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The nature of thinking and thinking skills

Perspectives on thinking

To be genuinely thoughtful, we must be willing to sustain and protract that state of doubt which is the stimulus to thorough enquiry, so as not to accept an idea or make a positive assertion of a belief until justifying reasons have been found.

Dewey, 1933, p. 16.

The aim of this book is to summarise and evaluate a number of systematic approaches to describing thinking and its relation to learning and teaching which have been developed over the last 50 years or so. We believe that each of these frameworks and taxonomies have value in attempting to describe aspects of thinking. The purpose of this collection is therefore to provide a resource for teachers, learners and researchers in order to make explicit a vocabulary with which to describe aspects of thinking which are relevant across a range of situations and contexts. Without a vocabulary to describe aspects of thinking that we believe to be teachable it is hard to develop teaching approaches or pedagogies that are effective. As a learner it is difficult to understand and make connections with what we have learned at different times and to plan how to take more control of our learning in the future without the language to describe our thinking and learning. For educational researchers it is impossible to describe aspects of the educational experience without developing concepts and terminology that can be identified with some reliability (or at least agreed regularity) across teaching and learning situations. With some clarity in these descriptions it may be possible to tackle important questions about how to improve education by attempting to measure

aspects of these essential components and therefore evaluate the impact of different approaches and techniques.

Thinking skills (or at least those skilled in thinking) are needed, not only in the worlds of work, education and training, but in the contexts of family, friendship and community and in the construction of personal and shared beliefs and values. There is good evidence that organisations are more successful the more they involve their members in the processes of problem-solving and decision-making. In the 'information age' qualities of independence and flexibility are highly valued and 'learning to learn' has become an important goal. A well-functioning democracy is not only one in which people feel that their views can be freely expressed and are adequately represented; but one where those views are informed by reliable information, critical appraisal of ideas, creative thinking and open debate.

A range of academic traditions has considered and examined thinking as an aspect of human experience. In particular, various philosophical, psychological and sociological perspectives provide insight into thinking and learning at both an individual and cultural level. Whereas psychology has always been interested in learning about the development of thinking and hence teaching and learning, the philosophical tradition has usually viewed thinking in terms of the theory of (adult) mind and the theory of knowledge (rather than learning or coming to know). Sociological tools offer valuable perspectives on what occurs in terms of the systems, their structures and functions in schooling and educational practices, and especially about the relation of the individual to the wider society with regard to customs, power and authority. Each of these traditions has influenced the frameworks, taxonomies and descriptions of thinking that we have collected and which we review in this handbook. Other traditions, of course, have relevance. Politics exert powerful influences on the educational practices of different cultures and eras and economic factors are often cited as having a significant impact on the policies that are implemented. Cognitive neuroscience and neurophysiology are beginning to have an impact on aspects of teaching and learning, despite the fact that descriptions of brain functioning are hard to translate into clear messages for classroom practice. In terms of the accounts of thinking described in this book, the various influences

have largely been mediated through psychological and philosophical traditions and their conceptualisations about thinking and learning to think.

In this first chapter we provide some background to these perspectives on thinking in education. A number of key terms and issues are outlined and discussed, since the evaluations of the frameworks and taxonomies which follow make some assumptions about the concepts and ideas that they rely upon. We give a brief overview of psychological, sociological and philosophical perspectives on thinking, and especially critical thinking. We then turn to the development of thinking skills approaches in education, including various programmes designed to develop particular aspects of thinking.

What is thinking?

Trying to understand how people think and learn is in some ways an impossible challenge, since we can only try to understand these things by using the very processes that we do not fully understand. In such circumstances choices are available. We can choose to focus on measurable aspects of human behaviour rather than on lived experience; or we can resort to metaphors which have personal or group appeal; or we can do what scientists have often done when entering a new and complex field – look for patterns and regularities between situations. All three approaches are evident in the theoretical frameworks and taxonomic approaches to thinking and learning that are described in this handbook and they all involve classification. Moreover, they all result in simplified accounts, since the human mind can only operate consciously with limited amounts of information.

Dewey's (1933) classic introduction to 'How We Think' offers an overview of some of the different senses in which the term *thinking* is used:

- thinking as a 'stream of consciousness' and the everyday 'uncontrolled coursing of ideas through our heads', including dreaming and daydreams (p. 3)
- thinking as imagination or mindfulness which is 'usually restricted to things not directly perceived' since we tend to say 'I saw a tree'

rather than 'I thought of a tree' if we are actually standing with our eyes open in front of one (p. 5)

- thinking as synonymous with *believing* expressed in statements such as 'I think it is going to rain tomorrow': in this sense it is contrasted with knowledge and the level of confidence with which we express such a belief (p. 6)
- reflective thinking as a chain of thought leading, through enquiry, to a conclusion (p. 9): this, of course is Dewey's aim in defining and recommending reflective thinking as the basis of both rationality and action.

Another sense implicit in the term *thinking* is more often explicit in the related term *thoughtful*: the sense of care and attention. When we are thoughtful we are either being considerate (usually towards another person) or spending time in deliberating about or considering a course of action. The critical thinking movement in the US has often identified this aspect of thinking and Matthew Lipman's framework makes 'caring thinking' explicit. The value that this implies is not always made so obvious. Thinking is, perhaps, generally a good thing, but there may be occasions where some kinds of thinking are more valuable than others. For example in a dangerous situation, such as when someone swimming is in difficulties, it may be more effective to recall what to do (and do it quickly) than thoughtfully identify all of the possible rescue options and evaluate their merits. A further issue here is that thinking usually implies a process or at least a state which continues for some time. However, when used in the past tense it can have the briefer sense of recall or remembering: 'I heard this tune and thought of you.'

The term 'thinking' can therefore be used in many senses: to describe mental activity that we may not be fully aware of (semi-conscious thought): from the everyday things that we perceive and routinely act upon, but which require little direct attention or effort; to the more conscious or deliberate act of reflecting or bringing to attention particular aspects of our experience. A number of the general issues in the frameworks which we have evaluated relate to these different senses and resulting connotations of the term.

It is hard to disentangle each of these various senses and we therefore acknowledge the complexity surrounding the terminology

involved in each of the sections of the book. What we can say is that the word 'thinking', particularly in educational contexts, is usually used to mean a consciously goal-directed process, such as remembering, forming concepts, planning what to do and say, imagining situations, reasoning, solving problems, considering opinions, making decisions and judgments, and generating new perspectives. When there is some uncertainty that a satisfactory end is achievable, it is useful to think. This has clear resonances with Dewey's definition of reflective thinking:

Active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends constitutes reflective thought. (Dewey, 1933, p. 9.)

The issue here is control. In Dewey's view the development of reflective thought is the most important goal of education and enables the individual to take control of and responsibility for their own thinking in order to participate effectively as a member of a democratic society. Paradoxically it is the teacher's role to develop this thinking: in the various frameworks and taxonomies which follow, the roles of the teacher and the roles of the learner are not always made explicit. In some, the purpose of the classification is for the teacher to ensure more effective planning, delivery or assessment of a curriculum, but without the explicit and active engagement of the learner in being made aware of the specified thinking processes. In others, the role of the learner is acknowledged as central to this task. Both the philosophy and sociology of education have wrestled with the problems of indoctrination and empowerment. Contemporary work in psychology of education has identified the role of metacognition and self-regulation as of crucial importance. We see the apparently competing disciplines as offering complementary perspectives which are of value to learners and educators.

Metacognition and self-regulation

There is considerable debate about the meaning of the term 'metacognition' in the research literature. Perry (1970) spoke about 'meta-reason' and 'meta-thought' but the coining of the term 'metacognition' is usually attributed to Flavell (1976):

Metacognition refers to one's knowledge concerning one's own cognitive processes and products or anything related to them . . . For example, I am engaging in metacognition (metamemory, metalearning, metaattention, metalanguage, or whatever) if I notice that I am having more trouble learning A than B; if it strikes me that I should double-check C before accepting it as a fact . . . if I sense that I had better make a note of D because I may forget it . . . Metacognition refers, among other things, to the active monitoring and consequent regulation and orchestration of these processes . . . usually in the service of some concrete goal or objective. (Flavell, 1976, p. 232.)

Metacognition involves two major dimensions (Boekaerts and Simons, 1993). Firstly, it involves an awareness of one's own cognitive functioning (metacognitive knowledge) and secondly, application of one's cognitive resources for learning or problem-solving; described by Hacker (1998) as two components, metacognitive monitoring and metacognitive regulation.

There is some confusion between the terms *self-regulation* and *metacognition* and, across theories, definitions often overlap (Zeidner, Boekaerts and Pintrich, 2000). For some (Ashman and Conway, 1997) self-regulation is seen as one part of metacognition with the latter including knowledge in the form of awareness of one's own cognitive strengths and weaknesses (although they also see metacognition as a component of self-regulation). Others (e.g. Zimmerman, 2000) would include such self-knowledge within self-regulation. In similar vein, Demetriou (2000) similarly considers self-regulation to be the more comprehensive term not only encompassing metacognitive (or, for Demetriou 'hypercognitive') knowledge and skills but also the conscious control of motivational, affective and behavioural processes. It is important to note that metacognition is used narrowly by some and much more broadly by others. However, there are dangers in rendering such terms in increasingly all-encompassing fashion and the expansion of the term metacognition to include the student's theories of self, learning and learning environments can result in a weakening of such a construct's explanatory power (Boekaerts, 1997).

An important aspect of self-regulation is a sense of personal agency. Some see self-efficacy as integral to self-regulation, on the grounds that not only must the individual have knowledge of skills for appropriate functioning but they must also believe that they can perform these

skills in the attainment of desired ends (Creer, 2000). Others, (e.g. Endler and Kocovski, 2000) see self-efficacy as an important factor in self-regulation, but do not conceive this as a subordinate or componential element. Despite their different theoretical and conceptual positions, most researchers appear to agree that self-regulation should be viewed as a systematic process involving the setting of personal goals and the subsequent channelling of one's behaviour towards their achievement. Zimmerman (1995, 2000) points out that an emphasis upon personal agency helps us to distinguish between metacognition that 'emphasises only knowledge states and deductive reasoning when, for example, choosing cognitive strategies' (2000, p. 14) and self-regulation that also includes self-beliefs and affective reactions with regard to specific performance contexts. Self-regulation involves cognitive, motivational, affective and behavioural components that enable individuals to adjust their actions and/or their goals in order to achieve desired results in changing environmental circumstances.

As one might anticipate, many classroom interventions, based upon theories of self-regulation, emphasise the importance of helping students develop a positive orientation to learning and a belief that they are capable of succeeding if they work hard and apply appropriate strategies. While such elements are also key to many thinking skills programmes, these often tend to be less theoretically explicit and subsidiary to the primary emphasis upon analytical reasoning and other problem-solving processes.

Psychological perspectives

Since the pioneering work of Bloom and his associates (1956), psychologists and educationalists have sought to conceptualise a multitude of cognitive processes as a means of improving teaching, learning and assessment. However, it is only during the past decade that the huge interest in the teaching of thinking has seen such work proliferate in everyday educational practices. Many initiatives originate from Western psychology and education, particularly the US and the UK. Various reasons have been adduced, such as relatively poor performance on international comparisons of educational attainment and a recognition that mature economies require more sophisticated

learners and problem-solvers. This has led to a search for new curricula and pedagogies that will stimulate more productive thinking. However, interest in cognitive enhancement has become a worldwide phenomenon. Many in countries performing low on international measures of performance, such as South Africa, see the teaching of thinking as a valuable means of raising educational levels and developing social inclusion. Others, in countries that appear to be high-achieving on such traditional measures, such as Singapore and China, believe that such approaches may address students' limited creative and problem-solving abilities in order to develop better productivity in the global economy.

Cognitive psychologists typically study thinking in other people – a third-person perspective in which the metaphor of the brain as a computer has been dominant. In this view, the higher levels of the brain make a model of the actual world, a mental picture that parallels the world, though no doubt with distortions (Craik, 1943; Zangwill, 1980; Nathan, 1987). Thinking is an internal, mental process that constructs and operates on mental representations of information. Thagard describes six approaches to modelling the mind, involving: logic, rules, concepts, analogies, images, and neural connections (Thagard, 1996, p. 19). Thagard writes that 'thinking can best be understood in terms of representational structures in the mind and computational procedures that operate on those structures . . . There is much disagreement about the nature of the representations and computations that constitute thinking' (p. 10). Thagard draws an analogy between the mind and a computer program, where the mental representations in the mind are like the organisation of stored data and the algorithms that are then executed by the software correspond to the thinking procedures in the mind. Seductive though this analogy may be, it does not capture some of the complexity, and particularly the quality of thinking that can be described by an individual. First-person introspective accounts of thinking have a different feel about them, since we all have the impression that we can consciously control our thoughts and actions. We experience wanting, will, effort and emotion in a holistic manner as we think, and it is only through subsequent analytical reflection that we can view these aspects dispassionately and identify some patterns or regularities in our experience.

Indeed a case can be made that while we are thinking (with our attention focused on certain elements) we are not aware of the thinking process itself (much of which is unconscious). It is only after the event that we can reflect on the products of our thinking and to a certain extent reconstruct and analyse the process. Like Velmans (2000) we take the view that first-person and third-person accounts of thinking are complementary and that one cannot be reduced to the other.

A teacher necessarily has a third-person perspective on the learner's thinking and can only make inferences about it on the basis of what the learner does. Some earlier approaches to instructional design have focused on precisely formulated, externally-imposed behavioural objectives in place of goals which learners set for themselves or agree with others. First-person goal setting may be desirable in some contexts and with certain types of content, whereas group negotiation of goals may be preferred in other contexts and teacher or other externally-driven instruction may be most effective in yet other contexts, particularly where masterly learning and accurate performance is expected. This argument applies just as much to the development of thinking skills as to any other kind of learning.

Sociological perspectives

One of Auguste Comte's aims in his *Cours de Philosophie Positive* was a scientific account of social aspects of human life which might account for the nature of society in the same way that natural sciences had described the physical world. Whilst this quest eluded him, it provides the grail of the subsequent academic tradition of sociology which he had effectively founded (Lawton and Gordon, 2002, p. 149). Sociological concepts and descriptions have been productively applied to education. For example, Durkheim's analysis of social solidarity and the transition from simple communities based on common interest to the interdependence of difference in modern society resonates with contemporary educational concerns. His belief in the power of education as a solution to this problem is repeated by thinkers in other traditions and has now become a commonplace for politicians across the spectrum. The work of the Frankfurt School and its key figures

in Horkheimer, Adorno and Marcuse, through to Habermas' efforts to establish a communicative rationality and 'knowledge-constitutive interest' all have a bearing on socialisation and the place of the individual in society and their thinking (see Illeris, 2004, Chapters 5–6 for a synthesis of the impact of these approaches for our understanding of learning).

Nisbet (1966) argues that the key features of a sociological perspective are the notions of community, authority, status, the sacred and alienation. Whilst these terms are relevant to aspects of educational systems and practices, their bearing upon aspects of the frameworks reviewed in this book are less direct. The terminology and concepts they embody are relevant, however, in the way that the individual relates to a wider society and the customs and practices that restrict and inhibit some behaviours and support and foster others. These ideas can perhaps be regarded as setting limits on how widely applicable the more abstract terminology of the frameworks are to particular individuals as they 'participate' (Wenger, 1998) in particular contexts. This is of course a complex and reciprocal relationship where the individual 'acts back' (Jarvis, 1992) on the social:

When children are born, they are born into a society whose culture preceded them and will almost certainly continue after their lives are over. Culture therefore appears to be objective and external. But the children have inherited no, or minimal, instincts to help them live within society and conform to its culture; thus they have to acquire that culture. In the first instance, then, learning is a matter of internalizing and transforming something that is apparently objective to the individual . . . However, there comes a time when they begin to think for themselves, ask questions and generally experiment . . . Children gradually become more independent; they usually develop a mind of their own and then process the external cultural stimuli and respond to them in a variety of ways. Individuals begin to act back on the social world that has formed them. (Jarvis, 1992, pp. 22–23.)

The issue is perhaps one of perspective. As Illeris (2004) notes in his integrative account of learning encompassing the social, cognitive and emotional domains:

For the internal psychological dimensions, the individual is the setting, while the action takes place through the individual's meetings with the surrounding

world. For the interaction dimension, it is the surrounding world that is the setting, and the action is the individual's deeds in relation to this surrounding world. (Illeris, 2004, pp. 117–118.)

Thinking always takes place in a context which has social influences and interactions whether direct or indirect, and the individual's thinking is affected by the various affordances and constraints of different contexts. The strategies that learners use in different situations suggest Vygotsky's 'functional learning systems' which Cole and Scribner (1974) describe as 'flexible and variable organisations of cognitive processes' (p. 193) and suggest that 'socio-cultural factors play a role in influencing which of possible alternative processes are evoked in a given situation and what role they play in total performance' (p. 193). We acknowledge the strength of these concerns, but suggest that it is still worth looking for features of thinking that recur across contexts. Identifying such similarities or regularities may have benefits for the educator by enabling teaching to build on different experiences and develop complementary teaching approaches. Awareness of aspects of thinking which can be applied in different contexts may also be of benefit to learners who can see that aspects of their own experience may be relevant in a new situation.

Philosophical perspectives

A number of philosophical issues have a bearing upon the aspects of thinking and learning covered in this book. In particular, aspects of epistemology, the philosophy of mind, the philosophy of language and related theories of meaning are relevant to an understanding of the way we think, know and learn. Educational philosophy has tended to view these issues in terms of learning to know or the development of knowledge: a genetic perspective. Indeed this forms the basis of the work of Jean Piaget (see pages 189–195). In contemporary educational philosophy the most pertinent debate is how general aspects of thinking can be identified in different contexts. On one side of the debate proponents of thinking skills, such as Ennis (1989, 1991) argue that there are important general thinking skills (or general critical thinking skills) that can be used or applied across different contexts. On the other, those like McPeck (1981) argue that thinking is always context

specific in what appears like a philosophical echo of some of the proponents of situated learning (e.g. Lave and Wenger, 1991) or 'situation specificity' in social learning (Burr, 1995, p. 25).

Descriptive or normative?

Differences become apparent in the various conceptions of thinking and critical thinking outlined in some of the taxonomies and frameworks. Two broad groups can be identified in these accounts which can be described as descriptive and normative versions. Descriptive definitions of thinking tend to be psychological in origin. They specify cognitive skills and the mental processes or procedures involved in different aspects of thinking. Implicit in this model is that being good at thinking is being proficient at particular mental processes such as classifying, inferring, and evaluating. This procedural view is often taken to imply that thinking and problem-solving can be undertaken by practising a series of steps or procedures. The appeal of this approach is that it seems possible to scrutinise aspects of a curriculum for planning or teaching using selected key terms, so as to develop particular thinking skills.

By contrast, philosophers argue for a normative definition. By this they mean that critical thinking is inextricably connected with values and it essentially means 'good thinking'. From this perspective, a purely descriptive account omits the central issue of the quality of the thinking. So, for example, consider making a decision about whether or not to adopt a local recycling scheme. From a descriptive perspective, critical thinking would involve analysing the issue, generating possible resolutions, evaluating these potential solutions and synthesising the information to reach a decision. However it would be possible to analyse the issue from superficial perspectives (such as residents do not have space for a second rubbish bin or that they might get confused about which bin to put different kinds of waste in) or to evaluate some options from a biased perspective (the local factory which makes recycling bins argues for each household to have a bin for each kind of recyclable rubbish). So a check-list of thinking skills used in a partial analysis or from a biased perspective may well involve most of the types of thinking in a descriptive list.

Thinking skills and critical thinking

Of course the philosophical perspective itself has difficulties. There is no clear consensus from philosophers about a definition of critical thinking. Critical thinking has been an important movement in the education system in the US for a number of years, so much so that in 1987 an expert panel was convened by the American Philosophical Association to undertake a systematic enquiry into the current situation in education and assessment. The report includes a consensus statement regarding critical thinking and the ideal critical thinker, which begins:

We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT (critical thinking) is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. Whilst not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. (Facione, 1990.)

Despite the ponderous tone of the statement, inevitable perhaps when a panel of experts is asked to reach a consensus on something so complex, the report provides a useful overview of what is understood by the term *critical thinking*. The concern with identifying rigorous and appropriate criteria for the formulation of judgments and the need to achieve a sound basis for belief and action as a key principle are evident. Ennis encapsulates this more succinctly when he describes critical thinking as 'reasonable, reflective thinking that is focused on deciding what to believe or do' (Ennis, 1985, see pages 152–157). In the UK, critical thinking has been gaining more attention since the introduction of the AS Level in Critical Thinking in 1999.

We have collected nearly 40 definitions of critical thinking, a term which has wider currency in the USA than in the UK. The literature on critical thinking is extensive: a search using this term on ERIC, a US-based electronic database, results in over 2000 references to articles alone. The term is used in different ways and has developed over time (see, for example, the review by Pithers and Soden, 2000). In the US 'critical thinking' is often considered to be synonymous with 'thinking

skills'. There are a number of key issues in understanding critical thinking and how it relates to teaching and learning in various curricula which it may be helpful to outline. First is the nature of definitions of critical thinking and how these relate to what might be categorised as psychological and philosophical perspectives. Second, there are some identified distinctions in different philosophical positions, which relate to the nature of thinking and thinking skills which need to be outlined because of the implications for teaching. Third is the issue of assessment and how critical thinking relates to teaching and a curriculum.

Ennis believes that critical thinking depends essentially on two overarching dispositions: caring to 'get it right' to the extent possible and caring to present positions honestly and clearly. It also depends on the process of evaluation (applying criteria to judge possible answers), a process implicit or explicit in most of the essential critical thinking abilities listed by Ennis (1987). The idea of evaluation is common to most, but not all, of the definitions we have found, but the overall impression is one of diversity and subjectivity rather than clarity. Each writer seems to have an individual conception of 'good' (i.e. 'critical') thinking, if not of 'reason' and 'truth'.

McPeck (1981) defines it as 'the appropriate use of reflective skepticism within the problem area under consideration' and closely identifies these problem areas with subject disciplines. In order to develop expertise in a subject discipline what you need, he argues, is more knowledge of that discipline, because thinking critically about something is thinking about that specific subject content. However, without going into the debate about subject specificity and general thinking skills in detail, this seems too extreme a position (Smith, 2002). It is not clear that it is only more subject content knowledge that an expert thinker needs. It seems likely that some tools in the critical thinking arsenal may well be useful across academic domains and beyond, and that these skills (or attitudes and dispositions) may be particularly useful as learners develop expertise. Such analysis has come from the use of argument and informal logic in reasoning broadly (e.g. Govier, 1988) or from a teaching and learning perspective, where making connections for learners to see similarities in what (and how) they are learning might usefully take a 'thinking' perspective (Higgins and

Baumfield, 1998). However it must be acknowledged that the use of the term 'thinking skills' is problematic. It seems to imply that teaching thinking skills can be successful without also developing attitudes or fostering dispositions or without being applied to specific contexts. Smith (2002) points to the negative connotations of specific schemes and approaches as well as to a lack of conceptual clarity.

Ennis' understanding of critical thinking is that it is 'reasonable reflective thinking that is focused on deciding what to believe and do' (Ennis, 1985, p. 45). Although he developed a taxonomy, he makes the point forcefully that the components cannot be so 'criterionized so that judgments can be made mechanically'. This is a crucial point about how critical thinking relates to teaching and learning and is taken up by Paul. Paul distinguishes two senses of critical thinking (1982): a weak sense in which a range of skills can be used to detect mistaken reasoning and a strong sense in which the complexity of most situations is acknowledged and 'precise identification and definition depends upon some arguable choice among alternative frames of reference'. This means that effective critical thinking involves judgment which is context dependent. Paul further argues (1987) that one of the purposes of critical thinking is to develop learners' perspectives, and argues for dialogue or 'dialectical experience' as an essential ingredient in helping to develop judgment about how and where particular skills can best be used. A further perspective comes from Lipman and the Philosophy for Children movement in school education. Although this was not intended to be a critical thinking programme, it has been interpreted as such and is widely used around the world in a range of educational contexts to achieve critical thinking aims. One key feature of the programme is that it cuts across subject boundaries, arguing for a position where learners develop connections between their areas of learning in order to draw on their experience and knowledge more broadly.

Each of these perspectives on critical thinking entails differences in a critical thinking curriculum. If McPeck's position is accepted, then each disciplinary area will need to identify its own distinctive rules carried out within that specific subject area. Students will learn knowledge about the subject and teaching critical thinking will form a part of this subject teaching, as a means of developing subject expertise.

On the other hand, other approaches, such as Lipman's, argue for a separate timetable slot where students learn and apply their thinking within a special pedagogical framework. The 'community of enquiry' structure is essential to Lipman's approach. McPeck, Paul and Ennis do not have published curricula that can be developed for different educational settings. Lipman has such material, and his work has been adapted internationally (Splitter and Sharp, 1995) for learners of different ages, from nursery children (e.g. Murris and Haynes, 2001) to post-16 contexts (e.g. Gregson, 2003).

From both philosophical and psychological perspectives, the assessment of critical thinking is challenging. It is not possible to assess single aspects of critical thinking or discrete skills without the risk of these separate assessments failing to capture either the quality of that thinking or the relation of the identified thinking skill to the task which aims to assess it. An example here might be learning to drive. Whilst it is possible to learn aspects of driving in a classroom or in a practice environment and become skilful, assessment by a qualified tester takes place in a real environment. The tester has criteria, but also needs to make a judgment about how well a learner has fitted together their observational and physical skills and evaluate whether or not their driving is good enough.

A synthesis of descriptive and normative approaches can be proposed. This involves taking in the strengths of each perspective. So a descriptive analysis is useful in identifying how particular aspects of thinking are valuable for a particular subject or in a curriculum in order to ensure that the teaching or elements of the course cover a range of thinking 'skills', though these may need to be taught through appropriate and relevant contexts. However the implications for the assessment of such skills from the normative perspective is that it needs to take into account not just whether a student shows such thinking, but that it is appropriate in the context or meets particular requirements to ensure its quality, needing some judgment on the part of an assessor.

Thinking skills in education

In educational discourse, 'teaching thinking' or 'teaching thinking skills' is often used to refer to pedagogic approaches through which

specific strategies and procedures may be taught and used by learners in a controlled, conscious way to make their learning more effective. These strategies and procedures may be what some use spontaneously and/or they may be otherwise contrived. Many such skills and abilities have been suggested, specific, broad, or general in nature. Ashman and Conway (1997) conclude that thinking skills programmes typically involve six related types of thinking:

- metacognition
- critical thinking
- creative thinking
- cognitive processes (such as problem-solving and decision-making)
- core thinking skills (such as representation and summarising)
- understanding the role of content knowledge.

For the purposes of this book we have conceptualised 'thinking skills approaches' as courses or organised activities which identify for learners translatable mental processes and/or which require learners to plan, describe and evaluate their thinking and learning. This usage of the term 'thinking skills' implies that there are learning and teaching situations that can induce processes which produce desired mental activity. It is underpinned by a judgment that thinking can be improved with practice particularly through the skilled intervention of a teacher. It also implies the use of mental processes to plan, describe and evaluate thinking and learning. One way of looking at this metacognitive aspect is to consider thinking skills as ways of managing working memory so that conscious and unconscious processes together are more likely to produce desired outcomes (Newton, 2000).

Without downplaying the importance of unconscious and social processes, we believe that thinking skills approaches or pedagogies which make aspects of thinking explicit to the teacher and learners will focus attention on self-aware goal-directed thinking, in which there can then be strategic management of attention and working memory, supported by various 'habits of mind', including critical reflection. The goals of thinking and learning may be concerned with information-gathering, with building understanding, with thinking that generates productive outcomes, or with dynamic combinations of all three. Directing attention by clarifying the language of thinking as the

taxonomies and frameworks in this book all attempt will be of help to those who wish to achieve this in their teaching or their learning.

Emphasis upon instruction in cognition is the product of many influences. Some of the main influences can be identified.

On the one hand, not many teachers are enthused by what are widely regarded as simplistic behaviourist models, in which the focus of teaching is primarily observable behaviours rather than mental processing. The behavioural objectives movement has been particularly influential in special education (Ainscow and Tweddle, 1988), and in mainstream practice there has also been a trend towards setting and assessing precise learning goals and targets. The sterility and mechanistic nature of such approaches, however, has resulted in renewed interest in cognitive processes that appear to underpin learning (Elliott, 2000).

There has also been recognition that developmental stage theories, such as those of Piaget, where the individual passes through a series of stages reflecting superior levels of thinking, do not necessarily lead to a 'deterministic trap' (Adey and Shayer, 1994, p. 6) in which environmental inputs might be seen as capable of limited influence. Following the widespead interest in Vygotskian theory in recent decades, it has been increasingly accepted that educators should try to help learners engage in thinking at higher levels than might be possible without highly structured assistance. Vygotskian theory has been complemented by Bruner's work, in particular, the notion of scaffolding (Wood, Bruner and Ross, 1976). Many teachers are attracted by the idea of *cognitive apprenticeship*, a term that refers to a process whereby the 'expert' (teacher) structures the conditions of learning a task in such a fashion that the 'novice' (learner) is progressively given less support as he or she gains in the capacity to complete it independently (Rogoff, 1990).

A proliferation of thinking skills programmes, approaches and initiatives have emerged in education, especially for use by teachers in schools. In some cases, these take the form of highly structured and discrete programmes (such as Feuerstein's *Instrumental Enrichment*); in others, principles from cognitive education are drawn upon and used with existing curricula (such as *Cognitive Acceleration Through Science Education* by Adey, Shayer and Yates, 1989). Further educational

initiatives take ideas from philosophy (such as Matthew Lipman's *Philosophy for Children* and can perhaps be better described as a pedagogy to support thinking rather than a thinking skills programme. Many are more eclectic and draw upon diverse perspectives, ranging from psychology to popular neuroscience. Wallace and Adams' *Thinking Actively in a Social Context (TASC)* (Wallace et al., 1993) has an eclectic, but coherent, theoretical foundation, drawing on psychological, philosophical, social and pedagogical sources. However, some of these initiatives are based upon such differing theoretical and conceptual perspectives that they bear little relationship to each other. Indeed, the same concept is often used to describe rather different cognitive processes. Given the lack of any unifying or overarching theory, the approaches, models and concepts are frequently adopted with little significant grasp of where these are located within the broader field of (albeit contested) knowledge.

It is hardly surprising that programmes to teach thinking have become plentiful (cf. Hamers and Overtoom, 1997). They often have powerful resonance with teachers and have been shown to have a generally beneficial effect (Higgins et al., 2004). While some maintain that their task is the delivery of a school or college subject, many others emphasise that they are trying to teach more generally applicable or 'translatable' skills or processes through the problem-solving elements of the curriculum, as well as encouraging learners to become thoughtful and reflective.

Teaching thinking: programmes and approaches

Widespread publicity is attached to highly charismatic and persuasive advocates of specific thinking skills programmes. One of these is de Bono, whose articulation of a set of thinking strategies, such as those set out in his Cognitive Research Trust (CoRT) programme, has been widely applied in both educational and vocational contexts.

The work of Lipman (see pages 157–164) has also received much attention. A teacher of philosophy in one of the USA's most prestigious universities, Lipman despaired at what he considered to be the widespread inability of his students to engage in high-quality thinking. As a consequence, he advocates the use of philosophical reasoning and argument with learners from as young as seven. He seeks to

create 'communities of enquiry' in educational contexts that encourage listening carefully to the views of others and setting out and justifying one's own opinions and responses by recourse to logical argument.

In the 1970s there was a general interest in the field of special education in various 'psycholinguistic' programmes which sought to remediate weak or faulty psychological processing in perceptual and cognitive areas, such as visual perception, auditory sequencing, visual–motor processing, and concept formation. The theory behind interventions based upon such analyses was that tackling processing deficits would result in raised academic performance in other areas such as reading and mathematics (Swanson, 1999). However, empirical studies failed to support such notions, with transfer proving particularly problematic (Arter and Jenkins, 1979; Kavale and Forness, 1987). More recent work has focused on specific cognitive processes, such as inductive reasoning, apparently with more positive results (Klauer and Phye, 1994; Büchel, Schlatter and Scharnhorst, 1997).

Proving highly durable over several decades, Feuerstein's 'Instrumental Enrichment' (see pages 55–62 for an analysis) has been largely applied to learners with various forms of special educational need. Feuerstein's optimistic views of the capacity of all learners to make progress, his highly detailed and comprehensive description of specific cognitive processes that were often deficient in poor learners, together with the articulation of a comprehensive intervention programme, have resulted in much teacher interest across the world and a number of derivatives (e.g. Blagg et al., 1988).

As attractive as such programmes as Feuerstein's were to many teachers, in the UK there has been an increasing movement to undertake thinking programmes in discrete academic subject areas. The strong subject discipline emphasis of the National Curriculum; a heavy inspection regime in which the appropriateness of 'esoteric' courses might be questioned; the costs involved in getting the required training; and inconsistent research findings have limited the take-up of stand-alone programmes. However, approaches that embed thinking skills interventions within a specific curriculum subject, and which appear to result in significant attainment gains in that subject (Adey and Shayer, 1994) have a greater appeal.

Starting in science with the Cognitive Acceleration through Science Education (CASE) programme (Adey, Shayer and Yates, 1989), a similar approach has been applied in mathematics, technology and the arts (Shayer and Adey, 2002). An innovative curriculum development project called Thinking through Geography (Leat, 1998) was designed around a list of 'big' concepts which are important for geography teaching. The approach has been expanded to history, Religious Education, English, Modern Foreign Languages and primary education. It focuses on the use of 'powerful pedagogical strategies' (Leat and Higgins, 2002) to support teachers in developing their pupils' thinking. Another example of the 'infusion' approach for developing thinking skills can also be seen in the ACTS project (Activating Children's Thinking Skills) for upper primary level (McGuinness et al., 1997). As in Swartz and Parks' infusion approach in the US (1994), teachers trained in the ACTS methodology develop a range of thinking skills across the Northern Ireland curriculum at Key Stage 2 by focusing on specific strategies. Other subject-specific work showing evidence of impact is in the area of collaborative talk and thinking. When primary-age pupils are taught to follow agreed 'talk rules', their attainment in mathematics and science (Mercer et al., 2002) has been shown to improve. This 'Thinking Together' approach is also being extended to other subjects and age groups. Similar theoretical concerns underpin other programmes such as Wallace's TASC 'Thinking Actively in a Social Context' (Adams and Wallace, 1990; Wallace, 2001).

Also involved in the development of 'thinking' approaches to learning and teaching across the curriculum has been a strong orientation to the teaching of strategies for learning in an explicit fashion. Research studies have highlighted the gains that can be achieved when specific cognitive and metacognitive strategies are embedded in the teaching of academic subjects such as reading and mathematics (e.g. de Corte, Verschaffel and van de Ven, 2001; Fuchs et al., 2003). Much early work in this area was undertaken in the fields of memory (Cohen and Nealon, 1979) and reading comprehension (Palincsar and Brown, 1984; Meyer et al., 1989). Such 'learning to learn' initiatives were greatly strengthened by increasing teacher familiarity with the constructs of *metacognition* and *self-regulation*. As a result, the importance

for learners of considering about how best to approach tasks involving such cognitive processes as memorising, problem-solving, and applying existing knowledge and skills to new areas (transfer), has become widely recognised by educators. Although metastrategic or metacognitive processes form a key part of most thinking skills programmes, they also now feature more independently in everyday teaching practices.

Cognitive forms of intervention have been influenced by several studies demonstrating that those with learning difficulties experience particular problems with metacognitive and self-regulatory functioning involving, for example, checking, planning, monitoring, reviewing, predicting and evaluating (Wong and Jones, 1982). Cognitive and metacognitive interventions in the US to help children with learning disabilities use a range of tactics and strategies (Swanson, 1999, 2000). These include: the use of advanced organisers (statements in learning materials that remind learners of procedures that they should employ in order to be more strategic in their approach); elaboration (in which students are actively encouraged to link material to be learned to information or ideas which they already have in mind); attributions (in which the reasons for a strategy succeeding or failing are considered); and thinking about and controlling one's thinking process (metacognition). The importance of metastrategic knowledge (knowledge of task objectives and knowledge of strategies) for all children is now widely accepted (Kuhn and Pearsall, 1998).

Developments in instructional design

Programmes and approaches for teaching thinking are located within the broader field of instructional design. Aims and objectives are required for any educational enterprise or training programme, as well as methods for achieving them. These can be expressed in global and/or specific terms, and with an emphasis on the learner and the learning process, and/or on the teacher and coverage of content. It is widely accepted that learners need to become skilled in accessing and using knowledge productively rather than learning factual content as a memory-based exercise (Resnick, 1989). Learning objectives usually focus on knowledge and skills, but long-term objectives are formulated in terms of attitudes and dispositions to behave in certain ways.

The instructional design community has undergone significant changes over the past 50 years. Eliasmith (1996) argues that the main reason for the failure of behaviourist theories of cognition was their rejection of the role of representation in animal and human thinking. The same author goes on to show how subsequently two main paradigms of cognitive science have gained prominence: 'connectionism', which sees cognition in terms of connectionist processing; and 'symbolicism', which argues that cognition is best understood as symbolic manipulation.

Other important new developments in instructional design theory are emerging. For example, Eliasmith points to the many powerful criticisms which have more recently been levelled against connectionist and symbolicist paradigms of cognitive science (Thelen and Smith, 1994; van Gelder, 1995; van Gelder and Port, 1995), particularly in relation to their inherent linear and unidirectional representation of thought processes and learning and their inability to explain the dynamic and socially and culturally situated nature of the complexities of human thinking.

De Corte (2000), Corno and Randi (1999) and Jonassen (1999) also draw attention to different fundamental problems in traditional approaches to instructional design and suggest how these shortcomings may be overcome. For example, de Corte (2000) points out that although recent research on learning and instruction has improved our understanding of how we think and learn, this has not resulted in proportional improvements and innovation in classroom practice.

He makes a distinction between a disciplinary orientation and an educational orientation in educational psychology. From the disciplinary orientation, educational psychology is considered as a branch of psychology, which is chiefly concerned with the development of theory, while the education orientation focuses upon developing a better understanding of education as a basis for improving educational practices. He argues that the disciplinary orientation effectively dominated 20th century research and is still alive in instructional psychology in the 21st century. He goes on to claim that this has led to 'the study of psychological variables and processes in isolation, and of individual learners independent of their social and cultural environment' (2000, p. 252).

Conducting research in this way, de Corte contends, not only runs the risk that educationally important aspects of learning are in danger of being overlooked, but also carries with it the assumption that 'in vitro' laboratory experiments can be extrapolated from the laboratory to the classroom. He points out how a lack of good communication between researchers and teachers has served to compound this problem and has culminated in a theory–practice gap. He illustrates how teachers tend to adapt rather than adopt educational innovations and it is for this reason that merely providing accessible and digestible research information or curriculum materials will simply not be enough to guarantee their translation into effective classroom practice.

Corno and Randi (1999) make an important and related point in a study of design theory for classroom instruction in self-regulation where they argue:

If teachers are to help students become self-regulated learners, their own self-regulation has to be unleashed as well. Traditional design theories of instruction run the risk of interfering with rather than supporting this goal.

(Corno and Randi, 1999, p. 296.)

De Corte emphasises how the education orientation, which developed from the work of Ausubel's criticism of the prevalence of the discipline orientation in the 1960s (Ausubel and Robinson, 1969), together with more recent research studies which have focused upon the design of new and powerful teaching–learning environments, has already resulted in an empirically underpinned knowledge base which can not only guide the analysis of the effectiveness and quality of teaching, but also serves to support the formulation and development of a practical and research-based theory of learning and instruction.

From a different starting point, Reigeluth (1999) arrives at a similar conclusion to de Corte. He distinguishes between descriptive theory (learning theory) and instructional design theory (theories or models of effective methods of instruction). He argues that the improvement of descriptive theory revolves around validity, whereas the improvement of design theories revolves around 'preferability' (which methods are better than their alternatives given a particular teacher's goals and values).

In contrast to de Corte, he claims that different kinds of research methodologies are required for improving each kind of theory and that most of the research methodologies developed to date were designed to advance descriptive theory. Through the work of Corno and Randi (1999) among others, he concurs with de Corte where he advocates a kind of formative research. By this he means a kind of developmental or action research that is intended to improve design theory for design and instructional practices or processes. Through the application of 'design experiments' he urges teachers and researchers to collaborate in the design, implementation and analysis of instructional design curriculum interventions in order to develop and refine instructional design theories. Reigeluth's underlying logic here is that, through the rigorous implementation and testing of an instructional design theory by teachers, any weaknesses found in implementation might reflect weaknesses in the theory. Conversely any improvements identified for the application may indicate ways to improve the theory. This resonates closely with the practical interests of teachers in actively investigating the impact of innovative approaches as a means both to develop their own practice, whilst at the same time testing the robustness of the theoretical and pedagogical design (Baumfield et al., 2002).

The instructional design community has come a long way since the pioneering work of Bloom and his associates. In the early 21st century it still struggles to balance the legacy of behaviourist theory with the sociocultural, multi-dimensional, multi-directional and dynamic nature of human thinking and learning. However, conceptions which emphasise sociocultural aspects of cognitive development are not always easily contextualised to classroom learning (Gruber, Law, Mandl and Renkl, 1999). Coaching individuals and small groups is not the same as trying to introduce concepts such as mediated learning and cognitive apprenticeship (Rogoff, 1990) into a class of 30 pupils. It remains to be seen how the research community and its counterparts in the teaching community will respond to the challenges of de Corte and Reigeluth to work together to develop ways of unifying theory-building and improving practice.