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Why develop thinking and assessment for learning in the classroom?



Guidance

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Audience	Teachers and senior managers in primary and secondary schools, further education colleges; local authorities; tutors in initial teacher training; and others with an interest in education. The booklet is essential for those practitioners involved in the development programme for thinking and assessment for learning.
Overview	This booklet is part of a series of guidance materials to support practitioners in implementing higher-quality teaching and learning by focusing on developing thinking and assessment for learning.
Action required	Schools' senior managers and local authority advisers are requested to raise awareness of these resources within their schools, and to encourage teachers to use the materials to support their focus on quality teaching and learning.
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Additional copies	This document can be accessed from the Welsh Assembly Government website at www.wales.gov.uk/educationandskills
Related documents	<i>How to develop thinking and assessment for learning in the classroom</i> (Welsh Assembly Government, 2010) <i>Developing thinking and assessment for learning programme: Leaflet</i> (Welsh Assembly Government, 2009) <i>Developing thinking and assessment for learning poster</i> (Welsh Assembly Government, 2007)

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1. Introduction

The ability to learn and apply new skills effectively throughout our lives is a fundamental requirement for today's generation living in an increasingly technological driven world. Successful lifelong learners need the ability to learn, whether in school, the workplace or at home. The information revolution and the restructuring of jobs and working lives continues to make an ever-growing impact on the relevance of traditional knowledge, subject content and skills currently taught in schools today. It is imperative, therefore, that teaching pedagogy is reviewed and updated in order that learners have experience of, engage in and develop the skills demanded of today's citizens.

Teaching learners to become motivated and effective learners is a primary role of teachers. It could be argued that until now, the process of learning as a skill in its own right has generally been of secondary importance to the learning of subject knowledge and key facts. As evidence from scientific research and classroom practice have been increasingly aligned and interwoven, a number of barriers have been overcome. The most notable advances have been in the areas of developing thinking and assessment for learning in the classroom.

This programme for developing thinking and assessment for learning aims to focus on addressing these issues and ultimately support more effective learning. Its implementation should enable all learners to benefit from the skills-focused, learner-centred revised school curriculum.

2. Definitions

Developing thinking¹ can be defined as developing patterns of ideas that help learners acquire deeper understanding and enable them to explore and make sense of their world. It refers to processes of thinking that we in Wales have defined as plan, develop and reflect. These processes enable learners to think creatively and critically to plan their work, carry out tasks, analyse and evaluate their findings, and to reflect on their learning, making links within and outside school. Although we are born with a capability to think there is ample evidence that we can learn to think more effectively.

Developing thinking pedagogy has considerable overlap with the principles of assessment for learning.

¹ Progression in Developing thinking is exemplified in the *Skills framework for 3 to 19-year-olds in Wales*, WAG 2008, and also further described in *How to develop thinking and assessment for learning in the classroom*.

Assessment for learning is the process of finding out where learners are within a learning continuum, where they need to go and **how** best to get there. Assessment for learning is a type of formative assessment.

3. Why focus on developing thinking and assessment for learning?

Both the ‘thinking skills’ and assessment for learning movements are well established. Much classroom research has been carried out to ascertain the benefits of employing techniques that focus on either developing thinking or assessment for learning. In addition, from 2005 to 2008, the Assembly Government ran a pilot of this programme, focusing on **both** developing thinking and assessment for learning. The outcomes included:

Improvements in:

- learners’ performance - leading to higher quality outcomes
- engagement of all learners in their own learning
- learners’ ability to transfer generic skills leading to greater flexibility and therefore employability.

Increase in:

- enjoyment of both teacher and learner.

The characterising features of developing thinking and assessment for learning overlap considerably, so that each actively supports and reinforces the other. Some essential features of this overlapping pedagogy are:

- a greater focus on **how** to learn, i.e. the *process* of learning, than on what to learn, i.e. the subject knowledge and skills
- learners are frequently required to verbalise and to articulate their thinking/learning so that the processes are made more *explicit and visible* in the classroom
- learners and teachers have a common language of learning
- a focus on group collaboration and co-operation, with teachers facilitating learning
- learners support each others’ efforts to learn and jointly construct their learning
- learners take responsibility for their own learning and make informed decisions
- learners reflect, monitor and self-evaluate their own progress
- learners are encouraged to transfer their learning across contexts and to make connections

- the environment is sensitive, constructive and reflective so that learners feel safe to make mistakes.

Employing strategies and using ‘tools’ that promote these features creates more independent, reflective and resilient learners, one of the main aims of the revised National Curriculum .

4. Fundamental principles

There are several fundamental principles, which need to be considered before attempting to shift pedagogy.

- Intelligence is modifiable therefore every learner can improve.
- Deep understanding is more important than superficial learning
- Learners need explicit strategies for **how** to learn
- Challenge and interest can lead to motivation.
- All participation is valued.
- Collaboration (learning with others) will allow learners to take greater educational risks and take their learning forward.
- Metacognition (thinking about thinking) is at the heart of the learning and teaching process.
- Skills and knowledge must be transferred both within the school and in the wider world.

5. Why develop thinking?

Developing thinking enables learners to gain a deeper understanding of topics, to be more critical about evidence, to think flexibly and to make reasoned judgements and decisions rather than jumping to conclusions. These qualities in thinking are needed both in school and in the wider world.

Learners need to develop a repertoire of thinking strategies/tools to be drawn on when they encounter new situations. Ideas as to some strategies/tools can be found in the *How* booklet.

5.1 Metacognition

A central crucial process in developing skilful thinking is **metacognition** (thinking about thinking). Learners must reflect on their learning and intentionally apply the results of reflection to further their learning. This reflection needs to be across several areas such as:

- making sense of the task
- knowledge of strategies and methods, how and when to use them
- knowledge and understanding of thinking processes
- monitoring and evaluating learning from the success (or otherwise) of chosen strategies or methods.
- making connections across contexts.

Teaching metacognition, thinking about thinking, is arguably the most difficult aspect of developing thinking. Learners and teachers need a shared vocabulary to enable clear expression of their thinking processes. A selection of such terms is suggested in the accompanying booklet *How to develop thinking and assessment for learning in the classroom* at page 5. To help learners become familiar with such terms, many teachers have developed thinking tools, such as word walls, mobiles or whiteboard materials.

Learners need to be asked how they have arrived at a particular idea. In other words, what thought processes have occurred in order for them to have worked out a particular answer or idea. Once learners have articulated their thoughts and reflected on the process, the strategy they have used could well be taken into another context or lesson. This transfer of strategies, or linking learning, is essential if learners are to make progress.

Learners need support initially to structure their thoughts so that they can reflect on the thinking processes they have used. Some suggestions as to strategies/tools are given in the accompanying *How* booklet.

It is essential that metacognition happens throughout the learning process, rather than being end-loaded. By embedding metacognition throughout learning, learners are better placed to reflect on decisions and make amendments and adjustments for improvement in real time. In addition, end-loading the metacognition can result in much confusion and poor quality reflection as the time-frame for reflection over a number of decisions and activities which have been taken in the meantime is far too great. It is essential that the reflective process is purposeful. Too frequently, ‘reflection’ is confused with a plenary; at that point any suggestions made for improvement are unlikely to be invoked as many learners feel that the

opportunity has passed and the ‘activity’ completed. By embedding metacognition as an integral ongoing element of learning, action on feedback is immediate and decision-making processes are fresh in the mind.

In order to maintain the flow of metacognition, as learners respond to tasks, they need to be asked questions such as, ‘Why do you think that?’, ‘Where did you get that idea from?’, ‘How did you work that out?’. This ensures that they focus on thinking about their thinking, and in time, will ask these questions of themselves.

Quality metacognition is a core element of both developing thinking and assessment for learning pedagogy. It is critical that it is managed effectively to further the learning.

5.2 How is developing thinking currently taught?

Schools across Wales are at different stages in introducing developing thinking. There are three main ways in which developing skilful thinking is currently taught:

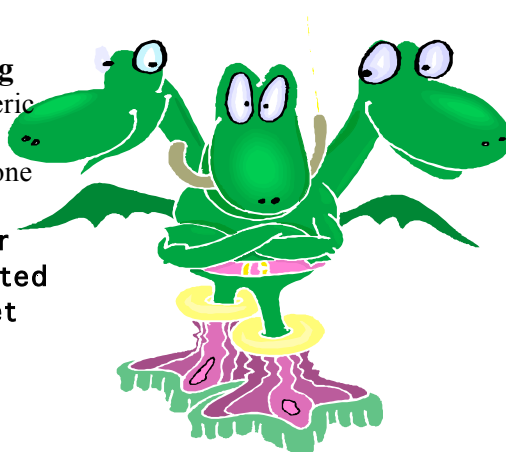
- teaching *of* thinking
- teaching *through* thinking
- cross-curricular *infusion*.

Diagram: Current methods for teaching thinking

Teaching *of* thinking

Direct teaching of generic thinking skills outside subject areas (stand-alone courses)

e.g. Philosophy for Children, Accelerated Learning, Somerset Thinking Skills



Teaching *through* thinking

Uses methods to promote thinking in subject contexts (stand-alone courses).

e.g. Intervention programmes, CASE, CAME, Thinking through History

Cross-curricular *infusion*

Restructuring lessons in subjects to provide developing thinking teaching

e.g. ACTS, Thinking for Learning (Cardiff LEA)

Most of these methods require the purchase of materials from commercial publishers and so require an initial outlay by schools. However, the most important outlay is in teachers' time, as in order to reap maximum benefit for learners, teachers must understand the principles behind them. Therefore an element of coaching/mentoring is also needed. An overview of the commercially produced materials can be found at **Appendix 1**. Exemplification of useful strategies/tools for developing effective thinking can be found in the accompanying *How* booklet.

Within the cross-curricular infusion group, teachers across Wales have started to develop their own thinking skills lessons, mainly with the assistance of advisory colleagues. These lessons make learners aware of their thinking and the learning strategies they can use to help them achieve a deeper understanding. The development programme aims to further enhance this work by enabling teachers to reflect on current practice and try out other strategies in the classroom.

6. Why develop assessment for learning?

A wide variety of research in this area has clearly shown the gains to be made by children in both motivation and performance from employing assessment for learning strategies. A succinct comparison of the different forms of assessment has been made by the Assessment Reform Group (1999):

*“A clear distinction should be made between assessment **of** learning for the purpose of grading and reporting, which has its own well-established procedure, and assessment **for** learning, which calls for different priorities, new procedures and new commitment.”*

In essence, assessment for learning is finding out where a learner is (A), knowing and making explicit where the learner needs to get to (B) and most importantly showing the learner **how** to get there.

A  B

It is essential that the **learner** takes action in order to reach B.

A range of assessment for learning strategies/tools can be used to help in each stage of this process. This range of tools, adopted by teachers and learners, can help to gain an understanding of what has been achieved and what next steps will be needed to take learning forward. Exemplification of such strategies/tools and the principles they promote are outlined in the additional *How* booklet.

Assessment for learning strategies/tools can be categorised into three main areas:

1. Questioning

- thinking (wait) time
- kinds of questions.

2. Quality of Feedback

- immediacy
- no grades just targets
- learner-centred but objective
- frequency of assessment (regular rather than end-loaded)
- opportunity to correct
- clarity.

3. Peer and self-assessment

- sharing and understanding learning intentions
- understanding success criteria
- recognising good quality work.

As assessment for learning is rooted in pedagogy, commercial packages to ‘transport’ directly into the classroom are generally unavailable; instead resources discuss and develop the teacher’s skills in implementing suggested strategies and ways of working. Useful resources and references have been included in **Appendix 3**.

The table below shows some of the factors that can improve progress and those that might inhibit progress comparing assessment for learning strategies compared with conventional methods.

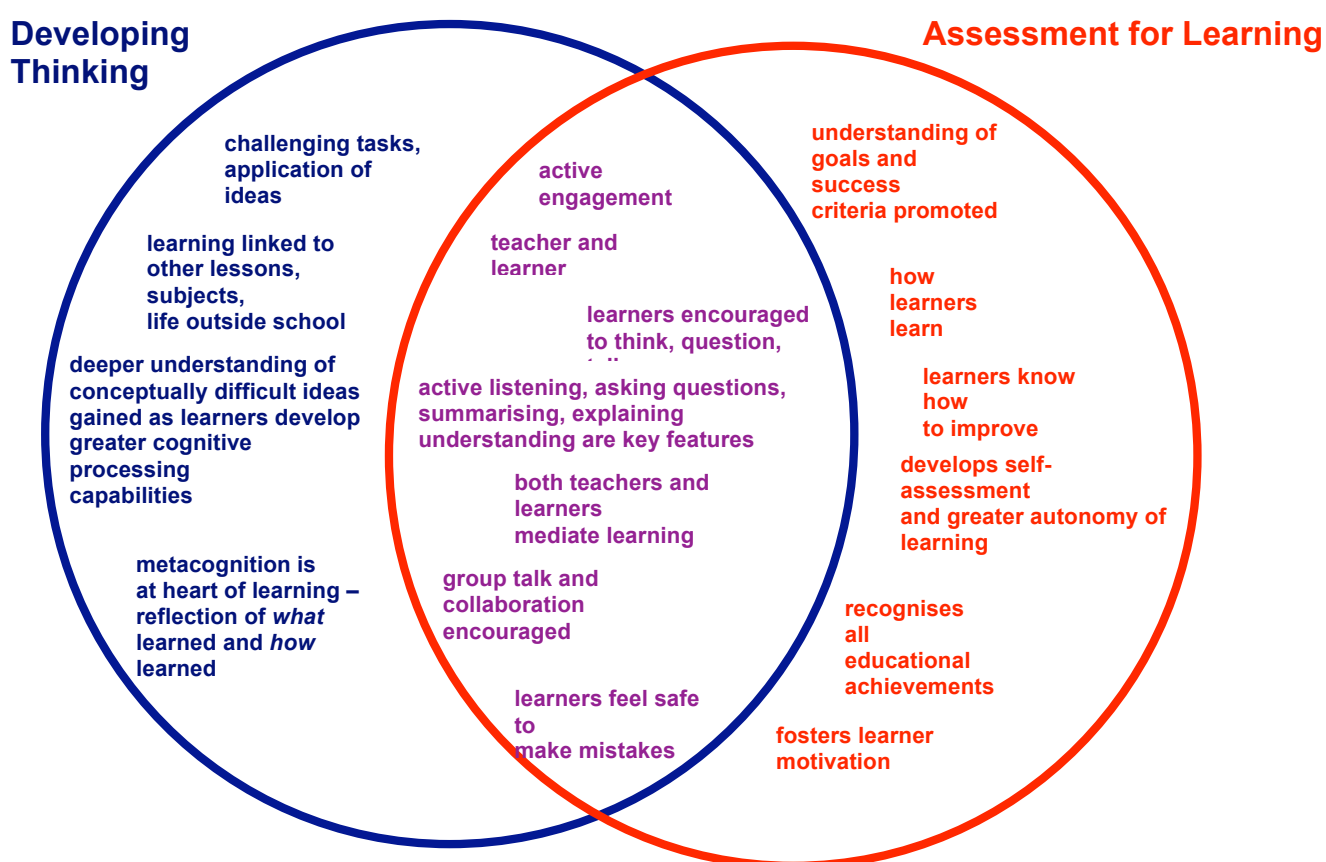
Improve progress	Inhibit progress
Involving learners in self-assessment against agreed transparent criteria.	A tendency for teachers to assess quantity of work and presentation rather than the quality of learning.
Providing feedback that leads to learners recognising their next steps and how to take them.	Greater attention given to marking and grading, much of it tending to lower the self-esteem of learners, rather than to provide advice for improvement.
Improving questioning technique	Teachers' feedback to learners often serves managerial and social purposes rather than helping them to learn more effectively.
The process underpinned by the confidence that every learner can improve.	A strong emphasis on comparing learners with each other, which demoralises the less successful learners and provides little challenge or motivation for the more successful learners.
Regular learner-teacher dialogue to support individual next steps and inform planning.	Teachers not knowing about their learners' learning needs.

6.1 How are assessment for learning strategies currently used?

There is much good practice in this area across Wales, although there is wide variation within and between schools/LEAs. The abolition of the National Curriculum Tests and a reduction in the size of the content of the National Curriculum itself should give more time for teachers to think about strategies they could use in the classroom to bring about more productive learning.

7. Characteristics of lessons that develop thinking and assessment for learning

The following Venn diagram summarises the characteristics of lessons developing thinking and assessment for learning in the classroom (see *Skills framework* page 11). It clearly shows that the two are inextricably linked so that development of one should influence the other. This also means that similar strategies may be employed to promote the quality of thinking and learning. However, the specific characteristics of each are also important; these may require different strategies to be employed.



The following sections further elaborate these characteristics.

Common Characteristics

- Learners are actively engaged in lessons from the very start.
- Teachers and learners explore, and take account of:
 - what learners already know (subject knowledge and thinking strategies)

- what learners can do
- what strategies may be useful to tackle the problem
- learners' misconceptions.
- Learners are encouraged to think, question and talk.
- Teachers and learners need to actively listen, ask questions, summarise and explain their understanding.
- Group talk and collaboration are encouraged. Through articulation, using appropriate vocabulary, learners clarify their learning. Focused talk in lessons allows learners to evaluate their own understanding and add to that of peers.
- Teachers and learners play a key role in mediating learning experiences, through active listening, asking appropriate questions, summarising and explaining understanding.
- The environment is sensitive, constructive, and reflective so that learners feel safe to make mistakes.

Further specific characteristics to develop quality thinking

- Rich challenging or application tasks are used to equip learners with the learning skills and dispositions that will be useful in lifelong learning situations.
- Learners are encouraged to link their learning to other lessons, subjects and/or life outside school.
- Reflection allows attention to be focused both on what has been learned and how it has been learned (metacognition).
- A deeper understanding of conceptually difficult concepts or 'big ideas' in curriculum subjects as learners develop greater cognitive processing capabilities.

Further specific characteristics to develop assessment for learning

- Promotes an understanding of goals and success criteria so that learners understand what they are trying to achieve and want to achieve it.
- Focuses on **how** learners learn.
- Helps learners know how to improve.
- Develops learners' capacity for self-assessment and fosters reflective learning.
- Recognises the educational achievement of all learners.
- Fosters learner motivation.

8. Managing effective group work

One of the overriding features of both, improving the quality of thinking and developing assessment for learning is the importance of establishing effective group work in the classroom. For the experiences to be conducive to learning, establishing the right kind of classroom climate is imperative. Learners will need to be coached (and frequently reminded) in their expected behaviour, with basic rules for interaction **agreed** beforehand. Some basic principles of developing a classroom climate for effective learning are:

- All contributions are valued
- No learners are excluded
- Learners feel safe to be creative and take risks in learning
- Co-operation, collaboration and respect for fellow learners is paramount.

One of the most powerful tools in promoting these values is teacher-modelling. If learners witness teachers actively promoting these values then they are more likely to embrace them. Some teachers have found great success in establishing basic rules for group work through class discussion; the learners themselves are central to devising a common list of values and rules for participation and these are drawn up for all to see. As all learners have ownership of these values (having agreed themselves that they are vital), then they are more likely to enforce them.

Teachers' checklists for group work

How?

- be explicit with learners about the quality of group work you want to achieve
- develop a checklist with learners; display it, large, in the classroom
- make spot checks, or stop the lesson and ask learners to carry out spot checks on the quality of group work
- every now and again spend a few minutes before the end of a lesson asking how much group working progress has been made.

When a group is working well ...

- the group sits so that each group member can see and hear all the others easily
- one person at a time speaks during discussion
- everyone turns to face the person who is speaking
- individual group members remind others if they break agreed ground rules

- any member at any time is able to explain:
 - what s/he is doing
 - how this contributes to the group task
 - what other group members are doing and why
 - what the next step will be
- the group always works to agreed and explicit deadlines. Each member should be able to answer the question ‘When will this be finished?’
- a group member who finishes a task early offers to help others, or negotiates the next step with the group manager
- everyone contributes equally to looking after resources, to clearing up and to moving furniture.

If group work isn’t going well, check that ...

- time has been given to creating ground rules and clarifying expectations of individuals’ behaviour within a group
- there is a designated leader, or manager, for each group
- the manager is the main channel of communication between the teacher and the group
- over a long period of group work (a technology project, for example) there are group meetings, chaired by the manager, at which agreements are made about division of labour, deadlines and use of resources
- apart from very short term tasks, notes are kept of who should be doing what by when
- the teacher is unbending about the maintenance of agreed ground rules
- the group has procedures for making decisions and solving problems.

Still problems? Check ...

- **classroom layout** - is the furniture arrangement conducive to group work?
- **resources** - are they appropriate for the task (content, readability), are they sufficient for the numbers and are they easily obtained by learners?
- **time** – has enough time been invested in setting up group work properly in the belief that it will be recouped later?
- **trust** - is it believed that learners will, in the end, handle group work well and use it to achieve great things?
- **safety** - are safety requirements, where they exist, built into the ground rules?
- **tasks** - have the tasks been designed and structured for group work - in other words, so that they cannot be achieved by any individual alone?

- **ground rules** – do they need re-visiting, or even re-creating?
- **skills** – do you need to learn how to operate differently?

Adapted from:

<http://www.pembschool.org.uk/learning/Check.PDF#search='rules%20group%20work%20in%20classroom'>

Appendix 1: An overview of the more common commercial packages for developing thinking

NB – this is not an exhaustive list it is a selection from hundreds of resources. Also many of the authors listed have published additional related resources.

Resource	Author	Features of the pack	Website
A Guide to Better Thinking	nferNelson (Anne Kite)	Draws upon a range of research into the teaching of thinking though aims to support classroom use. The programme emphasises higher order thinking skills with a focus on creative, critical and positive thinking while considering how to motivate learners to want to use these skills. The learners' book contains activities in each of the three areas of thinking to complete as well as a review and award section.	http://www.gl-assessment.co.uk/
ACTS	Carol McGuinness	Activating children's thinking skills - A methodology – not a package. Has a framework for different types of thinking (a theory of thinking). Infusion lessons across the curriculum (curriculum development) Classroom pedagogy (managing classroom talk...) Professional development of teachers (ways of working). Developing support materials (handbooks, videos). Evidence of impact of on learners' learning, teacher practices and beliefs, and school policy (research), Working with partners for sustainability (systems).	www.sustainablethinkingclassrooms.qub.ac.uk
Cognitive Acceleration through Mathematics Education (CAME)	Mundher Adhami, David Johnson, Michael Shayer	Cognitive Acceleration programme which is aimed at raising students' cognitive development and reasoning through Mathematics at Key Stage 3. Developed from pedagogy and fundamental principles of CASE project. Subsequently materials have been developed for learners in KS1 and 2 also.	http://www.heinemann.com/
Cognitive Acceleration through Science Education (CASE)	Philip Adey, Michael Shayer, Carolyn Yeates	Cognitive Acceleration is a method for the development of students' general thinking ability (or general intelligence) which has been developed at King's College London in a series of research and development programmes continuing from 1981 to the present. It was originally developed for science departments in secondary schools (CASE: Cognitive Acceleration through Science Education). Is underpinned by the cognitive psychology of Jean Piaget and Lev Vygotsky, from which has been derived a teaching approach which <i>Challenges</i> students' current level of thinking, which encourages the <i>Social Construction</i> of knowledge (students making knowledge cooperatively), and which encourages <i>Metacognition</i> – student's reflection on their own thinking and problem-solving processes.	http://www.nelsonthornes.com

Resource	Author	Features of the pack	Website
Games for Thinking	Robert Fisher	A programme for developing thinking and learning skills that includes over 100, easy-to-play games for children aged 7 and upwards . Can be used with individual children, small groups or whole classes. Each game is followed by extension activities and questions to challenge and extend thinking about the game.	www.teachingthinking.net
Inspiration Software	In the UK from Tag Learning	Software which encourages the use of a variety of graphical organisers.. The latest version of Inspiration can be used across the curriculum in all subjects for brainstorming, planning, and organising and concept development. Tools include concept mapping, flowcharts, outlining, diagramming, webbing and pre-writing to help develop thinking and structure research or work. Demo version can be downloaded from publisher's website	www.taglearning.com (www.inspiration.com)
Let's Think! Let's Think through Maths! Let's Think through Science! Let's Think! Early Years	Philip Adey, Anne Robertson, Grady Venville Mundher Adhami, Michael Shayer, Stuart Twiss	Programmes for developing thinking in early years, five and six year olds (Let's Think!, Let's think through Maths!); seven and eight year olds (Let's Think through Science!7&8); eight and nine year olds (Let's think through Science! 8&9); six to nine year olds (Let's Think through Maths! 6-9) Resource packs for primary schools developed by Kings College London researchers aims to encourage young children to understand their own learning and thinking strategies through practical investigative activities which focus on aspect of thinking such as ordering, classification and causation. Builds on research into cognitive acceleration in secondary science (CASE) and secondary mathematics (CAME).	http://www.gla-assessment.co.uk/
Somerset Thinking Skills	Nigel Blagg	Systematically teaches thinking skills Handbook and several modules including the foundations of problem-solving, analysing and synthesising, propositions in space and time, predicting and deciding etc. The exercises may be used as a free-standing programme or integrated across the curriculum, usually in the upper primary school or with mixed ability groups in secondary schools. Unlike the Instrumental Enrichment Programme which presents abstract concepts, the Somerset course is pictorial and naturalistic, visually based to motivate and maximise access Suitable for a wide range of ages and abilities Photocopiable activities for the learner Step-by-step advice for the teacher	http://www.somersetthinkingskills.co.uk
Storywise: Thinking through Stories	Karin Murriss and Joanna Haynes	Provides information and support for teachers to set up 'communities of enquiry' with learners of all ages. 'philosophical discussion of stories and picture books involving the whole class'. Includes a guide to help teachers develop philosophical enquiry and dialogue in the classroom and photocopiable resources for use with 55 classic picture books. Philosophy with Picture Books has been evaluated by Dyfed LEA with assistance from the Welsh Office 1993-1994 involving 18 schools. Robert Fisher's Thinking Through Stories advocates a similar approach.	www.dialogueworks.co.uk

Resource	Author	Features of the pack	Website
Teaching Thinking Skills Across the Middle Years	David Fulton - (Ed) Belle Wallace and Richard Bentley	Introduction to the TASC (Thinking Actively in a Social Context) rationale; numeracy; science; literacy; and ICT case studies of problem solving; case studies using the TASC approach. Presents a framework for the teaching of thinking skills and problem-solving across the primary curriculum using: examples of topics from the National Curriculum; classroom techniques; and activities which develop learners' thinking and problem-solving skills.	www.fultonpublishers.co.uk
The ALPS Approach: Accelerated Learning in Primary Schools	Alistair Smith & Nicola Call	Takes research collected by Alistair Smith and shows how it can be used in the primary classroom. Provides practical and accessible examples of strategies used in recent years at a UK primary school. The ALPS Method includes: how to design your day, teaching the skills of attention, a model for motivating every child, 20 strategies for positive learning behaviour , target setting that works, the best methods for feedback and marking, music and movement in learning, how to improve performance in tests, techniques to improve memory, ideas for Literacy and Numeracy and sample timetables.	www.networkpress.co.uk
Think Ahead!	Stephen Alty & Lorna Pout) Jane Petrie, Will Evans & Harry McLoughlin Nigel Leighton & Anne-Marie Quinn	Think Ahead is a programme of lessons that helps students develop their thinking through drama, music and visual arts. The Think Ahead! series provides a programme of lessons that helps students develop their thinking through drama, music and visual arts. Each resource can be used independently or together to create an effective approach to developing thinking across the art curriculum. Each Think Ahead resource includes 10 motivating group activities that encourage cognitive acceleration through the arts curricula with pupils aged 11, 12, 13 and 14. As well as developing pupils' thinking, the extensively trialled materials in Think Ahead provide the opportunity for increased creativity and better interaction, and for every pupil to be fully involved.	http://www.gl-assessment.co.uk/
Thinking Through Primary	Steve Higgins; Viv Baumfield; David Leat Newcastle University	This book aims to help develop children's thinking and understanding of their own learning. Each of the strategies and approaches are exemplified for use in the classroom and were developed collaboratively with teachers. Designed for teachers to use some activities as separate lessons, then adapt the strategies for use across the curriculum. The book provides a broad rationale from wider educational theories, and draws particularly from research into classroom talk, metacognition, teacher effectiveness and professional development (Chapters 11 -13).	www.chriskingtonpublishing.co.uk

Resource	Author	Features of the pack	Website
Thinking Together	Rupert Weigerif/Neil Mercer	Aimed at improving learners' use of language for thinking critically and constructively. The activities are organised into a series of 16 structured 'Talk Lessons'. Learners learn to collaborate by drawing up and using agreed ground rules for talk. They then apply these agreed rules as they work together on curriculum activities. The approach is based on a series of research studies which show that developing learners collaborative talk and reasoning improves their individual reasoning and attainment.	www.thinkingtogether.org.uk
Thinking with English	Mike Lake and Marjorie Needham	This approach takes the Top Ten Thinking Tactics and translates them into a context for teaching English. The programme makes use of five of the tactics; pinpointing the problem, systematic search, planning, check and change comparing and contrasting. All the resources required to use the 25 activities with the children are included in the pack. The introduction gives a rationale for the use of the five tactics and suggestions for lesson planning.	www.education-quest.com
Top Ten Thinking Tactics	Mike Lake and Marjorie Needham	A series of 11 classroom activities through which children learn, apply and review 10 tactics, such as 'Pinpointing the Problem'. Each of the 10 strategies comes with a suggested lesson plan and photocopiable support materials which the learners discuss and work through in small groups. The tactics are introduced and reviewed in whole class sessions.	www.education-quest.com
Zoombinis Logical Journey	Mindscap (UK) Limited - Computer software	Based in mathematics Activities to encourage divergent and creative thinking. Learners learn to solve various problems of increasing difficulty, organise information, test hypotheses, and develop strategies. Learners lead the peaceful Zoombinis on a digital trek to their new homeland by unravelling and solving a dozen intriguing challenges. <i>A case study is presented in Thinking Through Teaching.</i>	www.taglearning.com www.mindscape.co.uk

Appendix 2: An overview of some recent research in assessment for learning/formative assessment

Research by Black, Wiliam et al (2002) has revealed the following:

- Evidence that assessment for learning strategies improve attainment on average by half a level at KS2 and KS3 and half a grade at GCSE.
- Effective feedback plays a crucial part in a learner's development. The outcomes of a variety of studies have shown that effective feedback can improve learners' performance in 60% of them. The table below shows a summary of an Israeli study on types of feedback given to 132 low and high ability Year 7 children in 12 classes across four schools. Learners were exposed to the same basic teaching, given the same aims with the same teachers and undertook the same class work. Three kinds of feedback were given: solely marks, solely comments and marks **and** comments:

Type of Feedback	Learning gain made	Motivational outcomes	
Marks only	None	High ability Low ability	Positive Negative
Comments only	30%	All learners	Positive
Marks and comments	None	High ability Low ability	Positive Negative

This study highlights the importance of structured feedback that provides the learner with a means to improve his/her performance other than just judging performance against norm-referenced criteria.

The need to motivate learners is evident and although it is often assumed that this can be done with gold stars and stickers, there is growing evidence to challenge this assumption. Learners will only invest effort in a task if they believe they can achieve something. If the learning exercise is a competition, everyone is aware that there will be losers as well as winners.

Those learners who have a track record of being losers will see little point in trying. Feedback given as rewards and grades enhances ego rather than task involvement, as shown in the Israeli study. It focuses on ability rather than effort damaging the self-esteem of low attainers and leading to problems of 'learned helplessness'. Learners told that feedback will 'help you learn more' tend to achieve a lot more than those told 'how you do tells you how clever you are and what grades you'll get'. This difference is greatest for low attainers. Therefore effective feedback is essential.

A final outcome from the work of Black and Wiliam points out that far from having to choose between teaching well and getting good National Curriculum Test and exam results, teachers can actually improve their learners' results by working with the kinds of ideas developed through assessment for learning.

Appendix 3: References

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