity that is below average for their age. Working memory is like a mental jotter; we use it when problem solving to keep two or more pieces of information "alive" in our minds at once so that we can manipulate them for calculations, or relate them in complex ways. Pupils with poor working memory skills may have difficulty concentrating or frequently lose their place when taking down information, leaving their notes muddled. They can find it difficult to keep a list of 3-4 directions in mind in the classroom, perhaps completing the first and then forgetting what else they were supposed to do[13]. There is tentative research evidence to suggest that children who have poor working memory capacity can use metacognitive knowledge and skills to compensate for this deficit. Thus, there are likely many benefits of teaching pupils with working memory problems the metacognitive skills to monitor their performance and regulate their behaviour.[14]

Metacognitive skills training may help learners with SEN to develop an understanding of how their mind works, regulate their thinking and performance, and compensate for poor working memory.

[13] Gathercole, S.E. & Alloway, T.P. (2008). *Working memory and learning: A practical guide for teachers.* London: Sage.

[14] Whitebread, D. (1999) Interactions between children's metacognitive processes, working memory, choice of strategies and performance during problem-solving. *European Journal of Psychology of Education*, 14(4), 489-507

1.5.2 Exceptionally able learners.

There are a number of ways in which training in metacognition can benefit exceptionally able pupils. Exceptionally able pupils generally have higher levels of metacognitive knowledge than other children – they are more aware of constraints on their learning such as memory limitations and attentional distractions, and they can think of more learning strategies to apply at any given time. However, research findings regarding self-regulation are more mixed, and it appears that exceptionally able pupils do not necessarily excel in this regard. In studies of reading comprehension for example, high ability students were no more likely to pick out blatant inconsistencies in the text than readers of average ability. Given the fact that metacognitive knowledge supports self-regulation however, there is the possibility that if given the opportunity to practice self-regulatory skills on-task, exceptionally able students may improve this ability quickly, and indeed at a faster pace than other students. Thus far, preliminary research in this area has focused on primary school-aged children, but it is entirely possible that the same results would be seen in older pupils[15].

One of the cognitive advantages that almost all pupils who are identified as exceptionally able possess is a large working memory capacity. This often allows them to take shortcuts when it comes to planning, as they can keep more information in their heads. Further, the frequent high grades achieved by exceptionally able pupils can mean that they don't see the need for self-reflection and evaluation of work. In the senior years of secondary school however, when work becomes more demanding and perfect grades may no longer be so readily achievable, able students can experience a blow to their confidence and may be unwilling to push themselves for further challenges if they think they can't succeed. Training in metacognitive skills such as monitoring and self-reflection are important for exceptionally able pupils in this respect. Demonstrating to able pupils that learning is a cycle – that it is acceptable to revisit a piece of work, that there is value in taking risks and making mistakes, and that it is ok not to know an

[15] Steiner, H. H., & Carr, M. (2003). Cognitive development in gifted children: toward a more precise understanding of emerging differences in intelligence. *Educational Psychology Review, 15*(3), 215-246

answer to a complex question straight away – are important insights to help them understand that ability is not dependent on instant perfection.

Helping exceptionally able learners to develop metacognitive skills encourages self-discipline that may be important as schoolwork becomes more complex. It can also help to banish the notion that able pupils should be able to get things right first time and that mistakes are "disastrous".

1.5.3 Learners with Dual Exceptionality

It is believed that 1 in 20 pupils who are exceptionally able (and possibly more) are learners who are "twice exceptional": Not only are they highly able but they have an additional disability or learning difficulty that impacts upon their learning performance. There are generally two subgroups of pupils with dual exceptionalities

- Pupils who have been identified as exceptionally able but also have learning difficulties (perhaps unidentified). These pupils are often considered underachievers and struggle to reach their full potential. There may be a large discrepancy between their abilities and the quality of the work they produce. For example, exceptionally able children with ADHD may have lower than expected exam marks due to their attention difficulties and impulsivity, which makes sustained study and on-task exam performance difficult.
- Pupils who have recognised learning difficulties but whose exceptional abilities have not been identified, or are overlooked in preference to providing remediation. For example, exceptionally able pupils with dyslexia may be reading at their chronological age or below, instead of showing the advanced reading we tend to look for as a characteristic of able pupils. This may mean that their exceptional abilities in other areas may not be recognised if reading and production of work is poor, or does not exceed the minimum targets.

Support and training in metacognitive skills is likely to be very helpful to such dually exceptional learners. These pupils can often experience frustration and tension in the classroom that gradually leads them to become demotivated and "wander off task". They tend to have less belief in their academic capabilities and view their learning difficulties as "holding them back".

As well as the benefits outlined above for able learners and those with SEN, for dually exceptional pupils the practice of using metacognitive skills can help them to organise their thinking and their approach to class work and study, easing frustration with the learning process. Further, helping pupils get acquainted with the idea of a learning cycle, where work is evaluated and revised, may support exceptionally able pupils who feel under pressure due to SEN in realising that work need not be perfect on the first attempt. In both cases it is likely to have a positive impact on academic self-concept.

2. Section 2: Metacognition in the classroom and beyond

This section first of all takes a look at general approaches to encouraging metacognitive awareness that are suitable for general classroom use, for supporting differentiated approaches, and for learning support and mentoring situations. Later, specific strategies and teaching/learning approaches to foster metacognitive thinking and self-regulation are presented. Again, these are intended to be suitable for use in working with class groups or in mentoring and learning support contexts.

2.1 Four ways to promote general metacognitive awareness[16]

Research in metacognition in classroom settings suggests that there are four general ways to increase the occurrence of metacognitive behaviours. The four ways are presented in the box below:

Four steps to promote metacognitive awareness

1) Make pupils aware of the importance of metacognition;
2) Improve knowledge of cognition;
3) Improve regulation of cognitive activities;
4) Foster learning environments that value and promote metacognitive awareness.

We will consider how each of these suggestions can be implemented in turn:

1. Promoting awareness of the importance of metacognition

Tell pupils what it is!! Pupils need to understand what metacognition is if they are to practise regulating their cognitive performances. The concept can be introduced in a range of ways: Teachers can explicitly describe metacognition and model it for pupils. Pupils can be encouraged to "think aloud" and explain their approaches to problem-solving as they work. A few minutes of class time can be set aside regularly to discuss metacognitive approaches to learning.

[16] Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science, 26*, 113–125.

Teachers should take the time to explain the concept of thinking about our own thinking, introduce the two strands of metacognitive knowledge and self-regulation, and familiarise pupils with the ideas of planning, monitoring and evaluation. Presenting the concept in an explicit way is likely to resonate with at least some of the pupils, who will be intrigued by the possibilities.

Show pupils what metacognitive processes look like!! Secondly, one of the most powerful ways that we can show students how valued metacognitive skills are, is to model them ourselves. Very often we discuss and model ***how*** to do something, without modelling the thinking ***behind*** it. We allow our pupils to see the final, polished version of our thinking without showing them the decisions we made – the revisions, the dead-ends we went down, the ideas we changed or threw away. Consider thinking out loud for your pupils, discussing the stages **YOU** go through as you solve a problem (prove a maths theorem, polish an opening sentence for an essay, figure out which tense of a French verb to use). Other students can also be very powerful models in explaining the rationale for their thinking in a way that others can relate to.

2. Improving knowledge of cognition

In Part 1 we saw that metacognition can be sub-divided into two parts: knowledge of cognition and regulation of cognition. Knowledge of cognition was composed of declarative, procedural and conditional knowledge. Improving knowledge of cognition, and the types of learning strategies available to the pupil, as well as why they are useful and when they can be most usefully applied is an important step in supporting the development of metacognitive thought.

A reference aid called a strategy evaluation matrix (SEM) can help pupils to familiarise themselves with possible strategies that they might use, and the appropriate context for using them. Introduce one new strategy at a time (perhaps monthly), giving pupils the chance to practice each new one and integrate new strategies with old ones. Time should be allocated each week to reflect on where pupils have used the strategies and what benefits they saw – this can be done in the form of a journal entry or in small group discussion.

Pupils can build up a portfolio based on their SEMs detailing how and when they have used the strategies, providing concrete examples and reflection.

One advantage of ensuring consistent use of the SEM in the classroom over time is that they encourage strategy use (which is known to improve performance). It also encourages explicit metacognitive awareness, even in younger pupils, and helps them to construct understandings of how, when and where to use strategies to support their learning.

Strategy	How to Use	When to Use	What is it for?
Skim/Survey	Search for headings, highlighted words previews, summaries	Before you read a long piece of text	Gives an overview of the key concepts, helps you to focus on the important points
Slow down	Stop, read and think about information	When information seems important. If you realise you don't understand what you have just read.	Improves your focus on important information.
Activate prior knowledge	Stop and think about what you already know about a topic.	Before you read something or do an unfamiliar task.	Makes new information easier to remember and allows you to see links between subjects. Information is less daunting if you already know something about the topic
Fit ideas together	Relate main ideas to one another. Look for themes that connect the main ideas, or a conclusion	When thinking about complex information, when deep understanding is needed.	Once you know how ideas are related they are easier to remember than learning as if they are separate facts. Also helps to understand them more deeply
Draw Diagrams	Identify main ideas, connect them, classify ideas, decide which information is most important and which is supporting	When there is a lot of factual information that is interrelated	Helps to identify main ideas and organise them into categories. Reduces memory load. May be easier to visualise

Figure 2.1 - A sample Strategy Evaluation Matrix (SEM) (adapted from Schraw, 1998)

3. Improving regulation of cognition

While an SEM is useful to help pupils develop knowledge of their own cognitive abilities, it may not impact on how much they regulate their behaviour while learning. A checklist that pupils can refer to at any given point in a problem-solving process or extended task may help to make sure that they are on track. Research with pupils aged 10-12 years found that those who used checklists performed better than pupils who didn't in a number of ways including written problem-solving, asking strategic questions, and elaborating on information (King, 1991). It is possible that checklists prompting learners to maintain self-regulatory behaviours help them to be more strategic and systematic.

When introducing a checklist such as the one in Fig. 2.2, you may need to remind your pupils to refer to it at first. Ideally they should have it taped somewhere that is always accessible to them – such as in a homework diary (if you are aiming to use it across subjects), in the front of a workbook, or the inside of a desk lid.

Planning
What is the nature of the task? What is my goal? What kind of information and strategies do I need? How much time and resources do I need?
Monitoring
Do I have a clear understanding of what I am doing? Does the task make sense to me? Am I reaching my goals? Do I need to make changes?
Evaluating
Have I reached my goal? What worked? What didn't work? Would I do things differently the next time?

Figure 2.2 - A sample self-regulatory checklist (adapted from Schraw, 1999)

4. Fostering classrooms that value metacognition

The human brain is designed to look for short-cuts in the way we think and act. Specific strategies are often effortful to use and although we try to make do without them, they are worth the investment in the long-run, especially when the task is complex. For example, have you ever gone to the supermarket without making a list because you couldn't be bothered, only to find that you came home without half of the things you needed? (and a lot more that you didn't need?). Have you ever rushed ahead and filled in the answers to a sudoku or crossword without double-checking them against other clues, only to find that you have made a mistake? Metacognitive strategies that are beneficial in the long run take time to employ and therefore pupils might prefer to avoid them if they can. Why take ten minutes to plan an essay if you can save ten minutes of effort by just getting started?

Metacognition is effortful. The human brain is designed to look for shortcuts. We must show pupils that we value metacognitive enterprise and demonstrate its benefits if they are to subscribe to it.

If pupils are to understand the benefits of metacognitive skills and move towards using them independently, it is important that we model their usefulness and show that we value them day to day in the classroom. The onus is on us to make time for planning in our classes, to prompt students to monitor as they work, and to build-in time for reflection on class work, homework and exam performance.

This last task is particularly important if we wish pupils to view learning as a process and appreciate the amount of information on how to improve that can be gleaned from looking at our mistakes. Most students would rather not look at their mistakes again; they prefer to put them away and pretend they never happened and hope to do better the next time. Prioritising class time for reflection and deciding on next action demonstrates the value of revisiting work for learners.

Modelling metacognitive thinking, considering elements of AfL rather than a wholly grade-based approach, asking questions that evoke HOT skills, encouraging pupils to keep a diary reflecting on the thinking they use, strategies, self-regulation etc, are all ways of showing pupils that metacognition is valued.

Ways to demonstrate that metacognition is valued in the classroom

- ✓ Allocate specific time for planning before an activity
- ✓ Make sure there is adequate time available at the end of an activity or lesson to reflect on what went right, what went wrong, and what can be improved
- ✓ Model metacognitive thinking in your own work
- ✓ Praise instances of planning, monitoring and evaluation
- ✓ Get pupils to keep a diary reflecting on their metacognitive and higher-order thinking processes during a class or task. Allot time for them to complete this
- ✓ Consider not giving grades for some exercises or tests. Instead get pupils to reflect on their performance and plan how they will approach the next one

2.2 Higher-order thinking and questioning skills – a metacognitive approach

In this section we:

- ✓ **Define higher-order thinking skills,**
- ✓ **Examine the use of Bloom's Taxonomy in encouraging HOT skills**
- ✓ **Explore the importance of asking HOT questions & encouraging our pupils to generate higher-order questions**

2.2.1 What are higher-order (HOT) thinking skills?

In teaching young people, we aim to do more that just tell them what to learn. Psychological research into memory suggests that 60% of the factual information learned at school is forgotten within 2-3 years of leaving. So once that is gone, what are we leaving our students with? Beyond factual knowledge, we try to equip them with the tools and skills to allow them to learn ***how*** to learn. The idea of teaching thinking is not a new one, but one that is becoming increasingly important, as the pace of technology and the workplace intensifies. Focussing on metacognitive higher-order thinking skills is more important than ever.

McGuinness (2006) defines higher-order thinking as "the need for learners to go beyond the mere recall of factual information to develop a deeper understanding of topics, to be more critical about evidence, to solve problems and think flexibly, to make reasoned judgements and decisions rather than jumping to immediate conclusions".[17]

A classroom that values metacognitive skills will support and develop higher-order thinking beyond the recall of textbook information.

[17] McGuinness, C. (2005). *Teaching thinking: Theory and practice.* BJEP Monograph Series II, Number 3 - Pedagogy, 1(4):107–126.

2.2.2 What is Bloom's Taxonomy?

Bloom's Taxonomy is a classification system that outlines a variety of cognitive thinking skills, ranging from skills such as remembering factual information to more sophisticated cognitive procedures including the analysis of information to allow for its evaluation. While the original taxonomy was proposed by Bloom in 1956, it has been revised numerous times to make it more relevant and useful to today's classroom.

The six levels of Bloom's Taxonomy are:

1. Remembering **4. Analysing**

2. Understanding **5. Evaluating**

3. Applying **6. Creating**

At each level pupils are asked to engage with information or learning in a different way. The lower levels are often seen as the least "desirable" types of thinking, requiring less sophistication and effort of the student – this shouldn't be the case; each level is an important step in the process of moving towards higher order thinking skills.

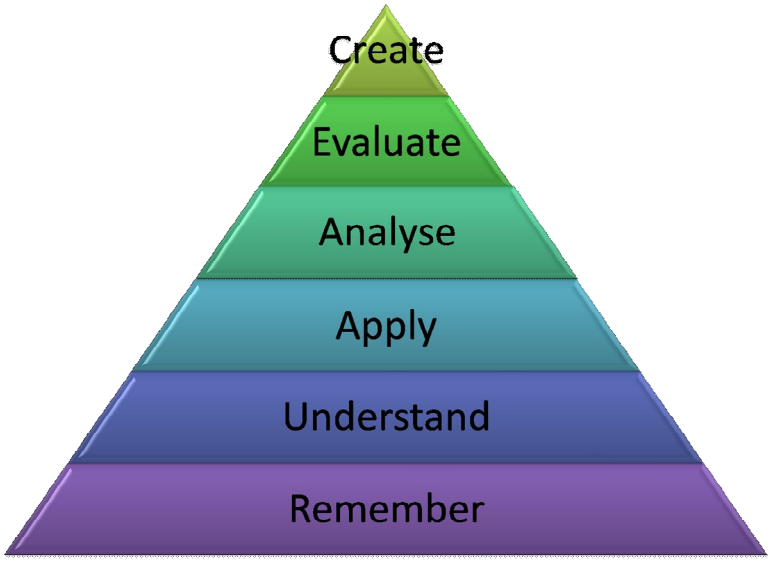


Figure 2.3 - Bloom's Taxonomy of Educational Objectives[18]

[18] Anderson, L.W. & Krathwohl, D.R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.

2.2.3 The six levels of Bloom's Taxonomy

1 Remembering.

Asking questions that require students only to recognise or recall information evokes the lowest level of cognitive processing. However, remembering is critical for meaningful learning and problem-solving. We must be familiar with the factual aspects of any topic or problem if we are to think about it in a complex way. Indeed, it is familiarity with "the basics" that allows us to move beyond them and combine ideas or arguments in new and creative ways. Examples of questions at this level might include

- ✓ What is the chemical formula of water?
- ✓ Name the three basic categories of rocks?
- ✓ Who was the first president of Ireland?
- ✓ Remembering activities ask:
- ✓ What happened when?....
- ✓ Give an account of…..
- ✓ Write a summary of…..

Remembering should not be viewed as the "poor relation" of thinking skills, but as the foundation for moving upwards. However, it is important to move beyond this, and where possible provide opportunities for this activity in conjunction with other higher order skills.

2. Understanding

Moving up to the second rung of the taxonomy, understanding requires students to move beyond merely recalling a piece of information in order to connect it new knowledge and link it to prior learning and experiences. Cognitive processes at this level include *classifying, inferring, comparing* and *explaining.* More able pupils can be pushed further to examine scenarios from other perspectives, re-order information, and consider the consequences of any given outcome.

Examples:

Describe how the common liver fluke (Fasciola Hepatica) has adapted to parasitic life.

3. Applying

Applying knowledge entails using it in new contexts, transferring what has been learned in one topic, situation or problem to a new one. The use of principles or rules from one area employed on a new task or the demonstration of the correct usage of a procedure constitutes the application level of the taxonomy.

Examples:

Carry out a titration to determine…

Show the importance of form, language, tone and theme in the poetry of Heaney

Factorise $(5x^2 - 20x - 25)$

4. Analysing

Analysing involves breaking down a whole idea into parts, and seeing the relationships and patterns between each part. We encourage pupils to fit all the information on a topic together like jigsaw pieces and see the big picture.

When we ask students to analyse information we look for them to:

- ✓ Distinguish fact from opinion
- ✓ Connect conclusions with supportive statements
- ✓ Decide which information is relevant and which can be ignored
- ✓ "Read between the lines" to identify assumptions that may be unstated.
- ✓ Find evidence to support a viewpoint
- ✓ Distinguish dominant from subordinate themes or ideas

Examples

Michael Collins played a vital role in the founding of the Irish Free State. Discuss.

What evidence is there that Portia from Shakespeare's the Merchant of Venice was wise beyond her years?

5. Evaluating

Once information has been understood in context and analysed for relationships and sequences within its constituent parts, it can be evaluated. Evaluation involves making a judgement after exploring a hypothesis and examining the evidence. It can be hard to keep emotional biases out of evaluations and it is important that pupils recognise and acknowledge these, alongside their consideration of the evidence.

Examples:

Evaluate the success of De Valera's policy of Irish neutrality during WWII for the Irish Free State.

Evaluate the consequences of Ireland's changing population pyramid on the social, financial and cultural life of the country.

6. Creating

The final part of the cognitive process challenges pupils to put together disparate ideas to form a new whole. At this level students are expected to draw upon information and ideas from many sources to create a novel resource, solution to a problem or object. Create results in a new product that is something that can be observed and that is more than the students' beginning materials (Anderson & Krathwohl, 2001)[19].

If possible, students should have to draw on as wide a spectrum of information as possible – from previous lessons, from previous chapter and from other subjects. Having the flexibility to integrate knowledge from different areas of the curriculum that may at first seem unrelated is the goal.

Examples:

Design a new experiment to examine sensitivity to touch

Create a campaign to encourage teenagers to reduce their Carbon Footprint. You may use as many different media as you like to get the message across.

[19] Anderson, L.W. & Krathwohl, D.R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives.* New York: Longman.

2.2.4 How can Bloom's Taxonomy be used?

Bloom's Taxonomy is most likely to be successful if it is introduced to pupils in the classroom, rather than kept as just a tool for planning lessons and devising questions. That way pupils get to know what is expected of them, how they should aim to progress their thinking, and what the next goal should be.

After it has been introduced in class, some teachers suggest keeping a poster of the pyramid on the classroom wall and referring pupils to it throughout the year. You could also prepare pupils for questioning by alerting them to the type of question that you are about to ask – point to the chart and say "ok, this next question is an analysis question". By being explicit, you are supporting your pupils in devising an answer by letting them know the level of depth you expect. This may be especially beneficial for less able pupils.

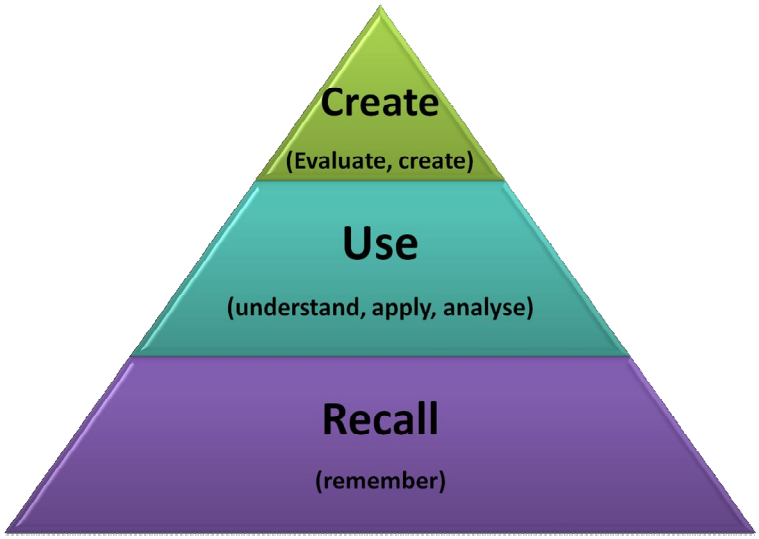
Bloom's Taxonomy is especially useful as it is already differentiated according to levels of complexity. Every pupil should be encouraged of moving beyond the lower levels of the taxonomy but planning a lesson to incorporate activities at the higher levels gives pupils the opportunity to move through the levels at the own pace.

A simpler version of the taxonomy:

Introducing Bloom's taxonomy from an early age, and adopting it across as many subject areas as possible allows pupils the opportunity to become familiar with the levels of the system and to become comfortable in using the terminology.

However, simpler versions of the taxonomy are available that may be more suitable for one to one work with students who have special educational needs and for whom six levels of differentiated work may be too difficult. Walsh and Satte (2003)[20] propose a simplified taxonomy with just three levels:

		Corresponds to	Bloom's Taxonomy Levels
1.	**Recall**	➔	Remember
2.	**Use**	➔	Understand
		➔	Apply
		➔	Analyse
3.	**Create**	➔	Evaluate
		➔	Create



[20] Walsh, J. A., & Sattes, B. D. (2005). *Quality questioning: Research practice to engage every learner*. Thousand Oaks, CA: Corwin Press.

2.2.5 Using HOT skills to develop questioning

Bloom's Taxonomy can be a very useful starting point to consider the types of questions asked (by you and by your pupils) in the classroom. Research indicates that pupils in classrooms that frequently experience high-level complex and supported questions perform better on subsequent examinations. Encouraging metacognition through questioning has two bases: the questions teachers ask, and the questions that pupils ask.

Research findings on Teachers' questioning

Finding #1: Teachers ask a *lot* of questions – many more than we think!

Finding #2: We tend to wait less than one second after asking a question before choosing a student to answer. We wait even less time after pupil responds before we begin to speak

Finding #3: We are often willing to accept an incorrect answer without probing and we frequently answer our own questions.

How many questions does the average teacher ask in a 30 minute period?

When surveyed, teachers estimated they asked an average of 15 questions in a half-hour period, and their pupils in turn asked about 10. In actual fact, when observed, the same teachers posed an average of 50.6 questions; their pupils asked an average of 1.8.[21]

With such a rapid-fire rate of questioning, it is unlikely that many questions required anything more than factual recall of information; Probing questions, those that require students to grapple with a topic, to piggy-back off one

[21] Walsh, J. A., & Sattes, B. D. (2005). *Quality questioning: Research practice to engage every learner*. Thousand Oaks, CA: Corwin Press.

another's answers, and to encourage hypothesising are most likely to be compromised.

- ✓ Questions requiring factual recall have a place establishing the level of understanding in the classroom and in supporting the initial transfer of information to long-term memory.
- ✓ Beyond initial questioning, questions posed should draw on concepts from the upper levels of Bloom's Taxonomy.
- ✓ The best questions are planned beforehand to match the educational objectives of the lesson.
- ✓ A few carefully selected and prepared questions that probe complex issues are preferable to large numbers of questions.

Supporting pupils in answering more complex questions

One of the best ways to help support students after you have asked a challenging question in the classroom is to do nothing. To be quiet. To intentionally allow pupils the time to think and formulate an answer without further prompting, interpretation, repeating of the question, or coaxing.

The way we ask questions affects the response that we get and in turn, the level of cognitive and metacognitive activity that our students engage in!

Obviously as we encourage pupils to think more deeply in class and to engage with HOT skills, all of this extra thinking effort takes time. How much time depends on the difficulty of the question, the pupil's familiarity with the material or topic, and the personality of the pupil in how they like to think, pay attention and respond.

How can we help this process? The answer is surprising. One of the best ways to help support students after you have asked a challenging question in the classroom is to do nothing. To be quiet. To intentionally allow pupils the time to think and formulate an answer without further prompting, interpretation, repeating of the question, or coaxing.

Research shows that in classrooms where there are occasional silences, pupils ask more questions, and give better-quality answers that are more considered. There are two critical junctures in classroom talk where adding a 3- to 5-second pause can greatly impact upon the number and quality of responses offered by pupils. Mary Rowe, the key researcher in this field calls these Wait Time 1 – after asking a question, before choosing a pupil to answer, and Wait Time 2 – after the pupil has offered a response and before the teacher comments in turn. Numerous studies have shown that teachers typically wait less than 1 second at each of these points. [22]

The benefits of adding of pauses in questioning

Pupils:

- ✓ give longer responses – answers that were once brief phrases can expand up to 600%!
- ✓ give evidence for their ideas and conclusions
- ✓ speculate and hypothesise
- ✓ ask more questions
- ✓ don't offer an "I don't know" answer so often
- ✓ talk more to other pupils and are more likely to participate in responding
- ✓ answer with more confidence

[22] Walsh, J. A., & Sattes, B. D. (2005). *Quality questioning: Research practice to engage every learner*. Thousand Oaks, CA: Corwin Press.

Supporting pupils in generating higher order questions

"When a student grapples to create her own questions about content, she is engaging in the process of meaning-making – a standard definition of thinking. By formulating questions, learners connect new information to old, and thereby experience learning as understanding"

Oakes & Lipton, 1999[23]

Morgan and Saxton[24] summed up the case for raising expectations of pupils questioning: "We learn by asking questions. We learn by asking better questions. We learn more by having opportunities to ask more questions".

Questioning can

- ✓ Develop thought processes and guide investigation
- ✓ Stimulate and sustain curiosity and motivation
- ✓ Encourage consideration of risk & new ideas
- ✓ Help clarify ideas, structure work and learn about things of interest
- ✓ Challenge beliefs and prompt reconsideration of current thinking
- ✓ Provoke pupils to share and debate their ideas
- ✓ Encourage learners to ask their own questions and to welcome an ethos of enquiry, risk and challenge.

Learners devise their own questions

Use Bloom's Taxonomy to challenge pupils to write their own questions to pose to the class. They should aim to devise at least one question per level of the taxonomy. In small groups, the questions can be posed, with the asker leading discussion and specifying the criteria that satisfies the answer he seeks.

Pair problem-solving

This strategy was devised for maths or science classrooms but could be applicable to other topics. One learner is designated the problem-solver, and must talk aloud throughout the problem-solving attempt, to explain their thinking. The second student must not intervene in the solution process, even if the

[23] Oakes, J., & Lipton, M. (1999). *Teaching to change the world*. Boston: McGraw-Hill.
[24] Morgan, N& Saxton, J. (2006) *Asking Better Questions.* Pembroke Publishers. Ontario.

partner makes mistakes, but they must to all they can to understand their partner's thinking and to "get behind it" by asking questions. It is difficult for pupils to engage in metacognitive monitoring and reflection while staying focused on the problem at hand itself. In this strategy, the listener clarifies the solver's thinking for him by asking questions. Ideas that might otherwise be fleeting, or threads of a solution that might get lost, are "kept alive" by the questioner.

There are a number of possibilities for employing this strategy with learners of different abilities:

- ✓ Exceptionally able pupils can be paired together for accelerated work
- ✓ The collaborative approach makes a supportive atmosphere for learners with SEN. It can be especially effective as an opportunity for learners with SEN to see questioning strategies modelled by a peer, and practice self-regulatory monitoring
- ✓ The strategy can also be used in one to one coaching or mentoring sessions between a teacher and pupil. The teacher should model the first problem to allow the pupil to warm up and not be "on the spot". The pupil may have difficulty formulating questions initially. Next the pupil should attempt a problem, with the teacher focussing on asking good questions. A period of reflection and discussion at this point on which questions elicited the best responses may be appropriate to evaluate the questions.

New ways to think about questioning:

- ✓ If you think about textbook chapters, where are the most interesting and challenging questions usually located? Often it is at the very end of the chapter, and after a block of questions that require only factual recall. Consider moving some of these key questions to the beginning of lessons or introduce them when you start a new topic. It may give students a chance to explore the topic and relate it to previous knowledge before exposition of the material. It can also help not only to focus thinking but to

provide a metacognitive road-map of the issues to be covered and also the level of depth that is desirable in the topic.

- ✓ After you ask a HOT question, tell students to take a minute to think before answering. This explicitly models that you value thinking time and that the quality of their thinking is more important than how quickly they can produce an answer.
- ✓ Questions should not stop once a question has been asked. Try to expand rather than let an answer (especially an underdeveloped one) pass by. Probing questions can extend pupils' thinking: "Can you expand on that?" "Can you clarify what you mean?" Does that always apply? Can you think of some situations where…? Does that fit with….? What makes you think that?
- ✓ Praise pupil questions that are well-thought out, clearly worded, challenging, or interesting. Before you answer, explicitly point out why you think that is a good question – "That's an unusual question, how did you think of that?" "That question shows a lot of reflective thinking…". It might be a good idea to repeat them, or even to be seen to take a note of them as good examples. This models the importance of good questions for pupils, shows that you appreciate the value, and makes explicit/obvious what some of the characteristics of a good question might be.
- ✓ Consider how the lay-out of your classroom may affect the way in which your pupils ask questions. Research with primary school-aged children suggests that the optimum group size to promote questioning is 4-6. In groups this size children ask more questions and better ones. Individuals in larger groups are less likely to take the risk of asking a question and the traditional classroom layout where all desks face the front may stifle any urge further. Pupils may also feel that they can direct a question to the teacher but not to any other class member
- ✓ Turn a visit from an outside speaker into a press conference. Get students to brainstorm questions beforehand and develop a "master list". Classify questions according to Bloom's Taxonomy and put questions in an appropriate order.

2.3 The SQ4R method of reading and studying

This strategy focuses on:

- ✓ **Activating prior knowledge**
- ✓ **Formulating questions – especially HOT skills**
- ✓ **Organising**
- ✓ **Monitoring understanding and progress**

This section draws on skills developed using:

- ✓ **SEM matrices**
- ✓ **Self-regulation checklists**
- ✓ **Bloom's Taxonomy**

Picture the scene:

> *You have an exam looming on a topic that you don't know very well at all. Perhaps you missed some of the classes through illness or an extra-curricular activity. Or maybe it was a topic that was taught some months ago that now only seems vaguely familiar. You begin with good intentions and firm resolve, at the first page of the textbook chapter. Fifteen minutes later you realise that you have completely lost the thread of what you have been reading about. In fact, you suspect you may have turned the page 2 or 3 times without even realising*.

Most of us can probably relate to the situation described above. We've all been there when we need to read something technical, something we find boring, or something that requires a lot of interpretation. At some point, (and hopefully sooner, rather than later) our system of metacognitive self-regulation is activated and we realised that we don't know what we have (supposedly) read. It can be quite demotivating; firstly that the time invested so far has been wasted, and secondly, that you must return to the beginning and start all over. Indeed in some situations, so much time is spent mastering the first parts of a topic from a textbook that the pupil runs out of time altogether and doesn't sufficiently cover the end – the part which often includes more challenging material, thought-provoking ideas and satisfactory resolutions.

The truth is that in most subjects, textbooks can't be read the same way we read books for pleasure. Starting at page one and expecting to follow the "plot" while retaining all of the information that we need is just not possible and it's certainly not an efficient way to proceed.

The SQ4R method provides a metacognitive road-map for reading and studying. It fosters a mindful and metacognitive approach to interacting with material that is to be read and studied. It encourages students to be active in how they read material and to question and make links as they read.

SQ4R stands for:

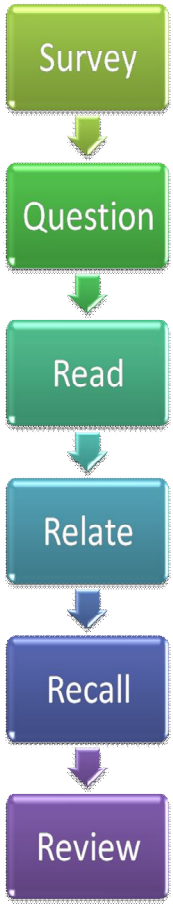


Figure 2.4 - The stages of the SQ4R method

Stage 1: Getting ready to read the textbook

This phase may feel like breaking all the rules! Rather than beginning to read at page 1 and proceeding in an orderly fashion, you are encourage to rummage around the chapter to get an idea of what is coming up.

Survey

Before settling down to read any chapter of a textbook, the first step is to survey chapter to see what lies ahead. Read the title of chapter and the introductory paragraph. This is will give you an indication of the overall theme of the chapter. Next, go through the chapter page by page and read any section headings. Try to formulate an idea of the sequence of facts or information that is presented and how they might fit together.

Flick through the chapter again and look at each picture and graph. Try to make sense of them, read any captions, and think about how they might relate to the information from the subheadings; pictures or graphs are only included in books if they illustrate an important point so pay attention to them!

Finally, turn to the end of the chapter and read the summary – this will focus on the most important parts. You should now have a clear idea of what the chapter is about. This phase of preparing to read is a bit like setting up a road map in your head. When trying to find a new place, you get there much faster if you have general idea of the direction to need to walk in, rather than meandering along, hoping for the best – the same is true of reading a textbook chapter.

Question

Hold on - You are still not ready to read! The next step is to draw up a list of questions to answer as you read. These might be questions that occurred to you as you surveyed the chapter. They might be some questions from the end of the chapter that refer to the text. A very good idea is to take each of the section headings and turn them into questions that you should answer as you go along. This has two functions:

1) Having questions to answer along the way makes reading active – it gives you something to **DO** other than just let the words wash over you. It means that you have to anticipate where an answer might appear and note it, keeping you involved.

2) If you have a list of questions to answer as you read, it is a good way to mark your progress. As you answer them you can really feel that you are moving through the text. It breaks up the journey a bit!

Stage 2 – Reading!!

Read

Now you are ready to read! As you read the text, keep thinking about the questions you asked, and note the answers as you go along. Make notes in the margin of things that surprise you, put a star beside anything that you think is a key point. Every few pages stop for a moment and try to…

Relate…

…the information that you have read to something you already know. The fact is that we remember new information better when we try to connect it to things we already know, to information from other lessons, to personal experiences.

Stage 3 – Thinking about what has been read

Recite/ Recall.

Now is the time to tell the story in your own words. The quickest way to see if you understand something is to check whether you can explain it out loud. Look back over the questions you devised and see if you can answer each of them fully, with more than one sentence. At the end of each section, try to talk out loud about the main points. Again, this forces your brain to be more active than just reading, it gives you immediate feedback on how much you understand, and which bits you need to take a second look at. Feel free to work in information that relates to what you have read, from the previous step. Humans are story-tellers by nature - try to “tell the story” of the chapter. Try your best to do this step aloud. If you do it in your head it is easy to glance at the page and think “yes, I

understand all that information" without really testing the truth of the statement! Don't allow your brain to be lazy!

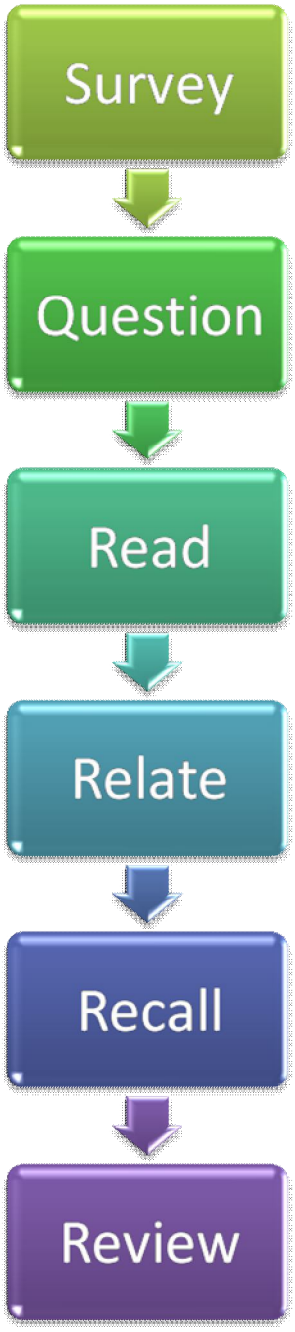
Review

If there is anything that you are unsure of, read it a second time. Review the questions you asked before you began and check that you have an answer for each of them. The following day, look at the notes that you have made from the chapter and check that they are complete. You might have to read some sections of the chapter again to be satisfied that you can make sense of them – this doesn't mean that your system doesn't work, or you are not doing it right. Quite the opposite – it is all part of the process of learning new material and it means that you are aware of problems along the way.

Feel free to devise a different acronym for this strategy if you think it would work better – it doesn't matter what you call it as long as the steps are applied.

SQ4R Method for reading and studying

Pupil Name_____



Survey : What do I do at this step?

_____
_____
_____
_____
_____

Question: What do I do at this step?

_____
_____
_____
_____
_____

Read: What do I do at this step?

_____
_____
_____
_____
_____

Relate: What do I do at this step?

_____
_____
_____
_____
_____

Recall: What do I do at this step?

_____
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_____
_____
_____

Review: What do I do at this step?

_____
_____
_____
_____
_____

2.4 K-W-L charts

This strategy focuses on

- ✓ **Activating prior knowledge**
- ✓ **Formulating questions – especially HOT skills**
- ✓ **Organising**
- ✓ **Monitoring understanding and progress**

This section draws on skills developed using:

- ✓ **SEM matrices**
- ✓ **Self-regulation checklists**
- ✓ **Bloom's Taxonomy**
- ✓ **SQ4R method**

K-W-L stands for ***know***, ***want*** *to know, have* ***learned***. A K-W-L chart is a graphic organiser that requires pupils to activate their prior knowledge about a topic, think about the topic in advance of reading/expository class work to decide what information they need to know, and finally encourages them to record their progress in learning and finding out.

Step 1 – What I know

When you introduce a new topic to the class, the first step is to get them to come up with as many things that they already know about the topic as possible. This can be done as a whole class brainstorm, as a think-pair-share activity, or individually. Once a list of familiar information is assembled, it should be revised to ensure that it doesn't contain repetition. It can also be organised thematically (or perhaps chronologically in a subject such as history) and should then be entered in the "What I know" column of the chart.

Step 2 – What I want to know

This step involves building upon the information that is already know, and guidance that may come from the title of the lesson, or the title of a book chapter that corresponds to it, hunches that the pupil may have or particular pockets of interest. Pupils must compile a list of questions that reflect "what they want to know" about a topic. These questions can then guide the direction of study and exploration of a topic which can act as a mechanism to involve and engage

pupils as they find out the answers to their specific questions. It can also act as sign-posts along the way as progress is made through the topic area, aiding monitoring.

Step 3 – What I have learned

At this step, pupils record the answers to the questions that they posed at step 2. This provides a tangible record of progress and also an organisational framework for the learning. It is important to complete this stage of chart so that learners can work through the full organisational strategy.

Extending the KWL charts

There are a number of ways in which the use of KWL charts can be extended for more able learners, or as learners become more familiar with them.

KWHL charts include an extra column where the pupil must record how they will find out the information that they need; obviously this is only applicable where a source other than a single text-book is being used! Classes where experiments, practical work, audio-visual resources etc are used can make good use of this extension.

KWLS charts have an extra column at the end where pupils can extend their thinking by noting what they **STILL** want to know. This may be either an original question that has gone unanswered, in which case the column acts as a useful checking mechanism, or a new question that has emerged as their understanding deepens, so the column becomes a springboard for further investigation.

Development of questions in the "What I want to know column"

It is likely that at first pupils' questions for the middle column will be fact based and relatively simple. However, used in conjunction with Bloom's Taxonomy, devising questions that require greater higher order thinking skills can be modelled for pupils and they can eventually move towards coming up with these questions themselves.

Name Date

Topic: World Population – **SAMPLE SHEET**

What I know	What I want to know	What I have learned
Countries have different population sizes • Is this due to land mass? Population in developing countries is increasing ; decreasing in developed Famine, War, health care, could all affect population size	Which countries have largest populations? Which have fastest growth? Why? What is a population pyramid? What other factors affect population size What is the impact on countries wealth if they have large population?	

Name: Date

Topic:

What I know	What I want to know	What I have learned

Name Date:

Topic

What I Know	What I want to know	How will I find out?	What I have learned

Name Date

Topic

What I Know	What I want to know	What I have learned	What I still need to know

2.5 PMI – Plus, Minus, Interesting

This strategy focuses on

- ✓ **Organising information**
- ✓ **Activating Prior Knowledge**
- ✓ **Formulating questions**
- ✓ **Building curiosity**

This section draws on skills developed using:

- ✓ **Bloom's Taxonomy**
- ✓ **KWL charts**

PMI is a short exercise devised by Edward de Bono[25] as a thinking warm-up. It is designed to encourage pupils to look at all sides of a problem before making their mind up. PMI stands for ***Plus, Minus and Interesting***

PMI is really easy to conduct. A statement is made, and pupils have one minute to think and note everything they can that is positive about it (or in favour of it). Then one minute is allocated to think up of as many negatives as possible. A final minute is devoted to thinking about interesting points that the statements raises.

As a whole class group led by the teacher, or in smaller groups, the positives of the statement are recorded and discussed. ONLY positive comments (or pros of the situation) should be recorded at this stage. Once fully explored, then discussion proceeds to the negatives. Finally, time is devoted at the end to the "interesting" ideas, thoughts or questions that the original statement provokes.

Using PMI encourages the whole class to work together to thoroughly consider a problem from all angles and to avoid reactive judgements. It also helps to avoid the competitive classroom situation that occurs when one child offers a response, which is then challenged by another pupil. The first pupil may feel put down, both are looking to you as teacher to say which is right, and you are left juggling two (or more) very pertinent but opposing points of view and trying to draw them together to show both sides of the argument.

[25] De Bono, E. (1985) *De Bono's Thinking Course*, London: Ariel Books.

As a class exercise PMI can be a good way to introduce a topic and encourage everyone to think about it in an orderly and managed way. A fun or silly statement can be used as an ice-breaker to warm a class up, or it can be used to tackle issues from the curriculum. PMI is most effective when a record is taken of the comments made, so that it is not merely forgotten about.

Extensions of PMI

- ✓ Use the technique for planning an essay in English or Irish in order to consider a topic from all angles
- ✓ Examine the consequences and positive outcome from events in History. You can even do the PMI from the perspective of each of the protagonists in a complex situation.
- ✓ Use the PMI strategy to generate ideas for a class debate on any curricular topic. Each side of the debate could do their own PMI assessment in order to pre-empt the other's arguments

Name: Subject:

Discussion Topic:

Plus +	Minus -	Interesting ?

Ainm:

Dearfach +	Diultach -	Suimiuil ?

2.6 Concept Maps

This strategy focuses on:

- ✓ **Organising**
- ✓ **Activating prior knowledge**
- ✓ **Monitoring and understanding progress**

This section draws on skills developed using:

- ✓ **SQ4R method**
- ✓ **K-W-L charts**

Concept maps are graphic organisers that spatially represent the ideas relevant to a topic, and the ways in which they are related and inter-linked. The maps are more formal and precise versions of the "spider diagrams" which are often used to collect ideas from a brainstorming session, as they require the learner to specify exactly how the ideas fit together.

Concept maps are constructed by placing key ideas in boxes or cells, and using arrows and very short descriptives to identify the relationships between the cells. Concept maps are usually hierarchical, with the broadest concept or overarching topic at the top of the map and subordinate concepts described underneath. However, depending on the depth of the map, or whether perhaps two previously constructed maps are being combined in order to show learning links, a strict hierarchical structure may not be appropriate.

Below is an example of a work-in-progress concept map based on a science lesson on the 'states of matter'. You can probably see a number of places where extra links can be added. Concept maps are always growing and can be added to over a number of lessons if appropriate. They may get messy, and it is important to remember that as knowledge becomes more complicated and interlinked it may not be possible to have a tidy map where everything fits in. However, concept maps can, and should, be revised as learning proceeds. Again, this demonstrates to pupils the way in which their knowledge changes,

and that revising work is important, especially as we are learning new things all the time.

Deep learning occurs as we attempt to integrate new information into existing concepts and to make links between new ideas as they are presented. Concept maps can be useful tools in this respect for a number of reasons:

1. They allow the teacher to see how pupils' understanding of a concept is developing based on the type of map they develop and its richness
2. Pupils are exposed to a technique that requires them to be precise in how they organise their knowledge and express it as succinctly as possible
3. Writing is kept to a minimum, reducing the load for pupils who have difficulty with text. This also makes them valuable study guides as it highlights key ideas within a topic without excessive "wordiness" – a contrast to some pupils' tendency to underline or highlight too much text, rather than the key points.

Deep learning occurs as we attempt to integrate new information into existing concepts and to make links between new ideas as they are presented. Concept maps can be useful tools in this respect

Concept maps can also be used as assessment of understanding; the number of concepts represented in the map can give an indication of breadth of learning, while the number of subordinate levels may suggest depth. Overall, the number of relationships that the pupil can identify and the precision with which they can do so may be indicative of familiarity with the topic.

An example of a simple concept map based on states of matter is included overleaf to give an idea of how one might look.

Tips for using concept maps

- ✓ Pupils may find concept maps very difficult to begin with, although once they have developed familiarity with them they become better practiced at organising their conceptual understanding
- ✓ Concept maps require a lot of puzzling out in order to fit them together in a sensible way. Unlike spider diagrams that are often used for quickly mapping out the main points of a topic, concept maps have a more rigid hierarchy. Be sure to explain to pupils that concept mapping takes effort, so that they are not discouraged from the outset.
- ✓ Consider using blank concept maps to test pupils' understanding of a topic, instead of a more traditional test. You could provide some keywords already in the diagram, or give the list of keywords that are to be slotted in to the blank spaces with accompanying links phrases at the arrows. This type of test may particularly support pupils who have difficulties with reading or writing large amounts of text – they still must demonstrate their understanding but the written requirement is limited.

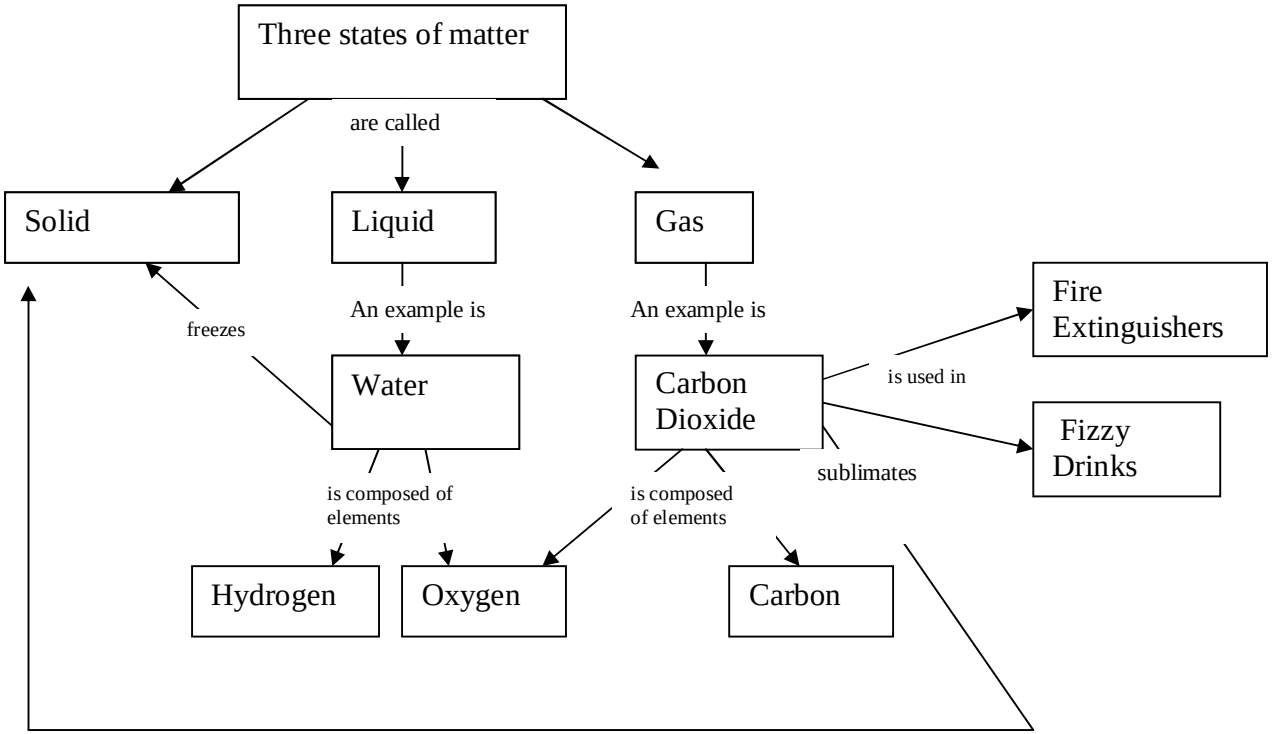


Figure 2.5 - Example of simple concept map of the states of matter

2.7 Self-reflection and evaluation techniques for learners

In section 1, we described the ideal learning cycle, which incorporates the metacognitive concepts of planning, monitoring and evaluating what is being learned at each step.

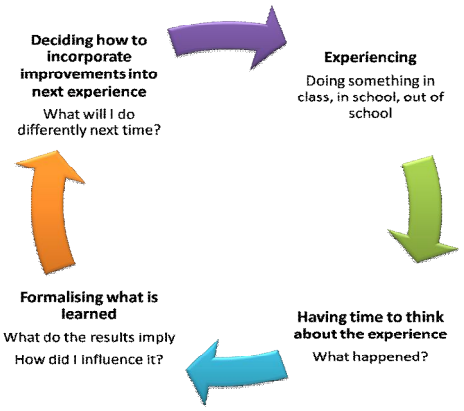


Figure 2.6 - The Learning cycle (adapted from Kolb, 1984)

Assessment for learning plays a key role in this cycle, with the teacher acting as a facilitator for self-reflection and evaluation. Encouraging pupils to reflect upon, and evaluate, their work may be a battle however!

Motivation for learning and engaging in reflection has an emotional component relating to a pupil's own goals and view of their abilities. Students who aim to master a subject or topic seek to ***improve*** their competence; students who are concerned only to get high grades to look smart seek only to ***prove*** their competence. Pupils who believe that the grade they get is both the most important part of the learning process and a reflection of their identity are likely to find making mistakes stressful and shy away from reflecting on their performance, preferring to just hope for the best next time. These pupils don't like to take risks and challenge themselves in case they make mistakes.

A classroom environment that is conducive to metacognitive thinking, that models the value of learning from errors, and that actively encourages self-reflection can work toward helping pupils who are strongly performance-oriented to understand that employing effort in thinking, planning and evaluating does not diminish their ability – in fact it adds another string to their bow.

Ideas for supporting pupils with self-reflection:

- ✓ Ask pupils to keep a reflective journal of their progress and thinking. This should not be simply a log of the things that they have done but of ideas they found difficult, successes, moments of understanding. Allocate a few minutes of class time to fill this in, and ask permission before you read it.
- ✓ Consider not giving a grade occasionally for a test or piece of homework. Instead give feedback on what the pupil can do to improve for the next time. Be sure to follow up on this next time around – point out where they have used the feedback to improve. If they haven't taken the feedback on board explicitly model how they can use it.
- ✓ Ask pupils to evaluate their own work – they are generally not too lenient with themselves. If they are too harsh, be sure to point out what they have done well.
- ✓ Pupils are unlikely to undertake evaluations in their own time, at least initially. Making time in your class period for them to evaluate their work shows that you consider the process important.
- ✓ It is important to follow up self-evaluations that pupils carry out – in this way you acknowledge the thinking that they have done
- ✓ Consider asking pupils to revise work. Learning is not a one-shot affair. Give constructive feedback on an essay or project, and then ask them to revise and improve it.
- ✓ Mid-task reflection time: In the middle of a task or project (over the course of one lesson or many), allow pupils time to reflect on the learning goals, and to compare their goals with the objectives. Pupils can revise their plans as they see fit.
- ✓ Use strategies such as KWL charts as opportunities to reflect on what progress has been made.
- ✓ Pupils can only evaluate their performance if the criteria for successful performance and learning objectives have been made clear to them beforehand. Be explicit about your expectations and the objectives.

Assessment for learning takes a lot of time and commitment to implement, especially on a whole-school basis and adopting it fully may not be appropriate for your school. However, employing key strategies from the philosophy (even only from time to time to begin with) can be effective in encouraging self-regulation and taking control of their own learning.

Self-evaluation techniques are helpful for exceptionally able pupils, who may be susceptible to performance orientations, if they are used to getting consistently high grades. Shifting the focus from “grade-chasing” to a more measured reflection can encourage them to extend and elaborate on their thinking, and to focus on study strategies to help in areas of weakness. Giving constructive feedback instead of grade can be liberating for able pupils, who may measure self-worth in academic grades.

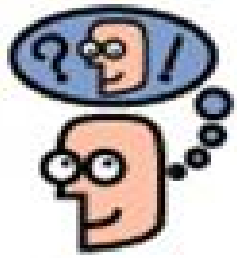
The techniques are also useful for learners with SEN, as they can help move the pupil towards independent learning. Pupils with SEN are particularly liable to feel disconnected from the learning process and disaffected. Taking part in self-evaluation, supported by a teacher who can guide the process and engage them in dialogue about future directions not only encourages self-reflection but shows them how the role they can play in their own learning.

The next page gives a sample suggestion of a poster for a classroom wall or noticeboard to spark class discussion about informal evaluations of the lesson. It can also be used as a handout/prompt card in a learning resource or mentoring scenario.

After that there are examples of “wrappers” that can be used to “wrap up” a unit of work, a test, or a piece of homework. They can easily be adapted to suit the subject that you teach and the age and ability of your learners. Finally, we present two examples of self-report questionnaires that could be used in classroom situations, learning support, or mentoring, to enable pupils to explore their own use of metacognitive processes.

Self-evaluation questions

- What did you find easy?
- What did you find difficult and what helped you move on? (friend/resource/teacher etc.)
- What do you need more help with?
- What are you most pleased with?
- Have you learnt anything new?
- How would you change this activity for another group or class?
- Do you have any questions?



Chemistry Homework Wrapper - sample

The goal of this homework is to give you practice balancing chemical equations.

1. Before you begin this homework rate each of the following statements according to how true it is for you.

The idea of balancing chemical equations is familiar to me, and I know why it is done

Not at all true for me					Very true for me	
1	2	3	4	5	6	7

I feel confident that I can accurately balance chemical equations

Not at all true for me					Very true for me	
1	2	3	4	5	6	7

2. Now balance these equations:

(a) $K_2O + H_2O \rightarrow KOH$

(b) $Al + O_2 \rightarrow Al_2O_3$

(c) $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$

3. **After** completing this assignment rate each of the statements in terms of how true it is for you :

If I was given new examples of equations to balance I could do it

Not at all true for me					Very true for me	
1	2	3	4	5	6	7

I can explain in my own words why we need to balance equations

Not at all true for me					Very true for me	
1	2	3	4	5	6	7

4. What can you do now to improve your understanding of this topic?

French Test Reflection Sheet - Sample

Topic of test: Date of test

1. Estimate how much time you spent preparing for this test? _____ hours

2. What percentage of your time did you spend doing each of the following:

a	Reading the textbook	_____%
b	Reading your notes/copybook from class	_____%
c	Learning vocabulary	_____%
d	Practicing speaking out loud	_____%
e	Learning verbs	_____%
f	Checking comprehension and noting words you didn't understand	_____%
g	Trying out practice questions	_____%

3. Now that you have looked over your test, check or estimate how many marks you lost because:

a	I wasn't sure of the verb to use, or used the wrong tense	_____marks
b	I didn't understand the vocabulary	_____marks
c	I didn't know the vocabulary I needed to complete my own writing	_____marks
d	I didn't spend enough time reading the comprehension and trying to figure it out before I started	_____marks
e	I spelled lots of words wrong	_____marks
f	I made some careless mistakes	_____marks

4. Based on your answers to the question above, name at least 3 things that you will do differently in preparing for your next test. Will you begin preparing earlier? Will you make flashcards to learn new words? Perhaps you will spend less time looking the book and more time? Try to be as specific as you can – Don't just say "I will study harder"!

   My study goals for the next test are:

   1)

   2)

   3)

Science Test Reflection Sheet - Sample

Topic of test: Date of test

1. Estimate how much time you spent preparing for this test? _____ hours

2. What percentage of your time did you spend doing each of the following:

a	Reading the textbook	_____%
b	Reading your notes/copybook from class	_____%
c	Learning definitions	_____%
d	Drawing diagrams	_____%
e	Checking you could explain something without looking at the textbook	_____%
f	Re-reading sections of your textbook	_____%
g	Trying out practice questions	_____%

5. Now that you have looked over your test, check or estimate how many marks you lost because:

a	I wasn't sure of key definitions	_____marks
b	My diagrams were not complete or were not labelled correctly	_____marks
c	I didn't describe an experiment fully or forgot key steps	_____marks
d	I didn't know how to do a calculation	_____marks
e	I forgot to include units (like cm^3 or g/cm^3)	_____marks
f	I didn't know the important information (concepts) about a topic/chapter	_____marks
g	I made some careless mistakes	_____marks

6. Based on your answers to the question above, name at least 3 things that you will do differently in preparing for your next test. Will you begin preparing earlier? Will you try a new way of learning definitions? Perhaps you will spend less time reading the book and more time trying out practice questions? Try to be as specific as you can – Don't just say "I will study harder"!

   My study goals for the next test are:

   1)

   2)

   3)

2.7.1 Self-report questionnaires for informal assessment of metacognitive awareness

In this section we present two questionnaires for pupils that can help both pupil and teacher to gauge the level of their understanding of metacognitive concepts and the likelihood that they use them. In essence, they check whether pupils recognise the value of actions such as monitoring progress or planning before attempting a task, and also requires them to report how likely they are use these strategies. The Metacognitive Strategies for Reading Questionnaire (MARSI) relates specifically to metacognitive behaviours while reading, whereas the Junior Metacognitive Awareness Inventory (Jr. MAI) refers to more generalised metacognitive strategies.

Informal assessment

It is very difficult to reliably test how "metacognitive" a pupil is on a day-to-day basis – firstly, there are no tests available that have been standardised against a representative population and secondly, the amount of metacognitive activity that a pupil engages in is likely to influenced by factors such as their enjoyment of a particular subject, how well they feel they have conceptualised the topic under study, their levels of energy, and the task they are carrying out.

In addition, the questionnaires presented here are self-report; the pupil must fill them in according to their own judgment of their metacognitive actions. Such questionnaires naturally incur bias – some may be too harsh in their assessment of their abilities, although it is more likely that exaggeration may occur in order to select responses that pupils think are desirable.

Therefore, it is strongly recommended that these questionnaires are used as exploratory tools to begin a dialogue between pupil and teacher about metacognition, or as a way to introduce the concept, or some of the strategies outlined in this resource to a group. The questionnaires should not carry any assessment weight.

It is very difficult to reliably test metacognition in pupils: it varies based on the subject, motivation levels, tiredness, enjoyment, and the measures are self-report, which are open to bias. Therefore, any assessments using the tools present here should be informal, and used to initiate discussion about metacognition, rather than "test" metacognitive awareness.

The Metacognitive Awareness of Reading Strategies Inventory (Mokhtari & Reichard, 2001)[26]

The Metacognitive Awareness of Reading Strategies Inventory (MARSI) is a self-report questionnaire of with 30 items that pupils can use to rate the frequency with which they use key metacognitive strategies related to reading when they read school textbooks or other study material.

The items on the inventory are arranged to form three subscales that focus on global reading strategies, problem-solving strategies and support strategies.

Global strategies	Problem-solving strategies	Support strategies
E.g. activating prior knowledge; predicting what text is about; checking that text fits the purpose of reading; previewing text for content; skimming to note text characteristics; deciding what to read closely; using context clues	E.g. reading slowly and carefully; adjusting reading rate; paying close attention to reading; pausing to reflect; rereading; visualising information read; reading text out loud; guessing meaning of unknown words	E.g. Taking notes while reading; paraphrasing text information; revisiting previously read information; asking self questions; underlining text information; discussing reading with others; writing summaries of text.

The MARSI is designed to be suitable for pupils from the age of 12. Pupils rate how often they perform each of the strategies listen on a scale of 1 to 5, where 1 represents

[26] Mokhtari, K., & Reichard, C. (2002). Assessing students' metacognitive awareness of reading strategies. *Journal of Educational Psychology, 94*, 249–259.

a strategy that is never carried out and 5 corresponds to a strategy that is used very frequently.

At the end, an overall score, and a score for each of the subscales is obtained. The average of the overall score and each subscale score can be obtained by dividing the score obtained in each case by the number of questions. A rough guideline is presented to suggest the pupil's level of metacognitive awareness where a score of 3.5 or higher represent a high score, scores in the range 2.5–3.4 are medium and scores of 2.4 or lower are in the low bracket.

The Junior Metacognitive Awareness Inventory (Sperling, Howard, Miller & Murphy, 2002)[27]

This inventory looks at general metacognitive awareness of learning strategies and taps understanding of the role of prior knowledge activation, monitoring progress during learning, planning, and evaluation at the end of the learning process.

This inventory was developed in the USA and has not been tried out with Irish schoolchildren. The maximum possible score that can be achieved is 90, and pupils aged 12-15 in the US scored an average of 64. These figures are provided to give a general indication however, and should not be considered as concrete standards of performance.

It is important to present the above assessments within an AfL context, as a tool to indicate where the pupil could improve. It is vital that the pupil understands that it is possible to improve their metacognitive performance, and that a low score indicates areas that can be developed rather than lack of ability and permanent failure.

[27] Sperling, R., Howard, L., Miller, L., & Murphy, C. (2002). Measures of children's knowledge and regulation of cognition, *Contemporary Educational Psychology, 27*, 51-79.

Metacognitive Awareness of Reading Strategies Inventory (MARSI)

Listed below are statements about what people do when they read *academic or school-related materials* such as textbooks or library books.

Five numbers follow each statement (1, 2, 3, 4, 5), and each number means the following:

- **1** means "I **never or almost never** do this."
- **2** means "I do this **only occasionally**."
- **3** means "I **sometimes** do this" (about **50%** of the time).
- **4** means "I **usually** do this."
- **5** means "I **always or almost always** do this."

After reading each statement, **circle the number** (1, 2, 3, 4, or 5) that applies to ***you*** using the scale provided.

Please note that there are **no right or wrong answers** to the statements.

Type		Strategy	Scale
G	1	I have a purpose in mind when I read.	1 2 3 4 5
S	2	I take notes while reading to help me understand what I read.	1 2 3 4 5
G	3	I think about what I know to help me understand what I read.	1 2 3 4 5
G	4	I preview the text to see what it's about before reading it	1 2 3 4 5
S	5	When text becomes difficult, I read aloud to help me understand what I read.	1 2 3 4 5
S	6	I summarize what I read to reflect on important information in the text.	1 2 3 4 5
G	7	I think about whether the content of the text fits my reading purpose.	1 2 3 4 5
P	8	I read slowly but carefully to be sure I understand what I'm reading.	1 2 3 4 5
S	9	I discuss what I read with others to check my understanding.	1 2 3 4 5
G	10	I skim the text first by noting characteristics like length and organization.	1 2 3 4 5
P	11	I try to get back on track when I lose concentration.	1 2 3 4 5
S	12	I underline or circle information in the text to help me remember it.	1 2 3 4 5
P	13	I adjust my reading speed according to what I'm reading.	1 2 3 4 5
G	14	I decide what to read closely and what to ignore	1 2 3 4 5
S	15	I use reference materials such as dictionaries to help me understand what I read.	1 2 3 4 5
P	16	When text becomes difficult, I pay closer attention to what I'm reading.	1 2 3 4 5

G	17	I use tables, figures, and pictures in text to increase my understanding.	1	2	3	4	5
P	18	I stop from time to time and think about what I'm reading.	1	2	3	4	5
G	19	I use context clues to help me better understand what I'm reading.	1	2	3	4	5
S	20	I paraphrase (restate ideas in my own words) to better understand what I read.	1	2	3	4	5
P	21	I try to picture or visualize information to help remember what I read	1	2	3	4	5
G	22	I use typographical aids like boldface and italics to identify key information.	1	2	3	4	5
G	23	I critically analyze and evaluate the information presented in the text	1	2	3	4	5
S	24	I go back and forth in the text to find relationships among ideas in it.	1	2	3	4	5
G	25	I check my understanding when I come across conflicting information.	1	2	3	4	5
G	26	I try to guess what the material is about when I read	1	2	3	4	5
P	27	When text becomes difficult, I reread to increase my understanding.	1	2	3	4	5
S	28	I ask myself questions I like to have answered in the text	1	2	3	4	5
G	29	I check to see if my guesses about the text are right or wrong.	1	2	3	4	5
P	30	I try to guess the meaning of unknown words or phrases.	1	2	3	4	5

Metacognitive Awareness of Reading Strategies Inventory (MARSI)
Score sheet

1. Write your response to each statement (i.e., 1, 2, 3, 4, or 5) in each of the blanks.
2. Add up the scores under each column. Place the result on the line under each column.
3. Divide the subscale score by the number of statements in each column to get the average for each subscale.
4. Calculate the average for the whole questionnaire by adding up the subscale scores and dividing by 30.
5. Discuss your results with your teacher or tutor.

Global reading strategies (G subscale)	Problem-solving strategies (P subscale)	Support reading strategies (S subscale)	Overall reading strategies
1._____	8._____	2._____	
3._____	11._____	5._____	G._____
4._____	13._____	6._____	
7._____	16._____	9._____	
10._____	18._____	12._____	P._____
14._____	21._____	15._____	
17._____	27._____	20._____	
19._____	30._____	24._____	S. ._____
22._____		28._____	
23._____			
25._____			
26._____			
29._____			
G score _____	P score _____	S score _____	Overall score _____
G mean _____	P mean _____	S mean _____	Overall mean _____

Key to averages: 3.5 or higher _ high 2.5–3.4 _ medium 2.4 or lower _ low

Interpreting your scores:
The overall average indicates how often you use reading strategies when reading academic materials.

The average for each subscale of the inventory shows which group of strategies (i.e., global, problem solving, and support strategies) you use most when reading. With this information, you can tell if you score very high or very low in any of these strategy groups. Note, however, that the best possible use of these strategies depends on your reading ability in English, the type of material read, and your purpose for reading it. A low score on any of the subscales or parts of the inventory indicates that there may be some strategies in these parts that you might want to learn about and consider using when reading

The Junior Metacognitive Awareness Inventory

We are interested in what learners do when they study. Please read the following sentences and circle the answer that relates to you and the way you are when you are doing school work or home work.

There are no right or wrong answers, so please answer as honestly as possible.

1 = **Never** **2** = **Seldom** **3** = **Sometimes** **4** = **Often** **5**= **Always**

Q.		Scale				
1	I know when I understand something.	1	2	3	4	5
2	I can make myself learn when I need to.	1	2	3	4	5
3	I try to use ways of studying that have worked for me before.	1	2	3	4	5
4	I know what the teacher expects me to learn.	1	2	3	4	5
5	I learn best when I already know something about the topic.	1	2	3	4	5
6	I draw pictures or diagrams to help me understand while learning.	1	2	3	4	5
7	When I am finished with my schoolwork, I ask myself if I learned what I wanted to learn	1	2	3	4	5
8	I think of several ways to solve a problem and then choose the best one.	1	2	3	4	5
9	I think about what I need to learn before I start working.	1	2	3	4	5
10	I ask myself how well I am doing while I am learning something new	1	2	3	4	5
11	I really pay attention to important information	1	2	3	4	5
12	I learn more when I am interested in the topic.	1	2	3	4	5
13	I use my learning strengths to make up for my weaknesses.	1	2	3	4	5
14	I use different learning strategies depending on the task	1	2	3	4	5
15	I occasionally check to make sure I'll get my work done on time.	1	2	3	4	5
16	I sometimes use learning strategies without thinking	1	2	3	4	5
17	I ask myself if there was an easier way to do things after I finish a task	1	2	3	4	5
18	I decide what I need to get done before I start a task.	1	2	3	4	5

3. Applying metacognitive strategies in the school context

As outlined throughout this document, metacognitive training and strategies are useful for all learners. However, the ways in which they are used and the different contexts in which they can be applied may vary from school to school depending on particular organisational arrangements. Especially in relation to pupils with SEN, we can be broadly advised by current policy and good practice such as the 'staged approach'. Thus, the main emphasis ought to be on assisting the learning of the curriculum in the mainstream classroom with, perhaps, additional support from more specialist staff under the normal SEN arrangements.

The following, for instance, are some brief examples of the different contexts in which the approaches outlined here might be applied:

- In mainstream classes for all pupils, including those with SEN.
- In mainstream classes with differentiated approaches for particular pupils.
- In team-teaching or group-work situations in mainstream classes.
- In 'withdrawal', banded or other such arrangements where pupils needing particular supports are concentrated.
- In one-to-one resource or learning support situations with particular pupils.
- In mentoring-type arrangements for particular individuals or groupings, such as by a Year Head, or subject teacher.
- As a form of 'study skills' coaching.

It is hoped that the schools involved in the Equality of Challenge initiative will get an opportunity to explore some of these principles and strategies in the Irish context and that some of these will be included in a further version of this resource.