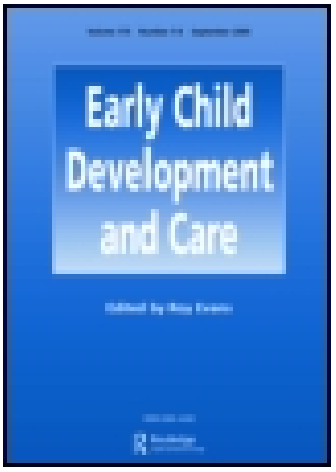

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Thinking About Thinking: Developing Metacognition in Children

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This article explores what metacognition is, why it is important and how it develops in children. It argues that teachers need to help children develop metacognitive awareness, and identifies the factors which enhance metacognitive development. Metacognitive thinking is a key element in the transfer of learning. The child's development of metacognitive skills is defined as meta-learning. Meta-teaching strategies can help mediate the metacognitive skills of children, help to stimulate children's metacognitive thinking. The article draws on research currently being undertaken in schools in one London borough on raising achievement in thinking and learning through developing the metacognition of children as learners in school.

Key words: Metacognition, development, children

INTRODUCTION

'The hardest kind of thinking is thinking about thinking' Anna, aged 9.

In recent years metacognition has emerged as a major focus of research interest in cognitive psychology (Metcalfe & Shimamura, 1996). There has been a growing recognition that metacognition or self awareness 'including awareness of ourselves as learners, helps us to learn more effectively' (Scottish CCC, 1996). But what is metacognition? How does it facilitate learning and what can teachers do to foster it in the classroom?

METACOGNITION: WHAT IS IT?

A *meta* was one of the conical columns set in the ground at each end of the Circus in Rome to mark the turning point in the race. Similarly the concept of metacognition can be seen as a turning point in our understanding of the mind. The prefix meta has come to refer to something that transcends the subject it is related

to. What does it mean then to transcend cognition? The term *metacognition* was introduced by Flavell in 1976 to refer to 'the individual's own awareness and consideration of his or her cognitive processes and strategies' (Flavell, 1979). It refers to that uniquely human capacity of people to be self-reflexive, not just to think and know but to think about their own thinking and knowing.

Psychologists such as William James (1890) had emphasised the importance of 'introspective observation' but Vygotsky (1962) was one of the first to realise that conscious reflective control and deliberate mastery were essential factors in school learning. He suggested there were two factors in the development of knowledge, first its automatic unconscious acquisition followed by a gradual increase in active conscious control over that knowledge, which essentially marked a separation between cognitive and metacognitive aspects of performance. Flavell argues that if we can bring the process of learning to a conscious level, we can help children to be more aware of their own thought processes and help them to gain control or mastery over the organization of their learning (Flavell *et al.*, 1995). On this view effective learning is not just the manipulation of information so that it is integrated into an existing knowledge base, but also involves directing one's attention to what has been assimilated, understanding the relationship between the new information and what is already known, understanding the processes which facilitated this, and being aware when something new has actually been learned.

Effective learning is not just a matter of innate intelligence. We must not fall into what de Bono calls the 'intelligence trap' (de Bono, 1992), and Boorstin (1985) calls 'the illusion of knowledge', which is that the greatest obstacle to discovery lies in what people already believe they know or can do. They may become trapped in what they already know, and not open to new learning. Some children are more competent at learning effective strategies and applying them appropriately, while others who seem more intelligent or knowledgeable can be remarkably unintelligent in their approach to learning. Binet believed that self criticism was a central factor in intelligence, that it is not inborn but must be nurtured through education.

Flavell and his colleagues (1995) suggest this metacognitive ability changes with age, and that older children are more successful learners because they have internalised a greater quantity of metacognitive information. The failure to use these strategies however may not be related so much to age but to experience, and that teachers' interventions can help even young children to develop some of the metacomponents that are the strategies of successful learning.

What are these metacognitive strategies? Nisbet and Shucksmith (1986) suggest a set of six strategies for successful learning, which involve asking questions, planning, monitoring, checking, revising and self testing. Harry-Augstein and Thomas (1985) feel such strategies do not go far enough. They argue that learning depends on 'conversations', on the negotiation of personal meanings through dialogue with others, leading to understanding. These conversations can be internal, but are particularly effective carried out in pairs or groups where different ways of interpreting experience can be explored to mutual benefit. Fisher (1995) summarises a number of 'teaching to learn' cognitive strategies identified in recent research, including 'discussing' and 'co-operative learning', as among those that help develop metacognition.

One area that has been much researched is that of problem solving (Fisher, 1987). As Miller and his colleagues (1960) point out 'an ordinary person almost never approaches a problem systematically and exhaustively unless specifically educated to do so..'. Perhaps the most common reaction to a problem situation is a random hunt for solutions and sometimes this will result in success, but in school situations where there is usually a limited number of possible solutions frequent failure is likely. The need to avoid impulsivity and take time to consider options and alternatives has been identified as a key strategy in overcoming learning failure (Feuerstein, 1980). In analysing Schoenfield's success in developing student's mathematical problem-solving ability Perkins & Salomon note the importance of fostering a general level of control that they call 'problem management':

> Students learn to monitor and direct their own progress, asking questions such as 'What am I doing now?', 'Is it getting me anywhere?'. 'What else could I be doing instead?'. This general metacognitive level helps students avoid persevering in unproductive approaches, to remember to check ... and so on. (Perkins & Salomon, 1989, p. 21)

Donaldson (1978) quotes with approval Piaget's finding that children's reflection on problems and consideration of possibilities are important aspects of cognitive development: 'If the child is going to control and direct his own thinking, in the kind of way we have been considering, he must become conscious of it.' (p. 94). Feuerstein (1980) shows how adults can play a key role in encouraging this metacognitive awareness in children. The teacher can ask children about the successes and difficulties they have had with problems. Students can be encouraged to reflect on the kinds of thinking they have been engaged in, and to be conscious of those processes that have been helpful or have hindered their progress. This meta-discourse on the problem-solving process is an application of the way Vygotsky (1978) described language as the mediator of learning. As Adey and Shayer (1994) comment: 'The language of reasoning mediates meta-learning'.

There is in the literature however some confusion about the meaning of metacognition, and how it is to be identified. These are important matters for if we wish to identify metacognitive development as one of the goals of teaching thinking then it is as well to be as clear as we can about what metacognition is. Metacognition also has an important bearing on the issue of the transferability of thinking skills. So what does it refer to? Von Wright (1992) distinguishes two levels of meta-reflection. Low level reflection involves the thinker:

> 'reflecting on her means of coping in familiar contexts. However ... she is unlikely to be capable of reflecting about herself as the intentional subject of her own actions.' (von Wright, 1992, pp. 60–61)

Higher level reflection is what we would generally call metacognition:

> Reflecting about one's own knowledge or intentions involves an element which is absent from reflection about the surrounding world....in order to reason about how I reason, I need access to a model of my reasoning performance. (von Wright, 1992, p. 61)

This distinction between two levels of reflection as von Wright argues, mirrors the distinction Vygotsky draws between consciousness in a broad sense ('soznanie') and conscious awareness ('osoznanie'). Brown (1983) defines four strands in her discussion of the literature on metacognition:

1. Verbal reports as data on self knowledge of cognitive processes (e.g. Flavell).
2. executive control within an information-processing framework (e.g. Sternberg, see below).
3. Self regulation, control and management of a person's own cognition (e.g. Piaget).
4. Other-regulation, involving the social mediation of thinking by others (e.g. Vygotsky).

Brown claims that two versions of metacognition are often confused, namely 'the essential distinction between self regulation during learning' and 'knowledge of, or even mental experimentation with, one's own thoughts' (Brown *et al.*, 1983). Adey and Shayer (1994) agree with this distinction, which they categorise as *going beyond*, and *going above*, the present learning behaviour. Going beyond one's present repertoire of reasoning is linked to 2,3 and 4 in Brown's list above. This can be equated with what Newman *et al.* (1989) call 'construction zone activity', a concept derived from Vygotsky's Zone of Proximal Development, which refers to mental activity, usually of a collaborative nature, which involves children going beyond their present levels of competence. One writer has described it, in words which could equally evoke Socratic enquiry at its best, as:

> ...a magic place where minds meet, where things are not the same to all who see them, where meanings are fluid, and where one person's construal may preempt another's. (Sheldon White, foreword to Newman *et al.*, 1989)

Going above can be described as 'self awareness judgements which refer to the monitoring and control of one's own cognitive processes' (Nelson *et al.*, 1990). This accords closely with Brown's metacognition 1 (above) and with Flavell's original definition of metacognition as an individual's conscious awareness of his own thought processes. However it is not clear whether going beyond and going above can be so clearly separated, since if students have not learned how to go beyond, they do not have anything to abstract from experience. So if teaching thinking is to include metacognitive components it must include both going beyond and going above, which I will call cognitive extension (CE) and metacognitive thinking (MT). Note however that the reverse does not necessarily follow — teachers may encourage going beyond in the sense of extending children's range of cognitive experience without any metacognitive going above (MT). It would be a mistake to believe that CE requires MT, or indeed any of the expanded consciousness of metacognitive activity. On this view CE is a necessary but not sufficient condition for MT.

Pramling argues that metacognition depends on content and context: 'One reason for not teaching strategies, in other words, is that these strategies do not exist in general terms, but only in relation to particular content' (Pramling, 1988).

The assumption is that 'children's thinking cannot be separated from the world since thinking is always directed towards something' (Pramling, 1990, p. 11). For Pramling the focus of teaching should not be on cognitive skills training, but on a metacognitive approach to thinking about curriculum content. Pramling (1988) divides this process into three stages, which can be summed up as moving from the **what** level of cognitive description (CD), to the **how** level of cognitive extension (CE), to the **why** level of metacognitive thinking (MT):

1. focus on *what* the child is thinking about a content (CD)
2. focus on *how* the child is thinking about the content (CE)
3. focus on the child's thinking about his/her own thinking about the content (MT)

One reason why Pramling may be so distrustful of cognitive skills training is that her research is primarily centred on pre-school children, where if children are at a concrete-operational stage generalisable skills may not seem so relevant. However there are cognitive education programmes for pre-school children such as High Scope which do aim to develop general cognitive abilities, particularly in planning and reviewing, that include elements of both CE and MT (Hohman *et al.*, 1995). Indeed where 'thinking skills' programmes are successful elements of metacognitive training in self appraisal and self management are characteristic of the learning experiences mediated by teachers (Fisher, 1990).

The cognitive and metacognitive elements of thinking are clearly identified in Sternberg's (1985a) information processing model of the mind. It has been the most widely used theoretical model for analysing intelligent performance. As with other researchers his analysis refers to two levels of cognitive process:

1. **Metacomponents or executive skills** (metacognition) the higher-level processes used for decision making, planning, monitoring, evaluating etc.
2. **Lower order components** (cognitive skills)
   (a) *Performance components or non-executive skills*, which carry out the orders of the metacomponents, providing the means such as comparing, classifying or combining elements to achieve an end, such as to solve a problem;
   (b) *acquisition components*, involved in learning new information;
   (c) *retention components*, involved in storing and retrieving information;
   (d) *transfer components*, involved in carrying information from one context to another.

This is only a model, and it does not provide any clear guidance on how to teach the thinking processes it seeks to describe. Some programmes aim to teach various of the component processes that are thought to be involved in intellectual tasks. Approaches such as Process Based Instruction (Ashman & Conway, 1993) attempt explicitly to teach the metacognitive strategies involved in planning and evaluating problem tasks. Others argue that such problem solving strategies are not sufficient. They also stress the need for problem posing (Brown & Walker, 1983) and what are called 'inquiry skills' which include questioning and reflective discussion (Lipman,

1985). These processes are mediated in group settings, such as the Community of Enquiry, where group discussion involving questioning, planning, monitoring and revising ideas in a social context becomes a model that children come to internalise (Fisher, 1996).

Metacognition has been linked to the development of reading and writing (Wray, 1994; Wray and Lewis, 1997). Although metacognitive deficits are not seen as solely responsible for reading problems there is now substantial evidence that many poor readers (and writers) are unaware of strategic problem solving elements in their approach to tasks, and that metacognitive teaching strategies such as 'reciprocal teaching' are reported as producing considerable gains in comprehension among poor readers (Palincsar & Brown, 1984; Brown & Palincsar, 1989). These improvements have been maintained over time, and show evidence of transfer and generalisation to other areas of learning. This is a contentious area and reflects a central controversy in cognitive education — whether there can be **transfer** of training in thinking skills from one domain of experience to another, and whether this transfer, if it occurs at all, is of a specific or general nature.

Metacognition is also linked to progress in science (Adey & Shayer, 1993) and in maths (Shayer, in press). Adey and Shayer (1993) lend strong support to the view that metacognitive elements in thinking exist and can assist transfer of learning, especially if the teaching explicitly targets metacognition as a key aim of the learning activity. Students who are good at transfer show the same kinds of metacognitive strategies in science, maths, English or whatever the subject — they plan their approach to problems, they seek the information they need, check on progress and change strategies when things go wrong. But how do they learn to do this?

Research suggests that learners conceptualise new experience as 'mental representations', representing new experiences in terms of 'frames' which act as kinds of mental 'scripts'. These individual cognitive representations derive from social and cultural experience to provide expected sequences of events. The ways in which mental representations frame our experience have been variously described as schema (Piaget), thinking frames (Perkins, 1986), scenarios, scripts and narratives (Bruner, 1991). The way that they construct mental representations of experience has a powerful effect on children's awareness of tasks, and of themselves as learners. Such research points to the crucial importance in learning of considering ways in which children internalise, or 'frame' their learning experiences.

Researchers investigating the differences between the thinking of experts and novices have found important differences in the ways these two groups approach or frame problems. This research suggests that experts, studied in a wide range of fields, have acquired a repertoire of automatic cognitive responses which are not available to novices (Hennessy, 1993). In solving complex problems a novice typically needs to focus on each part of the task, whereas the expert recalls the appropriate technique or 'thinking frame' from past experience, enabling their thinking to be concentrated at a broader and more strategic level. Experts are able to review and process larger chunks of information than novices because their thinking is strategic rather than localised. Experts tend to categorise their

knowledge whereas novices need to focus afresh on each individual task. This research points out the importance of emphasising the structure rather than the surface features of a task, for encouraging children to generalise their learning and to make links between experiences. As Wood (1988) says, 'Viewed in this way, learning is taking place on at least two levels: the child is learning about the task, developing 'local expertise'; and he is also learning how to structure his own learning and reasoning' (p. 77). It is the second level that involves metacognition and transfer of learning.

Perkins and Salomon (1987, 1989) proposed a much-quoted distinction between what they called the low road and the high road to transfer. The low road he called the automatic triggering of well-practised routines in perceptually similar contexts. Examples of this would be correct capitalisation in sentence structure and the successful implementation of common algorithms in arithmetic. High road transfer demands deliberate and mindful abstraction of a central idea, principle or rule from one situation so it can be applied in another (CE). Transfer tends not to occur spontaneously, but it can be encouraged through explicit guidance and varied practice. Low road transfer refers to domain specific skills and knowledge, whereas high road transfer refers to higher order skills such as analysis, synthesis and evaluation (Bloom, 1956; Fisher, 1990). Adey and Shayer (1994) argue that an even higher road to cognitive development and transfer may exist in the 'unconscious development of a central cognitive processor'. This higher road transfer can also be unconscious, triggered not only by metacognitive activity, but also by the internalisation of higher order skills through practice in supportive contexts. If one way to improve transfer of learning is through metacognitive thinking (MT), how does this develop, and can we teach it?

META-LEARNING: HOW DOES METACOGNITION DEVELOP?

Piaget called thinking about thinking 'reflective abstraction', and said that this develops in children through their growing awareness of different viewpoints and the experience of self-conflict when their understanding is challenged. The years from 4 to 9 see significant developments in children in their growing awareness of themselves as thinkers and learners. An illustration of this is provided by Istomina (1982) in studying the ways children of different ages set about a shopping task using a class shop. The 4 year olds ran impulsively back and forth 'buying' things on their oral list, the 5 and 6 year olds tried to memorize what they had been told by asking for it to be repeated, the 7 year olds tried to make some logical connections between items on their lists.

Metacognitive development in individual children varies widely. Poor learners show marked delays in metacognitive development (Campione, 1987; Watson, 1996). They have the metacognitive awareness of much younger children, they tend to over-estimate the capacity of their memory, they fail to try different approaches, fail to see that similar problems can be solved by similar means (Sternberg, 1985). Pupils with learning difficulties fail not only because they have less knowledge about

tasks, but also because they fail to utilise the knowledge and skills they have, they tend not to plan, have no strategy in attempting tasks and do not monitor their progress. What these studies point to is that these pupils need, not only the most explicit teaching, but also metacognitive help to improve their self regualtion and monitoring of learning.

If there is one characteristic of very able or gifted children it is that they have more metacognitive awareness than less able peers (Sternberg, 1983). They have a clearer grasp of what they know and what they do not know, they know what they can do and what they cannot do, and they know what will help them gain the knowledge or understanding they need. One researcher found that very able children could 'describe in detail how they managed their mental learning resources and what they did to improve their learning strategies. (They) also knew about the importance of involving the whole self — intellect, emotion, and body — in their learning' (Freeman, 1991). Metacognitive skill in able pupils does not necessarily show itself in evidence of 'quick thinking', but in their ability to use quick or slow thinking when the occasion demands. Creativity is not related to quickness of thinking. Indeed evidence suggests that children with high IQs tend to be slower not faster than those with lower IQs in creative problem solving, but show more insight and success (Davison, Deuser & Sternberg, 1996).

Children vary in their ability to solve problems and to learn from experience. These individual differences are related to differences of intelligence, differences in experience (including the experience of being taught) and to differences in the use of metacognitive processes. Four metacognitive processes seem to be especially important in solving problems. These are:

- recognising the problem, identifying and defining the elements of a given situation;
- representing the problem, making a mental map of the problem, comparing it with others;
- planning how to proceed, deciding steps, resources and setting targets;
- evaluating progress and solutions, knowing about what you know.

Many problems can be solved by cognitive methods alone, for example number problems or editing a text for correct punctuation, which require the application of set rules. Many of the steps however that children make in solving a problem are not simply about applying rules. Problem solvers need to direct and guide their problem solving, know how to define the problem and select an appropriate strategy or rule. Also many problems in learning and in life are ill-structured, complex and made 'messy' by containing many kinds of variables. Many problems have no simple solution. What do you do when you don't know what to do? What is needed is not only the application of knowledge but also the application of metacognitive skills, and evidence shows that these develop with age and through practice (Metcalfe & Shimamura, 1996).

Metacognition helps children make the most of their mental resources. We might use the metaphor of the machine and the workshop manual. Our mental machines

are very similar, what makes variation is the way that the operating instructions differ from person to person. Some of us have clearer mental representations of the way our minds work on problems than others, some have more effective metacognitive mechanisms of operation and control. One way to explore this is in children (and in adults) is to encourage self reflection. But how would you represent the workings of your own mind? Research into ways children represent, using drawing and metaphor, the workings of their minds show that their ability develops through the process of maturation but that this process can be accelerated through the mediated experience of self reflection (Fisher, 1990; 1995).

Metacognitive awareness includes knowledge of ourselves (how we usually do or do not perform in such a situation), and knowledge about the strategies we use to tackle tasks (how we do things). We might sum this up by saying that the metacognitive includes cognitive elements, but cognitive activity does not necessarily include the metacognitive. Another way of representing this is on a continuum of awareness. Below is a guide to levels of awareness in thinking that are increasingly metacognitive.

If metacognition is an essential ingredient in intelligent behaviour, the challenge for teachers is in finding ways to aid and accelerate the child's naturally developing awareness of self. So how do we teach for metacognition?

Levels of Awareness

Tacit use:	children make decisions without really thinking about them
Aware use:	children become consciously aware of a strategy or decision-making process
Strategic use:	children organise their thinking by selecting strategies for decision-making
Reflective use:	children reflect on thinking, before, during and after the process, pondering on progress and how to improve

Adapted from Swartz and Perkins (1989)

META-TEACHING: HOW DO WE TEACH FOR METACOGNITION?

Teaching strategies can be broadly divided into three categories: didactic, directed discovery and teaching for metacognition (what I will call *meta-teaching*). Didactic teaching is where the educator assumes complete control in setting tasks, prescribing procedures and evaluating results. This kind of teaching suits particular purposes in terms of exposition of knowledge and practice of skills, but it limits the scope of the child to benefit metacognitively from the experience. Directed discovery teaching enables children, under direction to 'discover', for example through investigation and problem solving, particular strategies and teaching points. The teacher facilitates transfer of learning by bridging new learning into existing knowledge through encouraging reflection and making links. This kind of teaching encourages the child to engage in cognitive description (CD) and extension (CE). Meta-teaching aims to mediate metacognition to help the child make explicit their thinking and learning for the purpose of self appraisal and self management (MT).

One way of teaching for metacognition is to make explicit and infuse the language of thinking and learning into the planning of teaching and into classroom discussion. The aim is to model the vocabulary we want children to use in their own thinking and understanding of learning by using it ourselves to describe our teaching, with such prompts as 'The thinking we are going to be using today is ...', 'This lesson is about ...', 'What thinking have we been doing ...?' This will also involve the direct explanation of terms being used, and also challenging children to define these terms in their own words. The following is a list of words compiled by teachers in a nursery school to provide them with a common vocabulary about thinking and learning for use in their planning and in their teaching of young children to raise awareness of metacognition:

Key words in Teaching Thinking and Learning: A List Devised by Teachers in a Nursery School

thinking	learning	understanding	teaching	mastering
trying	persevering	wondering	rehearsing	practising
modelling	describing	telling	asking	repeating
exploring	wondering	investigating	imagining	creating
listening	choosing	deciding	planning	assessing
evaluating	demonstrating	explaining	remembering	talking
discussing	guessing	predicting	suggesting	testing
sketching	checking	considering	reconsidering	reviewing
recalling	noting	noticing	hypothesis	idea
summarizing				

We need to encourage children to probe deeper into what they have said and what they think, through what has been called 'empathetic challenging' (Bonnet, 1994). Enquiring into a child's thinking facilitates thinking. Metacognitive questions can offer the challenge children need to become conscious of their thoughts and feelings, either before, during or after an activity. 'What helps us to learn in this lesson?' 'What do good readers do?' 'How should we plan this?' The following is a progressive list of questions that moves from describing their kind of thinking children have engaged in, to describing how they did their thinking, and to evaluating their thinking.

Metacognitivee Questioning: To Raise Levels of Awareness

1. Describe what kind of thinking you did
   * What kind of thinking did you do?
   * What do you call this kind of thinking?
   * Was this kind of thinking .....? (name a kind of thinking)
2. Describe how you did your thinking
   * How did you do this thinking?
   * What did you think about? Why?
   * Did you have a plan (or strategy)?
3. Evaluate your thinking
   * Was your thinking good? Why?
   * Did you have a good plan (or strategy)?
   * How could you improve your thinking next time?

(adapted from Schwartz & Parks, 1994)

Another way of introducing metacognitive language to children is through the use of 'think alouds', which model metacognitive processes. Here we raise awareness by using metacognitive language and self questionning in the way we present explanations to pupils and model a particular problem solving process. We aid metacognition by bringing to conscious awareness our thoughts and feelings, and communicate them by thinking aloud. We need to help children do the same. Posting a list of metacognitive questions on the wall can help to remind children of the sorts of questions they can ask themselves, for example questions that assess awareness of learning (What have you learnt? What have you found out? What did you find hard? What did you do well? What do you need to learn/do next?), assessing attitudes and feelings (What do you like doing/learning? What do you feel good/not good about ...? What do you feel proud of?) and in setting targets (What do you need to do better? What would help you? What are your targets?)

In a secondary school the following strategy card was used as a set of metacognitive reminders for group discussion with a group of below average attaining children. The strategy card was designed to remind pupils and children of the language of learning as well as being a useful reminder for small group discussion. The strategies were devised after discussion with the pupils.

Teaching the Language of Learning

A Strategy Card for Group Discussion with Year 7 children

'We must remember to:

1. Get ourselves in a learning mood.
2. Talk about what we have to do.
3. Look and listen carefully.
4. Decide who is going to do what.
5. Stop and think — work for several minutes without talking.
6. Work on the task — have a go
   — allow everyone to speak
   — listen to what they say
   — ask questions.
7. Check our work.
8. Think ahead.

(from Quicke, J. & Winter, C., 1994)

A child with learning difficulties recently said to me: 'I learn a lot in class, its just that I don't really understand what I'm doing'. How can we help such a child? One way is through meta-teaching, which occurs when metacognitive discussion is built into the lesson plan. This is based on the premise that talking about our learning helps improve our learning when such talk includes the metacognitive discussion. Obviously some tasks are better than others in terms of accessing the metacognitive. The following are some types of task that provide both cognitive and metacognitive challenge:

- difficult, novel or puzzling tasks, such as those offering more than one solution;
- tasks which include cognitive conflict, such as debates or Philosophy for Children;

- having children teach others, such as reciprocal teaching, peer or cross-age tutoring.

The following is an example of a lesson plan format which builds in time for metacognitive discussion of the learning activity:

A Meta-Teaching Lesson Format: Planning to Include Metacognitive Discussion

1. FOCUS	introducing the theme of the lesson
2. LESSON OBJECTIVE	discussing the thinking and learning objectives
3. INPUT / STIMULUS	providing information and stimulus to learning
4. STRUCTURED ACTIVITY	children engage in active learning task(s)
5. METACOGNITIVE DISCUSSION	group discuss what they have thought and learnt
6. END REVIEW	closure of lesson, reviewing objectives

Examples of such metacognitive discussion include the child who said: 'one important thing I've learnt about my own thinking is that to be creative I need time. When I don't get in a panic I am able to solve most problems'. Another child responded: 'Having a thinking time afterwards is a good idea because it gives you time to think about things you don't understand'. As another child said: Thinking about thinking is the hardest kind of thinking'. But it is the kind of thinking we all need to engage in as teachers and as learners.

References

Adey, P. and Shayer, M. (1994). *Really Raising Standards: Cognitive intervention and academic achievement*, London: Routledge.

Ashman, A. and Conway, R. (1993). *Using Cognitive Methods in the Classroom*, London: Routledge.

Bloom, B. and Krathwohl, D.R. (1956). *Taxonomy of Educational Objectives, handbook 1: Cognitive Domain*. New York: David McKay.

Bonnett, M. (1994). *Children's Thinking: Promoting Understanding in the Primary School*, London: Cassell.

Boorstin, D.J. (1985). *The Discoverers*, New York: Vintage.

Brown, S. and Walker, M. (1983). *The Art of problem Posing*, New York: Franklin Institute Press.

Brown, A., Bransford, J., Feffara, R. and Campione, J. (1983). Learning, remembering and understanding. In Mussen, P. (ed.) *Handbook of Child Psychology*. New York: John Wiley.

Brown, A.L. and Palincsar, A.S. (1989). Guided cooperative learning and individual knowledge acquisition. In Resnick, L. (ed.) *Knowing and Learning: Issues for a Cognitive Psychology of Learning. Essays in Honour of Robert Glaser*. Hillsdale, NJ: Erlbaum.

Bruner, J. (1991). The narrative construction of reality, *Critical Enquiry*, 18(1), 1–22.

Campione, J. (1987). 'Metacognitive components of instructional research with problem learners', in Weinert F. and Kluwer, R. (eds.) *Metacognition, Motivation and Understanding*, Hillsdale NJ: LEA.

Davidson, J.E., Deuser, R. and Sternberg, R.J (1996). in Metcalfe J. and Shimamura A.P. (1996) *Metacognition; Knowing about Knowing*, Cambridge. Mass: MIT Press.

de Bono, E. (1992). *Teach Your Child How to Think*, London: Viking.

Donaldson, M. (1978). *Children's Minds* London: Fontana.

Feuerstein, R. (1980). *Instrumental enrichment: An intervention program for cognitive modifiability*, Glenview, IL: Scott, Foresman and Company.

Fisher, R. (ed.) (1987). *Problem Solving in Primay Schools* Oxford: Blackwell.

Fisher, R. (1990, 1995). *Teaching Children to Think*, Stanley Thornes.

Fisher, R. (1995). *Teaching Children to Learn*, Stanley Thornes.

Flavell, J. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental enquiry, *American Psychologist*, **34**, 906–911.
Flavell, J., Green, F. and Flavell, E. (1995). *Young Children's Knowledge About Thinking.* Monographs for the Society for Research in Child Development. 60, 1, Chicago: University of Chicago Press.
Freeman, J. (1991). *Gifted Children Growing Up*, London: Cassell.
Harry-Augstein, S. and Thomas, L. (1991). *Learning Conversations*, London: Routledge.
Hennessy, S. (1993). Situated Cognition and Cognitive Apprenticeship: Implications for Classroom Learning. *Studies in Science Education*, **22**, 1–41.
Istomina, Z. (1982). 'The development of voluntary memory in children of pre-school age', in Neisser U. (ed.) *Memory Observed: Remembering in Natural Contexts*, San Francisco, CA: Freeman.
James, W. (1890). *Principles of psychology*, New York: Holt.
Lipman, M. (1985). Thinking skills fostered by Philosophy for Children. In Segal, S.F. Chipman and R. Glaser (eds) *Thinking and Learning Skills*, Vol 1. Hillsdale: New Jersey: Lawrence Erlbaum. pp. 83–108.
Metcalfe, J. and Shimamura, A.P. (1996). *Metacognition; Knowing about Knowing*, Cambridge. Mass: MIT Press.
Miller, G.A, Gallanter, E. and Pibram, K.H. (1960). *Plans and the Structure of Behaviour.* New York: Holt, Rinchart and Winston.
Nelson, T., Dunlosky, J., White, D., Steinberg, J., Townes and Anderson, D. (1990). Cognition and metacognition at extreme altitudes on Mt. Everest, *Journal of Experimental Psychology*, 119, 4, 317–334.
Newman, D., Griffin, P. and Cole, M. (1989). *The Construction Zone: Working for Cognitive Change in School* Cambridge: Cambridge University Press.
Nisbet, J. and Shucksmith, J. (1986) *Learning Strategies*, London: Routledge.
Perkins, D.N. (1986). *Knowledge as Design* Cambridge: Cambridge University Press.
Perkins, D.N. and Salomon, G. (1989). Are cognitive skills context bound? *Educational Researcher*, **18**(1), 16–25.
Palincsar, A.S. and Brown, A.L. (1984). Reciprocal Teaching of Comprehension. *Cognition and Instruction*, 1(2), 117–175.
Pramling, I. (1988). Developing Children's Thinking About Their Own Learning, *British Journal of Educational Psychology*, **58**, 266–278.
Pramling, I. (1990). *Learning to Learn: A Study of Swedish Preschool Children*, New York: Springer Verlag Press.
Quicke, J. and Winter, C. (1994). 'Teaching the language of learning', *British Educational Research Journal*, **20**(4), 429–45.
Scottish Consultative Council on the Curriculum (1996). *Teaching for Effective Learning* Dundee.
Schwartz and Parks (1994). *Infusing the Teaching of critical and Creative Thinking in Elementary Instruction*, Pacific Grove, CA: Critical Thinking Press.
Schwartz, R. and Perkins, D. (1989). *Teaching Thinking-issues and Approaches*, Pacific Grove, CA: Midwest Publications.
Shayer, M., *et al.* (in press) *Cognitive Acceleration through Maths Education* (CAME project).
Sternberg, R. (1985a). Approaches to intelligence. In Chipman, S.F., Segal, J.W. and Glaser, R. (eds.) *Thinking and learning skills*, vol 2, Hillsdale, NJ: Erlbaum.
Sternberg, R. (1985b). *Beyond IQ*, Cambridge: Cambridge University Press.
Sternberg, R. and Davidson, J.E. (1983). *Insight in the gifted*, Educational Psychologist 18, 51–57
Vygotsky, L.S, (1962). *Thought and Language*, Cambridge: MIT Press.
von Wright, J. (1992). Reflections on reflection. *Learning and Instruction*, **2**(1), 59–68.
Watson, J. (1996). *Reflection through Interaction: The Classroom Experience of pupils with Learning Difficulties*, London: Falmer Press.
Wood, D. (1988). *How Children Think and Learn: The social contexts of cognitive development.* Oxford: Blackwell.
Wray, D. (1994). *Literacy and Awareness*, London: Hodder/UKRA.
Wray, D. and Lewis, M. (1997). *Extending Literacy: children reading and writing non-fiction*, London: Routledge.