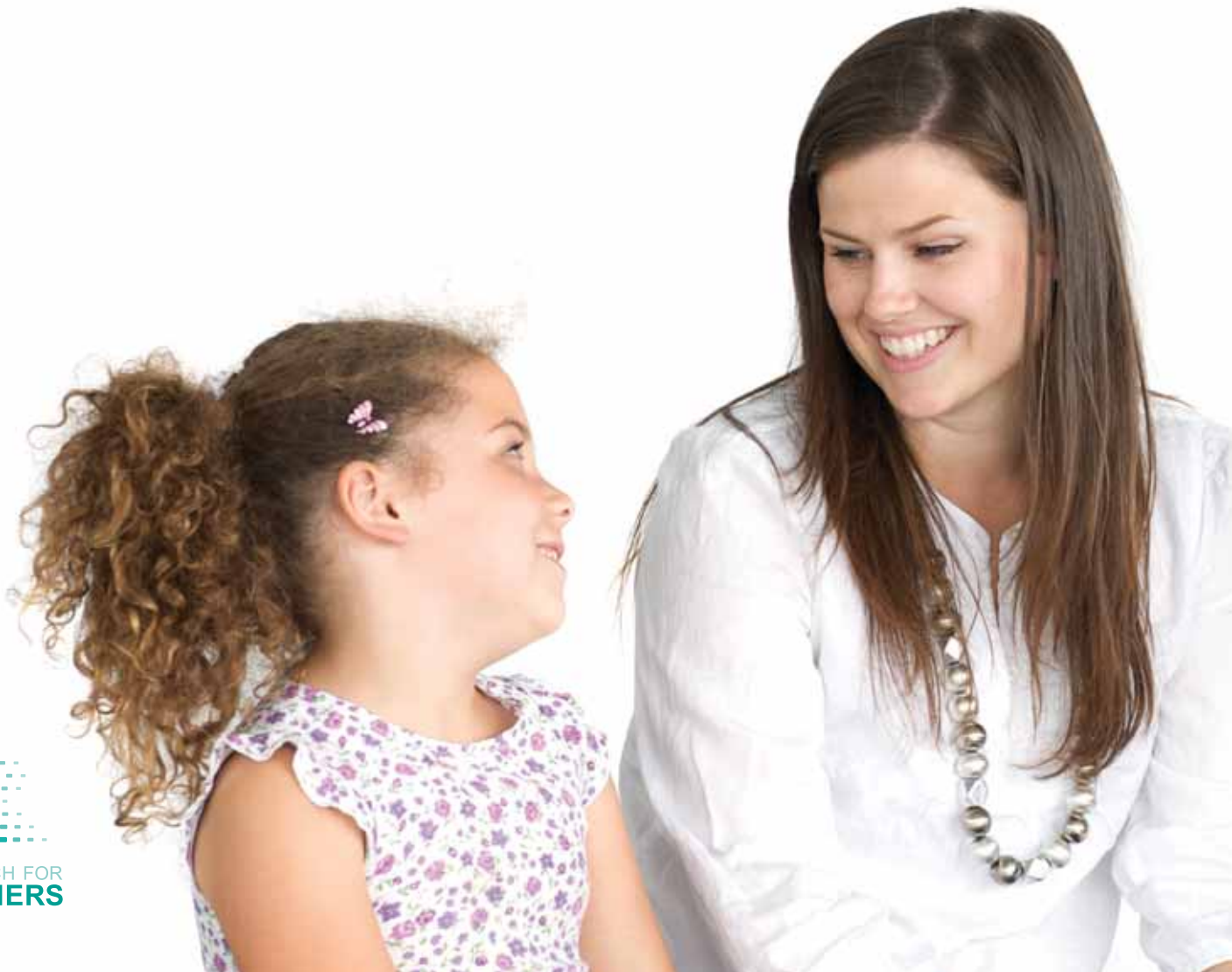
BEHAVIOUR FOR LEARNING

Research for Teachers anthology 1

General Teaching Council for England



RESEARCH FOR TEACHERS

CONTENTS

INTRODUCTION

Are you in your early years of teaching? Do you want to make sure that what you do in your classroom is based on strong evidence?

You need to have good grounds for believing that what you do is likely to have successful learning outcomes for your pupils. Like most new teachers, you are looking for proven teaching strategies and methods that you can use in your classroom. But being in your early years of teaching, you may also be anxious about keeping classroom order, which can make trying new things tricky.

That's why the GTC decided to bring together some of the cumulative findings from research in this anthology based on *Research for Teachers* (RfT) summaries. Our aim is to bring you sound evidence of effective teaching and learning behaviours for both primary and secondary phases, and to help you gain some understanding of the theories and ideas that underpin them.

This anthology

This anthology was first published in 2005. This updated version offers early career teachers sound evidence of effective teaching and learning behaviours, and the theories and practices underpinning them. It presents additional evidence about:

- the balance of ownership of learning between teacher and pupils in developing assessment for learning;
- prompting students to develop and justify their own varied methods in mathematics;
- teachers' and students' beliefs about students' capacities for learning;
- the kind of praise pupils found helped them persevere with tasks;
- enquiry-based learning;
- exploring students' existing understanding and methods in mathematics;
- ways of promoting more effective dialogue; and
- creating supportive learning environments

The anthology has four sections:

1. **What effective teachers believe**
2. **Thinking skills approaches**
3. **Collaborative group work**
4. **Assessment for Learning**

Each one is complete in itself so you can either read the whole anthology or just the sections you want to explore.

We considered a number of possible ways of structuring the anthology in the light of current knowledge about teachers' professional learning. We decided that what was most likely to be helpful to you as practitioners in your early years of teaching was to provide evidence about teaching and learning strategies that had proven themselves in the classroom.

We've put the emphasis on what teachers believe, know and do, both in relation to their subject knowledge and their knowledge of how pupils learn. Crucially this approach also includes an understanding of how these areas interact with one another. If you are interested in exploring this model further you will find

more details in the Research for Teachers summary 'Effective Teachers of Numeracy'.

What the anthology offers

In this anthology we start with the fundamental issue of teacher beliefs: what do effective teachers believe? We then go on to look at what effective teachers can do to promote learning in sections 2, 3 and 4.

We have examined the evidence to offer some answers to each of these questions. You will find that several important themes run through the anthology. Keep an eye open for them, because they are important. All the Research for Teachers summaries include a number of independent case studies which highlight and bring to life key findings in the summaries. They are worth looking at because they are all based in everyday classroom activity – so they can help you see how you might adapt some of the evidence for your own contexts.

You can see the sources of evidence we used in 'evidence boxes'. These will mostly list the titles of the relevant RfT summaries. You can find full references for all the studies on which each RfT is based, links to the summaries themselves and any other references at the end of each anthology in the **References** section.

And through the Research for Teachers website, you can can access all the summaries and this entire anthology online for free - the best way to get more detail and share the anthology with your colleagues.

Research for Teachers

It is more important than ever to use research and evidence to inform teaching, and indeed teaching's Code of conduct and practice reflects teachers' commitment to do this.

Our *Research for Teachers* resource has been supporting teachers to use research since 2002. One way in which it does this is by providing teachers with free access to summaries of research about teaching and learning online. It occasionally offers printed versions of some of the Research for Teachers materials, such as this anthology. Research for Teachers summaries and anthologies are commissioned by the GTC from the Centre for the Use of Research and Evidence in Education (Curee).

The *Research for Teachers* website now contains over 50 research summaries and resources. They all:

- draw out the meaning of the research for teachers' practice;
- come from research sources that have been thoroughly appraised for validity and reliability; and
- are interesting, clearly written and well presented, while remaining true to their source.

Recently published *Research for Teachers* summaries include:

- *Curriculum*: Examples from an international literature review of curriculum design and implementation;
- *Bilingualism*: What helps learners whose first language is not English?
- *Neuroscience*: What do we know about how the brain develops and how does teaching and learning need to take account of this?
- *Collaborative mathematics*: how best to help pupils overcome difficulties with mathematics?

SECTION 1
WHAT EFFECTIVE TEACHERS BELIEVE

Why are teachers' beliefs important in promoting pupil learning?

In the RfT summary 'Effective teachers of numeracy', a key framework helps to explain the importance of teachers' beliefs and the ways they affect teaching and learning. It highlights, in particular, the importance of linking teachers' subject knowledge with their beliefs and understanding of how pupils learned, and of teachers using feedback from the classroom to further develop their teaching.

Teachers have been found to have strong beliefs about such issues as:

- whether a pupil's ability to learn is fixed or can be changed;
- whether learners benefit more from working with others or from working individually;
- the balance of ownership of learning between teacher and pupils;
- appropriate ways to respond to learners' mistakes and how this might encourage or discourage them from taking risks; and
- the promotion of positive beliefs amongst pupils.

Your beliefs about learning are the foundation upon which you make choices about how to teach and how your pupils should learn. We know from research that some beliefs are deep-seated and 'taken-for-granted'. Such unconscious beliefs are rarely questioned and can have a profound and lasting effect on how you act.

Beliefs act as a filter for noticing and categorising information. They determine how you interpret new information and react to it, whether the new input comes from your pupils' responses to a learning activity, from research, or from theory. In short they are a key determinant of a teacher's approach to their own professional learning.

Can you change your beliefs?

Changing your beliefs isn't easy, but it is possible. It's certainly worthwhile if you become aware of evidence mounting up that doesn't fit your world view. Doing action research or getting involved in coaching, and especially watching and analysing video footage of your teaching, can help you uncover and examine your beliefs – and make big changes to your practice. Monitoring and tracking your pupils' progress can also lead to helpful and evidence-informed reflection on your own practice and beliefs.

Evidence box

See these RfT summaries.

- Effective teachers of numeracy
- Teachers and school-based research
- Making the difference: teaching and learning strategies in successful multi-ethnic schools
- Transforming teaching and learning with ICT
- Learning how to learn through assessment for learning
- Leading staff development in primary mathematics – the role of the mathematics co-ordinator in introducing the National Numeracy Strategy

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How do teachers' beliefs about pupils' abilities influence their teaching?

What do you believe? Is a person's ability in a given area fixed within certain limits, or can it be extended? How might a belief about either viewpoint affect the way you approach teaching and learning?

The evidence from several studies suggests that if you have expectations that all pupils have the ability to learn, you are likely to be more successful in promoting high standards than teachers who believe that ability is fixed. A key problem for teachers who believe ability is fixed and who consequently have low expectations of some pupils is the challenge of monitoring high expectations.

According to the research, teachers who believed that the ability of pupils in low sets was limited actually taught in ways that played a part in depressing these pupils' attainment. With the best of intentions, teachers who had low expectations of 'low-ability' pupils taught in heavily structured ways that were unhelpful when pupils needed to use their knowledge in unfamiliar contexts.

These teachers used:

- a great deal of repetition, practice and 'rote' learning;
- very little discussion;
- a series of closed questions that funnelled pupils unthinkingly towards particular responses; and
- procedures to help pupils reach a 'correct answer' that relied more on using memory than on understanding.

If a pupil persistently failed to grasp a concept, teachers who were positive that all pupils had the ability to learn tried new approaches to overcome this. Teachers who believe in fixed ability were likely to attribute this lack of success to the pupil: for example, they may believe that the pupil was not ready to learn a concept. These teachers then tended to return to practising skills learned earlier. They may also, again with the best of intentions, have set pupils tasks that were too easy and lacked challenge, because they did not want their pupils to become discouraged.

Evidence from a RfT comparing teaching and learning in England and France noted that beliefs about the importance of meeting the needs of individual students is widely ingrained in teachers in England. This was reflected in the greater use of differentiation and group work observed among the English teachers in the study.

Evidence box

See these RfT summaries.

- Effective teachers of numeracy
- Making the difference: teaching and learning strategies in successful multi-ethnic schools
- Inside the literacy hour
- Effective literacy teaching in the first years of school
- Inclusion and pupil achievement
- ICT for teaching and learning
- Consulting pupils about teaching and learning
- Grouping pupils and students – what difference does the type of grouping make to teaching and learning in schools?
- Experiencing Secondary School Mathematics
- Teaching methods in England and France – a comparison

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What do effective teachers believe about pupils working with others?

Do pupils learn better when they can discuss their work within groups of other pupils? Or do pupils learn better when they work on their own, uninterrupted by interactions with others and made to think for themselves?

If you are inclined towards one or the other of these beliefs, you are likely to favour different strategies for organising learning in your classroom.

There is not one single 'right way' of grouping pupils for learning and most teachers use a range of grouping strategies. But there is good evidence that particularly effective teachers believe that structuring co-operative group work is an effective learning strategy. They use this strategy to a larger extent than most, and studies have found positive effects on student achievement.

For example, more effective teachers of mathematics were convinced of the value of pupil discussion with their peers (and with the teacher) about all aspects of mathematics. They believed that group discussion:

- improved pupils' awareness of the relationships between numbers and of different methods of calculation; and
- helped to make pupil assumptions explicit and uncover their misconceptions, which could then be addressed.

Some less effective mathematics teachers believed that individual, practical problem-solving activity was the best approach to help pupils learn mathematics. One result of this belief was that these teachers rarely intervened to compare the effectiveness of different pupil approaches. Because the pupils worked individually, they did not become aware of others' approaches, thus narrowing pupils' sense of possibilities.

Some teachers used what the researchers called a 'transmission' approach. They believed it was important to teach standard procedures and techniques for calculating and for pupils to practise these techniques individually. They rarely asked pupils to work within groups. The study found that their pupils made relatively slow progress compared with the others.

Section 3 of this anthology, **Collaborative group work** (page 20), offers more evidence about how you can promote effective group work and structure small-group discussion.

Evidence box

See these RfT summaries.

- Effective teachers of numeracy
- Effective literacy teaching in the first years of school

There is a great deal of additional evidence on the effectiveness of structured collaborative learning, some of which is summarised online. The topic is covered in much greater detail in section 3, **Collaborative group work**.

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What do effective teachers believe about responding to pupil errors?

Learning something new always involves a lack of control and the probability of making errors, so it can feel a risky business. All but the very youngest pupils fear making a fool of themselves in front of others. As a recently qualified teacher, you'll be especially aware of how vulnerable this learning process can feel, so you'll be able to empathise with your pupils, as they encounter the risky process of learning every day.

According to the research, effective teachers believe that pupils can learn a lot from mistakes and learn most when they take the risk of exposing their ideas to others' scrutiny. In these studies, effective teachers in mathematics and science assessed work carefully and listened to discussion so as to diagnose the thinking that lay underneath pupils' errors. They then explicitly discussed these misconceptions and errors with pupils to improve understanding.

A recent study of post-16 mathematics reported how traditional practices, including students being asked to practise calculations repetitively with the same methods, gave way to discussions about concepts and differing methods. This study highlighted features of practice that had a particularly beneficial effect on student performance and learning, including:

- viewing mistakes as positive – identifying them and using them in subsequent discussions;
- allowing students to develop and justify their own varied methods; and
- encouraging students to set each other problems to solve.

What might this mean in practice?

Few pupils are prepared to take the risk of exposing their ideas if they feel it is not safe to do so. So it is vital that you create a safe classroom environment for discussing ideas and for learning. The research shows how effective teachers created a positive ethos in the classroom and a 'can-do' attitude amongst their pupils. They:

- praised pupils for their effort, attention and achievements;
- taught them to recognise and celebrate other children's achievements;
- prevented misbehaviour by pleasantly redirecting pupils' attention to aspects of their work as soon as they appeared to be distracted; and
- treated guesses and intuitive hunches with respect, as worthy hypotheses that could later be checked by experimentation or analysis.

In the **Assessment for Learning** section of this anthology (page 27) you'll find more detail on how effective teachers make it safe for pupils to expose their ideas for discussion and find appropriate ways to respond to pupils' mistakes.

Evidence box

See these RfT summaries.

- Effective teachers of numeracy
- Learning science – transforming pupils' everyday ideas about science into scientific thinking
- Enquiry-based learning, cognitive acceleration and the spiral curriculum: Jerome Bruner's constructivist view of teaching and learning
- Learning mathematics through collaboration and discussion

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How do effective teachers promote pupils' confidence and persistence?

In the studies featured on the RfT website, effective teachers believed in the importance of promoting pupil self-confidence. One RfT summarises the findings from research about what helps students persist with tasks in the face of difficulties. Key to this is encouraging students to regard challenges in learning as part of the learning process. The research showed that underpinning students' capacities to persist with the challenges lay radically different mind-sets.

Those who believed ability was fixed felt most successful when they outshone other pupils, even when they were not learning much. Those who believed ability was something that could grow felt successful when they were learning, even if others outperformed them.

The study recommended that adults encourage a growth mindset in learners, so that they viewed poor performance on a task as something that could be improved by effort and persistence, rather than as a personal, negative reflection on them. It also recommended that teachers explicitly taught learners:

- about the need to expend time and effort when learning a skill; and
- that initial failure was a healthy sign that a challenge was worth pursuing.

When consulted, pupils said that their confidence in their ability to learn was strongly affected by:

- their perceptions of assessment
- receiving praise
- having someone to talk to about their learning, and
- relationships with friends and families.

But the evidence shows that a specific kind of praise is required (see **Assessment and rewards**, below) – specifically, to give pupils information about their work that highlights its positive qualities and shows that they value effort. Studies summarised in Research for Teachers show this form of praise to be important in building pupils' confidence.

Furthermore, research suggests that you need to give specific, helpful advice on what pupils can do to improve. Instead of comparing pupils, teachers in these studies encouraged mutual support and insisted that pupils listen to one another.

They also:

- scaffolded pupils' work by using explanations, demonstrations, stories and analogies to help them understand relevant language, concepts and skills;
- used a collaborative, questioning approach to learning; and
- listened to pupils and valued their contributions to discussion.

Assessment and rewards

Pupils felt more confident about their ability to learn when they understood how assessment could help them make progress. Where the purposes of assessment were not clear, tests just made pupils more conscious of what they could *not* do than what they could do.

Receiving praise from teachers and parents improved pupils' self-esteem and their willingness to work hard, but the way in which praise and rewards were given was important. Young pupils seemed happy to receive merits or reward stickers in class or during assemblies, but secondary students often found public rewards embarrassing. Pupils of all ages appreciated letters of congratulation sent home to their parents, positive comments written on their work and praise and encouragement in annual reports.

Case study 1 (page 33) shows how a teacher improved the confidence of Year 6 pupils in spelling.

Research shows that the most helpful forms of praise celebrated students' efforts and strategies, rather than personal attributes, such as their 'ability'. A number of key studies proposed that person praise, that appreciated work only as a reflection of some ability, ignored the true merit of what had been accomplished.

This work suggested, for example, it would be better to praise:
- a lovely picture by discussing the choice of colours or formation of textures and images;
- a good story by discussing how the student made decisions about the plot and how they came up with interesting characters; and
- the solution to a maths problem by asking what strategies the student used and admiring the concentration that went into the problem solving.

The evidence seems clear: if you demonstrate your own belief in your pupils and encourage them to do their best, this will boost your pupils' self-confidence and self-esteem. Confidence seems to be catching.

Case study 2 (page 35) explores the impacts of different kinds of praise.

Evidence box

See numerous RfTs and their linked case studies, but especially in the following RfTs.
- Consulting pupils about teaching and learning
- Raising standards through classroom assessment
- Effective literacy teaching in the first years of school
- Promoting students' persistence in meeting challenges
- Learning how to learn through assessment for learning

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How do teachers' beliefs about pupils' capacity for learning influence how they structure teaching and learning?

Much research that explores the process through which teachers change their practice comments that teachers' beliefs have a strongly determining effect on the teaching and learning approaches they used in the classroom.

Research on teachers showed that effective teachers believed that:
- pupils' abilities were not fixed;
- all pupils were capable of learning;
- and pupils already had some knowledge.

Effective teachers also:
- tried to understand what their pupils already knew or believed;
- adjusted or changed their teaching to address particular misunderstandings; and
- persisted in trying a variety of approaches.

Effective teachers in these studies generally believed that activities should challenge *all* children, not just the most able.

As a mathematics teacher put it:
"… I have the same expectations for all the children, I think about it as not so much what the children are doing as what they have the potential to do."

When pupil tasks were open-ended and motivating, teachers were often surprised by just how much their pupils could achieve. This in turn led to higher expectations for the future.

Ownership of learning and pupils' independence emerged in research into teaching and learning with ICT. Teachers planned learning for their pupils that allowed them to decide on their own learning activities, choose resources to help them from books and e-learning materials, including the internet, and create presentations. Changing the teachers' role from being 'founts of knowledge' to being facilitators of learning gave the pupils the opportunity to take responsibility for their own learning.

The findings showed an increase in pupil motivation and performance. For example, a group of Year 9 students made a video about their school in German, for sending to their partner school in Germany. They planned and carried out the project. The teacher noticed that students, who would not normally speak German in class, felt comfortable in front of the camera, and were highly motivated to use the language accurately.

Beliefs about how pupils learn often determine the extent to which learning activities are open- or closed-ended, child- or teacher-centred. For example, John Dewey's approach to learning from experience – what he termed 'experiential learning', and what we would call enquiry-based learning – have become increasingly widely used.

The main features of this approach are based on the beliefs that:

- experience connects learning and challenges learners through continuity and interaction;
- teachers need to ensure that knowledge is experienced by pupils instead of just 'acquired'; and
- reflection helps learners to make sense of experience and identify routes for future action – experience without reflection does not produce real learning.

One study featured in a recent RfT described how teachers' belief in the centrality of children's thinking influenced how they taught.

"They came to believe that their role was not to tell children how to think, but to provide an environment in which children's knowledge could develop as the children engaged in problem-solving experiences and reported on solution strategies."

In one example from the study, children were expected to solve problems such as 24 + 46 in any way they could and to understand how they solved the problem so they could tell their teacher and other pupils about it. The pupils made gains in their learning when compared with control groups.

Case study 3 (page 36) illustrates how a secondary teacher used a child-centred, enquiry approach in geography.

Evidence box

See these RfT summaries.

- Consulting pupils about teaching and learning
- Raising standards through classroom assessment
- Effective literacy teaching in the first years of school
- Promoting students' persistence in meeting challenges
- Transforming teaching and learning with ICT
- Experience in and on action: How do they help learning?
- Curriculum: What effective features of curriculum planning and delivery do teachers use?

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How do teachers' beliefs affect their own professional learning?

There is plenty of evidence that not only do beliefs affect the teaching and learning approaches adopted by teachers in their classrooms but also their own professional learning.

For example, one teacher assumed that learning took place through observation and this belief underpinned her teaching methods. She tended to minimise situations in which her pupils struggled to overcome difficulties. The study commented that it may have been better if the teacher had come to recognise the value of struggling with challenge through a closer examination of her own beliefs about learning.

One RfT describes how teachers' professional development in mathematics was based on the teachers' belief that they could use their pupils' thinking when they tackled mathematics problems as a starting point for their own learning. Teachers got to know how their students were thinking by questioning them, reading what they had written and listening to their explanations.

Researchers have also found that teachers with connectionist beliefs were more likely to experiment with new practices and learn from their pupils. (Connectionist beliefs are based on valuing both pupils' methods and teaching strategies and emphasising connections within mathematics.)

Professional development that helped to move teachers towards a more connectionist standpoint was indentified from this research as:

- establishing an informal, candid and non judgemental culture;
- illustrating the use of contrasting practices;
- asking teachers to 'suspend belief and act in new ways';
- encouraging teachers to meet together and reflect on new experiences; and
- asking teachers to reflect on and recognise the growth of new beliefs.

One RfT emphasises the importance of reflection and analysis for teachers engaged in their own professional development. It proposes that they should:

- see themselves as learners;
- engage in an exploration process that requires them to raise questions, propose explanations, and use observations;
- reflect on their learning with their peers; and
- analyse their practice to help future planning.

In the classroom, it means 'meeting' the children's everyday knowledge that they bring to school and helping them relate this to school knowledge.

Evidence box

See numerous RfTs and their linked case studies, but especially the following RfTs.

- Consulting pupils about teaching and learning
- Raising standards through classroom assessment
- Effective literacy teaching in the first years of school
- Promoting students' persistence in meeting challenges
- Leading staff development in primary mathematics
- Learning mathematics through collaboration and discussion
- Experience in and on action: How do they help learning?
- The impact of collaborative CPD in the classroom
- Teachers' professional learning
- The role of the specialist in the teacher's CPD

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What are some of the implications of the evidence about teacher beliefs for your teaching?

How might the evidence about the beliefs of effective teachers affect you? Here are some questions and ideas that you might like to consider in thinking abut how to use this evidence.

Give pupils the chance to surprise themselves

The evidence highlights the importance of a belief in the elasticity of pupils' ability. What kinds of tasks offer pupils only limited options to show what they can do? What kinds of tasks might offer pupils opportunities to surprise themselves (and you)?

Structure group work

The evidence highlights the importance of structuring group work. What beliefs guide your current approaches to group work? How might these beliefs make you likely to feel when, for example, the noise level in the classroom rises? Would talking to a colleague help you disentangle beliefs about behaviour and learning?

Use mistakes

The evidence suggests that pupils' mistakes can be an indicator of confidence in the learning process and a useful learning tool. How have your beliefs about giving feedback to pupils been shaped by your own experiences of receiving feedback from others? How might you use mistakes sensitively to promote the process of learning?

Your beliefs

The evidence suggests that beliefs can be deeply rooted. When you notice new and surprising evidence, how do you weigh that against your own experience to date and that of others? Have you thought about getting a colleague to observe the way you approach a particular aspect of teaching in the classroom to test your practice and beliefs against the evidence?

Use praise

Praise is a key element in building pupils' self-confidence and willingness to persist with tasks. However, the type of praise you offer is what really matters and praise that reflects the child as a person rather than what they do and how they do it can be counter-productive. What kinds of praise do you give to your pupils and in what circumstances? You might find it helpful to keep a learning log in which to record your use of praise and its impacts for future reflection and action.

Professional development

One RfT describes how teachers' professional development in mathematics was based on the teachers' belief that they could use their pupils' thinking when they tackled mathematics problems as a starting point for their own learning. Could you get to know more about your students' mathematical thinking by questioning them, and asking them to go through their explanations? You could then use what you heard to inform your teaching

Students' reflection

Evidence suggests reflection helps learners to make sense of experience and identify routes for future action. How might you encourage your students to reflect on their learning? Could you ask them to keep a log in which to record what they learned?

Pupils' ownership of learning

Ownership of learning and pupils' independence emerged in research into teaching and learning with ICT. Teachers planned learning for their pupils that allowed them to decide on their own learning activities, choose resources and create presentations. How could you change your role from being a 'fount of knowledge' to being facilitators of learning and so give your students the opportunity to take responsibility for their own learning?

SECTION 2
THINKING SKILLS APPROACHES

What do effective teachers do to promote pupil learning?

In section 1, **What effective teachers believe**, we highlighted some of the beliefs of effective teachers and the relationship between those beliefs and the teaching and learning in their classrooms.

In this section and the other two sections we explore some of what effective teachers **do** to promote pupil learning. We look first at a key area of action for which the evidence of improved pupil learning is both plentiful and sound: improving pupils' **thinking skills**. The evidence for this section is rooted in many RfTs and also draws on wider research.

How do teachers challenge their pupils to extend their understanding and to think and to use their imaginations? Evidence about teaching thinking skills emphasises the importance of encouraging pupils to learn about their learning and to help them transfer learning from one situation into another. This strand of research and practice is sometimes called cognitive acceleration.

What are thinking skills approaches based on?

Over the past twenty years, there has been considerable research into how pupil learning can be accelerated. The range of approaches that has been developed is called 'thinking skills.'

Some approaches use specific subjects to deliver general thinking skills. CASE (Cognitive Acceleration Through Science Education), CAME (Cognitive Acceleration in Mathematics Education) and 'Thinking through …' (for example, geography) fall into this category. Others involve explicit and dedicated lessons in thinking skills. A third group aims to embed thinking skills across the curriculum.

They all share a core of similar techniques for developing thinking skills which we explore further on the next few pages. These are:

- preparation for the task – often known as concrete preparation;
- the setting of a challenge that contains surprises or ideas in tension that perplex or puzzle pupils to make them think – sometimes called cognitive conflict;
- collaborative work with other pupils to solve the challenge- sometimes called social construction of knowledge;
- sharing thinking aloud about their own thinking to raise pupils' awareness of what's involved – sometimes called metacognition; and
- using skills and insights that have just been acquired in one context to consider a problem in a new context – often called bridging.

The process always involves cognitive challenge followed by pupils working with each other to make their thinking explicit, learn from each other and construct a deeper understanding from their separate insights. The teacher listens in on the pupils' discussions to get an insight into their thinking and asks pupils for reasons for their views in order to stimulate metacognition (thinking about thinking).

How have thinking skills approaches benefited pupils?

One two-year programme aimed to increase students' understanding in science. It relied heavily on discussion amongst groups of students to create a new, joint understanding. The students discussed cause and effect, their reasons for making particular predictions, experimental evidence and scientific principles. Their performance in tests at the end of the research period improved and so did their GCSE grades.

Research into teaching and learning with gifted and talented students suggests that strategies that separate out individual pupils from the mainstream class run the risk that the students may feel isolated from their peers. Hence emphasis is being placed on the provision of enrichment activities within the classroom. Enrichment activities that form part of classroom learning may be designed to increase variety and/or pace of learning. They may also include using higher order thinking skills, developing students' enquiry and problem solving skills, and encouraging student independence and intellectual risk-taking.

Another approach is accelerated learning, which is based on Vygotsky's idea that learners can be supported in reaching a level of understanding and reasoning in advance of what they would achieve if left to themselves. Another key feature of this approach is that it intervenes actively at key points in pupils' cognitive development, thereby 'accelerating' their levels of thinking.

According to the researchers who first set up the Cognitive Acceleration through Science Education (CASE) project:

> "It is not what pupils learn, but how they learn it that matters. How they learn depends on their cognitive processing capability, and intervention in the process by which this capability develops is the route to fundamentally improved life chances in the population of learner".

Case study 4 (page 38) examines the improvement of pupils' thinking in a primary school.

Evidence box

See these RfT summaries.

- Effective teachers of numeracy
- Improving learning through cognitive intervention
- Effective pedagogies for gifted and talented students

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How can you provoke your pupils to think?

The approaches used in cognitive acceleration, or thinking skills, owe much to the Russian psychologist, Lev Vygotsky. He was fascinated by children's thinking and believed that they learned best in social situations where their curiosity was aroused by something they perceived as strange or perplexing.

Case study 5 (page 39) shows how a primary teacher used thinking skills to support literacy learning.

Concrete preparation

To make the most of such challenges pupils need to be prepared. Getting pupils ready to make the most out of a task is sometimes called concrete preparation.

Concrete preparation is important in making sure pupils understand the initial problem. Unless you ensure that the terms and vocabulary have a real meaning for pupils, a problem may not be seen as a problem.

> "To someone who has never seen a hat or a rabbit, it is not interesting to see a rabbit pulled out of a hat. For all she or he knows, hats are precisely the place where rabbits live." *(Adey, P. and Shayer, M. (1994) – see Improving learning through cognitive intervention in References below).*

To help pupils achieve this, you need to:

- recap relevant aspects of what pupils have already learned;
- highlight and clarify the meaning of essential vocabulary through discussion with the pupils; and
- help pupils to become familiar with the task and what they have to do.

Setting a cognitive challenge

When you use thinking skills approaches, you need to set pupils a cognitive challenge: a challenge that makes them think. This can be a challenge to someone's usual way of thinking or perceiving the world. It may introduce new information that does not fit with previous experience. The uncertainty arouses curiosity and makes your pupils think. The tasks you set should be interesting and challenging, but achievable with the help of others.

In Vygotsky's experiments with young children, he would challenge his subjects' thinking by introducing obstacles that made it impossible for them to solve the task in their usual way.

In one example of cognitive challenge a Key Stage 1 teacher deliberately introduced shared characteristics to make the task of sorting different objects more complex. She asked her pupils to sort plastic models of animals in a variety of ways by placing them within two hoops.

During the process, pupils were placing all the blue animals in one hoop and all the mammoths in another when they came across a blue mammoth. They were perplexed as to where to put it and discussed various options. Eventually, one child suggested overlapping the hoops and placing the blue mammoth in the overlapping section, so that it was in both hoops.

In a further example, from a secondary school science lesson, pupils investigated the effects of different variables (length, width and type of material) on the note produced when they blew across the top of a tube. The cognitive challenge here was about which variable was the key factor.

A more recent RfT summarised research that described a 'diagnostic teaching lesson':

- exploring students' existing understanding and methods – by tests and interviews prior to teaching;
- provoking and sharing 'cognitive conflicts' – by getting students to compare their responses with those of others, or by asking them to do the same task using a different method; and
- resolving and consolidating conflict – by discussing the new concepts and methods in groups, and then using them on other problems.

This research gave an example where students were asked to choose the correct equation to express this word problem:

'On a trip, one adult is needed for every six children. a=number of adults, c= the number of children. Which of these is correct? a=6c, c=6a, c=a/6, a=c/6.'

The teacher found that each answer had been chosen by at least one student. He used cognitive conflict in a novel way to engage their interest:

"Watch this carefully, because this is an opportunity for you to really get to grips with it. Let's be honest. Out of the group here, we have got someone thinking that each of these is correct. They can't all be."

Cognitive challenge is at the heart of Dewey's enquiry approach to learning. To Dewey, reflective thinking starts with 'some perplexity, confusion or doubt' and requires 'active, persistent, and careful consideration' of what we know about the problem and how we regard it. Immediate information cannot supply a solution, but past experience and prior knowledge can suggest where to start.

Reflection goes beyond accepting the first piece of evidence about a problem. It may mean having to cope with continuing mental discomfort in order to reach a more solid conclusion after further enquiry.

Social construction of learning

"In collaboration the child can always do more than he can do independently." Lev Vygotsky.

Once the pupils have been set the task they work together to solve the challenge, supported by each other, and by you as the teacher. This process is called social construction, because conversation between the pupils and the teachers helps them to build new knowledge and understanding. By engaging in discussion with others, children create a 'dialogue' within themselves in which they check and refine their own thinking.

For example, one study found that secondary science students were more motivated to learn if they were set a task which required them to solve a problem from a real-life context by collaborative discussion. Pupils were less enthusiastic if they received precise instructions from the teacher to carry out a task designed solely to convey a particular point.

In another study a teacher developed a local history project for her class of 8 and 9 year olds in which they had to solve the mystery of the suspected murder of Samuel Whitehouse, who died in April 1822. The project required the pupils to take on the role of history detectives – to think of questions, follow a line of enquiry and make hypotheses. The project was very successful in bringing history to life for these children.

Metacognition

While pupils are working together on a task you can prompt them to say what they are thinking and why. This process of articulating their thoughts leads pupils to become more consciously aware of their own thinking. This awareness of thinking is called metacognition.

The discussions pupils hold whilst tackling the task may well lead naturally in this direction as they explain their thinking to each other. But sometimes their talk will leave their thinking quite implicit. You can encourage improved metacognition by asking pupils to reflect on their learning after the task is completed, during a plenary session.

There are now many examples of thinking skills approaches, usually in the form of complete programmes, such as CASE, CAME (Cognitive Acceleration in Mathematics Education) and 'Thinking through …' referred to on page 14.

However, elements of thinking skills are also apparent in other examples of teaching and learning. For example research on teaching pupils to write more effectively required pupils to set clear goals, to create plans, and to carry out reflection and evaluation of what they were doing, which involves aspects of metacognition.

Case study 6 (page 40) shows how teachers from a North East secondary school used debriefing to stimulate metacognition.

Evidence box

See these RfT summaries.

- Social interaction as a means of constructing learning: the impact of Lev Vygotsky's ideas on teaching and learning
- Improving learning through cognitive intervention
- Learning science – transforming students' everyday ideas about science into scientific thinking
- Strategies for improving students' writing skills
- Experience and reflection in and on action: How do they help learning?
- Learning mathematics through collaboration and discussion

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How can you help pupils bridge learning in the classroom to learning in the wider world?

The final stage involved in accelerating learning is bridging, which is defined as the conscious transfer of a reasoning pattern from its initial context to a new context.

All too often, learning is specific to a situation. Pupils grasp new skills in one situation, but do not make generalisations that help the skills to transfer to other contexts. This can happen even if the context seems quite closely related.

For example, in one study, children in Brazil who often sold fruit on the streets were presented with three types of problem:

- the first set of problems were just like the buying and selling transactions with which the children were familiar;
- a second set of problems were similar but involved different types of goods; and
- a third set of questions removed the context of the problem altogether and set abstract sums like 65 + 49.

(From work by Nunes *et al* (1993) – see Vygotsky RfT in the evidence box opposite)

The children answered almost all the first set of problems correctly, but only three quarters of the second set of problems. They scored an average of less than 40% on the decontextualised questions.

Although the children had mastered some specific numerical techniques, they did not understand the underlying mathematical principles and so were unable to transfer the techniques to different contexts. So understanding why things work – or developing a practical theory is crucial to transfer. You will find that plenary sessions offer you an opportunity to broaden your pupils' understanding by connecting what they have just learned to other situations.

Another method of bridging is simply to offer an example of a similar situation to pupils and give them a few moments to discuss differences and similarities between that situation and the original problem in pairs. It helps pupils to make links between contexts if they have some time for discussion.

Alternatively, you could ask pupils to bring the new insights, skills and knowledge they have acquired from one context to bear on another problem in a new context. The new context could be from within the same topic, from another subject or from everyday life.

For example, in a science lesson, pupils had to control variables as they investigated objects falling under gravity. The teacher reminded pupils of a previous lesson in which they had had to plan an investigation into the conditions necessary for growing seeds. The discussion of the strategies they had previously used to control variables was an example of bridging.

Evidence box

See these RfT summaries.

- Improving learning through cognitive intervention
- Social interaction as a means of constructing learning: the impact of Lev Vygotsky's ideas on teaching and learning

www.gtce.org.uk/teachers/rft

What are some of the implications of the evidence about thinking skills approaches for your teaching?

So how might you act on the evidence from the last few pages about thinking skills?

Introducing thinking skills

If you are not familiar with Thinking Skills approaches could you begin in a small way by introducing to each exercise you set your pupils a requirement that prompts them to think about what they've been doing. This could, perhaps, take the form of a number of set questions like 'What have I learned previously that could help?', 'What is the main idea I am trying to use?', 'Why did I choose this approach?'

Concrete preparation – the vocabulary

The evidence shows that it is important to make sure that you and your pupils share an understanding of the vocabulary used to explain or set a task. How might you plan to pay more attention to the meaning of specialist vocabulary during your introduction to a topic? How can you check your pupils' understanding of a task?

Cognitive challenge

The evidence suggests that real-life problems and surprises can provoke pupils to think. How comfortable do you feel about challenging pupils and allowing them to struggle? Would a belief that this process can be beneficial to pupils' understanding in the long term help you to resist the temptation to step in and help?

Provoking and sharing 'cognitive conflicts' (or cognitive challenge) plays a key part in developing students' thinking skills. How could you build such challenge into some of your lessons? Could you start by getting students to compare their responses with those of others through mini-presentations followed by discussion?

Metacognition

The evidence is clear about the value of pupils thinking aloud, so they can find out and compare what they and others think and move towards new understandings. How could you encourage this process of thinking aloud by modelling it for pupils? How can you help pupils to understand that a suggestion that does not work can tell you as much as a suggestion that does work?

Bridging to everyday contexts

Extending learning across a variety of contexts helps pupils' understanding. How could you encourage pupils to identify everyday contexts in which to apply new learning?

Exploring students' existing understanding

A recent RfT summarised research that described a 'diagnostic teaching lesson' in which the teacher explored students' existing understanding and methods in mathematics. How could you find out what your students already know about a topic? What kinds of tests and interviews could you use prior to teaching?

SECTION 3
COLLABORATIVE GROUP WORK

Why use collaborative group work and small group discussion?

There is strong research evidence that collaborative learning can effectively promote student understanding, increase motivation to learn and enhance competence and self-esteem. Such outcomes were found where teachers in a range of subjects used collaborative group-work as part of the teaching and learning process. For example, there is evidence of this from science classrooms using the CASE approach, from mathematics taught using CAME, Philosophy for Children, Thinking Through History and many others.

In an RfT based on a review into ways of helping pupils learn to improve their writing, researchers found strong evidence that pupils benefited from supporting each other, and showed greater learning gains than comparable pupils who worked independently. Collaborative group work was effectively used by pupils to plan their writing, edit each others' compositions, and check final copies.

In one of the studies in the review, teachers used collaborative working in combination with sentence-combining as an alternative to more traditional grammar teaching. This strategy involved teaching pupils to construct more complex and sophisticated sentences by combining two or more basic sentences into a single sentence. One study described how higher-achieving pupils and lower-achieving pupils were trained to work together to use the strategy, which had a significant impact on the latter's performance.

Why is it important that group-work is structured?

How do teachers who believe that learning takes place when pupils discuss and think more deeply about their work together, support co-operative learning? This strand of research and practice is sometimes called collaborative learning, or when the discussion element is particularly stressed 'dialogic learning'.

But you can't just seat pupils in groups and expect them to work together productively. When pupils are sitting in a group with no specific requirement for them to work together, they are likely to work individually. Many studies have found that it is necessary to teach interpersonal and small group skills explicitly to help pupils interact well and get the most out of collaborative learning.

Some pupils find it hard to formulate and express coherent arguments during small-group discussions. There is good evidence that simple techniques to promote turn-taking and improve listening really help promote students' learning. It also helps to structure the group discussions so that each pupil is exposed to a variety of viewpoints, to stimulate their thinking and give them ideas to reflect on.

Evidence box

See these RfT summaries.

- Social interaction as a means of constructing learning: the impact of Lev Vygotsky's ideas on teaching and learning
- ICT for teaching and learning
- Inside the literacy hour
- Teachers and school-based research

There is a good deal of evidence from other sources about the effectiveness of collaborative group-work and discussion for pupils' learning and we have used some of the findings on the following pages. The NERF evidence bulletins, which can be downloaded from www.eep.ac.uk/nerf/bulletin/index.html, offer simple summaries of key pieces of evidence in this area.

www.gtce.org.uk/teachers/rft

How can you help children improve the quality of their collaborative work?

To ensure pupils collaborate, you have to put them in a situation that requires them to interact and cooperate in order to complete the task or solve the problem.

In collaborative group work, you will be establishing activities that require pupils to:
- work together as a group;
- exchange ideas and resources;
- contribute to group discussions;
- challenge others' reasons and understandings;
- discuss alternatives; and
- accept responsibility for the group's decisions.

The purpose of the task may be to make sense of a range of information, to prepare a group presentation, or to solve a problem that has a variety of possible solutions. The stimulus for discussion could be visual or text-based, but it is helpful if you present a group with a stimulus that presents different viewpoints in order to provoke a variety of opinions from within the group.

For example, there are many possibilities for discussion in geography stimulated by pictures of disasters such as the floods at Boscastle or Lynmouth, and the views of locals and experts about minimising such happenings in the future. Pupils could work in groups to compare and evaluate the various points of view in the light of additional data such as costs, local needs and practicalities, and present their own conclusions to the rest of the class.

In history, pupils studying the Tudors could compare quotes from English courtiers and foreign ambassadors on Queen Elizabeth I as part of their work on facts and opinions.

Case study 7 (page 40) examines the teaching of children how to reason together.

Supportive classroom climate

Effective relationships are key to productive group-work, and the teacher plays an important role in showing what is required of pupils.

Among others, the American psychologist Carl Rogers (1902-87) emphasised that effective relationships lie at the heart of successful learning and creating a successful learning environment. Rogers took his ideas about counselling into education. He argued that the way to create successful relationships is through being genuine, and showing students acceptance and empathy, as they work through learning challenges. Rogers believed it was important to acknowledge students' personal feelings that could promote or disturb learning, such as sibling rivalry, distrust of authority, lack of self-confidence, and generally being able to talk to students at their level.

Rogers found that when he tried to understand his students as learners it completely changed the interaction and the climate of the classroom. He ceased being a 'teacher' (ie directive). Rather he became a 'facilitator of learning' and a co-learner with his students. In order to create a successful learning environment Rogers proposed that teachers needed to incorporate student-focused approaches, including:
- learning through enquiry
- peer teaching
- co-operative learning
- self-assessment.

Methods and techniques that Rogers found to be effective in structuring student learning included:
- building on problems perceived as real, rather than providing pre-determined learning material;
- providing resources, such as a loan shelf of books, speakers from the community or feedback sheets summarising the major problems discussed or resolved in the previous session; and
- identifying objectives clearly, particularly in relation to learning rather than performance.

Research studies associated with his work showed how, when the teacher provided the kind of emotionally-supportive environment Rogers described, students learned more, enjoyed lessons and attended school more often. They were also more creative and more capable of problem-solving, showed more spontaneity, initiative and independence and liked their teacher more.

Furthermore, these benefits were cumulative; the more years in succession that students had facilitative teachers, the greater the gains, both intellectual and affective, when compared with students of traditional teachers.

Evidence box

See these RfT summaries and two studies by Gillies (2004, 2005) (see References, page 54)

- Teachers and school-based research
- Effective Talk in the Primary Classroom
- Carl Rogers and the classroom climate

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What techniques can you use to promote and structure small group discussion?

Many teachers find actually getting started with group work that is effective in terms of process and learning outcomes quite a challenge.

In one study of talk in the primary school, teachers spent a lot of time observing and reflecting on what happened, using video recordings, during group work. They then pooled ideas to identify aspects that they wanted to change and used these to plan the next stage of work. They produced guideline materials to encourage further reflection and changes in practice.

These teachers were particularly concerned about:

- generating greater pupil participation in classroom talk; and
- how to use classroom talk to improve pupils' understanding.

They decided to experiment with paired talk within whole-class teaching sessions. In order to create an expectation that everyone would respond to a question they suggested to pupils that they 'Write down two things that …' or 'Tell the person next to you what you think about …' after which anyone might be asked to share their response with the class.

One teacher said:

"I'd like to develop the idea of exchanging views or write ups with each other and saying whether they are clear or need further work done. The negotiations between pairs are very productive."

The small group discussions needed for effective collaborative work should last several minutes – long enough for all students to have the opportunity to contribute. The time required will increase with the size of the group and the complexity of the task. You can compose groups from clusters of friends and deliberately include pupils with a range of abilities.

Group size can vary from two to eight students. Pairs allow deep discussion, but may not cover a range of views. Larger groups tend to have a greater diversity of opinions, which

helps discussion, but they are more likely to be dominated by a few individuals than smaller groups.

Here are some ways in which you can structure small group discussion and increase the variety of viewpoints that pupils will encounter.

Talking sticks and tokens

Any group will have more and less vociferous members. To make sure that people listen to one another in turn, you can use a 'talking stick'. Only the person who holds the talking stick can speak. Teachers have to keep to this rule, too!

The talking stick can be handed round the group so everyone speaks in turn, or simply passed to a group member who wishes to speak next.

Another way of making sure everyone gets a turn to speak is to give each group member three tokens. Each token represents one opportunity to speak and is dropped into a bowl in the centre when the turn has been taken.

Envoying

Each group of pupils is given a different task, which they discuss. After an agreed time, the pupils are mixed up so that each new group contains one member from each of the original groups. (You can do this by asking members of each original group to number themselves and then ask all the pupils with the same number to form a new group. It works well with five groups of six and then six groups of five, for example.)

During the second group discussion, each member of the group acts as an envoy to report on their original group task.

Snowballing

In a 'snowball' exercise, pairs of students discuss a question or idea and agree on their views. Then they join with another pair to share what they have discussed and aim to reach agreement. These groups of four join with another couple of pairs to share their views.

Jigsawing

In a jigsaw exercise, each member of a group is given one small aspect of a task or topic to study (so they are really working individually to start with). Then each pupil who has read a particular aspect of the work joins others who have studied the same material and they discuss the material together.

After the discussion, each student returns to their original group and teaches their part to the other members.

Case study 8 (page 42) shows how teachers used pair work in whole class teaching and learning to initiate classroom dialogue.

Evidence box

The evidence on this page comes from two systematic reviews of the use and nature of small group discussions in science (Bennett et al, 2004, 2005; see page 54), and this RFT:

- Effective talk in the primary classroom

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How can you encourage more effective dialogue in group work?

Pupils need specific training and support from teachers to get the most out of cooperative group learning.

Students need to be taught:
- to ask questions;
- to be active and persistent in seeking help from their peers;
- to give help that is detailed; and
- to check that the help given is understood by the recipient.

You can help pupils to learn how to do this by modelling the types of verbal exchanges that encourage pupils to express ideas, explain reasons and solicit help. Here are some of the skills you will wish to encourage amongst pupils, followed by comments or questions that exemplify them.

- Reflecting meaning – "It sounds as though …"
- Challenging and probing thinking – "What makes you think …?"
- Offering tentative suggestions – "Have you thought about …?"
- Focusing on key issues – "What have you decided is the main problem here?"
- Focusing on solutions – "What might you need to do now to find the solution?"
- Validating efforts and ideas – "What an interesting suggestion!"
- Encouraging consensus – "Have you discussed this with the others?"
- Clarifying options – "So you've decided you could try it this way or that way …"
- Reframing statements to help pupils consider an alternative view – "On the one hand, I hear you saying … but on the other hand, you seem to …"
- Seeking other opinions – "What do you think?"

When teachers support small group discussion, their language tends to be more personal, friendly and supportive than it is in whole-class settings, when they tend to spend more time directing, lecturing and disciplining students. So you may wish to adopt an informal style of verbal interaction with pupils when you want to support their discussions.

What challenges arose in relation to changing classroom talk?

A number of studies covered by RfTs have highlighted the tendency for teachers to engage in pupil-teacher interactions which simply iterate from one to the other and are not conducive to effective classroom dialogue.

Teachers themselves had observed this tendency and deliberately tried to change these patterns. They followed the example of one teacher who responded to pupil interest in a discussion of capital punishment by asking them to talk in pairs for one minute, rather than simply respond. This had the effect of getting everyone actively involved in the lesson.

Teachers also broke the teacher-pupil-teacher-pupil pattern of discourse by:
- inviting other pupils to respond to something one of them had said;
- allowing pupils to answer one another directly;
- leaving silence and allowing more time for pupils to think about an answer;
- encouraging one pupil to make several responses to a question; and
- avoiding the habit of repeating each child's contribution.

Other research showed teachers tackling the problem of limited interactions in another way.

One RfT featured research into pupils' talk during learning activities. Teachers, supported by researchers, aimed to move pupils from disputative talk (mainly argument without agreement) and cumulative talk (characterised by adding to each others' views) to exploratory talk (construction of new knowledge). They showed how educational software could help encourage pupil interaction among reticent pupils.

Recognising that many classroom exchanges between teachers and pupils were of the form IRF (I = initiation, R = response, F = feedback,) the teacher researchers sought to extend the

exchange by including pupil discussion (D). So the sequence would now be IDRF.

They gave examples of pupils using educational software which transformed classroom dialogue by prompting the children to discuss their response together – the IDRF exchange. During their discussion, pupils came up with ideas and supported them with reasons before testing them out on the computer. The study suggested that the computer, as a non-human and therefore non-judgemental medium, for some children, provides a "safe" environment for them to engage in dialogue.

Research featured in RfTs has also highlighted the key role of the teacher in classroom dialogue. An essential part of this is being alert and ready to make split-second responses to pupils' answers at "critical moments" when, for example, pupils gave an unexpected answer that indicated a gap in their understanding.

This aspect of teacher behaviour is very similar to Donald Schön's *idea of reflection-in-action or "thinking on your feet".* Donald Schön (1930-97) was an American philosopher who researched and wrote extensively on reflective practice and learning.

Teachers' responses to critical moments determined the course of subsequent discussion, but video recordings of classroom exchanges showed it was rare for teachers to use these occasions to explore the pupils' thinking. They more often tried to make sure that the class continued to follow the teachers' pre-planned teaching objectives, by, for example:

- ignoring answers they felt were unhelpful;
- overtly redirecting pupils to the 'hoped-for' answer; or
- guiding them back to an aspect of the topic they wanted to consider.

The outcomes of such exchanges were missed opportunities to discover the learning implications of what the pupils had said. Watching the videos made teachers more aware of what was happening and they determined to do something about it.

Our RfT on reflection explored Schön's crucial insight that in real world situations there is the ever-present potential for surprise to occur. He emphasised how "reflection-in-action" involved

> "looking to our experiences, connecting with our feelings, and attending to our theories while we are engaged in practice. It entails building new understandings to inform our actions in the situation that is unfolding."

Case study 9 (page 44) shows how teachers worked together to develop their skills in promoting a more dialogic approach to teaching and learning of mathematics.

Evidence box

See these RfT summaries.

- Raising achievement through group work
- Experience and reflection in and on action: How do they help learning?
- Effective talk in the primary classroom

Further evidence comes from two systematic reviews (Bennett et al., 2004, 2005; see References, page 54) of the use and nature of small group discussions in science.

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What are some of the implications of the evidence about collaborative learning for your teaching?

So how might you act on the evidence from the last few pages about collaborative learning?

Rules for group work

It is important that pupils share expectations and understand clear guidelines on how to behave during group discussions. We've provided some examples of effective techniques but there are many more. Are any of your colleagues particularly effective in pupils' group-work? What have they found to be effective ways of negotiating agreed rules of behaviour with their classes? How can you share and build on this knowledge when you work with your students?

Appropriate tasks

There is much evidence of the value of truly collaborative learning. What types of task have you found most productive for encouraging students to use the perspectives of all group members when working together on a problem?

Promoting students group work skills

The ability to ask open-ended questions, to allow sufficient time for thought before gathering answers and to promote extended responses by asking for reasons and explanations all help teachers to promote effective collaborative learning. How can you expand and highlight the ways you model these skills for your pupils?

Computers and students' dialogue

Research featured in the 'Raising achievement through group work' RfT gave examples of pupils using educational software which transformed classroom dialogue by prompting the children to discuss their response together – the IDRF exchange (Initiation, Discussion, Response, Feedback).

How could you use such software to get the quieter pupils started on group-work?

Including different viewpoints in group work

The evidence suggests that pupils can learn much from encountering a variety of different viewpoints. If you don't already, could you use envoying or snowballing strategies to structure discussion beyond friendship groups and to enable pupils to become aware of a wider range of opinions?

Assigning pupils' roles in group work

Working together in a structured way is unfamiliar to many pupils. If you do not already do so, could you give pupils specific roles when they carry out group work, such as chair, information officer, summariser, in order to organise their work more effectively and to help them structure discussion?

Teachers and 'critical moments'

An essential part of promoting dialogue is teachers being alert and ready to make split-second responses to pupils' answers at "critical moments" when, for example, pupils gave an unexpected answer. How could you further develop your skills in this respect? Would it help to work with a colleague to identify a bank of possible responses and to observe each others' pupils' responses which you then try out?

Using opportunities to promote dialogue

Teachers in one study found that during class discussion they often tried to make sure that the class continued to follow their pre-planned teaching objectives, by, for example, ignoring answers they felt were unhelpful, etc. and so missed chances to develop dialogue with pupils. How aware are you of these tendencies? Could you ask a colleague to observe or video one of your lessons in order to investigate this further?

SECTION 4
ASSESSMENT FOR LEARNING

How can assessment for learning improve pupils' achievement?

Gathering accurate information about each pupil's learning and using this to adjust teaching so that it matches pupils' needs better is at the very heart of effective teaching. This process is called formative assessment, or assessment for learning (AfL).

The evidence that assessment for learning raises standards is strong and extensive. For effective learning to take place pupils need to understand what they are trying to achieve and how to achieve it. Involving pupils in their learning helps them to develop effective behaviour for learning – they learn how to learn.

How do teachers use assessment to inform their teaching and to improve their pupils' learning?

Such teachers involve pupils in the process of assessing their own learning by giving them the tools that they need to take charge of their learning and identifying the steps they need to take to make improvements.

One systematic review of hundreds of research papers on assessment showed that, although the use of assessment to improve teaching and learning could be highly effective, it was relatively rare. Types of assessment that emphasised marks and grades, compared one pupil against another, or measured pupils' achievement at a given time against externally agreed standards, were much more common.

The review found that formative assessment led to substantial learning gains, especially among low-attaining pupils and those with learning difficulties, if the teachers in the studies improved two-way feedback between pupils and teachers by:

- improving questioning and the quality of classroom dialogue; or
- changing the way in which they marked work.

They also:

- ensured that they adjusted their teaching to take account of what they had learned about their pupils from the assessment process; and
- helped pupils to develop self-assessment skills and thus to become more independent learners.

Another study featured in an RfT argued that the effectiveness of AfL practices was underpinned by a key belief about pupils' learning. All the teachers in the study who captured the underlying principles of AfL practices spoke of the value they placed on pupil autonomy. They believed all pupils had the capacity to learn and saw helping pupils to learn as their responsibility – that it was their responsibility if learning did not take place.

For example, one teacher explained:
"… sometimes you prepare the lesson which isn't appropriate for the pupils. It's over their head or it's too easy and that sometimes prevents learning from taking place … You might be able to control the situations so they complete the task, but they haven't actually learnt anything because it's too complicated and they didn't get the hang of it or it was too easy and it was something they could dash off".

Case study 10 (page 46) considers the features of assessment for learning one group of students found to be helpful.

Evidence box

See these RfT summaries.

- Raising standards through classroom assessment
- Assessment for learning: putting it into practice
- Learning how to learn through assessment for learning

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How can you use questioning techniques to help you match your plans to your pupils' starting points?

Using assessment to improve learning depends on improving the quality of the dialogue between you and your pupils, so you can understand where your pupils really are and then help them to move forwards.

One RfT featured a study which pointed out the link between AfL and thinking skills. If pupils are to really contribute to an effective dialogue with their teacher about the next steps in their learning, they need to be able to analyse their learning, which involves metacognition. This can include relating what you are learning to what you already know, monitoring whether you understand something or not, and evaluating and revising the strategies you've used.

Teachers can help pupils enact these higher-level strategies by framing questions to direct pupils' attention and giving pupils opportunities to think strategically and reflect on their learning.

Case study 4 in the group work RfT (see References section) gives examples of ways of challenging children's thinking and promoting meaningful engagement with the task.

Teachers often leave less than a second after asking a question before asking another question or answering their own question, if no answer is given by a pupil. The only sort of questions that can be answered in such a short time are those needing little thought, so this short 'wait time' results in superficial classroom dialogue. Such exchanges can appear to raise the energy level in the classroom and many teachers mistakenly believe that asking a series of closed, quick-fire questions increases the pace at which pupils work. The practice is deeply embedded in most teachers' repertoire of techniques and it is difficult to change.

Although it can be helpful to use questioning to find out what pupils know, according to the evidence the key functions of really effective questioning are to:

- provoke pupils to think; and
- elicit information that the teacher needs to plan next steps accurately.

The aim is one of thoughtful, continuous improvement, rather than getting it right first time.

If you give pupils a wait time of several seconds it allows them time to think. It also enables all pupils to be ready to answer. All answers, whether right or wrong, can be discussed and used to develop understanding. According to the evidence, effective questioning is a key element of good quality, whole-class interactive teaching.

Teachers trying out more effective questioning techniques found it useful to:

- take time to frame questions that were worth asking because they developed pupil understanding;
- extend the silence after asking a question to allow pupils to think;
- discourage the practice of using 'hands up' to indicate that a pupil knows the answer and instead, expect everyone to be prepared to answer, possibly after discussion in pairs; and
- ask pupils to explain the reasons for their answers.

Pupils could take time to adjust to the new style of questioning, but came to realise that learning depended less on their capacity to spot the right answer and more on their readiness to express and discuss their own understanding.

Case study 11 (page 47) gives an example of the way in which effective science teachers used questions and discussion to assess their pupils existing understanding and then to tailor their teaching more closely to their pupils' needs.

Evidence box

See these RfT summaries.

- Raising standards through classroom assessment
- Assessment for learning: putting it into practice
- Learning how to learn through assessment for learning
- Learning science: transforming students' everyday ideas about science into scientific thinking

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How can you mark work so as to improve pupil attainment?

The original research found that the most effective feedback to pupils made them think. This was best achieved by making comments that:

- identified what had been done well;
- identified what still needed improvement; and
- gave guidance on how to make that improvement.

Making this manageable

The follow-up research found that teachers needed to plan opportunities for pupils to follow up and act on comments, for example, by using some lesson time to allow pupils to redraft their work.

Teachers in the follow up study also monitored pupils' responses to comments. Rather than trawling through books to check pupils had followed up her comments, one teacher stuck a comment sheet at the back of her pupils' exercise books. She used the left-hand side of the sheet for her own comments and asked pupils to indicate on the right-hand side where in their books they had responded to her comments.

The evidence showed that the widespread practice of giving marks and grades for work **judged** pupils' work but did not explain to them how they could improve it. Moreover, it emphasised competition and tended to ` pupils who did relatively badly.

When the classroom culture focused on rewarding high quality work and emphasising pupils' relative position in the class, pupils looked for ways to obtain the best marks and avoided putting themselves in situations where they might fail. Low achievers often learned that they always did badly and concluded that there was no point in trying. The overall result was to increase the extent of under-achievement.

When both grades and comments were given, pupils were found to focus more attention on their grades. They often ignored the written comments that could have helped them to improve. So the researchers recommended using comment-only marking and not awarding grades at all.

Some teachers were nervous about this, fearing that pupils, parents, or Ofsted inspectors might react unfavourably. But negative reactions to comment-only marking were very rare. The comments seemed to help parents, as well as pupils, focus on the learning issues, rather than on trying to interpret a grade or mark.

Effective marking and good dialogue with pupils helped teachers to find out more about their pupils' learning and to use this as a basis for planning learning objectives that matched learners' needs; the key to making assessment formative rather than summative.

One of our RfTs looked at how teachers developed the curriculum in creative ways that matched more closely their students' learning needs. This RfT described a study in which a mathematics teacher explored her students' thinking and used what she heard to decide on the students' next steps in learning:

"She [a teacher] kept extensive notes about each child's thinking and used her notes to write problems to fit what she knew."

The same RfT also featured a chemistry thinking skills programme which began with the teachers interviewing each student in order to probe their understanding about chemical reactions.

Evidence box

See these RfT summaries.

- Raising standards through classroom assessment
- Assessment for learning: putting it into practice

www.gtce.org.uk/teachers/rft

How can you use assessment to help pupils become more independent learners?

One of the key aims of assessment for learners is to help pupils become independent learners. This is an important step towards developing effective behaviour for learning of pupils in that it encourages self-regulation, promotes efficient use of feedback, and supports pupils in gaining greater control of their learning.

To encourage independent learning you need to support pupils in developing their understanding of and skills in self-monitoring their work against the appropriate learning goals in the various subjects they are studying. This involves a number of processes including understanding the criteria and developing skills in applying them to others' and their own work

Improving pupils' understanding of assessment

To gain any measure of control over whether or not they achieve a learning goal, pupils need to understand both the goal and what they need to do to achieve it. Showing pupils an example of 'one I made earlier' helps them to recognise when they have succeeded.

You can help pupils to get a clearer picture of what they are aiming for by letting them discuss several examples of finished work and discovering in the process what it is about a finished product that makes it good (or not so good). This process uncovers the assessment criteria that teachers use which are usually invisible to pupils.

Scaffolding

You can make it easier for pupils to reach their learning goals by splitting up a big task into several smaller ones and providing support such as prompting questions. This process is called scaffolding and can be used for a variety of complex tasks, such as writing a story, or designing an experiment.

But an important aspect of scaffolding is that it is eventually removed. You can take pupils through this process by giving them fewer prompting questions as they gain experience of a task. You can also foster your pupils' independence by explicitly teaching them how they can split big tasks up into smaller tasks for themselves.

In our RfT based on helping students to write better, researchers found that systematically teaching pupils strategies for planning, revising, and editing their work had a high, significant, impact on writing achievement.

They described the strategy used by these effective teachers, including:

- teaching pupils how to memorise the writing strategy using a mnemonic such as PLAN (Pay attention to the prompt, List the main idea, Add supporting ideas, Number your ideas) in order to support planning;
- teacher supporting pupil learning of the strategy by, for example, constant reiteration of the process, that could be reduced as the pupil gained greater understanding; and
- pupils independently using the strategy.

Peer assessment

Peer assessment can be an effective way to help pupils understand their learning goals and how to meet them and to develop the detachment required for self-assessment.

In peer assessment, pupils:

- used the same language;
- were likely to interrupt an explanation they did not understand;
- accepted criticisms more readily;
- were motivated to work more carefully;
- could provide each other with models of achievement;
- learned by teaching one another; and
- had the opportunity to clarify what they understood and this improved their communication with their teacher about their learning.

Peer-assessment activities gave teachers time to observe, reflect and frame helpful interventions.

Case study 12 (page 49) examines peer- and self-assessment in creative writing.

Teachers used a variety of strategies to develop their pupils' peer and self-assessment skills. One simple method was to ask pupils to indicate whether they thought they had a good, partial or little understanding of a topic using a green, amber or red 'traffic light' code. The teacher then paired up the pupils self-rated as amber and green so they could help each other improve their work and worked with the remaining group of red pupils.

Increasing pupils' ownership of learning

Research has shown that whilst most teachers adopted AfL procedures or techniques, such as sharing quality criteria with learners, only around 20% did so in ways that helped their pupils to become more independent learners.

One example showed two English teachers, both of whom adopted the same formative assessment procedures: sharing the criteria with the learner and peer and self-assessment. But, crucially, one teacher gave her pupils more autonomy by asking them to create their own criteria for judging a piece of writing, which they discussed and refined with the teacher, rather than presenting them with criteria.

Such shifts in teacher practice involve changes in understanding, values and attitudes as well as behaviour for both pupils and teachers, points which are made in the work of Carl Rogers, also featured in an RfT summary. In student-focused learning environments, he suggested, students would be producers of ideas. Students would be encouraged to become engaged through collaborative learning activities, peer-teaching, field trips, projects and classroom talk that requires multiple levels of thinking. They would create new ideas and materials through projects, talk aloud about the way they derived an answer and take the initiative to interact with teachers and peers.

To Rogers, the kind of interpersonal relationship the teacher had with their students was fundamental. He believed the way to create successful relationships was through being ethical, honest and open, and treating others with acceptance and empathy. However, he also believed the teacher had to adhere to the standards required of students.

He told his students:

"Give yourselves the grade you think is fair, but I … must [also] sign the grade sheet, giving it my approval, so I believe the grade must be mutually acceptable. If I find a discrepancy between my subjective evaluation of your work and your subjective evaluation, we will discuss it together and try to agree on a reasonable grade."

There were reportedly few cases in which students' marks were revised downwards.

Giving pupils complete autonomy is clearly a bridge too far, but many teachers are using negotiation about learning aims with their pupils in order to increase their independence as learners. As an example of this, **case study 13** (page 50) illustrates how a primary teacher adopted this approach.

Evidence box

See these RfT summaries.

- Raising standards through classroom assessment
- Assessment for learning: putting it into practice
- Effective literacy teaching in the first years of school
- Learning how to learn through assessment for learning
- Carl Rogers and the classroom climate

www.gtce.org.uk/teachers/rft

What are the implications of the evidence about AfL for your teaching?

So how might you act on the evidence from the last few pages about assessment for learning?

Understanding students' starting-points

Effective teachers know not only where they want to get to, but understand where their pupils are starting from. To what extent might you adopt day-to-day assessment to discover exactly where your pupils are in their learning?

Sharing assessment criteria

Effective teachers help pupils understand the criteria by which they can recognise quality in a piece of work. Might it empower pupils to take more responsibility for their own learning if you gave them a series of examples to compare and analyse? Could you design check sheets for pupils to use so that they can begin to assess and edit their own work? Could one way of helping your students understand the purpose of assessment be to ask them to create their own criteria for assessing a piece of work and then compare it with those of others and those published by awarding bodies?

Comment-only marking

Teachers were often worried about how others would react to comment-only marking. Might it help to discuss this issue with colleagues, pupils and parents, so that everyone understands why this process is useful? Would it be helpful to take feedback from pupils after a few weeks of comment-only marking in order to see how pupils responded?

Promoting independent learning

Assessment for learning was effective when teachers gave pupils activities that offered them scope to think for themselves. Would you find it helpful to investigate how far the activities you offer your pupils promote independent learning? You could, for example, work with a colleague to observe each other's lessons, noting how the pupils make use of what they learn from one activity in the next.

Believing in pupil autonomy and showing this in interactions and dialogue with pupils made a difference to whether or not pupils became independent learners. How and when do you encourage students to be more independent in their learning? Would you find it helpful for future reflection and action to ask a colleague to observe a lesson and note down two or three instances when you promote pupils' independence? They might then indicate other opportunities for doing so that occurred during the lesson.

Pitching learning at the right level

Teachers who really engaged with assessment for learning believed all pupils had the capacity to learn and saw helping pupils to learn as their responsibility – that it was their fault if learning did not take place. How do you avoid pitching lessons over the heads of pupils or making it too easy? Would it be helpful to discuss this issue with subject colleagues who may have faced the same challenges?

CASE STUDIES

Case studies of effective teachers at work

We have included three independent case studies taken from our RfTs that show how teachers have implemented effective strategies for learning, based on our model of what effective teachers believe and what they do to improve teaching and learning. They are all based in everyday classroom activity – so they can help you to see how you might adapt some of the evidence for your own context. The case studies presented here illustrate how you can boost children's confidence, their willingness to persist with tasks and help them become independent learners.

Case study 1
Improving spelling confidence

We chose this case study because it provides an example of how a teacher boosted her pupils' confidence with spelling by encouraging a 'can-do' attitude. (The need to build pupil confidence is discussed on page 9.)

The study focused on seven Year 6 pupils who displayed haphazard spelling, low self-esteem, little enthusiasm for writing and below average writing skills. These pupils were identified as failing to make as much progress as their peers. They were taught literacy with a group of seven Year 5 pupils who had similar attitudes and ability.

Before the study, feedback in the form of weekly spelling tests had had a demoralising effect on these pupils and did not help them identify their weaknesses. The pupils were taught to use a different, specific way of learning spelling - the Dilt 'magical spelling' or visual memory strategy. The strategy is based on the way 'good' spellers spell. Good spellers write or think of a word and then check it against a 'dictionary' they have in their visual memory. If the word is the same as the one in their 'visual dictionary' they get a feeling that tells them it is correct.

The magical spelling strategy formed part of the spelling focus within the literacy hour several times each week. The teacher taught five or six spellings a week using the following format.

- The teacher held a card with the correct spelling written in lower case letters.
- The pupils imagined something 'good' whilst looking at the word.
- The teacher then held the card to her left and encouraged the pupils to look at the spelling, whilst maintaining the good feelings.
- The teacher slowly removed the card from view, but encouraged the pupils to keep picturing the word.
- The procedure was repeated, but when the card was removed, the pupils were asked to write down the word.

- Next they were asked to decide whether they thought they had spelled the word correctly.
- Finally the pupils checked the word, marking each correct letter with a tick - helping the pupils to reflect on the "hard spots" within mis-spelt words and giving pupils the opportunity to analyse where their particular spelling difficulties lay.

The pupils were also given dictations to assess their spelling accuracy and emphasise the good feeling being promoted within the magical spelling sessions.

The teacher reported improved enthusiasm from the group – the pupils became increasingly positive about the literacy hour and much more willing to write. The children reported feeling much more positive about learning spelling. For example, one girl before the study had said:

"I'm a mediocre speller. It sometimes worries me. I may not get a good job if I don't spell well. If there are lots of mistakes in my work I feel ashamed."

At the end of the study, the same girl said:

"I like learning my spellings the new way - magical spelling. It's easier to remember them. I can see the words in the air."

The teacher thought the spelling strategy contributed to the pupils' improved self- esteem and performance because:
- the strategy emphasised to the pupils that they were acquiring a very effective strategy for learning to spell – they believed it was helping them;
- marking their own spellings gave the pupils responsibility for their own learning; and
- having only five or six words to learn meant the pupils felt they were succeeding more often, reinforcing their belief that the method was working.

Factors other than the specific spelling strategy may also have played a part in increasing the pupils' confidence. For example, the teachers' enthusiasm for the project, their belief in the strategy and in the pupils' ability to learn, the smaller group size, and the more relaxed atmosphere may all have helped to make the strategy effective.

Reference

Howells, A. (2002) *Improving classroom practice - Focus Spelling* Best Practice Research Scholarship (BPRS) research project. Available at: **www.teachernet.gov.uk/_module/bprs/level2/docs/Best Practice Research Scholarship.doc**

Case study 2
The usefulness of specific praise

This case study investigated the impact of different types of praise. It showed that praise that provided informative and specific feedback on the processes and outputs of pupils' work helped to promote effort, persistence and progress. It involved four teachers in two English primary schools and 109 Year 4 pupils aged eight to nine years.

The researchers introduced the teachers to two different types of praise, which they called positive praise and specific praise. The teachers then used one of the two types of praise during daily numeracy lessons with their class. Each type of praise was used by two of the teachers.

Positive praise expressed approval, affirmed a correct answer, or gave general, positive reinforcement for aspects of behaviour: for example, 'well done', 'nice job' or 'clever girl'.

Specific praise expressed approval and also explicitly linked the praise to actions taken by the pupil. It described precisely the behaviour or aspect of work that was being praised: for example, 'it is clear that your essay was thoroughly researched and it provides quality evidence to support your conclusions'.

The study found that both types of praise increased the time pupils spent concentrating on their work and seemed to make them generally happier.

In addition, the specific praise helped pupils become:
- more aware of what made them successful at tasks;
- more capable of dealing positively with failure when they received explanations about successful academic performance;
- more open to challenge and willing to attempt difficult tasks; and
- more settled during group work.

The teachers involved in the study reported that they had become more aware of the praise they gave and that they praised pupils more frequently. Although they found it easier to praise groups than individuals, the study helped them pay more attention to precisely who and what they were praising.

Reference

Chalk, K & Lewis, A. B (2004) Specific Praise Improves On-task Behaviour and Numeracy Enjoyment: A study of year four pupils engaged in numeracy hour *Educational Psychology in Practice* Vol. 20 (4), pp.335-351
An online summary of this study is available at:
http://networkedlearning.ncsl.org.uk/knowledge-base/bibliography/research-summary-praise-be-the-effects-of-praise-on-student-behaviour.doc

Case study 3
Facilitating learning enquiry through questioning

This case study illustrates how a teacher prompted pupils to use an enquiry approach, of the kind associated with the work of Dewey, to explore the San Francisco Earthquake of 1989. It shows how getting students to think about what they wanted to know became a key part of the pupils' learning and helped them construct effective questions.

The activity was undertaken by a group of Year 9 pupils in a comprehensive school in the north-east of England.

How the teacher helped pupils create appropriate questions for their enquiry

The teacher used an approach known as the Five W's (or what? where? who? when? why?). It encouraged pupils to:
- consider what information they wanted and design appropriate questions to help them find the answers;
- plan how they are going to use the information before they get to it;
- reflect on why they chose the questions they used; and
- consider whether they deployed the questions to best effect.

Pupils were prompted to think about what they needed to know and why they needed it before going into the available resources. They were helped to see that the available data may not answer all the questions and that some of the data might not be relevant to the task. The teacher did this to combat dependency that arises when teachers provide exactly and only the data that pupils need.

How the pupils engaged in enquiry

The teacher asked the pupils to:
- think up some question words such as what, who, etc …? in pairs and share their questions with other groups (by doing this the pupils arrived at the five Ws);
- imagine themselves as journalists travelling to the scene of an earthquake in San Francisco and preparing questions that would best help them find out about and understand the earthquake so they could write reports for their newspaper. (Each pupil or group of pupils also provided one exemplar question that was put on the board to help pupils who were having difficulty);
- prioritise their questions; and
- study an article about the earthquake to find information. The teacher suggested they use other resources for homework.

The teacher circulated around the groups monitoring progress and offering support, by, for example, giving pupils the stem of a question such as 'Does anyone think it would help if we knew something about …? and prompting them to compose questions for themselves. The teacher then invited them to fill in the gaps with their own ideas.

Another example occurred when the teacher narrowed down broad questions like 'What effects has the earthquake had?' to 'Who was affected?' or 'What was affected?' In some groups the teacher mediated group discussion.

How the teacher helped the pupils to reflect on their work

A key feature of the lesson was a debriefing session in which the pupils fed back comments and reflected on their work. The teacher stimulated their thinking with lead questions as shown in this example.

Question: How did you construct your questions?
Pupils said: 'We thought about the information that readers would want to know and made up questions which would help us find this out.'
'We made sure the questions would give us clear answers.'

Question: How did you decide that a question was important enough to include?
Pupils said: 'We checked to see if the question related to the information we needed.'
'We chose questions that would pull the information together.'

Question: What makes a good question?
Pupils said: 'One that needs more than a one word answer, like an explanation.'

Pupils also made suggestions for transferring this approach. Examples included:

- other geographic phenomena such as volcanoes;
- in history, 'when you have to find out what happened'; and
- in science, 'when you have to develop your own experiment'.

The pupils' written work showed a range of quality from low-level, simple narrative accounts to high level reporting that linked cause and effect, explained processes and made judgments about human responses to the earthquake. Pupils began to group questions around related themes, for example: 'Where was the worst damage? What kind of damage was done? Why were some buildings affected worse than others? Who checks how they are built?'

Reference

Leat, D. More Thinking Through Geography Cambridge: Chris Kington Publishing, 2001, pp 54-58

Case study 4
Improving pupils' thinking in the primary school

We chose this case study because it exemplifies how different thinking skills strategies were successfully applied in one primary school. This links to the discussion of thinking skills on page 14.

The project aimed to develop effective thinking strategies across the curriculum and it was closely linked with the five thinking skills of the national curriculum 2000. The school used a number of strategies, including:

- the use of thinking logs in which children could record questions, ideas, mind maps and personal reflections;
- reading and discussing stories and poems in the literacy hour that had been designed to prompt philosophical discussion and higher order thinking;
- discussions in the numeracy hour aimed at improving pupils' understanding of what they had learned (metacognition) in mathematics;
- the use of pupil questioning, mind mapping and conceptual thinking in science;
- promoting discussion to develop thinking skills in PSHE and citizenship;
- applying 'Thinking through art' to develop visual literacy and creative thinking; and
- the inclusion of a thinking skills strategy in plans for all lessons.

Findings from this research project indicated that it improved pupils' skills in:

- listening;
- questioning and enquiry;
- critical reading;
- communicating ideas;
- self-expression;
- verbal reasoning;
- creative thinking;
- concept-building and mapping; and
- co-operative discussion.

The study also reported that the approach improved pupils' self-esteem and level of achievement and made them more aware of issues in citizenship. It also boosted teachers' professional confidence and self-esteem.

For the full report see: The Queen's Beacon School thinking skills project, R Fisher, Summary paper for the TTA/DfEE, Teacher Research Conference, March 2001.

Case study 5
Supporting young children's literacy development

This case study illustrates how a primary teacher set out to improve Year 1 children's comprehension of literacy texts and encourage wider participation within the class through speaking and listening. She also wanted to explore the use of thinking skills strategies when teaching literacy.

During the first (pilot) phase of the project the teacher tried two thinking skills strategies. The first thinking skills strategy was called 'Community of Enquiry', following the 'Philosophy for Children' programme devised by Matthew Lipman. The children shared a selected text by having the book read aloud to them. Then they generated questions, arising from their understanding of that shared text. These questions were then used as a basis for a communal debate. Techniques such as evidence-based comments were encouraged, such as 'I agree with … because …'

The second strategy was the 'odd one out' strategy, which is based on the skill of categorisation and comparison. The children listened to a story and then selected three main characters. They then identified similarities and differences between the characters, first working in pairs and then sharing their ideas with the whole class ('think-pair-share').

After the pilot phase, the teacher decided to use the odd one out strategy as this had produced a wider range of participation. Ten sessions of odd one out thinking strategy were carried out and the results compared to standard literacy teaching, which does not employ thinking strategies, in the control class.

The teacher researcher found that:

- the children could learn how to take turns in a discussion and give feedback within a structured activity, but these skills needed to be taught explicitly, they were not simply picked up through the everyday activities in the classroom;
- young children, aged 5 and 6, were able to compare and contrast characters in stories, identifying a range of characteristics through the odd one out strategy; and
- using adults to scribe for young children enabled them to articulate their thoughts explicitly.

The teacher summed up that the main benefit of using thinking strategies was that the children realised that discussing a story helps understand it better.

Reference

Anderson, B. *Can thinking skills offer a framework to support young children's comprehension in literacy?* **www.standards.dcsf.gov.uk/ntrp/publications/**

Case study 6
Using "debriefing" in a north-east secondary school

This study shows how debriefing was used with secondary school pupils to stimulate metacognition, which is discussed on page 17. Debriefing was a strategy used to get pupils to talk about their solutions to geography tasks and to explain how they carried out the tasks. The activity was designed for pupils from Year 7 to Year 10.

The features of the debriefing activity were that the teacher: made the point of the lesson explicit;

- asked a high number of open questions;
- prompted pupils by asking them to go on, so that many pupils gave lengthy responses that justified their answers to questions;
- made frequent references to concepts such as cause, effect and planning and to learning skills;
- summarised the discussion and learning for the pupils;
- made connections between learning outcomes and other contexts (bridging), offering analogies from pupils' everyday lives; and
- gave evaluative feedback to pupils by the teacher and other pupils.

Pupil discussion was usually animated. When asked their opinions about the lessons, pupils made the following comments:

- on using the strategy in literacy: "For writing essays and stuff, you have the reasons, the background and the trigger reasons, it can help you … arrange an essay and write it";
- when asked whether she minded if her friends corrected her: "No … I'm not bothered …. if you don't [listen] you just do it wrong next time";
- when asked whether it helped to make the point of the lesson explicit: "Yeah because then we understand what we're doing and why we're doing it"; and
- general comments:
  - "We learnt how to group things together and see what might affect other things";
  - "It's like we're relearning things that we've done in the past that we've been learning over two years"; and
  - "What's good is like when other people put up arguments (so) you can see everyone's different point of view."

Reference
Evans, E., Kinninment, D., McGrane, J. and Riches, A. (1999) *De-briefing: pupils' learning and teacher planning*, Teacher Research Grant (TRG) summary. Available at: **www.tda.gov.uk/upload/resources/pdf/t/tta99-11.pdf**

Case study 7
Teaching children how to reason together

We chose this case study because it shows how teachers helped to create and foster effective classroom discussion among students by developing systematic rules for discussion with their pupils. This is discussed on page 21 of this anthology.

The study involved eleven Year 2 classes and their teachers. In six classes, the teachers implemented a programme of lessons designed to improve the children's spoken language skills, and in five control classes, teachers and pupils pursued their normal activities. All the schools involved had low levels of academic achievement, a high proportion of pupils from low income families and many pupils who spoke English as an additional language.

The teachers, with the help of the researchers, generated a programme of lessons designed to improve the children's skills in talking and listening in groups. Early lessons in the six-month programme focused on raising an awareness of the importance of talk while developing skills such as listening, sharing information and cooperating. Later lessons encouraged critical argument for and against different cases and applied the approach to various curriculum subjects, including history and geography.

The pupils were usually placed in groups of three, but sometimes pairs and larger groups were used, depending on the specific task. Each group was of mixed ability, which enabled each group to include a fluent reader and writer. The pupils had opportunities to practise giving and asking for reasons and discussing alternative ideas. Everyone in the group was invited and encouraged to contribute.

The classes created and agreed a set of ground rules for discussion that would help them to reach a group consensus. These included, for example, that the group:

- shares all relevant information;
- expects people to give reasons for their ideas;
- considers all contributions with respect;
- accepts challenges;
- discusses alternatives before taking a decision;
- tries to reach agreement; and
- takes responsibility for decisions.

Some of the key features of the lessons were:

- teachers made the learning objectives for group talk explicit in their introduction;
- teachers directly taught the class skills such as asking questions;
- the teacher focused the class on the quality of their talk, intervened to support groups during discussion and acted as a model when talking to the class; and
- groups reflected on the quality of their talk in plenary sessions.

The pupils in the target group learned to involve each other, listen carefully to what was said and to respond constructively, even if their response was a challenge. This group of pupils asked more questions and gave reasons more often than the children in the control group. The target group children also completed more puzzles correctly on a reasoning test after the programme than before. The control group children's interactions did not show a similar pattern of change.

Reference

Wegerif, R., Littleton, K., Dawes, L., Mercer, N. and Rowe, D. (2004) Widening access to educational opportunities through teaching children how to reason together *Westminster Studies in Education* Vol. 27, No. 2.
An online digest of this study is available at:
www.standards.dcsf.gov.uk/research/themes/speakandlisten/wegerif_access/

Case study 8
Effective paired work

We chose this study because it investigated whether increasing the opportunities for paired work within whole-class teaching sessions increased pupils' levels of participation.

The teachers undertaking the study knew that young children often wanted to talk to their teacher but that this was not always possible, practical (in a class of 30 children), or they found it difficult to bring themselves to do so. Carefully planned paired work gave each child a chance to talk to an audience and to express their viewpoint.

The investigation took place with a Year 1 class and involved six classroom observations of whole-class teaching over a period of time. During each of the six sessions, the teacher included an opportunity for pupils to discuss in pairs.

The focus in each session varied. They included:
- interviewing – asking each other questions about their family;
- discussing elements on the front cover of a book;
- describing a personal experience, which led on to drama;
- explaining why they chose this particular toy to bring into school;
- recapping their visit to a museum and listing three things they liked; and
- discussing leisure activities in the local area.

The teacher researcher videoed a whole-class teaching session to establish the initial levels of participation across the class. She identified four children as reluctant participants and recorded their participation levels in future sessions. She analysed pupils' patterns of engagement during the six sessions and concluded that increasing the opportunities for paired work did increase pupils' level of interest and participation in the sessions.

The teacher found that paired work did not just happen, but needed careful planning. The teacher identified several practical issues that needed to be considered for successful paired work with young pupils.

Clarifying the content and ground rules

The teacher:
- taught the pupils how to work as a pair by modelling paired discussion with another adult;
- ensured that each session had a definite focus that was clearly explained;
- checked that the children understood what they were supposed to be talking about;
- found it helpful to limit information gathering to one aspect at first, increasing this only when the children were used to paired work; and
- made sure everyone was quiet and listening before taking feedback.

Timing

The teacher:
- agreed with the pupils beforehand how much time they had to talk in pairs;
- used an egg timer to show how time was going; and
- used agreed signals for starting and stopping.

Grouping

The teacher sometimes used different types of pairings for the pupils, such as same gender, mixed gender, similar or mixed ability, teacher allocation of pairs and pupil free choice. When deciding upon pairings, she considered:
- how many children might have to move to find an appropriate partner and whether there was room for them to do so; and
- whether she could avoid children feeling left out by including a group of three or involving a teaching assistant.

Resources

The teacher used dummy microphones in the first session and this worked well for the paired interviews but proved a distraction during feedback. She found that the use of small whiteboards and pens for recording hindered talk in the paired work and discouraged collaborative recording. The paired work could be successful when no special resources were used.

Reference

Penelope Robinson, Hawthorns First School, BPRS Ref. No. S623 *Does increasing the opportunities for pair work increase the levels of participation of Year 1 children in whole class teaching?*

Case study 9
Changing to an enquiry-based approach in KS3 mathematics

We chose this case study because it shows how a group of teachers moved away from their usual didactic approach towards offering students more collaborative work and open-ended tasks.

The study took place in the mathematics department of a girls' grammar school. The teachers were aware that the method of teaching they used was very traditional, as it was based mostly on exposition and practice. In particular, they felt that the syllabus they were following with their Year 7 classes relied too much on a textbook, that they also tended to compartmentalise mathematics and tended to miss opportunities for encouraging students to make connections across topics.

To begin with, the staff had mixed feelings about moving away from their usual teaching approach. Whilst there was excitement and enthusiasm for making the change, staff also felt some trepidation about working in an unfamiliar way and were concerned about how it would work. A number of factors helped them to make the transition.

Working with an experienced practitioner

The department invited an experienced practitioner to work with them. He discussed possible approaches to various topics during a number of extended departmental meetings. He also came in on several occasions to teach different classes so that staff could watch him model the new approach. Some staff opted to team teach with him.

Usually his lesson would throw up a number of lines of enquiry the teachers could pursue in subsequent lessons. For example, teachers followed up a lesson which involved trying to identify all of the possible quadrilaterals on a nine pin geoboard with other enquiries, such as 'What if we try triangles / more or less pins?'

Trying out the new approaches themselves

Staff trialled some of the new approaches with a view to including them into a new scheme of work for their Year 7 and Year 8 classes. In some cases the activities seemed appropriate or adaptable for other year groups, so they tried them there too.

Sharing the experience

Naturally, it followed that after the teachers had observed the experienced practitioner teaching, or had tried one of his suggestions with their own classes, they were inclined to discuss and dissect the experience. The experienced practitioner also encouraged them to write accounts of the lessons that they had taught, so that the sharing happened in a more formal and inclusive way than ad hoc staffroom discussions.

Joint planning and reflection

The teachers adopted a collaborative approach to planning. Two teachers would plan a unit of work lasting several weeks. They then swapped with another pair and taught their unit. Working in this way encouraged them to sit down together at the end of a module and debate the merits of particular activities and approaches. They also met regularly with the experienced practitioner to review what they had done.

Critical incidents

The staff were aware of a number of critical incidents during their journey. For example:

"Working with Mike [the experienced practitioner] helped us see how the new approach allowed students to think more freely … and how much more enriched it was mathematically speaking. It also gave a valuable insight into how work could allow greater student interaction with peers and with the whole class".

"Finding pupils can sort out problems themselves and pose questions and raise issues".

"I was surprised by the insights pupils shared when asked to find their own method to solve a problem or when asked to justify a particular solution".

What difference did the change of approach make to the students?

Students who had experienced the new curriculum were:
- more prepared to engage in open-ended tasks;
- well practised at justifying their reasoning or approach;
- enthusiastic about mathematics and less likely to say "I can't do mathematics";
- more likely to pose their own mathematical questions or make conjectures based on what they had noticed; and
- more inquisitive and critical in their thinking.

Staff commented:

"They feel that they can do mathematics as they aren't limited by one particular method. They seem to have more fun and work enthusiastically"

"They are able to demonstrate more reasoning and logic than in a more formal, working from a textbook situation".

Reference
Richards, M. (2008) Changing to an enquiry-based approach to mathematics teaching and learning at KS3. Teacher Enquiry Bulletin, National Centre for Excellence in the Teaching of Mathematics (NCETM)
www.ncetm.org.uk

Case study 10
Ways teachers can help secondary school students to learn

We chose this case study because it shows some of the kinds of interactions that older students felt helped extend their capacity to learn.

When interviewed, the students (who were aged 12-15 years) suggested that teachers provided them with the most useful help during one-to-one or small group situations because they disclosed more of their thinking to teachers during these times. They commented that they preferred it if teacher feedback took the form of suggestions because making sense of the teachers' ideas gave them an active role. Teachers who demonstrated they valued student learning and showed a willingness to explain ideas over again, encouraged students to feel they could ask questions until they understood.

Interacting with students informally whilst working

Students felt informal, one-to-one or one-to-group interactions that took place whilst they were working were particularly useful. At these times, the students felt able to be explicit about what they did not understand, which gave teachers a better appreciation of their level of understanding, meaning they could target problem areas.

For example, one student commented how her teacher came around and looked at everyone's work, asked if they did understand and made supportive comments. The students were unanimous about wanting more opportunities for this kind of interaction with their teachers.

Giving feedback in the form of suggestions

Students who talked about and were observed having asked questions to help them understand ideas, said they preferred feedback in the form of suggestions from the teacher. They felt this supported their active engagement with ideas – both their own and those proposed by the teacher.

One student commented how 'suggestions are still making us think'. Another pointed out that suggestions could be 'added' into students' own ideas to 'give a different way' and in this way allowed students to 'decide for ourselves how'.

The students felt that suggestions communicated respect for them and their ideas, something that was important to them at a time when they were working on the edges of their understanding.

Communicating to students that their learning is important

The students indicated that how teachers spent their time and what they gave their attention to, communicated what and who was important to the teacher.

Some students were particularly sensitive to the focus of teacher attention. These students could recall if the teacher had spoken to them during a lesson and often whether they had interacted with others in the class.

If a teacher revisited ideas, students felt this showed the idea and their understanding of it were important to the teacher. The teachers' willingness to revisit ideas and explanations influenced the students' willingness to pursue ideas when they did not understand.

Gaining students' trust and respect

The students indicated that genuine assessment for learning was sustained by relationships of respect and trust. They appreciated teachers 'who respected the way you want to learn' and who 'let you learn yourself'. They reported that respect was a reciprocal activity – they respected teachers who respected them. Trust was related to respect, in that it was related to students' experiences of their teachers' interactions as considerate and well intentioned. They needed to feel 'safe' or 'comfortable' with a teacher, to be able to trust their reaction, before they were prepared to disclose their ideas.

Reference
Cowie, B. (2005) 'Pupil commentary on assessment for learning' *The Curriculum Journal* 16 (2) pp.137-151.

Case study 11
Using diagnostic probes to identify pupils' understanding in science

We chose this case study because it gives an example of how teachers discovered and took careful note of their pupils' preconceptions so as to identify what they needed to learn and the order in which they might learn it best. This links to the discussion about using assessment to help learning on page 27.

The teachers created tools, or diagnostic probes, to help them identify pupils' understanding within particular areas of science. They then used this information to plan how to teach the topic by breaking it down into a series of steps. The study involved 200 Year 7, 8 and 9 pupils with a wide range of ability.

The teachers reviewed previous research on children's understanding in particular areas of science and identified typical ideas and misconceptions often held by pupils. They then developed questions or probes to address these areas of frequent difficulty and tried them out with a small group of pupils before refining them for use with the main group of pupils.

Developing 'the Earth in space and gravity' diagnostic probes

The review of previous research on pupils' understanding of the Earth in space and gravity, for example, revealed:

- a clear pattern of development in pupils' ideas from a flat earth to a spherical model;
- gravity pulls objects down – this may be in conflict with the idea of pulling towards the centre of mass;
- gravity does not exist in space;
- the universe takes the form of a sphere made of all the other objects lying outside the solar system; and
- great confusion exists regarding the sizes and distances of objects in the universe.

The teachers created the following five probes for the earth in space and gravity topic to probe their own pupils' understanding.

Models – the probe involved the use of a range of different sized balls to probe the problems children have with scale in the universe - in particular the solar system.

Order – this involved the use of a card sort in which pupils were asked to sequence bodies (sun, galaxy, solar system etc) in order of size. This was to identify the ideas pupils have about the orders of size of bodies and systems in the universe.

Solar system – this involved the use of a card activity in which pupils could choose bodies (star, planet, comet, galaxy, milky way etc) that they would find in our solar system. This was used to identify what pupils knew and believed about the objects present in the solar system.

Gravity (ball) – pupils were provided with a diagram and asked to explain what would happen when a ball was released in different places. This was intended to identify the ideas that pupils had about why objects fall.

Gravity (objects) – pupils were provided with a diagram on which different objects were shown around the earth and they were asked to explain what would happen when the objects were released. This was used to identify the ideas that pupils have about the effect of gravity on different objects.

When the teachers used the earth in space and gravity probes with the pupils, they found that many of the pupils:

- found it very hard to understand scale when thinking about the universe and found three dimensional models even harder to use than two dimensional diagrams;
- believed that the solar system is the largest system in the universe and that galaxies and other stars would be found in our solar system;
- did not associate objects falling under gravity with mass; and believed that gravity does not exist in space.

Learning sequences

Having found out what the pupils did and did not know about a particular science topic, the teachers recognised that the pupils had to go through some significant steps in learning. They developed a sequence of possible learning routes through the topic.

For example, for the Earth in space and gravity topic, they taught first, that objects fall, then that objects with mass fall, then that gravity acts over a distance. They also looked at the behaviour of falling objects on the earth before considering the behaviour of objects falling on the moon.

The place of diagnostic probes in teaching

The teachers recognised that the diagnostic probes they developed could be used for many purposes, including:

- measuring pupils' initial understanding prior to teaching a topic;
- challenging and stimulating thought during teaching;
- evaluating the teaching of a topic at the end of the topic;
- informing colleagues of the ideas that pupils may hold about a topic;
- helping teachers to review and develop schemes of work;
- helping teachers to set targets for individuals and groups of pupils; and
- challenging teachers' own thinking and understanding.

Reference

Nixon, D., Kirk, H. and Needham, R. Brooksbank School, Elland, West Yorkshire (1998) *The use of 'diagnostic probes' to aid teaching and learning in science.*
www.tda.gov.uk/upload/resources/pdf/t/tta99-03.pdf

Case study 12
Peer and self-assessment in creative writing

We chose this case study because it illustrates how asking pupils to work with a partner to assess each other's work in a structured way can have a positive impact on their understanding, performance, motivation and self esteem.

Two Year 8 classes – an above-average and a below-average literacy set – took part in the study. The pupils worked on producing a short story. This was an extended project, which spanned several weeks.

The teacher developed the creative writing project in the following sequence.

- The pupils chose "Writing Buddies" with whom they would work for the whole project.
- They were helped to compose assessment criteria based on work they had done previously on the genre.
- The writing buddies were encouraged to work together on planning before the writing process began, by explaining their ideas and swapping outline plans.
- During writing, partners read each other's work at frequent intervals and were encouraged to question and constructively criticise the writing, using the assessment criteria as a reference.
- The pupils were asked to write an assessment of their own and their partner's finished story, referring directly to their agreed assessment criteria.
- The pupils assigned a national curriculum level to each others' work using a checklist to help them, having previously practised using level descriptions to make assessments of model texts.

The teacher found in her evaluation of the impact of the project that:

- assessments made before and after the project showed clear gains in achievement for all pupils;
- pupils' attitudes were very positive and many felt that the project had increased their self-esteem as writers;
- the continual discussions about stylistic issues during the writing process provided a useful context for teaching input on grammar and structure when individuals needed this;
- pupils felt that they gained a greater understanding of what constitutes quality in writing and were able to apply this to their own work;
- most pupils were very accurate in the levels they assigned to their work; and
- the pupils' behaviour was exemplary, even where problems might have been expected.

Reference

Rachel Swaffield, *Self-assessment in creative writing*
www.teachernet.gov.uk/professionaldevelopment/resourcesandresearch/bprs/search

Case Study 13
An investigation into how AfL practices can help pupils to learn

We chose this case study because it shows how a teacher used AfL practices in her classroom to develop her pupils' learning and encourage independence.

She set out to examine how her pupils negotiated quality criteria for a task and then used the criteria to assess their work. She also explored how questioning, listening to the pupils' responses and intervening in order to move them on in their learning can improve children's learning. As a result of these AfL strategies, the children learned to reflect on and talk about their learning.

The teacher-researcher conducted her research with her class of 30 Year 6 pupils. She recorded the class discussions with a small hand-held tape recorder and later made transcriptions of some of the more interesting comments made by her pupils. She also recorded and transcribed pairs of pupils talking through the process of using criteria to assess each other's work. She made notes of the comments made by her pupils, and her own observations and reflections in a research diary.

What did the lessons involve?

The teacher started off by discussing the learning intention of the lesson, asking questions about what it meant, why they needed to learn about it, and what they might be expected to know, understand or do by the end of a lesson. She went on to talk about and establish a short list of success criteria for a task.

The class 'negotiated' criteria for the content and quality of story writing. The teacher showed the pupils how to use the criteria, as an aide-memoire whilst writing, and afterwards as a checklist to assess their own writing.

Next, she asked the pupils to work in pairs and use a checklist to mark each others' work. They repeated this process to mark their own work. In this way they were able to reflect on their work and could see what needed to be improved, by referring to the checklist.

Using simplified National Curriculum statements, some pupils were able to award their own work grades, marks out of ten or levels according to how many criteria had been ticked off.

What did the pupils learn?

The teacher researcher found that her pupils were able to:

- assess their own work and that of others appropriately using simplified "I can …" level descriptions as a checklist. Where the statements of the level descriptions included more difficult vocabulary, they negotiated the meaning of the words with partners. When work did not meet all the relevant criteria pupils collaborated to decide how many statements within a level determined a 'best fit' level of attainment;
- identify three 'good' things about a friend's writing, indicate one thing that needed improving and suggest a way in which the improvement could be made;
- reflect on their work and discuss any difficulties they experience; and
- reflect on the processes of learning and assessment and compare their views with others.

Overall, the teacher-researcher found that her pupils were interested in knowing about the AfL strategies and felt empowered through discussing the different aspects of the lesson. Understanding the nature of a task helped them to feel more motivated in their work, whilst working with a partner on a task, helped them to recognise the benefit of mutual support.

Reference
Gill, J. (2006) 'Investigating children's perspectives on formative assessment: developing an action research approach' National Teacher Research Panel. Available at: **www.standards.dfes.gov.uk/ntrp/publications/gill/**

REFERENCES

Research for Teachers

This anthology summarises key research studies in the field of teaching and learning, but does not draw from all the RfTs. The full list of Research for Teachers summaries used in creating this section of the anthology and their weblinks, plus the studies on which they are based, is given below.

You can find other RfTs by going to:
www.gtce.org.uk/teachers/rft/

Assessment for Learning: putting it into practice
www.gtce.org.uk/teachers/rft/afl_prac0904/
Based on Black, P., Harrison, C., Lee, C., Marshall, B., and Wiliam, D. (2003) *Assessment for Learning: putting it into practice* Maidenhead: Open University Press

Carl Rogers and the classroom climate
www.gtce.org.uk/teachers/rft/rogers1008/
Based on Carl R. Rogers & H. Jerome Freiberg (1994) *Freedom to Learn* Prentice Hall; 3rd Revised edition

Consulting pupils about teaching and learning
www.gtce.org.uk/teachers/rft/pup_learn0605/
Based on several studies:
Flutter, J. and Rudduck, J. (2004) *Consulting pupils: What's in it for schools?* London: Routledge Falmer
Arnot, M. McIntyre, D. Pedder, D. and Reay, D. (2003) *Consultation in the classroom: Pupil perspectives on teaching and learning* Cambridge: Pearson Publishing
Fielding, M. and Bragg, S. (2003) *Students as researchers: Making a difference* Cambridge: Pearson Publishing
MacBeath, J. Demetriou, H. Rudduck, J. and Myers, K. (2003) *Consulting pupils: A toolkit for teachers* Cambridge: Pearson Publishing
Arnot, M., McIntyre, D., Pedder, D. and Reay, D. (2003) *Consultation in the Classroom: Developing dialogue about teaching and learning* Cambridge: Pearson Publishing

Curriculum: What effective features of curriculum planning and delivery do teachers use?
www.gtce.org.uk/teachers/rft/curriculum0809/
Based on systematic research reviews published by QCDA in 2008, see: www.qca.org.uk/qca_20522.aspx

Effective literacy teaching in the first years of school
www.gtce.org.uk/teachers/rft/literacy_0304/
Based on several studies:
Wharton-McDonald, R., Pressley M. and Hampston, J.M. (1998) Literacy Instruction in Nine First-Grade Classrooms: Teacher Characteristics and Student Achievement, in *Elementary School Journal*, Vol. 99, pp. 103-119
Pressley, M., Wharton-McDonald, R. et al. (2001) A Study of Effective First Grade Literacy Instruction, *Scientific Studies of Reading* Vol. 5, pp. 35-58
Taylor, B.M., Pearson, P. D. et al. (2000) Effective Schools and Accomplished Teachers: Lessons about Primary-Grade Reading Instruction in Low-Income Schools *Elementary School Journal*, Vol. 101, No. 2., pp. 121-165

Effective pedagogies for gifted and talented students
www.gtce.org.uk/teachers/rft/gifted0607/
Based on Hewston, R., Campbell, R.J., Eyre, D., Muijis, R.D., Neelands, J.G.A., & Robinson, W. (2005) *A baseline review of the literature on effective pedagogies for gifted and talented students*

Effective talk in the primary classroom
www.gtce.org.uk/teachers/rft/talk_prim0506/
Based on Myhill, D., Jones, S. and Hopper, R. (2006) *Talking, listening learning: effective talk in the primary classroom* Open University Press, Maidenhead

Effective teachers of numeracy
www.gtce.org.uk/teachers/rft/numeracy0403/
Based on Askew, M., Brown, M., Rhodes, V., Johnson, D. and Wiliam, D. (1997)E*ffective teachers of numeracy: Report of a study carried out for the Teacher Training Agency* London: King's College, University of London

Enquiry-based learning, cognitive acceleration and the spiral curriculum: Jerome Bruner's constructivist view of teaching and learning
www.gtce.org.uk/teachers/rft/bruner0506/
Based on several works by Bruner, including:
Bruner, J. S. (1977) *The Process of Education*, (Revised Edition) Harvard University Press.
Bruner, J. S. (1966) *Toward a Theory of Instruction*, Harvard University Press.
Bruner, J. S. (1971) *The Relevance of Education*, Penguin Education.

Experience and reflection in and on action: How do they help learning?
www.gtce.org.uk/teachers/rft/reflection0507/
Based on:
Dewey, J. (1991) *How We Think*, New York: Prometheus Books (Originally published in 1910 and revised in 1933)
Schön, D (2005) *The Reflective Practitioner*, UK: Ashgate (Originally published in 1983)

Experiencing secondary school mathematics
www.gtce.org.uk/teachers/rft/math0905/
Based on: Boaler, J. (2002) *Experiencing School Mathematics (Revised Edition)* New Jersey: Lawrence Erlbaum Associates

Grouping pupils and students - what difference does the type of grouping make to teaching and learning in schools?
www.gtce.org.uk/teachers/rft/group0504/
Based on: Ireson, J. and Hallam, S. (2001) A*bility grouping in education* London: Paul Chapman Publishing

ICT for teaching and learning
www.gtce.org.uk/teachers/rft/ict1107/
Based on Moseley, D., Higgins, S., **et al.** (1999) *Ways forward with ICT: effective pedagogy using information and communications technology for literacy and numeracy in primary schools* Newcastle upon Tyne: University of Newcastle

Improving learning through cognitive intervention
www.gtce.org.uk/teachers/rft/learn_cog0601/
Based on Adey, P. and Shayer, M. (1994) *Really raising standards* London: Routledge

Inside the literacy hour
www.gtce.org.uk/teachers/rft/rural_lit0202/
Based on two studies:
Fisher, R., Lewis, M. and Davis, B. (2000) *An investigation into the implementation of a literacy hour in small rural schools* Plymouth: University of Plymouth
Fisher, R. (2000) *Changing teacher practice: A report of changes in the practice of teachers in England following the introduction of a national literacy strategy* Plymouth: University of Plymouth

Leading staff development in primary mathematics – the role of the mathematics co-ordinator in introducing the National Numeracy Strategy
www.gtce.org.uk/teachers/rft/prim_math0306/
Based on Millett, A. Brown, M. & Askew, M. (eds) (2004), *Primary Mathematics and the developing professional*, Dordrecht: Kluwer.

Learning how to learn through assessment for learning
www.gtce.org.uk/teachers/rft/afl_strats0507/
Based on the following research:
Black, P., McCormick, R., James, M. & Pedder, D. (2006) 'Learning how to learn and assessment for learning: a theoretical enquiry' *Research Papers in Education Special Issue* 21 (2) pp. 119-132
James, M. & Pedder, D. (2006) 'Professional learning as a condition for assessment for learning' in Gardner, J (Ed) *Assessment and learning* London: Sage
James. M. et al (2006) *Learning how to learn: Tools for schools* London: Routledge
Marshall, B. & Drummond, M-J. (2006) 'How teachers engage with assessment for learning: lessons from the classroom' *Research Papers in Education Special Issue 21 (2)* pp.133-14
Swaffield, S., & MacBeath, J. (2006) 'Embedding LHTL in school policy: the challenge for leadership' *Research Papers in Education Special Issue 21 (2)*, pp.201-215

Learning mathematics through collaboration and discussion
www.gtce.org.uk/teachers/rft/collabmaths/
Based on Swan, M. (2006) *Collaborative learning in mathematics: A challenge to our beliefs and practices.* National Research and Development Centre for adult literacy and numeracy (NRDC) and the National Institute of Adult Continuing Education (NIACE). A CD of resources and video clips is available with the book.

Learning science – transforming students' everyday ideas about science into scientific thinking
www.gtce.org.uk/teachers/rft/science1204/
Based on Millar, R., Leach, J., Osborne, J. and Ratcliffe, M. (2003) The 'Evidence-based Practice in Science Education (EPSE) Research Network', part of the Teaching and Learning Research Programme (www.ex.ac.uk/ESRC-TLRP)

Making the difference: teaching and learning strategies in successful multi-ethnic schools
www.gtce.org.uk/teachers/rft/ethnic0901/
Based on Blair, M. and Bourne, J. with Coffin, C., Creese, A. and Kenner, C. (1998) Research Report RR59 *Making the difference: teaching and learning strategies in successful multi-ethnic schools* London: DfEE

Promoting students' persistence in meeting challenges
www.gtce.org.uk/teachers/rft/challenge1007/
Based on Dweck, C. (2000) *Self-theories: Their role in motivation, personality and development*, Philadelphia: Taylor and Francis

Raising achievement through group work
www.gtce.org.uk/teachers/rft/achieve1106/
Based on the three studies:
Wegerif, R., Mercer, N., and Dawes, L. (1999), From social interaction to individual reasoning: an empirical investigation of a possible socio-cultural model of cognitive development, *Learning and Instruction* 9 (5) pp.493-516
Wegerif, R., Littleton, K., Dawes, L., Mercer, N., & Rowe, D. (2004), Widening access to educational opportunities through teaching children how to reason together, *Westminster Studies in Education* 27 (2) pp. 143-156
Wegerif, R. (2004),.The role of ICT as catalyst and support for dialogue, *NALDIC Quarterly* 1 (4) pp. 4-12

Raising standards through classroom assessment
www.gtce.org.uk/teachers/rft/assess0501/
Based on Black, P. and Wiliam, D. (1998) *Inside the Black Box* London: King's College, University of London

Social interaction as a means of constructing learning: the impact of Lev Vygotsky's ideas on teaching and learning
www.gtce.org.uk/teachers/rft/vygotsky1203/
Based on Cole, M. (ed.) et al. (1978): *Mind in Society, The Development of Higher Psychological Processes* Massachusetts/London: Harvard University Press

Strategies for improving students' writing skills
www.gtce.org.uk/teachers/rft/improv_curric0208/
Based on Graham, S. & Perin, D. (2007) *Writing next: Effective strategies to improve writing of adolescents in middle and high schools - A report to the Carnegie Corporation of New York.* Washington, DC: Alliance for Excellent Education

Teachers and school-based research
www.gtce.org.uk/teachers/rft/res_cpd0503/
This RfT was based on the reports of the TTA/CfBT funded school-based research consortia initiative, 1997-2000. Teacher Training Agency

Teachers' professional learning
www.gtce.org.uk/teachers/rft/prof_learn1205/
This RfT was based on two systematic reviews:
Cordingley P, Bell M, Thomason S, Firth A (2005) The impact of collaborative continuing professional development (CPD) on classroom teaching and learning. Review: How do collaborative and sustained CPD and sustained but not collaborative CPD affect teaching and learning? In: *Research Evidence in Education Library*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
Cordingley P, Bell M, Evans D, Firth A (2005) The impact of collaborative CPD on classroom teaching and learning. Review: What do teacher impact data tell us about collaborative CPD? In: *Research Evidence in Education Library.* London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London

Teaching methods in England and France – a comparison
www.gtce.org.uk/teachers/rft/eng_fr0708/
Based on Broadfoot, P., Osborn, M., Planel, C. and Sharpe, K. (2000) *Promoting Quality in Learning: Does England Have the Answer?* London: Cassell

The impact of collaborative CPD in the classroom
www.gtce.org.uk/teachers/rft/collab_cpd0204/
Based on Cordingley P, Bell M, Rundell B, Evans D (2003) The impact of collaborative CPD on classroom teaching and learning. In: *Research Evidence in Education Library.* London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

The role of the specialist in the teacher's CPD
www.gtce.org.uk/teachers/rft/cpd0508/
Based on Cordingley, P. et al. (2007) 'What do specialists do in CPD programmes for which there is evidence of positive outcomes for pupils and teachers?' In: *Research Evidence in Education Library.* London: EPPI-Centre, Social Science Research Unit, Institute of Education.

Other studies

Bennett J, Lubben F, Hogarth S, Campbell B (2004) A systematic review of the use of small-group discussions in science teaching with students aged 11-18, and their effects on students' understanding in science or attitude to science. In: *Research Evidence in Education Library*. London: EPPI Centre, Social Science Research Unit, Institute of Education. For an online summary, go to:
http://eppi.ioe.ac.uk/EPPIWeb/home.aspx?page=/reel/review_groups/science/review_one_abstract.htm

Bennett, J., Lubben, F., Hogarth, S., Campbell, B. Robinson, A. (2005) A systematic review of the nature of small-group discussions aimed at improving students' understanding of evidence in science In: *Research Evidence in Education Library*. London: EPPI Centre, Social Science Research Unit, Institute of Education. For an online summary, go to:
http://eppi.ioe.ac.uk/EPPIWeb/home.aspx?page=/reel/review_groups/science/review_three_abstract.htm

Gillies, R.M. & Boyle, M. (2004), The effects of co-operative learning on junior high school students during small group learning *Learning and Instruction* 14 pp.197-213
For an online summary, go to:
www.standards.dcsf.gov.uk/research/themes/pupil_grouping/ThuAug261107362004/

Gillies, R.M. & Boyle, M. (2005), Teachers' scaffolding behaviours during co-operative learning *Asia-Pacific Journal of Teacher Education* 33 (3) pp.243-259
For an online summary, go to:
www.standards.dcsf.gov.uk/research/themes/pupil_grouping/communicationplay/

Find out more online

A variety of other research evidence is available on-line.

The NERF Bulletins, published termly from summer 2004 to summer 2006, give succinct, readable summaries of a wide range of research. You can download them from **www.eep.ac.uk/nerf/bulletin/index.html**

The DCSF Research Informed Practice Site (TRIPS) provides accessible digests of research in plain language. You can search over one hundred summaries by theme, subject, author or keyword at **www.standards.dcsf.gov.uk/research/**

The Centre for the Use of Research and Evidence in Education (Curee) works to support and develop teachers' and policy makers' access to and use of educational research. The team from Curee choose, appraise and write the RfTs and the other research summaries mentioned above. The Curee website is packed with information about useful research for teachers and includes a useful links page to other educational organisations. Click on: **www.curee-paccts.com/index.jsp**

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