

Critical thinking in education: a review

R. T. Pithers, Faculty of Education, University of Technology, Sydney, PO Box 123, Broadway, NSW 2007, Australia and **Rebecca Soden**, University of Strathclyde, Glasgow, UK

Summary

National governments and employers have argued that it is important for all sectors of education to prepare individuals who are able to think well and for themselves. 'Good thinking' and 'thinking well' are commonly used terms bound up with what is called 'critical thinking' in the research literature. Evidence is presented in this paper, however, which suggests that not all students may be good at critical thinking; nor do some teachers appear to teach students 'good thinking' skills. A review of the research literature in this area was undertaken and the methods and conceptions of teaching likely to inhibit and enhance critical thinking are outlined, as well as what is required to improve students' thinking skills. Ways forward in teaching critical thinking, and in helping students to learn to think well and for themselves, are described and discussed.

Keywords: critical thinking, critical reasoning, education, teaching and learning

'Good thinking' – an avowed aim of education

While the contemporary education curriculum is a highly contested arena, there seems to be consensus that it should help students to think well and to think for themselves. National government policy as well as employers are demanding that education, no matter in what discipline or at which level, ought to enable graduates to think 'smarter' than was the case in the past. This position has recently received a new impetus, because as these stakeholders have observed, national development is tied up with education outcomes and because the pace of globalization with increased economic competition is unrelenting. One effect of this change is that secondary and tertiary education graduates now more often find themselves in workplaces where they are exposed to large-scale social, technological and social change.

What all of this might mean for 'good thinking', 'thinking well' or 'thinking smarter' than before is explored and contested in a growing philosophically and

Address for correspondence: Dr R. T. Pithers, Faculty of Education, University of Technology, Sydney, PO Box 123, Broadway, NSW 2007, Australia.

psychologically informed literature on helping students to engage in thinking for themselves (e.g. Bonnett, 1995; Gardner and Johnson, 1996; Hyland and Johnston, 1988; Perkins, 1993). In another body of literature concerned with learning and teaching in education, it is implied that 'good thinking' in any area involves being able to identify questions worth pursuing, being able to pursue one's questions through self-directed search and interrogation of knowledge, a sense that knowledge is contestable and being able to present evidence to support one's arguments. This burgeoning literature describes teaching approaches claimed to be optimal for developing such abilities (e.g. Boekaerts, 1997; Cederbloom and Paulsen, 1991; Entwistle, 1994; Gibbs, 1992; Laurillard, 1993; Ramsden, 1992; Tait and Knight, 1996; Wisker and Brown, 1996).

The purpose of this paper is to integrate ideas in bodies of literature concerned with 'good thinking' or in helping students to think well in a way which makes sense to teachers and which could be implemented in all sectors of education within existing resources. The authors recognize that the nature of thinking is contested and they acknowledge that the notion of 'far' transfer, for instance, from one discipline domain to another, is problematic (Drew, 1998; Garnham and Oakhill, 1994). The term 'critical thinking' is used in the paper not only as defined in the literature, but also as a way of summarizing some of the major generic abilities being emphasized in recent government papers on higher education in the UK, Australia, New Zealand, North America and elsewhere.

The idea that education and training should help students to develop the dispositions or attitudes deemed to be associated with critical thinking, as well as the ability to think well, has been connected with employers' alleged desires for school, university and college graduates who are curious, critical, analytic reflective thinkers – problem-solvers who are quick to learn, as well as flexible and able to add value to their organizations (Harvey *et al.*, 1997).

Generic abilities

This notion has been expressed recently, in the UK, in the 1996 Dearing Report on higher education, and 'generic' abilities through terms such as 'key skills' (Higher Education Quality Council, 1995, 1996). According to the Higher Education Quality Council, graduates are expected to learn not only the content and methods of a discipline, but also to develop 'generic' abilities which can be deployed flexibly in a wide range of work and life contexts. The UK Quality Assessment Agency has indicated an interest in requiring higher education institutions to include provision for developing 'key skills', one of which is 'learning to learn'.

In the Australian context, the teaching and learning of a range of 'generic competencies' are seen to be at the core of life-long learning to improve students' flexibility and adaptability when they enter the workforce. These competencies are represented, for example, by knowledge and skills relating to: collecting, analysing and organizing information; planning activities; problem-solving; communicating information; working with others; and using technology (Mayer, 1992). These competencies, in most instances, parallel those developed in the UK (NCVQ core skills), New Zealand (Essential skills) and the USA (Workplace know-how skills). Future national and global success in business and industry, or so it is said by government in these places, is dependent on the ability of teachers, lecturers and tutors to teach knowledge, skills and attitudes relevant to these generic competencies, as well as those more specific to their own subject-matter content domain or discipline area.

Conceptions of critical thinking

In the literature on the nature of 'good thinking' and how it might be taught, the term 'critical thinking' is often used to describe competencies which seem to be applicable to teaching-learning in context but also to learning in many workplace contexts. These include, for example, the skills of argument (Kuhn, 1991). The term 'critical thinking' is used in a body of research literature to describe reasonable, reflective thinking, focusing on task, people or belief (Ennis, 1993). It is a definition which attempts to exclude creative thinking.

As it is conceived, critical thinking involves abilities in addition to certain dispositions. They are brought to bear in identifying a problem and its associated assumptions; clarifying and focusing the problem; and analysing, understanding and making use of inferences, inductive and deductive logic, as well as judging the validity and reliability of the assumptions, sources of data or information available (e.g. Kennedy, Fisher and Ennis, 1991). Evaluation is seen as a core ability. Attitudes or dispositions such as a 'spirit of inquiry' are also seen by some writers in the field as very important (e.g. Ennis, 1993; Perkins, Jay and Tishman, 1993). For instance, Ennis's view of critical thinking involves broad dispositions, transferable over various domains such as being 'open-minded', 'drawing unwarranted assumptions cautiously' and 'weighing the credibility of evidence'. These abilities and dispositions occur within a global perspective in which thinking is conceptualized as a type of reasoned argument with an explicitly social dimension (Kuhn, 1991).

Some recent research evidence from tertiary education

Kember (1997), after reviewing the available published research evidence, suggested that teaching approaches in tertiary education may be influenced by an interplay of factors. For example, one factor, curriculum design, was seen to influence university and college lecturers to focus on subject-matter content when teaching rather than on the development of critical thinking. This may be because content is usually specified far more fully than potentially generalizable abilities. It seems too that lecturers are offered little help in clarifying what is encompassed in the notion of 'good' thinking. Thus they are not clear on what it is they are supposed to be helping students to develop. Not surprisingly, lack of clarity about the nature of critical thinking leads to confusion about how good thinking might be assessed; assessment and evaluation of critical thinking has been sorely neglected worldwide (e.g. Kennedy *et al.*, 1991). Ongoing confusion about these matters seems sometimes to lead to teaching approaches to problem-solving which are unlikely to develop more widely transferable generalizable critical thinking abilities and dispositions.

Research in the UK further education sector, where the development of work-related thinking has been emphasized since the late 1980s, provides examples of teaching which is inconsistent with this aim. Teaching behaviours likely to develop critical thinking were found to be rare in Social Care courses. This was a surprising finding, given that the courses in this area were an induction into a profession which values critical inquiry (Anderson *et al.*, 1997). Bloomer (1998) reported a similar finding based on his research of a range of programmes leading to General National Vocational Qualifications (GNVQ). In these courses students engaged in much activity, although it rarely included critical inquiry.

Nevertheless, there appears to be a dearth of published research which examines the development of critical thinking during degree-level courses. In a study of critical thinking involving 256 Scottish and Australian university students studying education, an attempt was made to measure critical thinking using the Smith–Whetton *Critical Reasoning Test* (CRT), a reasonably valid and reliable standardized psychological test with versions available for both countries (Pithers and Soden, 1999). Mean CRT scores were compared for course entrants with degrees and those who had no degree, as well as for stage (year) of course. Overall, it was found that there was no significant between-group CRT differences for graduate vs non-graduate students or for stage of the course.

In fact, graduate entrants had CRT scores not significantly higher than non-graduates. Nor did final stage (Years 2 and 3) students, on average, perform significantly better than Stage 1 students. Overall, these results suggest that the sort of critical thinking measured by the CRT, based on Ennis's (1993) conception which is outlined shortly, was not being well developed in the tertiary education course examined in both countries. Nor did the critical thinking abilities and dispositions measured by the CRT appear to have been developed significantly by the students during their previous study at degree level. Furthermore, CRT mean scores for these students were not significantly higher than the normative sample means provided in the CRT Manual (Smith and Whetton, 1992) for school-leavers who had taken examinations qualifying them for university entry (e.g. in the UK, A-levels; in Australia, HSC-level).

In a subsequent paper (in preparation) the authors report instances of critical thinking in a sample ($n = 40$) of essays for a similar degree course whose programme aims included the development of abilities encompassed by the term critical thinking; these abilities were described explicitly in course descriptors issued to lecturers and students. Instances of critical thinking were rare and there was a high frequency of assertions without justification. Lecturers, tutors and students seemed not to share an understanding of what it means to think critically. These findings, perhaps, should not be viewed as surprising, given the published literature over a relatively long period about the practices which inhibit critical thinking (e.g. Raths *et al.*, 1966; Sternberg, 1987). Evidence that students enter higher education with underdeveloped ability to think critically is another argument for finding effective measures to promote this ability.

Kuhn (1991) supposed that thinking as argument was variably implicated in the beliefs people hold, the judgements they make and the conclusions they arrive at; it was at the heart of everyday thinking. Among Kuhn's 'skills of argument' are the ability to propose opinions alternative to one's own and to know what evidence would support these, to provide evidence that simultaneously supports one's own opinions while rebutting the alternatives and to weigh the goodness of one's own evidence and that of others. Kuhn provided evidence that none of these abilities is widespread in the adult population in the USA, even among those who have had a college education.

In a UK intervention, Anderson *et al.* (1997) demonstrated that students' thinking, as conceptualized in Kuhn's model, could be significantly improved (over that of a control group) in the normal curriculum by embedding measures reflecting the main themes in the literature reviewed in this paper. The improved quantity and quality of justifications the students incorporated into their report writing by the fourth month of the intervention were still observable at the end of the academic year.

Many writers have emphasized that thinking and content are intimately

connected (e.g. Biggs and Collins, 1982; Laurillard, 1993; Ramsden, 1992). These workers imply that learning to think involves learning to use content in successively more sophisticated ways in understanding the world. Barnet (1994, p. 153) suggested that an educational goal should be the development of wisdom, defined as 'a form of deep reflection, collective exchange, and a recognition even a critique of inner values'. Bonnett (1995) argued that any view of 'good thinking' which fails to affirm the sanctity of content is likely to be deficient. Indeed there is sound empirical evidence that good knowledge and good thinking are inextricably bound up (Bereiter and Scardamalia, 1993; Chi, Glaser and Farr, 1988). It seems important therefore that critical thinking is taught in the course of teaching discipline knowledge. Blending these ideas with the descriptions of critical thinking already outlined, it seems that one straightforward and effective measure lecturers and teachers could deploy in their teaching is to put far more emphasis on the particular forms of reasoning within their own discipline area and to give examples of how these forms of reasoning can be applied both within and outside of that discipline.

Another important strand in the discourse on 'good thinking' which helps to unify the ideas previously outlined is the notion of self-regulation of thinking (e.g. Schunk and Zimmerman, 1994). The assumption is that this metacognitive ability, for instance, involving perception, critique, judgement and decision-making, allows people to orchestrate and self-regulate their own learning strategies and those abilities encompassed in the term 'critical thinking'.

Teaching approaches which seem to inhibit or enhance students' ability to think well

Ways to inhibit students' critical thinking

Historically, the published literature on teaching thinking has concentrated on methods which are likely to hinder rather than enhance 'good' thinking. Researchers such as Rath *et al.* (1966) and, more recently, Sternberg (1987) have discussed theories and practices which tend to inhibit or cause the outright failure of the development of students' critical thinking abilities and dispositions. This literature serves to further inform teachers about what they should not think and do.

For instance, Rath *et al.* (1966) described the links between thinking and behaviour and provided evidence that some students engage in 'thoughtless' or 'unwise' behaviours as their primary behavioural patterns. These researchers argued that such individual patterns of behaviour can and should be changed, substituting more 'thoughtful' and 'wise' behaviours for the maladaptive patterns. Rath's good thinking operations included: comparing, interpreting, observing, summarizing and classifying; suggesting hypotheses; taking decisions; creating; criticizing and evaluating; designing investigations; identifying assumptions; and coding, gathering and organizing data or information, as well as applying principles to new situations. This list is very similar to more modern ideas (see Ennis, 1993) of what constitutes critical thinking (except for the imagining and creating aspects). Rath's idea that there should be no new subject called 'critical thinking', rather that it should be conceived as a means of teaching-learning in any subject area, resonates too with well-regarded modern research (e.g. Perkins, 1993).

Raths *et al.* (1966) saw teacher–student interaction as the place where thinking could be best promoted, and in that sense they identified, via their research, eight behavioural patterns (they called them ‘types’, which suggests more permanent and immutable student attributes) that identified deficits in good thinking. These were learners who: (1) act without thinking (impulsive); (2) need help at each step (overdependent); (3) use goal-incompatible strategies (do not perceive cause–effect relationships); (4) have difficulty with comprehension (miss meaning); (5) are convinced of the ‘rightness’ of their beliefs (dogmatism); (6) operate within narrow rule sets (rigidity/inflexibility); (7) are fearful (not confident); and (8) condemn good thinking as a waste of time (anti-intellectual).

Raths *et al.* went on to discuss the types of teacher behaviour which they argued inhibit good thinking. For example, any teacher, no matter at what level, who simply agrees or disagrees, just demonstrates and explains, cuts off student responses, uses reproof rather than praise, shakes the learner’s confidence in the value of new ideas or uses basically only retrieval or recall types of questions inhibits thinking. Furthermore, their argument examined the sort of student teachers tend to reward best: the quiet non-thinker. These researchers argued that school-based educational programmes that advocated more effective instructional courses rarely provided the means by which students could learn ‘good thinking’ practices. It seems as we reach the twenty-first century that for many education students, in these respects, not a lot has changed.

More recently, Sternberg (1987) has argued that in teaching critical thinking, there are more ways to fail than to succeed. Unlike Raths *et al.* (1966), with their focus on the teaching–learning interface, however, he argued that many teaching programmes in school education are doomed in this area in the planning phase. He stated that eight teacher fallacies obstruct the teaching and learning of ‘generic critical thinking’. The first of these concerns lecturers who believe they have nothing to learn from students: in the area of critical thinking, the teacher is also a learner who needs to be receptive to new ideas. The second fallacy is that critical thinking is solely the lecturer’s job: this is a belief that they must think out the responses and these should be presented smoothly and slickly, using the best available technology. The point to be made here which resonates with the current advocacy of problem-based learning as a means of enhancing students’ thinking is that the teacher needs to be involved in this process sometimes more as a facilitator than as an instructor.

The third fallacy is that there is a ‘correct programme’ for the delivery of critical thinking. Sternberg (1987) made the useful point that there is no one correct thinking programme: it depends on the programme goals and the content. It also depends, of course, on the context or culture in which the learner’s thinking is to be situated. A fourth fallacy is that the choice of a critical thinking programme is based on a number of binary choices (e.g. holistic or process-based, flexible delivery vs face-to-face); usually what will be effective is a combination of approaches from a wide range. A fifth fallacy is that what really is important is the ‘right’ answer, when plainly it is the thinking behind the answer which is important. Related to the foregoing conception is a sixth fallacy that discussion is a means to an end. Critical thinking may prove to be an end in itself. The seventh fallacy is the notion of mastery-learning (e.g. the student is expected to be 90 per cent correct, 90 per cent of the time) which implies (unreasonably) some ceiling on good thinking: usually thinking and performance can be further improved. Sternberg’s final fallacy is that the role of a course in critical thinking is to teach critical thinking.

Most writers in the field seem to be agreed on the point that to promote critical thinking the students must learn to teach themselves to reflect and refine the strategies, to develop their metacognitive knowledge and skills (e.g. weigh evidence, look for interrelatedness or interrelationships, develop stable hypotheses). The school teacher, like those at other educational levels, can only *facilitate* this individual process. Nevertheless, too often it seems to be the teacher or lecturer who sets the problem(s) and shows the student how to pose it and solve it and then leaves the student to solve similar problems, often with model answers provided as feedback. There appears to be little doubt that Sternberg's eight obstructive fallacies about critical thinking are worthy of consideration and action at the curriculum design stage to ensure planned changes that enhance rather than inhibit critical thinking.

Enhancing critical thinking

The notion that abilities encompassed by the term critical thinking should be taught in separate 'add-on' courses has given way because of emerging literature which supports the notion that such abilities can be developed more effectively in the course of teaching subject-matter content.

Langer (1997) is one of the researchers who is concerned with teachers presenting content 'mindfully'. Langer's view, like some of the others outlined, is that teachers should learn to teach from multiple perspectives and focus on linkages and similarities of content. For example, during a course in high school history a teacher might point to, ask questions about and discuss similar causes underlying the world wars, in a range of areas such as economic, political, militaristic and social, as well as covering the specific causes of a particular war. Alternatively, during a poetry course, while studying the Romantic poets, common themes (e.g. their views of Nature and its beauty, significance for individuals) written about by different poets of this period (e.g. Keats, Wordsworth, Coleridge, Byron) could be examined and compared and, perhaps, linked to student research on the life experiences of the different poets and how this experience may have led them to their poetic conceptions of Nature and its influence. In this way, in each respective subject, some themes could be explored in a wider perspective. This, it is assumed, will encourage student sensitivity, novelty and awareness of thinking in different contexts. In such a scenario, the learners are active; they ask questions, seek information, link it to a relevant question and are able to tolerate ambiguity and uncertainty.

A way forward to enhance students' critical thinking, according to Langer, is to change the myths on which current educational practice is based. These myths are similar to the critical thinking inhibitors earlier outlined. By rejecting the myths, it is possible to consider notions such as looking for novel approaches, the notion that the 'truth' may be fluid and context dependent and that the learner needs to develop more control and independence over their own learning.

It seems that students' and teachers' thinking might be enhanced if they were to avoid those fallacies, myths or thinking defects that are seen to hinder the development of critical thinking. There are other specific ideas which course-development teams could adopt and that are likely to enhance critical thinking. Raths *et al.* (1966) indicated a range of teaching techniques which, according to their follow-up research, brought about changes in students' thinking. The more important of these involved having the students consciously reflect on their core ideas and encouraging them to analyse these ideas. Students, for example, can be

assisted to analyse their ideas via the teacher asking for examples, similarities, assumptions, inconsistencies/alternatives; by questioning prior assumptions; by using classification; and by deciding what data or information support the idea.

Furthermore, an outcome of this work is the idea that the teacher should aim to challenge current student ideas. For example, by facilitating the generation of hypotheses, the interpretation of information or data, specification of criteria or helping students to understand the judgmental processes for applying principles to new situations or for making predictions. A classroom question about why the dinosaurs died out about 65 million years ago could ask for students to gather what secondary information they could find about the various hypotheses on this issue (e.g. asteroid/comet strike with fast global environmental change, or alternatively, gradually changing warmer, drier global conditions). Students could be helped to devise the questions, gather information, question, discuss and weigh the different types of evidence and its validity and, perhaps, come to a tentative conclusion. A similar process might attend an answer to a primary school topic of how something works (e.g. how do birds fly?) or why something exists or behaves in the way that it does (e.g. how does a snake catch its prey and 'eat' it, or why butterflies exist or why it rains and how erosion is caused).

Metacognitive approaches to generalize 'good thinking'

A related strand of theorizing has generated extensive empirical data which has considerable potential for informing the teaching of 'good thinking' (e.g. Jarvela, 1995; McGuinness, 1993; Perkins and Grotzer, 1997). As McGuinness (1993, p. 311) has pointed out, a variety of methods are used to teach thinking, all of which rely on metacognition to some extent: 'all methods try to make the students' thought processes more explicit, thus enabling them to clarify and reflect upon their thinking and gain more self-control.' Within this strand are ideas about how teachers might help students to learn to think in the course of learning their discipline (e.g. Bliss, Askew and Macrae, 1996; De Corte, 1996; Perkins, 1993). These ideas include modelling ways of thinking, 'scaffolding' students' attempts to understand and use concepts and encouraging students to reflect on the strengths and weaknesses of the thinking processes they are using.

'Scaffolding' has been the focus of some research (e.g. Perkins, 1989; Wood and Wood, 1996). The concept encapsulates many ideas about what teachers can do to enhance critical thinking. It is a teaching concept associated with assessing through dialogue the level of a student's thinking and moving it on through a systematic series of questions. For example, if students were handing in essays or reports which suggested that they have only an embryonic notion of analysis, the 'scaffolder' might routinely organize tutorial sessions around problematic assumptions in the students' prescribed reading or writing. In one of these sessions, the learners could be directly asked to increase the number of counter-arguments they can mount and to evaluate evidence for and against 'my side'/'other side' arguments.

'Scaffolding' comes into play when students cannot make any reasonable response to such questions: the 'scaffolder' might then point out the assumptions underlying the issue and use a series of questions to lead the students to understand why they are problematic. For instance, if a student wrote that taxes should not be used to subsidize child care, the tutor might ask why good child care might benefit the state. They might then move on to pressing the students to bring in

evidence to the next tutorial session which can be validated. Derived from the way that Vygotsky (1978) described a person's potential for development, scaffolding is intended to facilitate the learner's 'zone of proximal development', which in this example is a more critical way of thinking. Unfortunately, Bliss, Askew and Macrae (1996), after analysing their video data of high school teaching, concluded that teachers did not notice most of the opportunities which arose to 'scaffold' students' thinking in the traditional disciplines.

An account of a research study in which scaffolding was used in a systematic way, and which could be adapted for tutorial work, can be found in Perkins (1989). A useful source of ideas and materials for teachers and lecturers who want to place more emphasis on critical thinking can be found in Bensley (1998). The conception of critical thinking underlying this text is that critical thinking skills are taught as the student learns the concepts and completes the work of a particular discipline. This book purports to help with teaching the sorts of critical thinking involved in evaluating psychological research and in engaging in psychological informed analysis of the issues. The work includes explicit modelling of 'good thinking' and a sequence of activities designed to ensure that students become skilled in thinking with and about psychological theories (see Soden's forthcoming review of this text in *Psychology Review*). All of this material could be adapted for other disciplines, particularly in social science. The chapter entitled 'Do we perceive the world as we know it?' illustrates what lecturers might do in their own subject area: a brief text introducing epistemological questions about the topic, in this case the influence of perception on what we know, is interspersed with activities such as generating hypotheses about illusions and 'questioning observations with evidence'. Throughout the text there are activities designed to encourage exploration of problems using psychological theories, and a form for answering critical reading questions is designed for use throughout the course. Texts such as the foregoing are quite useful not only for the discipline-based information that they contain, but because they provide examples, in a more general sense, of some generic methods for improving students' critical thinking and 'metacognitive' skills.

This need for help in generalizing thinking is supported by a recent review of studies of the transfer of learning (Garnham and Oakhill, 1994). It was concluded here that any transfer is usually within the domain in which the thinking was learned. It is worth considering whether this apparent lack of transfer is inherent in thinking or happens because of poor pedagogical practices in promoting generalization of abilities. A minimum condition for generalizing thinking is that the forms of thinking were learned in the first place. Yet many studies cast doubt on this assumption. It seems likely that mostly course design simply does not emphasize approaches which encourage good thinking, and that there are insufficient opportunities for students to practise analysis, critique, synthesis and other aspects of thinking.

The transfer of good thinking to a new context seems to be more likely when the teaching approach is similar to that described in Cowan (1994). For several years, he has been experimenting with an approach in which 'the central task of the tutor, working with a pair of students, was to help each student to unearth from their experiences of studying science a list of examples of relevant transferable skills taken from past and future studies' (p. 57). Cowan acknowledged that some abilities learned through studying science have wider generalizability than others to tasks outside this discipline. It is important to note that this attempt to teach students to generalize their thinking beyond their discipline proceeded

in parallel with work designed to improve understanding of fundamental discipline-specific principles and possibly enhanced such understanding.

Schwartz and Parks (1994) have produced some ideas in education for realizing the messages in the literature which has been reviewed. These ideas are easily integrated into a wide range of disciplines. For example, students might be asked to read a brief article making certain claims: their task is to suggest ways of investigating the validity of these claims, implementing their suggestions and, finally, reaching conclusions about the validity of the article.

It is difficult to conceive of any broad type of thinking that has no significant application outside a particular discipline. For example, the thinking involved in designing experiments, and gathering and interpreting evidence, has applications beyond any particular discipline. Similarly, learning to look for contested conceptions of any phenomenon seems widely applicable. If an aim of teaching-learning is to equip students to generalize forms of reasoning in any discipline domain, then it would seem sensible for teachers and lecturers to make much more systematic use of the sorts of explicit modelling and scaffolding just outlined.

These approaches can be used in ways which are consistent with conceptions of thinking encapsulated in Glaser and Chi's (1988) summary of differences between experts and novices as 'primarily reflecting the expert's possession of an organised body of conceptual and procedural knowledge that can be readily accessed and used with superior monitoring and self-regulation skills' (p. xxi). The changing nature of work may mean that breadth of knowledge is becoming more important and that secondary or tertiary education graduates may need to start acquiring knowledge of other disciplines as soon as they enter the workplace. It seems unlikely that broad forms of thinking, such as those involved in hypothesis generation and testing, have to be learned from scratch each time the graduate has to learn knowledge from another discipline. Self-regulation of one's cognitive abilities is likely to be widely generalizable. Thus all the abilities and dispositions encompassed by the term 'critical thinking' are likely to facilitate the comparatively fast rate of assimilation required in academic study and in many occupations.

Ways forward

Research evidence suggests that learning to think well needs to be acknowledged explicitly as an aim and appropriate changes made to courses. Lonka and Ahola (1995) interpreted their results as suggesting that there are two qualitatively different ways of progressing in psychology studies: high-quality active learning, which may be slow in the beginning, but provides qualitatively better results in the long run, and highly structured lecture/tutorial teaching, which is related to success in early phases of studying. There would seem to be benefits in overhauling the entire degree curriculum, so that the amount of first-year discipline-specific knowledge could be reduced to allow the students time to engage in activities which are likely to develop their thinking in the ways discussed in this paper. The question of how much discipline knowledge is good for students needs to be revisited.

Research suggests too at all educational levels that staff development initiatives may need to focus more on teachers' conceptions of learning and teaching if they are to deploy the teaching approaches suggested in a generative way. In fact some empirical research indicates quite strong relationships between

teachers' conceptions and teaching approaches (Kember, 1997). Teachers or lecturers who are simply following guidelines in curriculum documents do not seem to teach thinking well. Kember proposes that conceptions of teaching can be summarized in terms of two broad orientations labelled teacher-centred/content-oriented and student-centred/learning-oriented. The teacher-centred orientation includes conceptions that teaching is about imparting information or transmitting structured knowledge, whereas the student-centred orientation includes beliefs that teaching is about facilitating understandings, promoting conceptual change and intellectual development.

Plainly, the student-centred orientation is more consistent with approaches outlined above for developing students' thinking. According to Prosser, Trigwell and Taylor's (1994) research, there is significant scope for helping lecturers and teachers to expand their conceptions of learning and teaching in this direction. Students' conceptions of learning are also likely to be an important influence on the outcomes of lecturers' efforts to implement a 'thinking curriculum' in tertiary education. Indeed affecting students' conceptions is an important plank in any initiative.

Some types of self-managed, technology-based learning may be useful, but the process of analysis, critical review, evaluation and synthesis included in most notions of good thinking is likely to be enhanced through the sort of human dialogue characteristic of well-run class or small-group tutorials. Critical thinking and problem-solving in the workplace, or in life, are not isolated activities. Usually it is influenced by the context and culture in which it is 'situated'. Indeed sensitivity to this culture may be another important characteristic or disposition of 'good thinking'.

The growing enthusiasm in education for problem-based learning (PBL) seems promising for developing critical thinking, in that this approach seems to offer a structure for incorporating the messages in the literature reviewed in this paper. Well-designed problem-based courses are likely to encourage learners to think critically about content since courses start with problems rather than with a programme of lectures and tutorials aimed at teaching students a body of knowledge. For example, students are required to establish what the main issues are within the problems, how the problem might be resolved, how any proposed resolution might be evaluated and what knowledge they need to interrogate before they can construct a way forward. However, PBL cannot be put into place effectively in a piecemeal way. It requires funding and a commitment from course teams to redesign whole programmes with radical changes in content, the production of student learning resources and a staff development programme which inducts educators into the messages from the literature on teaching thinking.

If all education sectors aim to and are to prepare graduates for a new millennium in which the ability to think well is at a premium, it will be important not only to pay attention to the ideas reviewed here, but also to recognize that the interests, expectations and wishes of the students will impact on their learning and plan programmes accordingly.

References

- ANDERSON, R., HALLIDAY, J., HOWE, C. and SODEN, R. (1997). Bridging the Academic/Vocational Divide by Integrating Critical Thinking. End of Award Report to ESRC (research grant number R000221801).

- BARNETT, R. (1994). *The Limits of Competence: Knowledge, Higher Education and Society*. Buckingham: Society for Research into Higher Education/Open University Press.
- BENSLEY, A. (1998). *Thinking in Psychology: A Unified Skills Approach*. Pacific Grove, Calif.: Brooks/Cole.
- BEREITER, C. and SCARDAMALIA, M. (1993). *Surpassing Ourselves: An Inquiry into the Nature and Implications of Expertise*. Chicago: Open Court.
- BIGGS, J. B. and COLLINS, K. F. (1982). *Evaluating the Quality of Learning: The SOLO Taxonomy*. New York: Academic Press.
- BLISS, J., ASKEW, M. and MACRAE, S. (1996). 'Effective teaching and learning: scaffolding revisited', *Oxford Review of Education*, 22, 167–86.
- BLOOMER, M. (1998). 'They tell you what to do and then they let you get on with it: the illusion of progressivism in GNVQ', *Journal of Education and Work*, 11, 2, 37–62.
- BOEKAERTS, M. (1997). 'Self-regulated learning: a new concept embraced by researchers, policy makers, educators, teachers, and students', *Learning and Instruction*, 7, 161–86.
- BONNETT, M. (1995). 'Teaching thinking and the sanctity of content', *Journal of Philosophy of Education*, 29, 295–309.
- CHI, M., GLASER, R. and FARR, M. (Eds) (1988). *The Nature of Expertise*. Hillsdale, NJ: Erlbaum.
- CEDERBLOOM, J. and PAULSEN, D. W. (1991). *Critical Reasoning*. Belmont, Calif.: Wadsworth.
- COWAN, J. (1994). 'Research into student learning – Yes, but by whom?' In: TORNKVIST, S. (Ed) *Teaching Science and Technology at Tertiary Level*. Proceedings of Conference of Royal Swedish Academy of Engineering Sciences, Stockholm, Sweden, 6–9 June, pp. 51–9.
- DE CORTE, E. (1996). 'New perspectives on teaching and learning in higher education.' In: BURGESS, A. (Ed) *Goals and Purposes of Higher Education in the 21st Century*. London: Jessica Kingsley.
- DREW, S. (1998). *Key Skills in Higher Education: Background and Rationale*. London: Educational Development Association, No. 6.
- ENNIS, R. H. (1993). 'Critical thinking assessment', *Theory into Practice*, 32, 179–86.
- ENTWISTLE, N. (1994). Report on seminars organized by the Committee of Vice-Chancellors and Principals and the Society for Research into Higher Education, London.
- GARDNER, P. and JOHNSON, S. (1996). 'Thinking critically about critical thinking: an unskilled inquiry into Quinn and McPeck', *Journal of Philosophy of Education*, 30, 3, 441–56.
- GARNHAM, A. and OAKHILL, J. (1994). *Thinking and Reasoning*. Oxford: Blackwell.
- GIBBS, G. (1992). *Improving the Quality of Students' Learning*. Bristol: Technical and Educational Services.
- GLASER, R. and CHI, M. T. H. (1988). 'Overview.' In: CHI, M. T. H., GLASER, R. and FARR, M. (Eds) *The Nature of Expertise*. Hillsdale, NJ: Erlbaum, pp. xv–xxviii.
- HARVEY, L., MOON, S., GEALL, V. and BOWER, R. (1997). *Graduates' Work: Organisational Change and Students' Attributes*. Birmingham: Centre for Research into Quality, University of Central England.
- HIGHER EDUCATION QUALITY COUNCIL (1995). *The Graduate Standards Programme: Interim Report*. London: HEQC.
- HIGHER EDUCATION QUALITY COUNCIL, QUALITY ENHANCEMENT GROUP (1996). *What are Graduates? Clarifying the Attributes of 'Graduateness'*. London: HEQC.
- HYLAND, T. and JOHNSON, S. (1998). 'Of cabbages and key skills: exploding the mythology of core transferable skills in post-school education', *Journal of Further and Higher Education*, 22, 163–72.
- JARVELA, S. (1995). 'The cognitive apprenticeship model in a technologically rich learning environment: interpreting the learning interaction', *Learning and Instruction*, 5, 237–59.

- KEMBER, D. (1997). 'A reconceptualisation of the research into university academics' conceptions of teaching', *Learning and Instruction*, 7, 255–75.
- KENNEDY, M., FISHER, M. B. and ENNIS, R. H. (1991). 'Critical thinking: literature review and needed research.' In: IDOL, L. and JONES, B. F. (Eds) *Educational Values and Cognitive Instruction: Implications for Reform*. Hillsdale, NJ: Erlbaum.
- KUHN, D. (1991). *The Skills of Argument*. Cambridge: Cambridge University Press.
- LANGER, E. (1997). *The Power of Mindful Learning*. New York: Addison-Wesley.
- LAURILLARD, D. (1993). *Rethinking University Teaching*. London: Routledge.
- LONKA, K. and AHOLA, K. (1995). 'Activating instruction: how to foster study and thinking skills in higher education', *European Journal of Psychology of Education*, 10, 351–68.
- MCGUINNESS, C. (1993). 'Teaching thinking: new signs for theories of cognition', *British Journal of Educational Psychology*, 13, 305–16.
- MAYER, E. (1992). *Putting General Education to Work: The Key-Competency Report*. Canberra: Australian Education Council.
- PERKINS, D. N. (1989). 'Reasoning as it is and could be: an empirical perspective.' In: TOPPING, D., CROMWELL, D. and KOBAYASHI, V. (Eds) *Thinking across Cultures*. New York: Erlbaum.
- PERKINS, D. N. (1993). 'Teaching for understanding', *American Educator*, 17, 28–35.
- PERKINS, D. N. and GROTZER, T. A. (1997). 'Teaching intelligence', *American Psychologist*, 52, 1125–33.
- PERKINS, D. N., JAY, E. and TISHMAN, S. (1993). 'Beyond abilities: a dispositional theory of thinking', *Merrill Palmer Quarterly*, 39, 1–21.
- PITHERS, R. and SODEN, R. (1999). 'Assessing vocational tutors' thinking skills', *Journal of Vocational Education and Training*, 51, 23–37.
- PROSSER, M., TRIGWELL, K. and TAYLOR, P. (1994). 'A phenomenographic study of academics' conceptions of science learning and teaching', *Learning and Instruction*, 4, 217–31.
- RAMSDEN, P. (1992). *Learning to Teach in Higher Education*. London: Routledge.
- RATHS, L. E., WASSERMAN, S., JONAS, A. and ROTHSTEIN, A. (1966). *Teaching for Critical Thinking: Theory and Application*. Columbus, Ohio: Charles-Merrill.
- SCHUNK, D. H. and ZIMMERMAN, B. J. (1994). *Self Regulation of Learning and Instruction: Issues and Educational Applications*. Hillsdale, NJ: Erlbaum.
- SCHWARTZ, R. and PARKS, S. (1994). *Infusing Critical and Creative Thinking into Content Instruction*. Pacific Grove, Calif.: Critical Thinking Press and Software.
- SMITH, P. and WHETTON, C. (1992). *Critical Reasoning Test: User's Guide*. Windsor: NFER-NELSON.
- STERNBERG, R. J. (1987). 'Teaching critical thinking: eight ways to fail before you begin', *Phi Delta Kappan*, 68, 456–9.
- TAIT, J. and KNIGHT, P. (Eds) (1996). *The Management of Independent Learning*. London: Kogan Page/Staff and Educational Development Association.
- VYGOTSKY, L. S. (1978). *Mind in Society: The Development of Higher Educational Processes*. Cambridge, Mass.: Harvard University Press.
- WOOD, D. and WOOD, H. (1996). 'Vygotsky, tutoring and learning', *Oxford Review of Education*, 22, 5–16.
- WISKER, G. and BROWN, S. (Eds) (1996). *Enabling Student Learning*. London: Kogan Page/Staff and Educational Development Association.