Can Thinking Skills Be Taught?

Valerie Wilson, Scottish Council for Research in Education

It is now over ten years since Professor John Nisbet's review of published research on teaching thinking appeared in this Spotlight series (Nisbet, 1990). Since then interest in thinking skills has increased and many teachers in Scottish schools now have experience of incorporating some elements of these into their teaching practices (Kite, 2000). This paper, based upon a literature review completed recently for the Scottish Executive (Wilson, 2000) focuses on the research which has been published in the intervening years and draws out the implications for learning and teaching in Scotland.

Exactly how to portray the human mind has preoccupied philosophers for centuries and more recently psychologists, educationalists, physiologists and neuroscientists have contributed to the debate. In 1997, world authorities on intelligence including Feuerstein, Gardner and De Bono meeting in Singapore for the Seventh International Conference on Thinking, admitted to 'being only on the edge of understanding the inner magic of the thinking brain'. This, then, is the overarching context for this *Spotlight*:

- a long history of interest in the workings of the mind by members of disparate disciplines
- a dissatisfaction with the concept of intelligence as one stable measurable quality (Gardner, 1993)
- the possibility now of observing the brain 'at work' with the development of magnetic resonance imaging
- renewed interest in the ways in which children think
- a belief that teachers can improve children's thinking with specific interventions.

In this paper, I present the findings from a short review of the literature which was prepared for a Scottish Executive forum on teaching thinking skills in March 2000 (Wilson, 2000). Three databases were searched using *teaching thinking* as key words: ERSDAT, the British Education Index and ERIC yielded 2, 14 and 97 references respectively. The evidence is organised under a series of questions which teachers and others may wish to consider.

THE QUESTION REDEFINED

As Nisbet notes (1990) the concept of teaching thinking is not new. From the ancient Greeks onwards improving the intellect was perceived to be a prime aim of education. Some European countries have traditionally included philosophy in the school curriculum and the subject may now be studied at the Higher Still level in Scotland. Others have argued that the teaching of Greek and Latin provide a training in rational thinking. But the question has become more complicated because the notion of inborn intelligence, which dominated educational practice until the 1960s (Nisbet, 1990), was challenged by Vygotsky (1962) and others who portray learners as active creators of their own knowledge. In addition as Ryle (1962) notes all human beings, except those who have sustained specific injury or suffer from certain disabilities, demonstrate that they can think. It may, therefore, be more helpful if we redefine the question as: 'Can children be taught to think more effectively?'

WHAT DOES SCIENCE TELL US?

Clearly, physiology (the science concerned with the functioning of human organs), psychology (the development of theories of mind) and epistemology (the branch of philosophy which focuses on theories of knowledge), all impact on thinking. From developments in different disciplines we can conclude that:

- despite advances in knowledge, there is still much to learn about the 'working' brain
- most of the growth in the human brain occurs in early childhood: by the age of six, the brain in most children is approximately 90% of its adult size. This implies that intervention, while the brain is still growing, may be more effective than waiting until the brain is fully developed
- although specific areas of the brain are associated with particular functions, large parts of the cerebrum (known as the 'thinking cap') appear to have a more general function
- there appears to be a two-way relationship between the working of the cerebrum and the tasks upon which it is engaged: while the connections within it are necessary for higher level activities to be undertaken, those connections also develop if stimulated.

Psychological theories provide a link between the physiology of the brain and thinking; here too developments have occurred. Constructivists stress the active role of learners in developing their own thinking (Vygotsky, 1962). Continuing this attack on the concept of a fixed general intelligence, Gardner (1983) makes a case for at least seven (perhaps ten)

different intelligences which he described as competencies in logical-mathematical, linguistic, musical, spatial, kinesthetic, interpersonal and intrapersonal domains. All of these developments have implications for teaching thinking skills because:

- brains are portrayed as under-used and, therefore, capable of further development
- learning is seen as requiring active participation by learners in a social environment
- learners must be supported by teachers (Vygotsky's scaffolding) who should gradually extend the learning challenges for their students.

WHAT ARE THINKING SKILLS?

'Thinking skills' is an ambiguous term and some argue that mental processes cannot accurately be described as skills. While recognising these difficulties, McGuinness (1999) points out that many definitions include some of the following:

- collecting information
- sorting and analysing information
- drawing conclusions from the information
- 'brainstorming' new ideas
- problem solving
- determining cause and effect
- evaluating options
- planning and setting goals
- monitoring progress
- decision making
- reflecting on one's own progress.

All are based upon the assumption that thinking (cognition) goes beyond the acquisition of knowledge and includes the process(es) of knowing and reflecting on thinking (metacognition).

WHY ARE THEY IMPORTANT?

Most countries are currently concerned with raising educational standards. But it is suggested that the minimal requirements of schooling, ie mastery of the 'basics' (reading, writing, etc), however excellently taught, are not sufficient to meet the demands of the labour market. A broader range of competencies, redefined as 'higher order' thinking skills, is required because:

- individuals cannot 'store' sufficient knowledge in their memories for future use
- information is expanding at such a rate that individuals require transferable skills
- modern society requires active citizenship.

Collectively, these present, as Resnick (1987) argues, 'a new challenge to develop educational programmes that assume that all individuals, not just an elite, can become competent thinkers' (p.7).

WHAT HAVE TEACHERS TRIED?

There are two main approaches to teaching accelerated cognition: one through specifically designed programmes and the other by embedding the approach in the curriculum. Some specifically designed programmes are discussed below.

Feuerstein's Instrumental Enrichment (IE)

This programme (Feuerstein *et al*, 1980) is probably the best known example of a thinking skills programme. Developed over 40 years ago for use with low-performing Israeli adolescents, it is a context-free programme based upon the concept of 'mediated learning' in which adults show learners specific methods for interpreting information and problem-solving.

Cognitive Research Trust (CoRT)

Edward De Bono's (De Bono, 1991) approach, especially such tools as 'thinking hats' developed through the Cognitive Research Trust, is now accessible to schools. It covers aspects of De Bono's definition of thinking: breadth, organisation, interaction, creativity, information and feeling, and action. The lessons encourage learners to consider the views of other people involved in the situation, ie the 'hats they wear'.

The Somerset Thinking Skills Course

This course (Blagg *et al*, 1988) is a general thinking skills course. Unlike the Instrumental Enrichment Programme, which presents abstract concepts, the Somerset course is pictorial and naturalistic.

Cognitive Acceleration through Science Education (CASE)

Although set within the context of science, CASE is a structured programme based upon inductive reasoning. It encourages children to move from concrete examples to abstract generalisations.

Philosophy for Children

This is a programme developed in the UK by Fisher (1990, 1995) in which teachers model dialogue and structure classroom activities in ways that promote its development. They also use novels which illustrate problem-solving by children.

Embedded in the curriculum

Teaching thinking skills may also be embedded within specific subjects or infused across the curriculum. Examples include:

Mathematics . Modern teaching of mathematics focuses on the skills children require to solve mathematical problems and to encourage 'situated learning', ie the use of maths in a real context.

History . Changes in the teaching of history represent a major shift away from teaching 'historical facts'. Students are introduced to the concepts of historical evidence, sources and interpretation associated with thinking, problem-solving, analysis and interpretation.

Thinking through Geography . This programme designed by David Leat of the University of Newcastle (Leat, 1998) identifies a list of 'big concepts' for an understanding of geography, such as cause and effect, classification, planning and decision-making.

Activating Children's Thinking Skills (ACTS) . This project, developed by McGuinness and a small group of teachers in Northern Ireland, aims to promote the development of thinking skills in ordinary classrooms at Key

Stage 2. Thinking diagrams or 'graphic organisers' for decision-making were produced as an aid to making the steps in thinking explicit to learners.

WHAT DOES RESEARCH TELL US?

Specific programmes

Unfortunately, the evidence is contradictory. For the Instrumental Enrichment programme, statistically significant differences were reported between IE-trained groups and control groups in four different countries (Israel, USA, Canada and Venezuela). Increases in non-verbal reasoning were identified but other effects, such as self-esteem, improved classroom behaviour and attainment tests, were inconsistent.

De Bono (1991) presents evidence from a sample of small-scale experiments which shows that more ideas were generated from discussions in four CoRT-trained primary school classes of children aged 10 to 11 than in four control groups.

McGuinness (1999) reports that no large-scale evaluation of the effects of the Somerset Thinking Skills Course is available (p.11). However, 14 controlled studies of the former Department of Employment funded *Thinking Skills at Work* programme, which was based upon the Somerset Course, were conducted by Blagg *et al* (1993). In 12 of the 14 studies significant benefits in terms of the ability to recognise complex problems, plan and review work and demonstrate greater self-confidence were identified.

Adey and Shyer's (1993) two-year evaluation of *Cognitive Acceleration through Science Education (CASE)* from 12 classes (four of 11-year-olds and eight of 12-year-olds) shows that CASE pupils' subsequent GCSE results in Science were on average one grade above the control groups; smaller gains were recorded for Mathematics and English.

In the UK, Fisher (1990) admits that evaluating the *Philosophy for Children* programme is difficult given its wide-ranging goals and the absence of appropriate evaluative dimensions on standardised tests. He suggests that gains are related to the quality of ideas generated, the skills of discussion and analysis and to self-esteem – all of which are more difficult to measure.

Infusion method

Evaluations of thinking skills embedded into specific subjects or across the curriculum are less well-documented. McGuinness (1999) suggests that small-scale teaching experiments are beginning to find their way into the literature but these are not necessarily accompanied by objective evaluations. An exception is Kirkwood's (1998) study of the effects of an introductory programming course to foster understanding of problem solving, higher order thinking and metacognition on pupils in a Lanarkshire secondary school. Other research by Kite is on-going at Edinburgh University. Schonenfield (quoted in McGuinness, 1999) also reports improvements in college students' problem-solving skills following a programme of teaching mathematics by modelling problem-solving through analysis, exploration and verification.

Teachers using *Activating Children's Thinking Skills* (ACTS) in Northern Ireland report benefits in children's reasoning powers and creativity and in teachers' own ability to review schemes of work and plan effectively. However, as McGuinness points out there are limitations to an evaluation of this type because it relies on teachers' perceptions which were unrelated to learning outcomes in the classrooms.

WHAT ARE THE IMPLICATIONS?

A number of conclusions may be drawn from the evidence of published studies.

The 'mind'

First, there has been a 'rediscovery of the concept of mind', an interest in cognitive psychology linked with attempts to analyse the processes involved in learning, and a dissatisfaction with the concept of one measurable form of intelligence. An 'active' theory of 'learning how' rather than 'learning that' provides the theoretical basis for teaching thinking skills.

A possible framework

Second, there may now be sufficient evidence (McGuinness, 1999) for a general framework for teaching thinking which would include the need to:

- make thinking skills explicit in the curriculum
- adopt a coaching style to teach thinking
- operate within a metacognitive perspective
- develop collaborative learning in both face-to-face and computer-mediated learning
- encourage good thinking habits or general dispositions
- generalise the framework beyond a narrow focus on special skills to encompass the whole curriculum and concepts of 'thinking classrooms' and 'thinking schools'.

Two or three approaches?

Third, researchers are divided on the number of approaches to teaching thinking skills: Nisbet suggests two, while McGuinness proposes three. All, however, distinguish between specific programmes on the one hand, and an approach which is embedded either in subjects or across the curriculum on the other. Transference beyond the specific context remains problematic.

Outcomes

Fourth, evaluation studies are inconclusive. A number purport to link successful outcomes with teaching thinking skills but it is difficult to control for the influence of other variables. McGuinness (1999) points out that the most successful interventions are associated with a 'strong theoretical underpinning, well-designed and contextualised materials, explicit pedagogy and teacher support' (p.1). However, 'scaling-up' and generalising findings from small evaluation studies have still to be overcome. And problems of mediation, transference and bridging also remain.

What is achievable?

Fifth, most research has been conducted under optimal learning conditions. Problems of embedding the approach into everyday classroom practice, based upon what the average

teacher can achieve rather than the expert practitioner working in good conditions with well-motivated pupils, remains to be demonstrated.

Information and communications technology

Sixth, information and communication technologies provide logical frameworks which some argue will enhance children's thinking, either through individual interactions with computers or opportunities for collaborative learning through networks. More evidence on computer/learner interaction and collaborative learning is still required.

Finally, there appears to have been a general shift from discussing 'thinking children', through 'thinking classrooms' to 'thinking schools'. These may be realisable aims for an education system, or alternatively, simply more metaphors for teachers to decode and translate into practice. McGuinness (1999), while accepting the limitations of available evidence, comes down strongly on the side of the value of teaching thinking skills. My own conclusions are more cautious. Given the paucity of evidence, it would, perhaps, be fairer to conclude that 'the jury is still out' on this particular issue. This position may, of course, alter as findings begin to emerge from the ESRC's Teaching and Learning Programme. As Nisbet (1990) pointed out, encouraging metacognition, accelerated learning or thinking is an unfinished story but one which, I think, may prove to be worth both teachers and researchers exploring further.

SELECTED REFERENCES

ADEY, P. and SHYER, M. (1993) An exploration of long-term far-transfer effects following extended intervention program in the high school science curriculum. *Cognition and Instruction*, 11 (1), 1-29.

BLAGG, N. R., LEWIS, R. E. and BALLINGER, M. P. (1993) *Thinking and Learning at Work: A report on the development and evaluation of the thinking skills at work modules*. Sheffield: Department of Employment.

De BONO, E. (1991) *Teaching Thinking*. Penguin Books.

FEUERSTEIN, R., RAND, Y., HOFFMAN, M. B. and MILLER, R. (1980) *Instrumental Enrichment: An intervention for cognitive modifiability*. Baltimore, MD: University Press.

FISHER, R. (1990) *Teaching Children to Think*. Oxford: Blackwell. (Reprinted 1995)

GARDNER, H. (1993) *Multiple Intelligences: The theory in practice*. New York. Basic Books.

KIRKWOOD, M. J. (1998) *A Study of Teaching and Learning in Computer Education: Designing an introductory programming course to foster understanding, problem solving, higher order thinking and metacognition*. (Unpublished PhD) Glasgow: University of Glasgow.

KITE, A. (2000) *A Guide to Better Thinking.* Slough: NFER–Nelson.

LEAT, D. (1998) Rolling the stone uphill: teachers' development and the implementation of thinking skills programmes. *Oxford Review of Education*, 25, 3, 387-403.

MCGUINNESS, C. (1999) *From Thinking Skills to Thinking Classrooms: A review and evaluation of approaches for developing pupils' thinking*. Nottingham: DfEE Publications.

NISBET, J. (1990) *Teaching Thinking: An introduction to the research literature*. (Spotlight 26) Edinburgh: SCRE.

RESNICK, L. B. (1987) *Education and Learning to Think*. Washington, DC: National Academy Press.

RYLE, G. (1962) *The Concept of Mind*. Hutchinson.

VYGOTSKY, L. S. (1962) *Thought and Language*. New York: Wiley.

WILSON, V. (2000) *Educational Forum on Teaching Thinking Skills.* Edinburgh: Scottish Executive Education Department.

NOTES

- ERSDAT is a database of educational research in Scotland maintained by SCRE.
- The British Education Index is the major indexing service of educational journals in the UK.
- ERIC is the major US indexing service of educational research.
- Constructivists believe learners construct meaning from their own experiences.
- Scaffolding is the support which Vygotsky(1962) believed that teachers provide for children to enable them to learn.
- Metacognition is the ability of learners to reflect on their own ways of learning.
- The Economic and Social Research Council (ESRC) is one of the agencies which allocate Government funding for research. A current priority is teaching and learning to which £12.5 million has been allocated.

The full report of the Forum is available from the Scottish Executive Education Department, Victoria Quay, Edinburgh, EH6 6QQ, and the literature review, *Can Thinking Skills by Taught: A paper for discussion* by Valerie Wilson, Scottish Council for Research in Education, is on the SCRE website (at www.scre.ac.uk/scot-research/thinking/).

Printed and published by the Scottish Council for Research in Education, 61 Dublin Street, Edinburgh, EH3 6NL, December 2000