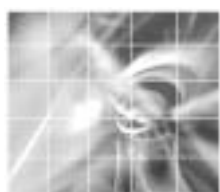


A Staff Development Handbook



Learning, Thinking and Creativity

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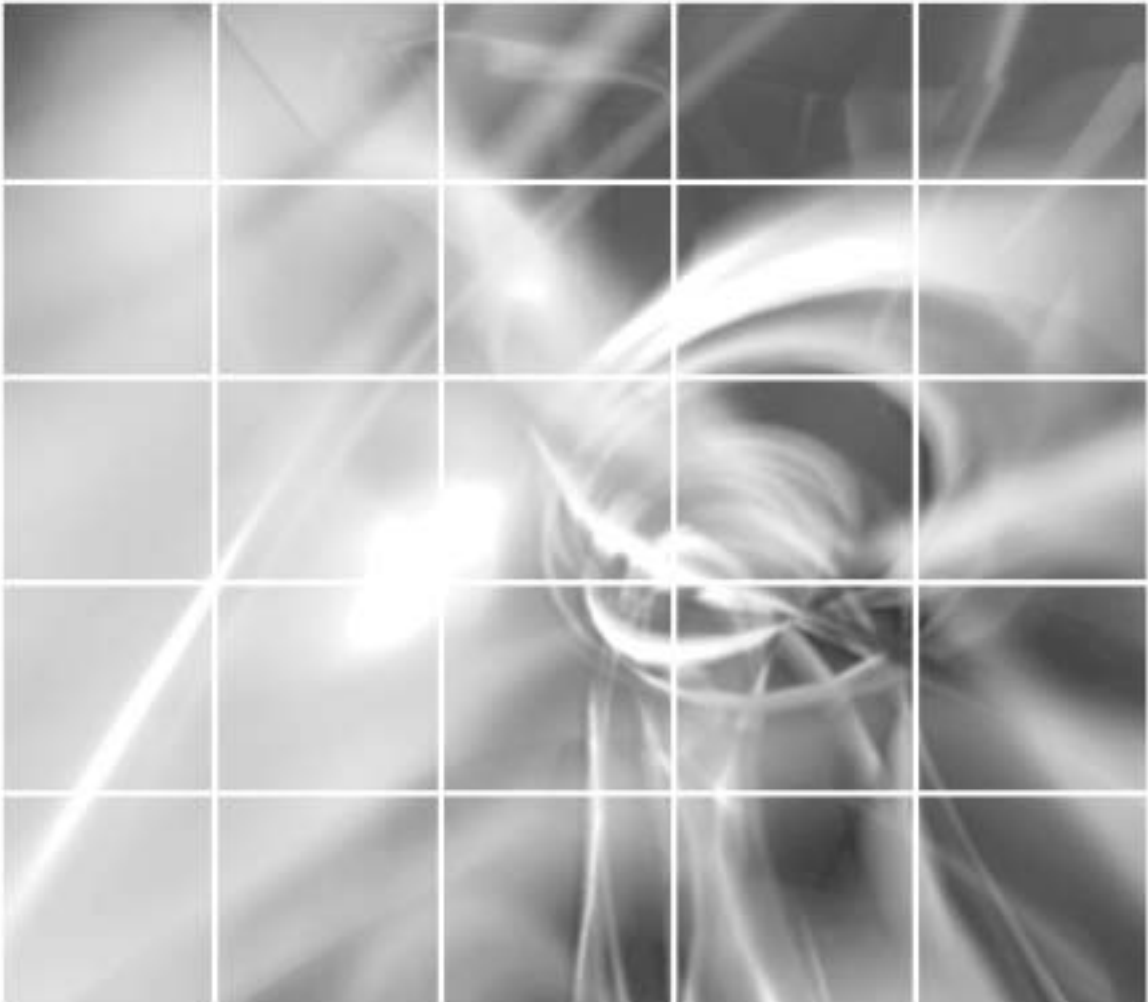
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Introduction



Introduction

... good thinking is essential in meeting the challenge of living in a technologically oriented, multicultural world ... knowledgeable thinkers have a better chance of taking charge of their lives and achieving personal advancement and fulfilment. Our students must be prepared to exercise critical judgement and creative thinking to gather, evaluate and use information for effective problem solving and decision-making in their jobs, in their professions and their lives.

Swartz, R and Parks, S, *Infusing the Teaching of Critical and Creative Thinking into Content Instruction*, Pacific Grove, CA, 1994

Who is the handbook for?

This book is for teachers and groups of teachers. It will be of particular interest to staff development coordinators, headteachers or depute heads with responsibility for development work within the school. It will be helpful to faculty heads and subject leaders who want to introduce or extend the role of thinking skills within their own curricular areas. It will also be useful to individual teachers who simply want to improve their own teaching.

What are the aims of the handbook?

The aims of the handbook are to provide opportunities for teachers to discuss various aspects of thinking and thinking skills and to offer practical strategies for taking these forward. Its intended outcome is to assist teachers to improve the quality of teaching and learning in the classroom.

What are its guiding principles?

The handbook is underpinned by two guiding principles.

1. Learning is a consequence of thinking – and good thinking can be developed by all pupils.
2. Learning should include developing deep understanding through active engagement with different kinds of thinking, for example creative thinking, critical thinking and problem solving.

Where do the ideas come from?

The book is based on an overview of thinking and thinking skills produced for the Scottish Executive Education Department by education consultant, Mike Kincaid. The paper is called 'Learning to Think, Thinking to Learn', and is available online at www.LTScotland.org.uk/creativity. A summary of the paper is included as Appendix 10.

How should the book be used?

The book should be used as a guide and introduction to the variety of approaches that can be taken to the development of thinking skills. It consists of 10 topics together with related activities. There are also appendices that elaborate on and provide further examples of the ideas within the topics. Although the topics are not arranged in any particular order, the first two 'Learning, Thinking and Creativity' and 'What are thinking skills?' should be considered as important starting points. Topic 3 'Planning for development' provides a framework that could form the basis of a departmental, faculty or whole school approach.

Learning, thinking and creativity

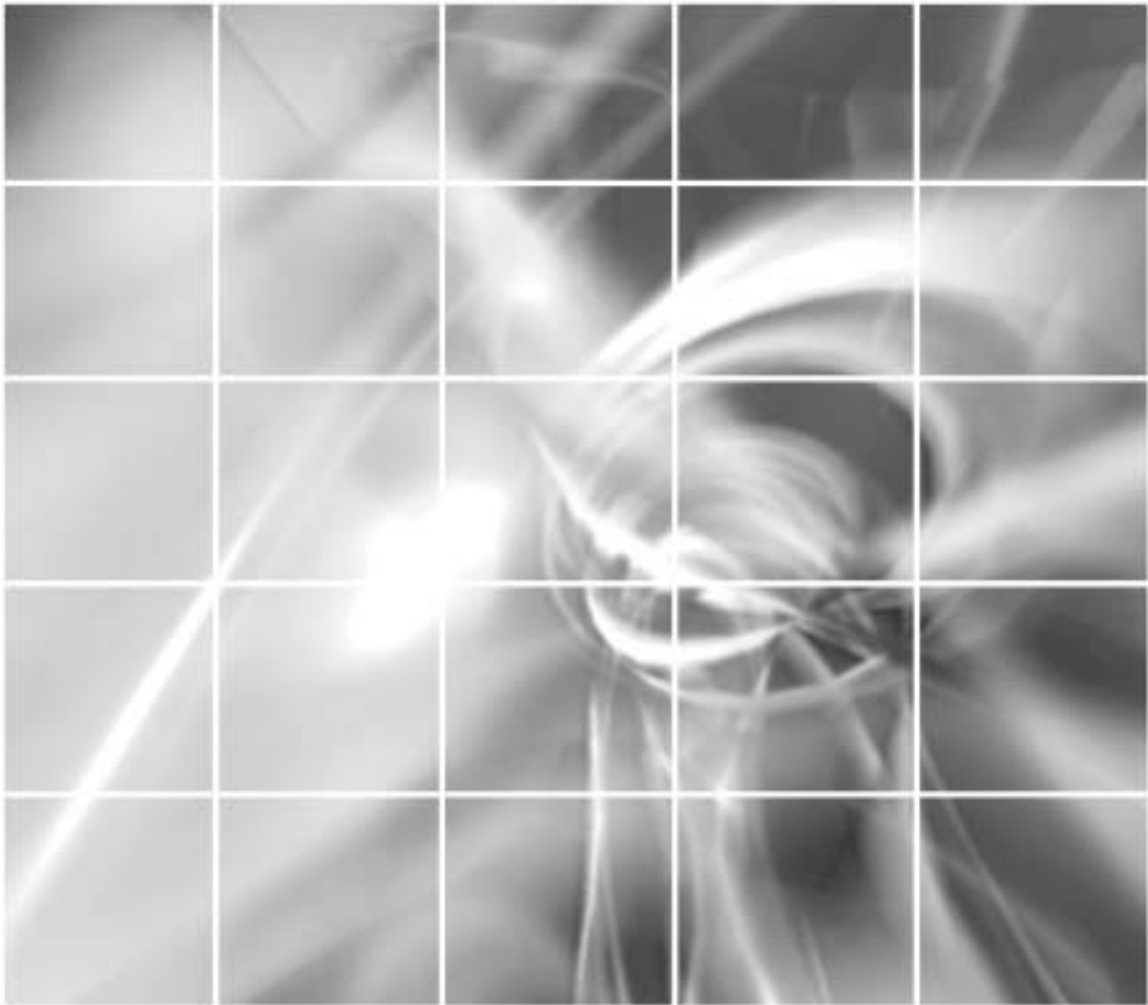
There is a great deal of interest and enthusiasm among teachers with regard to thinking skills and creativity. Many teachers and schools are developing innovative approaches and introducing programmes to help pupils improve their abilities to think, reason and solve problems.

In *The Structure and Balance of the Curriculum: 5–14 National Guidelines*¹ and *Curriculum Design for the Secondary Stages, Guidelines for Schools*² 'learning and thinking skills' is included in the lists of important skills. *Creativity in Education*³ drew attention to the fact that all individuals are endowed with creative potential and that this can be fostered and expressed across a range of different curricular and subject areas.

Our ideas about thinking and about different kinds of thinking come largely from two fields of enquiry, philosophy and psychology. Part of the activity of philosophy is learning how to support and justify the claims that we make. It is associated with giving reasons, weighing up pros and cons, constructing arguments, solving problems and making decisions. It relies on reasoning and logic and is deliberate and purposeful. The process is often referred to as 'critical thinking'. Part of the activity of psychology is to investigate the ways in which we generate and develop ideas and to consider the factors that might influence this process, such as the depth of our knowledge and the impact of emotions and stress. It reflects a process that involves forming or making something new and can include just mulling things over rather than deliberately trying to solve a problem. It relies on imagination, intuition and divergent thinking. It is often referred to as 'creative thinking' or 'creativity'.

Creative thinking almost always involves critical thinking in selecting from alternatives and evaluating outcomes and solutions. Similarly, creative thinking makes an important contribution to critical thinking, for example, in generating reasons and in the imaginative exploration of points of view other than one's own. Problem solving and decision-making will usually involve elements of both creative and critical thinking. For example, problem solving and decision-making involve generating ideas and alternatives, and making judgements about what are the most promising or best of these to pursue and test out.

Other aspects of thinking are directed at more general goals, for example as we try to relate new information to what we already know, deepen our understanding and find ways of retaining and recalling what is important. The opportunity to think about and evaluate the processes of learning – how we arrived at a particular answer or conclusion or whether it might have been better to approach the task differently – is also an important aspect of thinking.



Topics



Topics

Topic 1: Learning, thinking and creativity

Creativity can be exercised in relation to any form of human activity and is an aspect of all kinds of human intelligence.

Critical thinking and creative thinking are not at odds. Although distinguishable, they are interconnected and rely on each other.

Creativity in Education, Learning and Teaching Scotland, 2001

- *Educating for Excellence:* Pupils should leave school 'creative and skilled at solving problems'.
- *Education for Citizenship:* Involves developing 'creative skills, including the ability to apply knowledge and skills gained in one context to another, in order to take advantage of an opportunity, solve a problem or resolve an issue'.
- *Mathematics:* 'Mathematics should be viewed in the widest sense as a problem-solving activity. Where pupils are involved in problem solving and enquiry, they will be challenged to think about what they are doing, to question and to explain.'
- *Language:* Involves 'thinking: for example, speculating; hypothesising, discovering; reflecting; generalising; synthesising; classifying; evaluating'.
- *Environmental Studies 5–14:* Part of the rationale and purpose is to develop in pupils 'a range of skills that will enhance their capacity for critical thinking and problem solving within social, scientific and technological contexts'.
- *Expressive Arts 5–14:* One of the aims is 'to promote pupils' cognitive development by including questioning, reasoning, problem solving and decision-making; creative, imaginative, divergent thinking ...'.
- *Religious and Moral Education 5–14:* One of the aims is to help pupils 'develop their own beliefs and values through a process of personal search, discovery and critical evaluation'.

Topic 2: What are thinking skills?

Making the thinking skills explicit gives us the opportunity to focus directly; to teach thinking. Thus the learners in our schools and classrooms are empowered to see the connections in learning, to understand how thinking and learning works and to apply the skills across and beyond the curriculum.

Mike Jeffries and Trevor Hancock, *Thinking Skills, A Teacher's Guide*,
Hopscotch Educational Publishing Ltd, 2002

*The Structure and Balance of the Curriculum: 5–14 National Guidelines*¹ and *Curriculum Design for the Secondary Stages, Guidelines for Schools*² both include 'learning and thinking skills' in their lists of important skills. A survey of curricular guidelines reveals a wide range of cross-cutting skills that fall into this category for example:

- identify and select relevant information
- plan how to carry out tasks and investigations
- sort, order and classify information
- clarify and reflect on ideas, experiences and opinions
- generate ideas, questions and hypotheses
- give reasons for opinions, actions and decisions
- draw conclusions informed by reasons or evidence
- identify problems and discuss possible ways of solving them
- judge the value of ideas, outcomes and solutions and discuss possible improvements
- make evaluations of own and other's work.

The term 'thinking skills' can also be thought of as a broad term to describe a wide range of different capabilities and activities. It can include:

- specific skills relating to creative and critical thinking
- strategies for improving memory, understanding, and problem solving
- processes such as 'think-pair-share' and the community of enquiry approach to discussion and debate
- the use of open questions to extend and improve pupils' thinking
- procedures for helping pupils to reflect on their own thinking.

Topic 3: Planning for development

... we need to sharpen our awareness of how we can systematically teach all children the skills of problem-solving and efficient thinking.

Belle Wallace, *Teaching Thinking Skills Across the Curriculum*,

David Fulton, 2001

There are currently many different approaches to the development of thinking skills in Scottish schools. Some of these involve:

- teaching creative and critical skills, for example school-based courses as well as commercial programmes such as 'A Guide to Better Thinking' and 'The Learning File'
- encouraging particular strategies to enhance learning and problem solving, for example 'Thinking with English', 'Edward De Bono's Thinking Tools', 'Somerset Thinking Skills', study skills programmes and mind mapping
- developing thinking by extending the kind of questions and forms of dialogue being used in the classroom, for example through 'Philosophy for Children', 'Thinking Together' programme, 'Improving Thinking Skills' programme
- promoting deeper thinking within subject content and concepts, for example Cognitive Acceleration in Science and Mathematics Education (CASE and CAME), Thinking Through Geography, Thinking Through History, Thinking Through Religious Education, Activating Children's Thinking Skills (ACTS).

Teachers and schools seem to have one or more of the following aims in mind when developing pupils' thinking. These involve introducing skills, strategies, activities and programmes that will help pupils to:

- put forward their own ideas, views and arguments
- think more deeply about content and concepts
- develop skills and strategies
- reflect on their own thinking and learning.

The four purposes are not mutually exclusive. The ability to express ideas, views and arguments will be aided by acquiring certain skills and strategies. Part of what is meant by thinking more deeply will be putting forward ideas, views and arguments. Strategies that pupils learn for improving memory, understanding and creativity will help to achieve deeper thinking. All of these may involve opportunities for reflection.

Topic 4: Creating the right climate

What was so striking about her pupils was that they were manifestly thinking as they framed their answers. They were encouraged so to do by her refraining from saying that an answer was wrong; instead, if she thought it was not altogether right, she would respond non-committally in a tone that suggested to the pupil that he should go on thinking about what he had just said. In this way pupils were led to find faults in their own responses and amend them. Thus, for children in her class, knowledge and ideas were open-ended, originality was something to be valued, and their own views and interests counted.

Powell, J, *Ways of Teaching*, SCRE, 1985

- Accept that all pupils have the ability to improve and learn and convey that attitude to pupils
Acquire some familiarity with research on the nature of intelligence and the impact of pupils' views about their own intelligence on their learning.
- Influence positively pupils' beliefs about themselves and their learning
Acknowledge pupils' successes whether in the academic or non-academic fields and encourage their effort and good work.
- Encourage pupils to take risks
Respect their opinions and give opportunities for them to express their views.
- Reduce stress for pupils
Set up clear expectations with regard to classroom behaviour; establish a start of class 'transition' time to help draw a line between learning time and what went on before.
- Provide plenty of positive feedback
Indicate what did not go well and help pupils to learn from their mistakes and extend their thinking.

Topic 5: Creative thinking

The traditional way in which creative thinking is fostered in many schools is through project work, investigations or problem-solving activities.

Creativity in Education, LT Scotland, 2001

Most commercial programmes designed to increase individual creativity ... try to enhance three dimensions of divergent thinking that are generally held to be important to creativity: fluency, or the knack for coming up with a great number of responses; flexibility, or the tendency to produce ideas that are different from each other; and originality, which refers to the relative rarity of the ideas produced.

Csikszentmihalyi, M, Creativity, HarperCollins, 1996

Some of the key skills of creative thinking are:

- generating ideas
- making connections
- altering perspectives
- applying imagination
- fashioning outcomes.

The techniques and strategies for developing creative thinking include:

- organising brainstorming sessions so that pupils can generate and develop ideas, and make connections
- engaging pupils in activities that encourage them to see things from different points of view, for example imagining themselves in another person's shoes, adopting various roles, collaborative group work
- providing opportunities for pupils to develop their abilities for imagination and visualisation, for example predicting outcomes, anticipating consequences, visualising goals, situations and problems
- providing opportunities for pupils to be involved in activities of creating and designing, especially in the expressive and visual arts and in technology
- introducing pupils to strategies that develop the three dimensions of divergent thinking – fluency, flexibility and originality.

Topic 6: Critical thinking

... A mechanic working out why an engine will not fire, a family arguing over the brochures about where to go for next summer's holiday, a scientist trying to interpret an intriguing experimental result, a student wrestling with an examination question: all are employing a way of knowing that relies on reason and logic, on deliberate conscious thinking.

Claxton, G, *Hare Brain, Tortoise Mind*, Fourth Estate, 1998

The word 'reason' is derived from the word 'ratio' which means balance. A child can only think critically or reasonably to the extent that he is able carefully to examine experience, assess knowledge and ideas, and to weigh arguments before reaching a balanced judgement.

Fisher, R, *Teaching Children to Think*, Blackwell, 1990

Among the skills important in the development of critical thinking are:

- interpreting information
- assessing evidence
- identifying assumptions and errors in reasoning
- presenting arguments
- drawing conclusions.

Critical thinking skills can be developed by:

- asking questions that encourage pupils to express their views and develop their ideas
- providing opportunities for pupils to discuss open-ended issues and prepare arguments
- providing opportunities for pupils to take part in collaborative talk to figure things out, solve problems and make decisions
- directing teaching at specific skills, for example classifying, analysing, evaluating, drawing conclusions
- teaching some of the principles of logical thinking and giving practice at identifying the flaws in logical arguments.

Topic 7: Thinking strategies for deepening understanding

Memory is not like a box into which we put things; it is a process. What we can learn or remember depends on what we understand, and on how we structure or make sense of information.

Thornton, S, *Growing Minds*, Palgrave Macmillan, 2002

In the many different types of learning there remains a great measure of agreement that underlying all of them is the distinction between 'deep' and 'surface' learning.

Cullingford, C, *The Nature of Learning*, Cassell, 1990

- **Organising information**
Organising information under key words, ideas and concepts will help pupils to understand and remember more.
- **Drawing maps**
Topic webs and memory maps help to provide an overview of a topic or area and develop thinking by bringing out the connections between ideas.
- **Using templates**
Templates, writing frames and visual organisers help learners to think about and reflect upon their responses to tasks.
- **Taking notes**
Encouraging pupils to underline, highlight and take notes will help them to 'think' as they read.
- **Tests and homework exercises**
Regular testing helps to inform both teacher and pupils about how well new learning is being understood.
- **Sharing and explaining**
Exchanging information from notes or a memory map and identifying points of agreement and disagreement as well as shared uncertainties can help to deepen understanding of a topic.
- **Dialogue**
Dialogue with pupils provides the opportunity for the teacher to extend and re-orientate pupils' thinking.

Topic 8: Thinking through questions

There was evidence that the more time teachers spent asking questions the greater the positive effect upon progress. Furthermore the more teachers were able to make use of higher-order questions and statements (those designed to elicit problem solving, reasoning or imaginative responses) the better the progress made.

Mortimore, P, *School Matters*, P Chapman, 1995

Increasing waiting time after asking questions proved difficult to start with – due to my habitual desire to ‘add’ something almost immediately after asking the original question. The pause after asking the question was sometimes ‘painful’... Given more thinking time students seemed to realise that a more thoughtful answer was required. Now, after many months of changing my style of questioning I have noticed that most students will give an answer and an explanation (where necessary) without additional prompting.

Black, P and Wiliam, D, *Working Inside the Black Box*, King's College London, 2002

Among the questioning strategies to help pupils think are:

- Give pupils time
Everyone should be expected have an answer and to contribute to discussions, even if it is ‘I don't know’.
- Accept wrong answers as well as right ones
Let pupils know that wrong answers are also useful. In this way all answers, right and wrong can be used to develop thinking and understanding.
- Frame key questions
For each lesson or block of lessons frame a series of key questions that you want to ask, questions that explore issues important for the development of pupils thinking and understanding.
- Use questions to provide feedback
Use open-ended questions such as, ‘What makes you think that?’ or ‘What reasons do you have?’ in order to give pupils immediate feedback in discussions or on their written work.
- Provide cues
If necessary, help pupils to answer by providing cues and assistance rather than just moving on to another question.
- Avoid making judgements
Instead show that you appreciate their contribution and encourage them to go on thinking.

Topic 9: Metacognition – thinking about thinking

The best way to encourage pupils to think about thinking is to model the process yourself – show pupils that you are thinking about your own thinking and learning and that you are also interested in their thinking.

Rocket, M, *Thinking for Learning*, Network Educational Press, 2002

Students should select and monitor options when they analyse a learning task, when they plan their work, when they work their plan, and when they reflect on the final product. What strategies and skills did I employ? How well did they work? What might I keep or change for next time.

Foster, G, *I Think, Therefore I Learn*, Pembroke Publishing, 2002

Among the questions that can help pupils to reflect on their own thinking and learning are:

What am I being asked to do?	Why can't I do this?
Have I met this before?	Am I doing this correctly?
What information do I have?	Is there another way to do this?
How much do I understand?	Would I do it differently next time?
What do I need to think about?	Did I work as well as I could?
How can I find this out?	How did I learn what I learned?
Do I need a plan?	Could I use what I learned in another situation?
How can I check my progress?	Can I think of one?

There are a number of strategies for encouraging pupils to reflect on their thinking, for example:

- use modelling to discuss with pupils how a particular task might be approached and to show the kinds of questions that they need to ask themselves
- get pupils to explain tasks in their own words
- introduce a language for learning and thinking, for example using words such as skills, strategies, check, review, evaluate, analyse, criticise and paraphrase
- take time to analyse processes and evaluate outcomes after activities
- make pupils aware of different thinking styles, for example convergent and divergent.

Topic 10: Thinking through dialogue

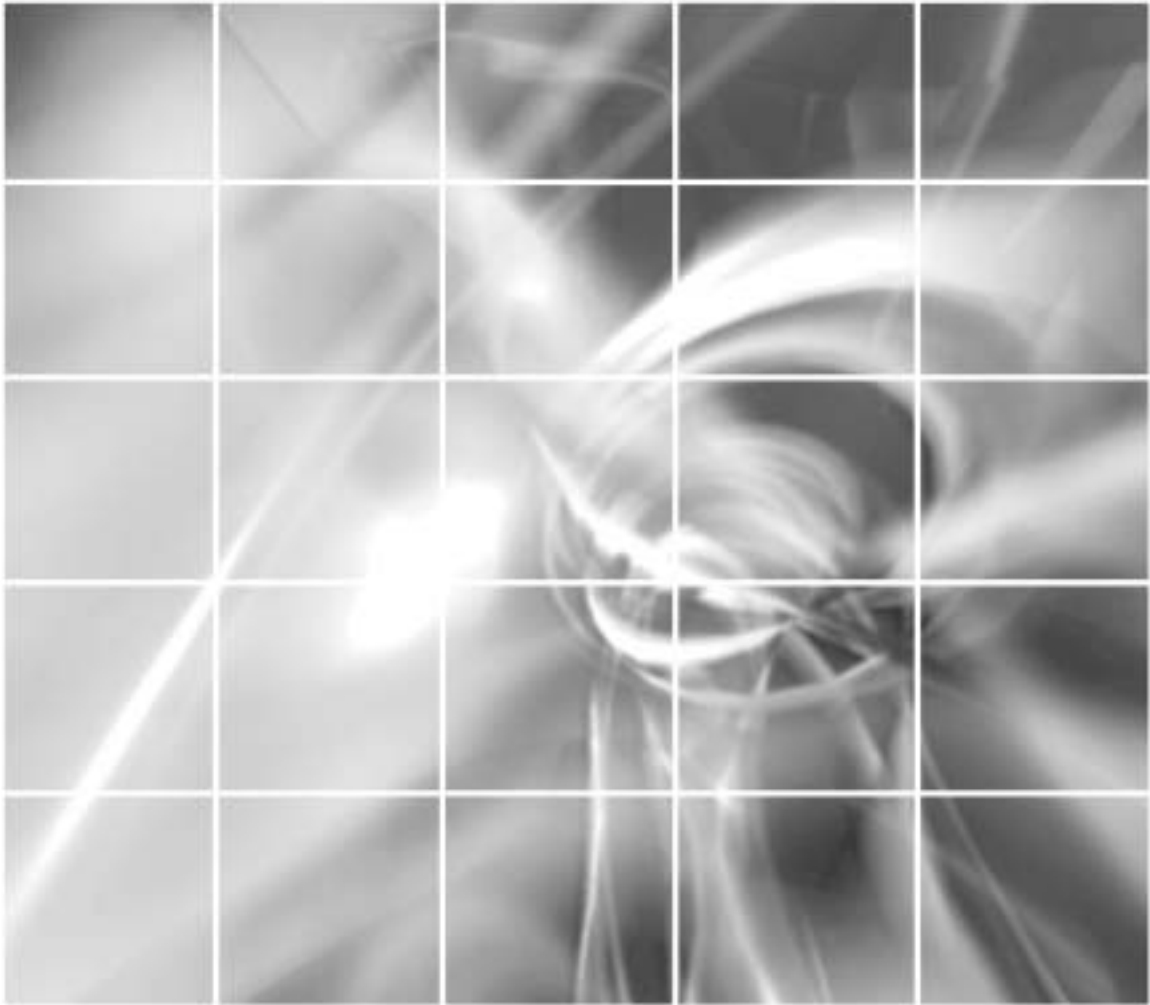
The idea that schools would engage in the systematic teaching of thinking skills is a relatively new one in British education. Whether this enterprise will be successful will depend, in part, on the importance which teachers and others accord to classroom discussion.

Costello, P, *Thinking Skills and Early Childhood Education*, David Fulton, 2000

The research provided clear evidence of a link between the development of children's communication skills and the improvement of their critical thinking.

Dawes, L, Mercer, N, Wegerif, R, *Thinking Together*, Questions Publishing, 2001

- **Buzz groups**
These provide an opportunity for pupils to say what they think and ask questions about what they have been studying. It allows individual difficulties and points for clarification to surface within a small group context.
- **Think–pair–share**
Initially individual pupils spend time considering a problem or issue on their own before pairing up with a neighbour to compare notes. The results of their deliberations are then shared with the rest of the class.
- **Rainbow groups**
Each pupil in a group is given a number or a colour. When the group has worked together, all the pupils with the same number or colour form new groups to compare what they have done. In this way pupils' initial thoughts and suggestions can be challenged and extended by others.
- **Twos to fours**
Here pupils work initially in pairs before joining with another pair to compare notes. Again this provides a valuable opportunity to explain their own points of view and respond to the views of the others.
- **Listening triads**
Pupils take on the roles of talker, questioner or recorder. The talker explains his or her own point of view on an issue or problem. The questioner then seeks clarification and asks questions. The recorder takes notes and at the end of the time gives a report of the conversation. Next time the roles are changed.
- **Critique session**
In groups, pupils offer constructive suggestions and comments about ways to improve each other's work.
- **Community of enquiry**
Where pupils are engaged in exploring ideas through discussion. Rules for productive discussion are set out and agreed. Ideally pupils should be sitting in such a way that all can see each other, for example in a circle if the group or class is small enough.



Activities



Activities

Topic 1: Learning, thinking and creativity

Distribute the topic sheet 'Learning, thinking and creativity' and the curriculum evaluation pro-forma.

Introduction

Introduce the topic by explaining that this is one of 10 topics on the subject of thinking and creativity, and their importance for learning. It is taken from *Learning Thinking and Creativity: A Staff Development Handbook*, published jointly by LT Scotland and the IDES Network.

The topic sheet begins by quoting from the publication *Creativity in Education*.³ The first quotation makes the point that creativity applies within all forms of human activity. The second emphasises the relationship between creative thinking and other forms of thinking, particularly critical thinking. Both creative and critical thinking are the subject of later topics. (At this point staff might be given an overview of the topics contained in the handbook – see contents page.)

Also included are brief quotations from recent education documents and the 5–14 subject guidelines. These reveal a widespread concern with thinking and thinking skills.

Activities

- (a) Individual: In relation to one of the documents or curricular guidelines mentioned in the topic sheet complete the curriculum evaluation pro-forma.
- (b) Pairs or small groups: Discuss what you have written with a colleague or colleagues.

Secondary staff should discuss with colleagues in their own department/faculty or subject area. Primary schools might want to focus on one or two areas only.

Plenary

Invite groups to describe any points of interest that emerged from their discussions.

Taking it forward

In relation to one of the curricular areas or subjects, carry out research into recent developments in thinking skills, and identify resources. Prepare a brief report.

Topic 1: Learning, Thinking and Creativity – curriculum evaluation
pro-forma

Curricular area/subject: _____

What opportunities do you provide for pupils to develop the skills mentioned in the topic sheet?

What particular difficulties are there, if any, in teaching these skills?

Are you satisfied that your pupils are progressing well with regard to the development of thinking skills?

What resources are available to support the development of appropriate aspects of thinking and creativity?

In your view what is required to further develop thinking and creativity in this subject/curricular area?

Topic 2: What are thinking skills?

Distribute the topic sheet 'What are thinking skills?'

Introduction

Introduce the topic by pointing out that *The Structure and Balance of the Curriculum: 5–14 National Guidelines*¹ and *Curriculum Design for the Secondary Stages, Guidelines for Schools*² both include 'learning and thinking skills' in their lists of important skills. The skills set out here are derived from a survey of current 5–14 guidelines and represent some of the skills that appear across a number of curricular areas and subjects.

Other lists of skills are included in Appendix 1.

In addition to a list of skills the term 'thinking skills' can be usefully thought of as also including a wide range of different capabilities and activities. These are set out in the topic sheet.

Activities

Secondary staff should discuss with colleagues in their own department/faculty or subject area. Primary schools might want to focus on one or two areas only.

- (a) Individual: Think of a lesson or topic you have recently taught that involved an aspect of thinking or creativity. Describe the activities in which pupils engaged and explain what your main intention was in introducing them.
- (b) Pairs or small groups: Discuss how the aspect of thinking or creativity linked with the national guidelines, how pupils responded and what improvements you might introduce.

Plenary

Invite responses from several subjects/curricular areas.

Taking it forward

In the context of a topic you are about to teach devise activities that will develop in your pupils one of the following: their skills of creative thinking, critical thinking, problem solving or decision-making.

Topic 3: Planning for development

Introduction

Distribute the topic sheet, 'Planning for development' and Appendix 2.

The topic sheet shows some of the different approaches, together with examples of programmes, currently being used in schools around Scotland. They reflect different views about what it means to develop thinking skills and different interests and experiences on the part of individual teachers and headteachers.

There seem to be at least four aims that teachers and schools might have in mind when developing pupils' thinking. These aims, together with the suggestions in Appendix 2 provide a possible framework for developing a departmental, faculty or whole-school strategy on thinking and thinking skills. The four aims are to help pupils to:

- put forward their own ideas, views and arguments
- think more deeply about content and concepts
- develop specific skills and strategies
- reflect on their own thinking and learning.

Appendix 2 shows possible ways forward in relation to each of the aims. While some of the suggestions can easily be introduced by individual teachers, others have wider curricular and resource implications.

Activities

Teachers should work initially in pairs before joining with another pair to compare notes. The activity could be discussed within the context of a department/faculty or whole school.

Pairs/groups: Within your particular context, which of the four aims (or combination of aims) would it be most appropriate to take forward initially? Why? Plan how you would intend to develop these, taking account of available resources and identified staff development needs.

Plenary

Invite groups to report back on their ideas.

Taking it forward

Begin implementation of the plan.

Topic 4: Creating the right climate

Introduction

Introduce the topic by asking 'What do we mean by the "right climate"?'.

Highlight two important points.

First, if children are to learn to think, they must be encouraged to think – for example to make suggestions, hypothesise and express their views – and this without fear of being 'wrong' or being ridiculed in any way. They need to feel that their ideas and views count. Spontaneity, originality and intuition are to be valued.

Second, the 'right climate' must include the belief that all children can learn. True, all children will not achieve to the same level at the same time. On the other hand we need to be careful in case what we say and do in the classroom places upper limits on what pupils might achieve. In their booklet *Inside the Black Box* (Kings College London, 1998), Black and Wiliam say that if we work with the assumption that all pupils have 'untapped potential' this helps all pupils to learn.

Further information on intelligence and on the effects of beliefs about intelligence on learning are included in Appendix 3.

Activities

This activity should include the offering of constructive suggestions and comments about ways to improve each other's practice.

- (a) Mixed groups: What steps do you currently take to ensure that the right climate is created for thinking and learning? What problems are there and how might these be overcome?

Distribute the topic sheet, 'Creating the right climate'. What do you think of the 'practice' described in the quotation?

- (b) Mixed groups: Discuss the strategies suggested in terms of their implications for classroom practice.

Plenary

Take feedback from groups on activity (b).

Taking things forward

Teachers/departments are to implement one or more of the strategies.

Topic 5: Creative Thinking

Introduction

The topic on creative thinking is intended to help staff to identify some of the key skills of creative thinking, and to consider some techniques and strategies for developing it.

The initial quotation from *Creativity in Education*³ points out that the traditional ways of fostering creative thinking are through projects, investigations and problem-solving activities. The second draws attention to the importance of divergent thinking and in particular, the three dimensions of fluency, flexibility and originality.

Activities

- (a) Mixed groups: Make a list of the key skills you think are required for creativity and creative thinking.

Distribute topic sheet, 'Creative Thinking'.

Further information on strategies for creative thinking is available in Appendix 4.

- (b) How does your list compare with that on the sheet?
- (c) Individual: Choose one of the strategies and describe how and in what context you could use it in your teaching.
- (d) Share your ideas with others in your group.

Plenary

Take feedback from groups by asking initially for an example of each strategy from activity (c).

Taking it forward

Teachers are to introduce the strategy into an appropriate topic.

Topic 6: Critical thinking

Introduction

The topic on critical thinking is intended to encourage staff to think about the skills of critical thinking and to consider some techniques and strategies for developing them. The quotation from Guy Claxton's book *Hare Brain, Tortoise Mind* (Fourth Estate, 1998) indicates that critical thinking relies principally on reason and logic. It also shows that critical thinking is an essential element in many everyday tasks.

Activities

- (a) Mixed groups: Make a list of the skills you think are important in the development of critical thinking.

Distribute topic sheet, 'Critical thinking'.

Further information about critical thinking is available in Appendix 5.

- (b) How does your list compare with that on the sheet?
- (c) Individual: Choose one of the strategies and describe how and in what context you could use it in your teaching.
- (d) Share your ideas with others in your group.

Plenary

Take feedback from groups by asking initially for an example of each strategy from activity (c).

Taking it forward

Teachers are to introduce the strategy into an appropriate topic.

Topic 7: Thinking strategies for deepening understanding

Introduction

Distribute the topic sheet, 'Thinking strategies for deepening understanding' and the accompanying pro-forma.

The quotations for this topic emphasise the importance of deep learning and deep thinking, and how these can help us to remember. What we can learn or remember depends on what we understand, and on how we structure or make sense of information. One model of how our memory works maintains that our ability to remember depends upon the degree to which we process the information we want to remember. The key idea in this model is the depth of processing that takes place – in other words the more ways and the more varied the ways in which we process information, the more effective our memory and our understanding.

The topic sheet on deepening understanding includes a range of ways by which information can be processed to aid learning and memory.

Further information and practical strategies are included in Appendix 6.

Activities

In secondary schools activities (a) and (b) should be completed within department or faculty groups. In primary and special schools groups could be organised on a curricular or stage basis.

- (a) Pairs/groups: Complete the pro-forma of existing practice of using the thinking strategies outlined. As a group discuss the implications of the findings.
- (b) Pairs/groups: Consider the kind of contexts in which some of the strategies might be effectively implemented.

Plenary

Invite responses and comments on activity (a).

Taking it forward

Identify a block of work that would benefit from the introduction of some of these strategies. Introduce one or more of the strategies as appropriate.

Topic 7: Thinking strategies for deepening understanding – pro-forma of existing practice

Strategy	Often	Sometimes	Never
Organising information			
Drawing maps			
Using templates			
Taking notes			
Tests and homework/ exercises			
Sharing and explaining			
Dialogue			

Topic 8: Thinking through questions

Introduction

Distribute the topic sheet, 'Thinking through questions'.

The first quotation describes the evidence regarding questioning that emerged from the study of classroom practice entitled *School Matters* (P. Chapman, 1995). Peter Mortimore and colleagues concluded that pupil progress was greatest in classes where teachers use more higher-order questions and statements to challenge and stimulate pupils' thinking.

The second quotation, from Black and Wiliam, emphasises the importance of providing enough time so that pupils can think out and offer an answer. Research shows that without sufficient time it is questions of fact that tend to dominate. A number of strategies are given in the topic sheet for helping pupils to 'think through questions'.

Activities

- (a) Mixed groups: Which of the strategies have you used? Discuss their effectiveness with others in your group. Which other strategies might you want to introduce? Why?
- (b) Individual: Identify some recent lessons that you thought went well. Compile a list of the questions you asked that resulted in problem solving, reasoning and imaginative responses.
- (c) Pairs: Compare your results with a colleague.

Plenary

Take feedback on activity (c).

Taking it forward

Distribute Appendix 7.

Plan and teach a lesson where the kind of questions designed to develop pupils' thinking predominates.

Topic 9: Metacognition – Thinking about thinking

Introduction

Distribute the topic sheet, 'Metacognition – Thinking about thinking'.

Metacognition is the process of reflecting on one's own thinking and learning. It involves being aware of and in control of one's own knowledge and thinking and therefore learning. For example, the person who knows that a particular thinking strategy will help them to solve a problem is reflecting on their own thinking and learning.

Paying attention to how well you understand something by asking questions such as 'What have I learned so far?' 'Why am I finding this difficult?' is also part of the process of reflecting on learning.

Other activities could involve explaining to oneself in order to improve understanding, correcting mistakes and reviewing progress, planning the different stages of a task or project.

It also involves being aware of different styles of thinking. A note on convergent and divergent thinking is included in Appendix 8.

Activities

- (a) Mixed groups: Discuss with colleagues steps you have already taken to encourage your pupils to reflect on their own thinking and learning. What benefits have you noticed, for example in relation to pupils' commitment, improved work, increased confidence, increased independence, improved classroom atmosphere.

Activity (b) should be completed within department or faculty groups. In primary and special schools groups could be organised on a curricular or stage basis.

- (b) In pairs, plan for the inclusion of one or more of the strategies within a forthcoming lesson or block of lessons. What difficulties, if any, do you foresee in making such strategies a regular part of your teaching?

Plenary

Take feedback on the benefits and difficulties from (a) and (b).

Taking it forward

Teach the planned lesson or block of lessons and record your thoughts on the benefits and difficulties in relation to the aspects set out in activity (a).

Topic 10: Thinking through dialogue

Introduction

Distribute the topic sheet, 'Thinking through dialogue' and the accompanying proforma.

Discussion with the whole class can often be useful, for example when introducing a topic, reinforcing important points, drawing together the results of group work or sharing ideas and views about an issue or problem before going on to further activities. It does, however, have one major drawback – it does not allow sufficient space for pupils to think things through or explore things in depth. Wherever there are different possibilities to be explored, solutions to be found and depths of meaning to be uncovered, the opportunity to talk through these in pairs and small groups will be important.

The first quotation in the topic sheet emphasises the crucial importance of classroom discussion in the development of pupils' thinking. The second quotation comes from research conducted by a team based at the Open University. The research showed clear evidence of a link between the development of children's ability to communicate and the improvement of their critical thinking and decision-making. The emphasis within the published materials is on exploratory talk – which the authors describe as occurring when pupils 'engage critically but constructively with each other's ideas'.

Further information on dialogue and direct interactive teaching is included in Appendix 9.

Activities

In secondary schools activities (a) and (b) should be completed within department or faculty groups. In primary and special schools groups could be organised on a curricular or stage basis.

- (a) Individual/groups: Complete the pro-forma of existing practice of using the discussion strategies outlined. As a group discuss the implications of the findings.
- (b) Individuals/pairs or groups: Identify a block of work that would benefit from the introduction of some of these strategies. Describe the context(s) in which you would introduce it (them).

Plenary

Take feedback on the results of the pro-forma.

Taking it forward

Teachers are to introduce one or more of the strategies as appropriate.

Topic 10: Thinking through dialogue – pro-forma of existing practice

Strategy	Often	Sometimes	Never
Buzz groups			
Think–pair–share			
Rainbow groups			
Twos to fours			
Listening triads			
Critique session			
Community of enquiry			



Appendices



Appendices

Appendix 1

Another way of looking at thinking skills is this list from two of the leading American experts, Swartz and Parks. In their book, *Infusing the Teaching of Critical and Creative Thinking into Content Instruction* (Pacific Grove, 1994), Swartz and Parks have developed what they call 'thinking maps' and 'visual organisers' for each of their skills. Thinking maps are used to direct children to a number of key questions that will help them to understand what is involved in a particular skill. And visual organisers, as the name suggests, allows them to set out the different stages of the process visually as they work through it. The skills are:

- sequencing and ordering information
- sorting, classifying and grouping
- analysing and identifying relationships
- comparing and contrasting
- making predictions, hypothesising
- drawing conclusions
- generating ideas, brainstorming
- recognising cause and effect
- defining and clarifying problems
- thinking up solutions
- setting goals and sub-goals
- testing and evaluating outcomes
- planning and monitoring
- making decisions
- setting priorities.

Within the English National Curriculum all subjects are expected to develop thinking skills. The skills to be developed are divided into five categories as follows.

Information processing

This includes locating and collecting relevant information, sorting, classifying, sequencing, comparing and contrasting, and analysing part/whole relationships.

Reasoning

This includes giving reasons for opinions and actions, drawing inferences and making deductions, using precise language to explain what we think, and making judgements.

Enquiry

This includes asking relevant questions, posing and defining problems, planning what to do and how to do research, predicting outcomes and anticipating consequences, testing conclusions and improving ideas.

Creative thinking

This includes generating and extending ideas, suggesting hypotheses, applying imagination, looking for alternative innovative outcomes.

Evaluation

This includes evaluating information, judging the value of what they read, hear and do, developing criteria for judging the value of their own and other's work and ideas, and having confidence in their judgements.

Appendix 2

To help pupils put forward ideas, views and arguments teachers could:

- widen the range of questions they use in the classroom
- set up a 'community of enquiry' approach in personal, social and health education
- make a conscious effort to increase waiting times after asking questions
- give more opportunities for pupils to talk through ideas and issues by using a wider range of discussion methods
- introduce stories and poems for thinking into language work in the primary school
- begin a course of 'philosophy for children' in P6 and P7
- discuss with pupils in S3/S4 a structure for writing argumentative essays
- ensure that pupils have opportunities to develop their own views on a range of political, economic, social, moral and environmental issues
- introduce a course to enhance pupils development as independent thinkers and learners, for example Award Scheme of the Development and Accreditation Network (ASDAN) for S3 and S4
- provide opportunities through drama and role play to discuss differences and resolve conflicts.

To help pupils think more deeply about content and concepts teachers could:

- present pupils with stimulating challenges to make them think
- ensure that pupils receive sufficient feedback on both their oral and written work
- introduce strategies to help pupils reflect on their thinking
- make explicit the specialist skills associated with different subject areas
- provide opportunities for pupils to think about and make judgements about ideas, evidence, arguments and assumptions, for example in relation to sources both contemporary and historical
- introduce special programmes for thinking established in various subjects, for example CASE Science, CAME, Thinking Through Geography
- absorb the methods and processes used in a special programme into normal teaching
- encourage pupils to apply their knowledge and skills to the real world through questions, examples, case studies and problem solving
- implement a system for interacting and talking with groups on a regular basis
- introduce pupils to the principles and practice of effective study, for example mind mapping, note-taking, revision strategies.

To help pupils develop skills and strategies teachers could:

- use mind maps and encourage pupils to use them
- introduce a strategy to help primary pupils with problem solving in mathematics
- use thinking strategies to improve comprehension in language in P3 and P4, for example Mike Lake's five thinking strategies
- introduce strategies for improving memory, for example breaking down information into smaller chunks, adopting an efficient revision strategy
- introduce a programme for developing general thinking skills and strategies, for example Let's Think! in P2, 'A Guide to Better Thinking' in P6, The Learning File in S1
- introduce a framework for tackling 'real' problems

- encourage pupils to use strategies to develop creative thinking, for example De Bono's thinking tools
- use lateral thinking puzzles and games to develop pupils' creativity, especially their fluency and flexibility
- set pupils creative tasks and problems to develop their powers of originality and elaboration
- introduce a course on critical thinking for pupils in S2.

To help pupils reflect on their thinking and learning teachers could:

- make pupils aware of strategies and give them opportunities to use them
- ask pupils to comment on the ease or difficulty of tasks
- discuss appropriate strategies with them before they begin tasks
- engage pupils in thinking about the problems they might encounter in a task and the strategies for dealing with these
- provide opportunities for pupils to think about their strengths and learning preferences and to comment on themselves as learners
- include peer and self-assessment to encourage pupils to reflect on their work
- encourage pupils to set goals for learning on a regular basis
- ask pupils to explain their decisions and choices when completing tasks
- show pupils examples of work related to particular tasks
- encourage pupils to confirm their understanding of a task by asking them to explain it to their peers or put it into their own words on paper.

Appendix 3

At one time, it was believed that intelligence is fixed – that we are stuck forever with whatever level of intelligence we may have at birth. Today, many and perhaps most researchers in the field of intelligence believe that it is malleable – that it can be shaped and even increased through various kinds of interventions.

Sternberg, R, *Successful Intelligence*, Simon and Schuster, 1996

Brain research

The view of intelligence as capable of improving and expanding is supported by research on the brain. One of the most fascinating discoveries about the brain and the way it learns is the fact that it has plasticity. In other words, as a result of the experiences we have the physical structure of our brain changes. We now know that the brain is made up of billions of nerve cells, or neurons, which send out innumerable long fibres, or axons. These make contact with other neurons through special connections called synapses. A particular neuron may be receiving tens of thousands of connections from other neurons at the same time. In other words, learning moulds the brain by growing new connections between brain cells.

As the brain becomes more sophisticated, it appears to exploit instinct less and less and instead uses increasingly the results of individual experience, of learning. Hence individuality, I would argue, becomes more evident: the balance starts to tip correspondingly away from nature towards nurture – the effects of the environment.

Greenfield, S, *The Private Life of the Brain*, Penguin, 2000

Children's beliefs about their own ability

Research conducted by Carol Dweck of Columbia University in New York suggests that the beliefs learners have about their own ability and intelligence can have a dramatic effect on their performance. She found that some believed that their ability was more or less a fixed commodity that they were born with and that they would always have it in roughly the same fixed amount. Children who believed this often avoided tasks that were more challenging and did not respond when they are unsure of the correct answer. When they encountered difficulties or were not successful their experience of having tried and failed simply confirmed that they had reached the ceiling of their ability, and that they were inadequate.

Others believed that their ability was something they could improve on and expand. As a result they were more persistent and adventurous in their learning. When asked how they felt when they encountered difficulties they said they enjoyed it because they felt they were learning something new. They also regarded making mistakes as an inevitable part of learning. (See Claxton, *Wise Up: The Challenge of Lifelong Learning*, Bloomsbury, 1999, pp. 34–35)

Teachers' beliefs about children's ability

In their study of formative assessment Black and William discuss the different beliefs that teachers hold about their pupils potential to learn. They categorise these beliefs as the 'fixed IQ' view and the 'untapped potential' view. They conclude:

... the evidence is that ways of managing formative assessment which work with the assumptions of 'untapped potential' do help all pupils to learn and can give particular help to those who have previously fallen behind.

Inside the Black Box, King's College London, 1998

Appendix 4

Brainstorming

Students work in groups where the idea is for each member to think up as many ideas as possible about a problem or issue. Individual contributions are gathered together without any attempt initially to categorise them or establish a priority. Brainstorming helps to develop the important creative skills of generating and developing ideas. It also encourages divergent thinking and the altering of perspectives by coming up with ideas that at first sight may seem irrelevant or even silly. Once the brainstorm is complete, groups can then turn to the task of thinking more critically about the ideas that have emerged, so that some basis for choosing what is relevant or important is established.

To be most effective brainstorming should follow four main rules.

1. There should be no evaluation of or criticism of ideas, to make sure that pupils are focused on generating ideas rather than defending them.
2. They should be encouraged to suggest the most outrageous ideas and solutions they can think of, on the assumption that these may contain some element of truth.
3. They should be encouraged to come up with as many ideas as possible, on the grounds that out of quantity will come quality.
4. They should try to build on and develop ideas that have already been suggested in the session.

Creative thinking tools

The creative thinking tools of Edward De Bono provide a good starting point for teachers wishing to help pupils develop their creative skills. They are intended to direct children's attention to aspects of a situation or problem that might otherwise be neglected (see De Bono, *Serious Creativity*, HarperCollins, 1996). They focus on the skills of generating ideas and altering perspectives.

AGO: Aims, Goals, Objectives

This strategy is intended to help us focus more clearly on the task at hand. Setting their own personal and school goals can also help pupils to develop a greater sense of control over their own lives and their own learning. Without some sense of where we are going and why, our ability to think creatively will be reduced.

PMI: Plus, Minus, and Interesting

This is a useful brainstorming technique in which the good points of an idea are listed under P (Plus), the bad points under M (Minus) and points neither good or bad are (Interesting). This forces us to explore ideas, situations and problems before coming to a judgement about them. Interesting points are neither benefits nor drawbacks but simply points of interest. They consist mainly of observations and comments.

CAF: Consider All Factors

While PMI includes making judgements about whether certain points are good or bad, CAF is simply concerned to ensure that when making a decision we take account of all the possible factors that are relevant.

OPV: Other People's Views

This is useful in helping pupils to see and understand a situation or issue from someone else's point of view. If we are to come up with good ideas and solve problems we need to look at what other people have to say and consider alternatives.

C&S: Consequences and Sequel

This, says De Bono, is one of the most important strategies for thinking in real life. If our thinking is going to result in any kind of action or decision then we need to take account of what might happen in the future as a result.

Visualisation

There is good evidence for the value of imagination as a learning tool – active imagination and visualisation can often prove more effective than rational self-talk.

Claxton, G, *Hare Brain, Tortoise Mind*, Fourth Estate, 1998

Research conducted at the University of California shows that imagination and visualisation can have a positive effect on students' preparation for examinations. For five minutes every day students were asked to visualise themselves studying in a way that would lead to an 'A' grade – they were asked to see themselves sitting at their desks or in the library, getting up and turning off the TV, declining a friend's invitation to go out and actively reviewing their notes. Compared to a control group who did not go through the process, the visualisers started their revision early, spent a third longer actually studying, and improved their examination results significantly. (See Claxton, *Wise Up: The Challenge of Lifelong Learning*, Bloomsbury, 1999, pp. 93–94.)

Creativity means forging un-thought-of links between ideas, images and senses.

Robertson, I, *The Mind's Eye*, Bantam, 2003

In his book 'The Mind's Eye', psychologist, Ian Robertson describes the importance of mental imagery and visualisation for developing creativity. He argues that many problems require divergent, intuitive and insightful thinking. These are styles of thinking in which imagery is often more successful than words – particularly where the problems are blue-sky, unfamiliar and not amenable to deductive solutions.

Appendix 5

Our ultimate goal in studying critical thinking is to learn to evaluate arguments – other people’s arguments and our own.

Jill LeBlanc, *Thinking Clearly: A Guide to Critical Reasoning*, Norton, 1998

There are at least three aspects that might be taken into account when evaluating an argument. One is the possibility that the argument is based on inaccurate factual claims. A second is that the argument may be making use of inappropriate logic or reasoning strategies, for example the conclusion may not follow from the facts or the argument may contain inconsistencies. A third is that the assumptions which form the basis of the argument turn out to be questionable.

Recent research

Research shows that even young children, below the age of six years, can solve logical problems and draw conclusions to some extent. However, these children cannot understand the idea of logic or logical arguments. They cannot distinguish between conclusions that follow from the premise of an argument and those that do not. The young child, for example, does not see anything illogical about saying a character in a story is both tall and very short.

Logical thinking, however, is not only a problem for young children. Research indicates that adolescents and adults also have difficulties with logic and logical thinking. Even adults tend to be influenced more by what they believe to be true than by logical considerations. Logical thinking, it would appear, does not develop naturally, as a matter of course. It is a style of thinking that has been invented and which has to be taught. Research suggests that only teenagers who have been taught about it directly show any real understanding of logical thinking (see Thornton, *Growing Minds*, Palgrave MacMillan, 2002, pp. 105–110).

Evaluating arguments

One way of teaching logical thinking is to help pupils to evaluate arguments by identifying logical flaws – for example in newspapers and magazines, radio and television programmes, and in statements from scientific, business and political leaders. Some of the flaws that might be illustrated are:

- the facts or evidence upon which an argument is based are questionable
- the conclusion does not follow from the premise or starting point
- an authority is used to ‘prove’ an argument when the authority might well be wrong
- sources of information are vaguely referred to but are not actually identified
- the person who is putting forward the argument is attacked rather than the argument
- the argument contains contradictions and inconsistencies
- only the extremes are considered, in-between options are ignored
- favourable factors are selected, unfavourable ones missed out
- statistics are misunderstood
- there is confusion between correlation and causation.

Appendix 6

By definition, learning involves memory. Each time we recall something it is as a result of previous learning. It is also the case that learning depends on memory; we could never learn anything if we immediately forgot what we had just learned. There is a wide range of strategies that can help us improve our memory. These can be divided into at least three broad categories – organisation, association and revision (see Chernow, *The Sharper Mind*, Souvenir Press, 1997).

Organisation

Over 40 years ago an American psychologist, George A Miller proposed that our short-term memory capacity is limited to about seven 'bits' of information. (See Gamon and Bragdon, *Learn Faster and Remember More*, BCA, 2002.) These bits might be composed of either single digits and letters, or 'chunks' of digits and letters or combinations of both. One way of organising and increasing the amount of information we can remember is by 'chunking' or grouping it. For example an eight-digit number can be grouped into four two-digit sequences making it much easier to remember. Other ways of organising and remembering information is to structure it into patterns, for example multiplication tables, mnemonics and rhymes. Teachers need to help pupils to look for significant patterns in the verbal or visual information presented and help them think about and process the patterns through talking, writing and visualising.

Association

One of the most important memory tools is association – matching up or linking new facts to something we already know. When approaching new information in a book for example it helps to spend a few minutes thinking about what we already know about the topic. The next step is to browse or skim through the chapter or series of pages in order to obtain an overview. This will provide a good picture of what the book or passage is about and begin to identify the information and ideas that relate to what we already know.

'Mind mapping' is widely regarded as a key strategy for building up associations. As the creator of mind maps, Tony Buzan believes that mind mapping is a tool that enables us to engender and build up associations between ideas (see Buzan, *The Power of Creative Intelligence*, Thorsons, 2001).

Revision

One of the keys to good memory is revision and a 'structured' revision process can ensure that we learn effectively and efficiently. In their book, *Manage Your Mind* (OUP, 1995), Butler and Hope argue that a 35-minute study period should act as the basic building block for learning. This is a period for which most people can concentrate well. The basic principle is to spend 60 per cent of the time in new learning; the rest of the time is for revising, either things learned recently or things learned a week or a month ago. For example, the first 20 minutes are spent in new learning or revision. This is followed by a short break of, say, four minutes. Two minutes is then spent revising what was learned in yesterday's 35-minute study period, a couple of minutes revising what was learned in the study period a week ago and a couple of minutes on what was learned in the study period a month ago. In the last five minutes revision focuses on what was learned in the first 20 minutes of the study period.

Appendix 7

One way of providing challenge is to set pupils demanding tasks. But equally, it is important for teachers to organise their classrooms so that they have the opportunity to interact with their pupils: to offer explanations which develop thinking, to encourage speculation and hypothesis through sensitive questioning.

*Curriculum Organisation and Classroom Practice in Primary Schools, Great Britain,
Department of Education and Science, 1992*

Questioning can form part of everything from quick reviews of previous lessons through to the thoughtful discussion of issues. Although on occasions questions may be of a 'closed' variety inviting recall of what pupils have learned, much of the questioning needs to be 'open' if it is to stimulate their thinking.

Among the important forms that questions can take to develop pupils' thinking are:

- questions that seek clarification
'Can you explain that?' 'What do you mean by ...?' 'Can you give me an example of ...?' 'How does that help us?' 'Does anyone have a question to ask?'
- questions that look for reasons and evidence
'Why do you think that?' 'How do we know that?' 'What are your reasons?' 'What evidence do you have?' 'What makes you so sure?'
- questions that explore alternatives
'Can you put that another way?' 'Is there another point of view?' 'What if someone were to say that ...?' 'What might someone who disagreed with you say?' 'What difference is there between those points of view?'
- questions that consider implications and consequences
'What follows from what you say?' 'What might be the consequence of that?' 'What might happen if ...?' 'Does that agree with what we said earlier?' 'How can we tell if that's true?'
- questions that attempt to pull things together
'Where have we got to?' 'Can anyone summarise so far?' 'How does that relate to ...?' 'Are we any closer to resolving the issue?'

Appendix 8

Guilford (*The Nature of Human Intelligence*, McGraw Hill, 1967), identified two main styles of thinking – convergent and divergent.

Convergent thinking

In convergent thinking individuals are said to converge along a single answer to a problem. For example, convergent thinking is operating when individuals are involved in narrowing down options or locating and selecting specific information. It is used in analysing, refining and evaluating. It involves questions and well-defined problems that typically have a single acceptable answer. It is the kind of thinking associated with conventional intelligence tests and many mathematical problems.

Divergent thinking

In divergent thinking individuals 'diverge' with the intention of throwing up as many ideas and solutions as possible. For example, divergent thinking is about thinking outwards or widening and extending the range of options to be considered. It involves the ability to generate a range of possible solutions to a given problem, in particular to problems that have no single agreed answer. It is associated with open-ended questions and seeks to draw in all possible ideas that may have a bearing on the issue or problem. It is closely related to Edward De Bono's lateral thinking that involves looking at things in a different, perhaps unorthodox way, and trying out different angles, different perceptions and different ideas.

Convergent thinking and divergent thinking are complimentary. The point made by many psychologists is that in emphasising convergent thinking we have tended to neglect divergent altogether and consequently have done little to teach or develop creativity in schools. This is a point brought out by *Creativity in Education*:³

The importance of creativity is increasingly recognised. But paradoxically, as that recognition has grown, it has highlighted a mismatch between what we say about the importance of creativity and the creative process and what we actually do to foster it in education, industry and society at large.

Appendix 9

Most contemporary scholars of child development still follow Piaget and believe that children actively construct their knowledge of the world, largely by reflecting on their own activities. Piaget accepted that social experiences and interpersonal dialogue were important. Talking and discussing with other children and adults will often lead us to rethink and review our own ideas and points of view. But for Piaget this played a rather limited and secondary role. Dialogue would only be worthwhile when pupils' level of understanding was at an appropriate state of 'readiness' for change. It is the structure of our thinking, he argued, our stage of development that determines when certain kinds of conversations can or cannot take place.

Drawing on the work of the Russian psychologist Vygotsky, and the American Jerome Bruner, David Wood has emphasised how much we learn from interacting with other people, talking with them and observing what they are doing. He argues that:

adults, social interaction and communication play a far more formative role in the development of children's thinking and learning than Piaget's theory allows ... children's knowledge is often a product of the joint construction of understanding by the child and by more expert members of his culture.

Wood, D, *How Children Think and Learn*, Blackwell, 1997

Pupils learn through first being exposed to new information and then attempting to make sense of that new knowledge by relating it to their existing knowledge. The teacher's role is to create the right climate for this to happen and to support their efforts. To do this the teacher has to make a judgement with regard to a pupils' level of understanding and provide appropriate comments and explanations to allow them to move on. This process is sometimes described as 'scaffolding'.

The view of learning that has emerged from this has been termed 'social constructivist'. In other words, children are social beings who construct their understanding of the world around them by entering into dialogue with others more or less expert than themselves. The adult or teacher therefore plays a crucial role in supporting pupils' thinking. The social constructivist view of how children learn suggests that teachers can lead pupils to new levels of thinking by interacting and talking with them.

It seems that it is the amount, nature and content of teacher–pupil talk which is crucial to pupil learning and that communicating with groups and the whole class enables more children to experience sustained, higher-order, work-related interactions with the teacher.

Gipps, C, 'What we know about effective primary teaching' in Bourne, J, *Thinking Through Primary Practice*, Open University, 1994

It is these ideas that lie behind the importance that has been attached to direct interactive teaching – where teachers explain ideas, demonstrate practical activities, ask different kinds of questions, and help pupils to understand how well they have done. (For further information and practical strategies on direct interactive teaching see *Direct Interactive Teaching*, LT Scotland, 2000.)

Appendix 10

Summary of 'Learning to Think, Thinking to Learn'

This paper is about thinking and thinking skills and their significance for learning. Its aims are to:

- provide some theoretical background on aspects of thinking and learning
- identify and describe the most important kinds of thinking
- describe a range of approaches to thinking and thinking skills
- propose a framework for developing pupils' thinking and thinking skills.

It is divided into four parts.

Part 1: Learning and Thinking

Part 2: Kinds of Thinking

Part 3: Case Studies

Part 4: A Framework for Development

Part 1 considers some key aspects of thinking including intelligence, the impact of emotions and stress and the importance of questioning and dialogue.

A set of learning and thinking skills, drawn from a survey of current Scottish curricular guidelines, is presented and a number of reasons are given to explain why thinking skills are important within education today. As well as specific skills, the term 'thinking skills' is seen as including a range of strategies and processes that can be used in the classroom to enhance pupils' thinking.

The links between thinking and intelligence and between thinking and emotions are discussed and a number of practical suggestions are made for reducing stress and improving thinking among pupils. The importance of dialogue for developing thinking is explained and a range of formats for improving questioning and classroom discussion are presented.

Part 2 deals with different kinds of thinking – creative thinking, critical thinking, problem solving, decision-making, memory and understanding, and metacognition.

The key aspects of creative thinking are identified as fluency, flexibility, originality and elaboration. A number of techniques for developing creative thinking are suggested. Critical thinking is said to involve two fundamental activities – identifying and challenging assumptions and imagining and exploring alternatives. An important style of thinking required for these activities is 'logical' thinking, which research indicates even adults have difficulty with. A list of foundation skills necessary for the development of critical thinking is suggested.

A distinction is drawn between everyday problem solving and problem solving in specific domains such as maths, science and geography. Everyday or real problems can often be dealt with by making use of general strategies. Many other problems, particularly those within specific domains often require specialised knowledge. Research shows that the knowledge we have and the way that knowledge is structured is critical for our ability to think, reason and solve problems.

Good decision making involves elements of both critical and creative thinking. It is said to be dependent on four major strategies and should take account of subjective feelings and intuitive thinking when appropriate.

The section on memory and understanding emphasises that both these activities involve thinking. Strategies for improving memory are suggested under three broad categories – organisation, association and revision. Strategies for deepening pupils' understanding are also set out. Metacognition is an acknowledgement that children and young people must learn to reflect on their own thinking. A series of questions that can help pupils to reflect on their own thinking is provided and ways of encourage metacognition in the classroom are suggested.

Part 3 describes current developments that are taking place within a local authority, two secondary schools and two primary schools.

In the local authority a strategic approach has been taken to the development of pupils' thinking. It began with a research project set up under the Government's early intervention scheme to examine the effectiveness of accelerating reading and spelling among children who had just started their first year at school. It now also includes an ambitious development involving 'philosophy for children', a central feature of which is the idea of a 'community of enquiry' where children are encouraged to listen, to talk to each other, and to discuss philosophical ideas.

In one secondary school the emphasis is on developing critical thinking skills in S1/S2, while in the other pupils' skills as independent thinkers and learners are being developed through the Award Scheme of the Development and Accreditation Network (ASDAN).

In one of the primary schools the focus is on developing a range of strategies for thinking and problem solving, especially within mathematics. In the other, teachers in nursery and Primary 1 are working with parents to develop pupils' thinking. Parents are provided with a sheet of open questions and are encouraged to use these in conjunction with the children's library books.

Part 4 puts forward a framework for developing pupils' thinking and thinking skills.

It is suggested that there are at least four purposes that teachers and schools might have in mind when developing pupils' thinking. These involve introducing strategies, programmes and approaches that will help pupils to:

- put forward their own ideas, views and arguments
- think more deeply about content and concepts
- develop skills and strategies
- reflect on their own thinking and learning.

Examples of programmes and approaches are given for each purpose and a range of suggestions are made for taking them forward within schools and classrooms.



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