OXFORD BROOKES UNIVERSITY

department for education and skills
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Unit 2, Section 2

The Cognitive Curriculum

Key issues

- Evidence suggests that an understanding of thinking processes on the part both of learners and of teachers aids high achievement.
- Gifted and talented pupils are particularly able to benefit from an understanding of thinking strategies.
- Debates exist as to whether thinking skills should be taught within curricular subjects or as a discrete domain.
- Thinking skills are at their most valuable when the student is able to 'transfer' them from one situation to another.

Introduction

It was once a central belief in education that the study of certain subjects, particularly classics and mathematics, operated as a form of mental discipline which strengthened the 'faculty' of reason. The notion of 'faculties' of the mind has long been discredited, and there has been a great deal of research into cognition and its place in education. Vygotsky, Bruner, and others were particularly influential in encouraging a view of learners as active creators of their own knowledge. Solving problems and arriving at decisions are now a common experience in classrooms throughout the country.

In the cognitive curriculum, the development of thinking skills holds a central place. In this section we shall look at some of the literature about thinking skills, suggest why they are particularly important for gifted and talented pupils, and consider models for teaching them in school.

First, though, it is sensible to look honestly at what we know about their value. Nisbet (1990) points out: 'If people are to be persuaded to take teaching thinking seriously, there must be hard evidence that it can be done, that it achieves what it claims, that children and adults think more effectively as a result of instruction. Inevitably, this is difficult to prove. It is difficult to decide what should be taken as firm evidence of success: improved performance on IQ tests (or in exercises similar to those included in the programme of instruction) are not enough, since these may merely reflect a coaching effect. Nor can we readily distinguish between the merits of a programme and the methods adopted in implementing it, or take account of the quality of teaching. Evaluation studies are inevitably short-term and cannot assess long-term effects. The affective and social elements contaminate objective measurements.' He is not alone in this view. Nickerson (1988) was critical of what he called `unsubstantiated claims... one-sided assessments... excessive promotionalism'.

These caveats are useful, but a very considerable body of research has been devoted to thinking skills, and the teaching of them, and there is a lot to be learned from it. Perhaps an observation by McGuinness (1999) strikes the right note. She points out that several evaluation studies have successfully linked the teaching of thinking with outcomes in terms of pupils' learning, both in the short term and in the longer term, but adds

that not all interventions are equally successful. The more successful approaches tend to have 'a strong theoretical underpinning', materials well designed and contextualised, explicit teaching, and good support from the teacher. To these can be added the value of establishing the right climate in the classroom. Helping pupils acquire thinking skills will work best where there is a general atmosphere of enquiry, and where all pupils are encouraged, in the everyday course of their work, to doubt, question, predict, and contradict.

What is thinking?

There are many different kinds of thinking: daydreaming, reconstructing past events, predicting future ones, and interpreting the actions or utterances of others, to name but a few. Nearly all human activities, and in particular all learning activities, involve thinking. Various writers have categorised different types of thinking; for example, Gilhooey (1996) lists:

1. Solving puzzles (eg Tower of Hanoi type)
2. Adversary problems (eg chess)
3. Non-adversary problems (eg mathematical problems)
4. Deductive reasoning (eg syllogisms)
5. Inductive reasoning (eg testing hypotheses)
6. Decision-making (similar to 1 but involving choice)
7. Daydreaming
8. Creative processes

Fisher (1990) draws a distinction between creative and critical thinking, as follows:

Creative	**Critical**
Exploratory	Analytical
Inductive	Deductive
Informal thinking	Formal thinking
Adventurous thinking	Closed thinking (after Bartlett)
Left-handed thinking	Right handed thinking (after Bruner)
Divergent thinking	Convergent thinking (after Guilford)
Lateral thinking	Vertical thinking (after de Bono)

Fisher emphasises that this is a simplification. 'There is a danger in all our thinking of a "hardening of the categories" in which the labels we attach to clusters of ideas become limiting boundaries. One of the misconceptions that can arise about creativity is that it is something quite unrelated to critical thinking'. As we shall see later, most thinking involves elements of both.

What is meant by critical thinking?

Paul (1990) defined the term 'critical thinking' as thinking about your thinking, so as to make it more precise, accurate, relevant, consistent and fair. Flavell had previously called this process metacognition, and argued that it contributes in a major way to intelligence. In essence, metacognition is being aware of one's own thinking processes and knowing how to control them. Nisbet (1990) describes it as giving pupils practice in monitoring their thinking. 'The teacher makes the strategies explicit and the learners must then internalise them, making them part of their habitual mode of thinking. Thus learning to learn means taking over from the teacher the control and management of your own

learning and thinking.'

Paul's model of critical thinking is

- the art of identifying and reversing bias, prejudice, and one-sidedness of thought
- the art of self-directed, rational thinking
- thinking which rationally certifies what is known, and makes clear where the thinker is ignorant.

Paul argues that the prevailing model of teaching throughout most education systems is didactic. Knowledge is viewed as independent of thinking, students are taught what to think rather than how to think, and an educated person is one who is 'fundamentally a repository of content analogous to an encyclopaedia.' In contrast, where critical thinking is at work a knowledge of content is generated, organised, applied and analysed, synthesised, and assessed. Students are taught how to think, not what to think, and an educated person is 'fundamentally a repository of strategies, principles, concepts and insights.'

Why is critical thinking particularly important for gifted and talented pupils?

Sternberg, in his Triarchic theory of human intelligence (1984), identified the ability to plan, monitor, and evaluate their own thinking and performance as one of three key factors which distinguish the thinking of more able pupils. Span (1995) argued a direct relationship between ability and self-regulation. The more able an individual, the more self-regulation will be needed for high achievement; the less able an individual the more regulation by the teacher is needed. Resnick (1989) found that the knowledge gifted pupils possess is highly interconnected, and new knowledge is immediately linked to prior knowledge. If *all* pupils are given opportunities to employ metacognition, then potentially able pupils may be helped to become able thinkers, but gifted pupils, because of their superior intellect, are particularly well placed to take advantage of the opportunities.

What, then, is the central value of teaching critical thinking?

In the classroom, we expect our pupils to think about the subject content of the lesson, but rarely do we give them opportunities to learn and think about thinking itself. Research by Wang and Lindval (1984) showed that critical thinking activities led not only to a better grasp of subject content but also to improved generalisation and transfer of knowledge and skills. Moreover, the activities gave students a sense of being in control of their own learning.

What is creative thinking?

Various misconceptions exist about creativity: that it is unrelated to critical thinking; that it is found in some subjects but not in others; that it is 'simply doing your own thing'; or that it requires a high IQ (Fisher 1990). Creativity has traditionally been seen as rather mysterious, but only relatively recently has there been any attempt to study it.

Guilford (1956) distinguished between divergent and convergent thinking. Convergent thinking is the kind required for the correct solution to the sort of closed tasks which are a feature of intelligence tests. Divergent thinking is characterised by fluency,

flexibility, originality, and elaboration. The first of these is the ease with which we use stored information when we need it. The second is the ability to overcome mental blocks, and the third is the ability to produce an unusual or rare response.
Getzels and Jackson (1962) looked at the links between high divergent thinking and high IQ. Some children were seen as exhibiting both high IQ and creativity, but some showed high ability only in one. According to Getzels and Jackson, highly creative pupils are also of high intelligence, but need not be outstandingly so.

Jausovec analysed electro-encephelograph (EEG) measures to explore the differences in cognitive processes in respect of creativity and intelligence. The investigation and its findings were complex, and they cannot be fully conveyed in a brief synopsis, but Jausovec himself summed them up as follows: 'In two experiments, gifted, creative intelligent subjects, and individuals of average ability solved closed and open problems while their EEG was recorded……The results of both experiments suggest that creativity and intelligence are different abilities that also differ in the neurological activity displayed by individuals when solving open and closed problems. …..it is likely that highly intelligent individuals have fewer difficulties with closed problems because they use specific brain areas relevant for the solution of such tasks. However, when confronted with open problems they probably activated brain areas that are not relevant for the solution of the tasks at hand, and therefore have less creative answers.'

Torrance (1966) believed creativity could be measured, and devised a series of tests. These were based on Guilford's notion of fluency, flexibility, originality and elaboration. The validity of such tests is still a subject of debate.

Personality factors such as curiosity, risk-taking, and wit have been identified by Rimm, Davis and Bien (1982) as being closely linked to creativity.

Why is creative thinking important for gifted and talented pupils, and why should we teach it?
Treffinger (1982) suggests four reasons why encouraging creativity in schools is important, all of which, of course, apply equally to the most able pupils.

- because it helps pupils to be more effective when we are not around
- because it creates possibilities for solving future problems we can't anticipate
- because it may lead to more powerful consequences in life
- because it can produce great satisfaction and joy.

In 'Schools Count', a study of school effectiveness, Mortimore identified effective schools as those which stimulate and extend creative thinking in children, particularly more able children. An effective school is characterised by intellectually challenging teaching, and the pupil's ability to think creatively is an essential feature of this.

Given that thinking skills should be taught, is there a best way to teach them?

As shown above, most thinking is a combination of the critical and the creative. Gifted and talented pupils should be encouraged to develop both. Creativity is not just a question of creating new solutions but of applying critical judgement to choose which is the best. As Fisher suggests, 'An education which is focused on one type of thinking would be incomplete and unbalanced.' The key question which then arises is how can the teaching of such skills best be put into practice in the school? In de Bono's words (1970) 'Thinking is a skill and, like a skill, it can be developed and improved if one knows how.'

McGuinness (1999), in the work cited earlier, identified three models of delivering thinking skills:

- through structured programmes on general thinking skills, additional to the normal curriculum
- targeted subject-specific or domain-specific thinking skills in such subjects as mathematics and geography
- cross-curricular initiatives which infuse thinking skills into every area of the curriculum.

Each model has its proponents. We shall now discuss examples of the various models and consider the advantages and disadvantages of each.

Models of teaching thinking skills

Thinking skills as an additional curriculum area

Some workers in the field, such as Feuerstein, de Bono, Blagg et al, and Lipman, have argued strongly that thinking should be treated as a subject in its own right, and that it should be placed on the curriculum as a distinct subject area.

Programmes which derive from this view are usually based on an analysis of the component skills involved in the process of thinking. Nisbet and Davies (1990) list 30 of this kind, but Nisbet (1990) has pointed out elsewhere that there are over 100 programmes on the market in the USA alone. They include such titles as Talents Unlimited, HOTS (Higher Order Thinking Skills), and Project Impact. Among the best known programmes are Feuerstein's Instrumental Enrichment and de Bono's CoRT project. The next sub-section gives a brief synopsis of four of the programmes.

Feuerstein's Instrumental Enrichment

Feuerstein is known for a cognitive development programme known as 'Instrumental Enrichment'. The programme was originally developed to help children who had been intellectually and emotionally damaged by war, and central to Feuerstein's theory is a belief that anyone of any age can become an effective learner. The programme is content-free and emphasises the cognitive processes common across all subject areas. There are two main aspects to Feuerstein's model: the idea of a cognitive map, and the essential role of the teacher as mediator. He identifies seven elements which make up the cognitive map. Some are features which the learner brings to the learning situation, and others are provided by the tasks themselves.
They are:

- Content: domain-specific knowledge
- Modality: how the mental act is expressed, i.e. written, numerical, etc

- Complexity
- Abstraction: seen in terms of the distance between the mental act and the concrete object it refers to
- Efficiency: the balance between accuracy and fluency
- Cognitive operations: classifying, predicting, etc
- Learning phase: the sequence of events to perform a mental act. These are identified as input (the process of gathering all relevant information), elaboration (efficiently using the information to find solutions), and output (executing tasks and communicating findings, and solutions both to oneself and to others).

The programme is a graded series of about 400 cognitive tasks, designed to emphasise the organisation of ideas, comparison, and classification. Instructions are given through a variety of modes, leading to high level inductive and deductive reasoning. Feuerstein was heavily influenced by Vygotsky and Bruner, who both emphasised the social nature of learning, so the role of the teacher as mediator in Feuerstein's activities is vital.

De Bono's CoRT programme

De Bono coined the phrase 'lateral thinking'. He argues that 'education' is too inward looking and complacent, that its curriculum is too crowded, and that it does not really understand what is meant by thinking. His answer is the CoRT project, which advocates lateral thinking as an essential complement to vertical thinking. He claims lateral thinking is closely related to insight, creativity, and humour, but that unlike those three it is something that can be taught.

Blagg et al's Somerset Thinking Skills Project

Blagg et al are known for the Somerset Thinking Skills Project, which arose from a research project intended to evaluate Feuerstein's Instrumental Enrichment programme. As Blagg and colleagues developed materials for teachers to use in school, their ideas diverged from Feuerstein's. They eventually produced a cognitive model which identified two broad teachable aspects: cognitive resources and cognitive strategies. They identify resources as:

- Conceptual understanding; e.g. time, colour, analogy.
- Skills and procedures; e.g. scanning, analysing, grouping
- Knowledge and experience; e.g. symbols, conventions
- Verbal tools ; e.g. vocabulary, terminology.

The cognitive strategies combine these resources. In Blagg's words they are 'higher level general control processes concerned with selection and co-ordination of specific cognitive resources for particular purposes'. In this model, as in Feuerstein's, the role of teacher as mediator is paramount. Blagg insists that the teacher should introduce the language of thinking in order to make the process of metacognition useful for both pupil and mediator.

Lipman's Philosophy for Children

In Lipman's work, philosophy is seen as the vehicle for creating a community of enquiry. There are three premises to his approach:

- Logic is implicit in language, i.e. dialogue is inherently related to thinking
- Discussion forms the basis of thinking skills. Lipman proposes the use of questions which have no right answers

(contestable concepts) to give practice in thinking

- Dialogue is the essence of enquiry; children acquire meanings through thinking and testing their ideas against those of others.

His programme often uses fiction or artistic content as a stimulus. The aim of any session is to set in motion what Lipman calls a 'continuous flow of self-modifying debate'. There are basic rules which all those taking part must adhere to, and the teacher is a facilitator not a participant. Fisher has written extensively on using these and other techniques, especially with primary children.

Subject-specific thinking skills programmes

Programmes such as the Somerset Thinking Skills Course have been influential as a starting point for producing subject-specific programmes. Examples of these are:

- Shayer and Adey's CASE (Cognitive acceleration through Science)
- Halpern's CAME (Cognitive acceleration through Mathematics)
- Leat's 'Thinking through Geography'.

They set out, through introducing cognitive conflict, to help pupils make a 'conceptual leap in all attainment targets, from the concrete to the abstract'. The CASE project, for example, aimed to promote higher level thinking in Year 7 and Year 8 pupils. In 1991 it reported that pupils who used the activities showed greater gains in cognitive development than were achieved by matched control groups. 'More importantly, when they were followed through to their GCSE two or three years later, those who had used the CASE activities performed significantly better than controls in science, and also in mathematics and English.' None of these programmes was designed specifically with the most able in mind, but all concentrate on pupils' thinking, and their aim is to promote higher level thinking for all pupils.

A case for the importance of English in this regard is made in the National Literacy Strategy. Appendix 4 of the document is headed 'Thinking Skills', and it expressly states: 'English teachers have a significant role to play in developing thinking skills because it is a subject rich in opportunities to reflect explicitly on learning processes, for example in reflecting on the experience of group work, considering explicitly how to marshal diverse ideas into an essay, or in evaluating a piece of work.' The Appendix then presents in the form of a grid a number of thinking skills, such as reasoning, creative thinking, and evaluation, which various activities in English can be made to call upon. In their writing, for example, Year 9 pupils can 'develop and signpost arguments in ways that make the logic clear to the reader and anticipate responses and objections'. In activities that involve speaking and listening they can 'develop critical thinking and problem solving through questioning, hypothesising, speculating and analysing.' Year 7 pupils, in their reading, can 'adopt an active reading approach: visualising, predicting, empathising, bringing one's own experience to bear, questioning the text and searching for sense and meaning.'

There has not been a great deal of evaluation of any of the four models described in the sub-section headed 'Thinking skills as an additional curriculum area'. Lipman's model, for example, has not been the subject of any rigorous research. The courses subjected to the closest analysis have been Feuerstein's and Blagg's. The general belief was that able pupils did not benefit greatly from the thinking skills sessions, although the researchers acknowledged there were many contributing factors which made it difficult to draw conclusions.

The infusion model

The main alternative to the two models above is the 'infusion' model, upon which the Harvard Connections Program is based. The infusion model involves a deliberate attempt to reconstruct the content and approach of traditional curriculum subjects in such a way as to make thinking a primary aim. It is founded in the belief that thinking cannot and should not be separated from its context, and that transfer is more likely to take place if thinking is integral to all the teaching and learning the pupils experience. It has the added advantage that it can be incorporated quite naturally into current practice without the need to restructure the curriculum. As Nisbet (1990) points out, 'content and process are both important: thinking is always thinking about something'. This kind of approach clearly gives teachers the opportunity to be creative and to act autonomously.

'Curriculum 2000', produced by the Curriculum and Qualifications Authority (QCA), makes the point that a number of thinking skills 'are embedded in the National Curriculum'. It lists them as information processing, reasoning, enquiry, creative and evaluation skills. Across all subjects, pupils can use these thinking skills to 'focus on "knowing how" as well as "knowing what" – learning how to learn.'

In her book *Educating the Able*, Montgomery (1996) describes a 15-year project to develop her programme, in which the learning of subject content and skills is subordinate to the two central objectives:

- to enable students to think efficiently
- to enable them to communicate those thoughts succinctly through a variety of modes and media.

She then identifies six 'cognitive process pedagogies' which can be used in every curriculum area. They are:

- 'Investigative and problem solving and resolving strategies,
- particularly in real problem solving situations
- Cognitive study skills requiring higher-order reading and study skills
- Games and simulations
- Experiential learning; experience-based action learning
- Collaborative learning in which pair and small group discussion is part of the students' learning activity
- Language experience method in which students' own experience is used as a major part of the study and resource material for learning.'

Her other central tenet is that the cognitive process approach should be integral to the curriculum for all learners and should

- match the intellectual level of the student
- be cross-curricular

- be used in mixed ability teaching.

Montgomery suggests that by using a mixture of these the teacher will help pupils to develop higher order cognitive and metacognitive skills, and offer challenge in all content areas. But as in the case of the previous models, the success of such methods depends hugely on the teacher.

The notion of transfer

When all is said and done, the real test of the teaching of thinking skills is whether it enables the pupil to transfer the ability he or she has developed in one context to a wholly different one. There is a strong case for teaching in such a way that transfer is assured. Perkins and Salomon (1989) distinguish between what they call 'low road' and 'high road' transfer. They define low road transfer as `the automatic triggering of well rehearsed schemata', which is what happens when the skill of driving a car is adapted to driving a van or lorry, for example. Teaching aimed at this kind of transfer involves the pupils in practising the skills until they can apply them virtually without thinking. High road transfer, on the other hand, involves `active decontextualisation... the deliberate mindful abstraction of a principle and its application to a different context'.

There is a place for both forms of transfer, and the teacher has to know when it is appropriate to use one or the other. At the early stages of education, when children are learning to read and to handle number, much of the learning takes the form of low road transfer. At the advanced stages of education, where knowledge and skills are 'domain-specific', high road transfer operates. Perkins and Salomon recommend what they call 'hugging' and 'bridging'. Hugging involves the teacher in demonstrating linkages, applications, and examples. Bridging requires that the teacher 'mediate' the processes of abstraction and the making of connections, by pointing out principles and encouraging generalisations.

Activity 2.2

Activity

- Consider the three different models set out in the section headed Models of teaching thinking skills, namely: thinking skills as an additional curriculum area; subject-specific programmes; and the infusion model.
- To what extent, and how, are thinking skills already a part of the provision for the gifted and talented in your school?
- In the sub-section headed 'Thinking skills as an additional curriculum area', we described four cognitive strategies, namely those proposed by Blagg, Feuerstein, de Bono and Lipman. You may wish to compare and contrast these with the ones in Bloom's Taxonomy.

Learning outcomes

- To recognise the importance of thinking skills in the education of gifted and talented pupils
- To understand the different models that have been proposed for the teaching of thinking skills, and the advantages and disadvantages of each.
- To consider the learning of thinking skills in your own school.

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Additional reading

You may wish to read McGuiness' research in **McGuiness, C. (1999)** *From Thinking Skills to Thinking Classroom* London: DfEE Publications