Research for Teachers

The impact of collaborative CPD in the classroom

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How can such professional development programmes be thoroughly evaluated in terms of outcomes for teachers and for students?

For this TLA research summary we looked at a systematic review of studies into whether and how collaborative continuing professional development (CPD) affects both teaching and learning. Collaborative CPD was initially defined as teachers working with at least one other related professional on more than a one-off basis. In fact, in all studies teachers collaborated with an external specialist and, in all but two, with colleague teachers for a period of at least twelve weeks.

The reviewers sifted systematically through over 13,000 studies to find those that could answer their question in terms of both teacher and pupil outcomes. The findings are described in terms that teachers will readily identify with, such as the impact of the CPD on their knowledge, understanding, skills, beliefs, practice and attitudes - and, excitingly, on pupil motivation and achievement. The review also found a number of distinctive elements of the CPD, such as peer support, which were linked to successful outcomes for both teachers and students.

The findings of this review have influenced a number of policy initiatives and helped schools and local authorities build their professional development capacity. The review also raised a number of issues for practitioners to consider. It offers insights into those features of CPD which were found to be effective, ranging from peer observation and feedback to external expertise and coaching. It should prove helpful to teachers who are thinking about planning their professional development.

Cordingley, Philippa, Miranda Bell, Barbara Rundell and Donald Evans. *How does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?* Centre for the Use of Research and Evidence in Education (CUREE): June 2003.

The full review can be accessed at the EPPI-Centre Research Evidence in Education Library (REEL).

You may also like to read our summaries of subsequent systematic reviews produced by the research team about teachers' professional learning and the role of the specialist in CPD.

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Overview

Why is the issue important?
Gaining an insight into effective features of continuing professional development (CPD) will be helpful to teachers planning their professional development and schools wanting to build their professional capacity.

What did the research show?
CPD which was collaborative and which was sustained over a period of time appeared to have positive effects on teaching and learning. In particular, there were improvements in:

- teachers' attitudes and beliefs
- teaching strategies
- students' attitudes and behaviour
- students' achievement.

How was this achieved?
Common features of successful CPD interventions, which were linked, in combination, to the positive benefits for teachers and learners, included:

- observation with professional dialogue including feedback
- the use of external expertise linked to school-based activity
- an emphasis on peer support rather than leadership by supervisors
- scope for teacher participants to identify their own CPD focus
- processes to encourage, extend, and structure professional dialogue
- processes for sustaining the CPD over time to enable teachers to embed the practices in their own classroom settings.

How was the research designed to be trustworthy?
The researchers used a diligent and consistent approach for their literature review. The process involved:

- clarifying the aims and objectives clearly
- accessing all potentially relevant studies that might inform the review question
- filtering these potential studies against set criteria, to ensure they were reliable and contained enough detail to answer the review question
- examining the studies in depth using the EPPI Centre's 'data extraction' software and weighing up their potential to answer the review question.

They obtained 13,479 reports published between 1998 and 2001 and completed full data extractions on fifteen studies. In all fifteen studies teachers collaborated with an external specialist and, in all but two, with colleague teachers for a period of at least twelve weeks.

What are the implications?
The study showed the importance of:

- building on teachers' existing knowledge and taking account of teachers' individual learning needs
- encouraging teacher ownership by using teachers' real concerns as a focus for enquiry
- sustaining the CPD over a period of time so that new approaches can be adapted, trialled and gradually embedded in teachers' practice

- providing opportunities for promoting "equal partnerships" between teachers and specialists where the knowledge and experience of teachers is valued
- providing opportunities for coaching
- providing teachers with time to participate in collaborative professional development activities.

What do the case studies illustrate?
The case studies explore, for example:

- the effective use of teacher collaboration in order to improve teaching and pupils' learning
- how peer observation and support helped play a valuable role in research into teaching effectiveness by a consortium of primary schools
- the impact of collaborative and sustained CPD on teachers' practice and students' attitudes and achievement in science
- how a combination of peer support, the input of an outside expert and teacher ownership helped a small-scale project become a popular and self-sustaining CPD programme.

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Study

Why was the review carried out and what role did teachers play in it?
Schools have many choices to make as they develop their strategies for continuing professional development. While the government's CPD policy will give schools more control of CPD funding, teachers and others involved in education want to know more about what works in CPD. This is what the review set out to find.

The studies broadly aimed to explore:

- how a particular type of CPD, for example, 'professional conversations', changed or affected teaching behaviours and pupil learning
- the impact of teachers' use of specific intervention strategies, for example mindmapping, or development of reading skills, on students' learning.

Involvement of teachers
The review team wanted to be able to address teachers' interest in the nature of CPD and its impact on teaching and learning at the same time as they looked for evidence of effective CPD which could help to inform policy. The final choice of focus on sustained and collaborative CPD was strongly influenced by teachers who were involved in all stages of the review process.

The review was funded by the National Union of Teachers (NUT) with support from the General Teaching Council (GTC) and the Centre for the Use of Research and Evidence in Education (CUREE). DfES support came through the Evidence for Policy and Practice Information Centre (EPPI Centre). The review group was registered with the EPPI Centre and used its tools and methods to carry out the review.

What did the review discover?
The review found that CPD which was collaborative and which was sustained over a period of time did appear to have positive effects on teaching and learning. In particular, the reviewers found improvements in:

- teachers' attitudes and beliefs
- teaching strategies
- students' attitudes and behaviour
- students' achievement.

Evidence from the studies showed that within the CPD programmes teachers worked with colleagues to:

- study new approaches
- design tentative programmes for introducing these approaches into their classrooms

- trial and evaluate such strategies.

The reviewers identified common features of successful CPD interventions, which were linked, in combination, to the positive benefits for teachers and learners, including:

- observation with professional dialogue including feedback
- the use of external expertise linked to school-based activity
- an emphasis on peer support rather than leadership by supervisors
- scope for teacher participants to identify their own CPD focus
- processes to encourage, extend, and structure professional dialogue
- processes for sustaining the CPD over time to enable teachers to embed the practices in their own classroom settings.

Support for identifying and refining new strategies, in modelling them at work and evaluating progress was in all cases provided by experts from other organisations such as university research departments.

In the sections that follow, the processes and outcomes of the CPD highlighted by the review are described in greater detail.

Were improvements in students' learning linked to the teachers' CPD?
There was evidence that collaborative CPD was linked to measured increases in student performance in all the studies. Specifically the positive outcomes for students concentrated on measured improvements in student performance or specifically assessed learning approaches including:

- demonstrable enhancement of student motivation
- improvements in performance such as improved test results, greater ability in decoding, enhanced reading fluency
- more positive responses to specific subjects
- better organisation of work
- increased sophistication in response to questions.

These benefits were manifested in specific ways in response to the specific goals of the different programmes:

Students appeared to be motivated by new strategies. A student in Brown's study, reflecting on sharing ideas, commented: "It made me work harder when doing a task." Another said; "It is also a way to meet various people in the class and it is then easier to share ideas with the whole class..." In Gersten's study pupils were motivated by new vocabulary and reading skills strategies and showed improved reading skills.
There was evidence of improved performance. For example, Brown's study reported that students' performance improved in the following ways:

- Genetics topic: before CPD, the average class score was 32.6%; after the CPD the score was 55% (the least proficient third of the class had an average gain of 25%)
- Forces topic: before the CPD, the average class score was 53.5%; after the CPD the score was 73.3% (the least proficient third of the class had an average gain of 13%).

Another study (Bryant) reported that "Teachers were beginning to see the effects of the strategies ...through overt student behaviour... using the reading strategies to break apart words. In the math classes, students were begging for multisyllabic words to decode".

Students demonstrated better organisation of their work. Kirkwood's study commented: "The students' programming behaviors exhibited far fewer of the undesirable characteristics noted of beginning programmers in 'typical' classrooms.....Students.. stressed the necessity to think ahead to anticipate problems and to take appropriate action to avoid them."

There was evidence (Parke and Coble) that an increase in students' participation in class discussions, use of questions and volunteering explanations was linked to the CPD undertaken by their teachers.

How did student's attitudes to learning change?
All but two of the studies reported observable improvements in students' attitudes to learning. Such evidence

emerged from lesson observations, teacher questionnaires and in some cases students' own log books, and included the following:

- increased self-confidence
- increased satisfaction with their work
- the development of a more collaborative, questioning approach to learning.

Evidence suggested that students became more self-confident as they began to see the benefits of new strategies introduced by their teachers, such as co-operative working: '[Working in groups] makes you feel more confident about talking out loud.'

The review provided evidence that new approaches were linked also to improvements in students' satisfaction with their work. For example, they enjoyed work set at a pace suitable for them and the opportunity to work more independently of the teacher (Kirkwood): "[When I am working on my own] I can work in my own way and design things the way I like and find interesting." More details of this CPD programme can be seen in case study 5

Some of the features of teachers' collaboration in the CPD process appeared to have resulted in greater pupil-teacher and pupil-pupil collaboration in the classroom. There was evidence that students had begun to question each other, evaluate each others' work and show an interest in the process of their own learning. Many teachers believed that modeling these processes during their own professional development had played a key part in this. For example, Kirkwood reflected that "teachers who think independently, reflect critically, problem solve and collaborate effectively provide excellent role models for children".

What sort of changes in teachers' beliefs and practices were linked to collaborative CPD?
Many positive changes to teachers' attitudes and pedagogic knowledge, understanding and strategies were evident as the programmes unfolded.
How did teachers' attitudes and motivation change?

The review identified a number of changes in teacher attitudes and motivation including:

- increased confidence in their own learning, in trying oput new ideas and in changing their practice
- strengthened beliefs in their power to make a difference to their students' learning (self efficacy)
- enthusiasm for collaborative working, despite initial anxieties about being observed and receiving feedback
- greater commitment to changing practice and increased willingness to try new things.

Teachers in most studies felt more open and confident about trying new ideas. Other teachers shared an increasing belief in their own and their profession's capacity to enhance students' learning. Perhaps as a result of growing confidence they also showed an increased willingness to change their practice. For example, in one study (Ertmer), teachers noted "I'm less apprehensive about trying new things and I'm more willing to explore" and "I think everyone at first had a lot of reservations, a lot of trepidation. I think [now] we're all in a learning mode."

Changes in attitude often unfolded gradually during the CPD programme, or in one case (Britt) even after the programme ended. In this case a teacher, who was initially reluctant to admit that she had changed her practice, later became mathematics coordinator and persuaded others of the benefits of the new methods of teaching.

Why did this change in attitude occur? Some studies referred to the benefit of collaboration in providing moral support to teachers as they worked through the often stressful process of change. Evidence suggested that collaborative CPD enhanced teacher morale and gave them a sense that what they were doing was important for themselves and their students, as illustrated by this comment from Brown's study: "the willingness of teachers to continue with the programme, the many hours of their own time which they devoted to developing skills and working collaboratively all attest to a very high level of motivation."

The review suggested that teachers enjoyed working together and particularly valued the opportunity to share

personal knowledge to solve problems and plan: "It pulled us together as a team, and it was really nice to meet other professionals who had the same goals in mind as we do."

How did the CPD relate to teachers' pedagogic knowledge and understanding?
Whilst there was evidence in many studies that the CPD increased teachers' subject knowledge to a greater or lesser extent, the more significant changes reported were to do with the way teachers used their subject knowledge, in conjunction with their knowledge of how students learn, in order to select the most appropriate strategies for their students. The changes included:

- greater flexibility in their use of teaching strategies
- increased awareness of new teaching techniques
- greater insight into students' thinking
- enhanced planning skills to ensure more effective content and pupil task match (as illustrated in relation to student outcomes).

The review showed that teachers made changes either to their lesson activities, for example, by implementing a greater use of apparatus, or to their teaching styles so as to encourage more opportunities for active student learning. Several studies referred explicitly to teachers learning to 'teach with less telling'. Examples of changes included:

Some teachers were concerned about struggling readers and used the CPD to gain knowledge and skills in new strategies for implementing word identification, partner reading and collaborative strategic reading approaches in order to tackle the problem.
In a mathematics study teachers undertook CPD which explicitly linked together:

- teachers' understanding of the mathematics to be taught
- teachers' understanding of the way children learn the mathematics
- teachers' understanding of what motivates children to learn mathematics.

Through the CPD the teachers learnt how to teach for understanding by building on 'wrong' answers, problem solving, close observation of the way children worked and varying activities to keep children focused.

Teachers began to rethink the purpose of assessment and designed assessments that offered more helpful feedback about student understanding. For example one teacher asked her students, "can you apply the idea, can you think of an example, can you give me an analogy, can you relate the idea to anything else?" Readers may recollect that this approach has features in common with the earlier Assessment for learning RoM based on the work of Black and Wiliam.

Which types of collaborative CPD were linked to positive outcomes?
Collaboration within the CPD programmes took a variety of forms. Specific types of collaborative CPD that were linked to positive outcomes included:

- using observation and feedback to support the teachers in implementing new strategies
- creating an emphasis on peer support and coaching rather than leadership by supervisors
- involving outside 'experts' to support the school based activities, including coaching
- offering scope for teachers to identify their own CPD focus
- taking account of teachers' individual starting points
- introducing processes to facilitate and encourage professional dialogues
- conducting focused workshops
- providing quality time for teachers to participate in collaborative professional development activities
- developing processes for sustaining the CPD over time to enable teachers to embed the new practices in their own classroom settings.

A detailed exploration of the different CPD processes is presented in the following sections.

How did teacher colleagues support each other effectively?
Thirteen studies reported on teacher to teacher collaboration in various forms including:

- coaching
- joint preparation of materials
- planning
- team building.

Many studies referred to the value of peer support in helping them work through difficult changes which they often found stressful. Case study 1 illustrates many of the core features of teacher to teacher collaboration in a classroom context.

Where peer coaching was a feature of the CPD it was built around the following stages:

- a baseline stage where teachers planned and implemented the programme strategies unaided
- peer coaching to help teachers introduce new strategies and analyse their effects
- peer coaching to refine the strategies
- a maintenance phase to consolidate progress.

Harvey noted that teachers who were supported by coaching used a wider variety of teaching strategies and kept students more actively involved in lessons than colleagues who had only participated in workshops. Supported teachers also used a wider range of questioning and assessment strategies. Coaching was seen as important in permitting "a focus on activities that are beyond the teachers' normal repertoire of skills, but within their capabilities with assistance."

Coaching helped to develop teachers' awareness of how to adapt teaching materials, skills or responses to students' needs: "One benefit of this study is that I've become more focused on students' individual needs. I've always taught to the majority and this project has helped me to individualise it".

By working collaboratively teachers helped to keep the projects moving when enthusiasm might have waned. "The presence of individuals who can drive ideas forward is crucial. When enthusiasm wanes among the group ...certain individuals can, through their analytical strengths, keep the project moving forward so that it eventually bears fruit". Teachers also found that cross-fertilisation of ideas and shared effort helped to reduce the load on individuals, while simultaneously enhancing the productivity of the group: "having to develop the course materials exacerbated the problems of making time available for research and evaluation... Distributing this work among the participants made it manageable".

Other teachers used team planning as a helpful means of refining strategies. In some cases they worked as a team to implement different components of a strategy as did the teachers in Bryant's study when implementing three reading strategies in successive stages using three different teachers.

Teachers can support each other at various levels of organisation including:

- small-scale activity involving individual pairs or groups of teachers
- departments
- whole school.

Case study 2 illustrates how small scale action research grew to involve a whole primary school staff.

Creating a window on and for teacher learning: observing teachers' and students' learning
Researchers and teachers were involved in observing classroom practice in nine of the studies. Sometimes this was an informal arrangement between teachers and at other times a more formal part of the CPD process in which 'outside experts' observed lessons. Likewise, feedback varied from professional discussion of shared experiences with peers or experts, through structured feedback to the use of audio and video tapes to provide feedback on mutually agreed foci of the lesson.

Where the observation was informed and structured, it enabled teachers to engage collaboratively with specific aspects of teaching and learning such as:

- use of whole class versus group teaching

- use of particular teaching materials
- participation of students
- use of students' existing knowledge.

Teachers in Britt's mathematics study used observation to focus on all the above features. Evidence suggested that through feedback and reflection teachers were successful in changing their practice. Observers noted that teachers encouraged students to make connections for themselves rather than telling them, allowed more time for them to work in groups to solve problems and learnt to use students' misconceptions for building new connections. (These approaches to teaching mathematics echo those advanced by Askew, Brown and co-workers, which we summarised in our Effective Teachers of Numeracy RfT.

Teachers and special educators (Gersten) who were trying to improve reading skills of low-achieving students used classroom observation to identify problems and develop new strategies. The observations focused down on specific details of teaching such as the pace and frequency of vocabulary teaching of key words to support text comprehension. Teachers used peer observation to help them get the balance right. Further observation showed they were successful in raising reading effectiveness among the students.

Observing each other and giving feedback also had its painful side. For example, one teacher in Gersten's study highlighted a possible dilemma which many teachers across the studies were aware of: "Closer to the classroom is also closer to the bone - closer to the day to day performance on which personal esteem and professional standing rest. The prospects for conflict are high". But although many studies reported that the early stages of learning and observation were uncomfortable they also reported that the benefits significantly outweighed the pain.

Tracking the benefits of observation and feedback to improvements in teaching and learning is complex and difficult. However Da Costa's study included a structured comparison of three different studies, one of which did not involve observations. He found that teachers who used CPD involving classroom observation were more likely to effect changes which were linked to enhanced pupil achievement.

Observation may focus on teacher or student behaviour or both. In Kohler's study about improving communication among five and six year old children, teachers used observation for both purposes. They used it to help them develop their skills in listening to children, asking them the right sort of questions to stimulate further conversation, providing helpful prompts and giving feedback. They also assessed the effectiveness of the strategies by using observation to assess how much pupil-pupil interaction was generated, to what extent pupils' talk was reciprocated and the extent of non-verbal communication. One participating teacher commented: "My teaching skills improved...[for example]... I noticed that peers bring out a lot of things that I could not bring out in my lower-achieving pupils."

Readers can find out more about the practice of peer observation in Leeds schools in case study 3.

Peer observation and feedback supported by video (see Teachers and school based research RfT) has become a widely used tool for professional development in schools.

What external specialist expertise made a difference?
The review highlighted a number of benefits that external experts who acted as consultants brought to the CPD including:

- providing examples of relevant existing research to inform teachers about what the evidence tells so far
- support in refining the development focus or enquiry question to make it both useful and manageable
- modelling the new practices
- mentoring or coaching teachers as they embarked on the new practices
- providing a focus for debate, encouraging professional reflection
- giving advice about collecting and analysing data.

This was not a story of outsiders riding to the rescue of ignorant teachers. Sensitivity and flexibility were needed to develop partnerships between teachers and external specialists on a mutually acceptable basis. Evidence from the review suggested that the most effective consultants:

- went to considerable lengths to establish working processes and relationships to help them become "insiders"
- worked with teachers as equal partners, each partner being considered to have "separate but complementary bodies of knowledge"
- provided detailed feedback
- valued the past experience of teachers as a starting point for further development.

The teachers' own expertise was also highly valued - so much so that Harwell concluded that all CPD should combine the expertise of researchers and the knowledge of practising teachers. In his study, support offered by a university colleague included providing a phone line dedicated to IT support and opportunities for developing on-line expertise in an interactive 'chat' setting between school and university. Comments from the teachers reflected the rejuvenating effect of collaboration with outside experts: "the most stimulating and productive thing he had done in his teaching career". (Brown)

Teachers in Parke and Coble's study participated in 'theory-meets-practice' discussions with researchers. As teachers spoke about their practice, they observed how ideas from research prompted them to think about their classrooms in other ways. Teachers reported that this was different from previous experiences of staff development in which they were "told or trained". From these conversations teachers rethought their beliefs about teaching and learning, and started to look at their practice in a new light.

Evidence from Brown's study contains many examples of quite detailed feedback comments from the consultant which teachers clearly found helpful. The following comments about a teacher's plan is just one of many in this study:

The group work is much more complex and, on reflection, I would like to talk more about the groups...Your class discussion on roles was a very good idea. The roles you have chosen are all good ones. By choosing the groups yourself you will have better control over the situation...In co-operative groups the kids have to get the hang of being responsible for all their members and that really does make a different orientation...The team building exercise is a good idea...The lessons to be drawn out of the exercise are:

1. everyone should participate
2. everyone should learn the required amount
3. everyone can represent the group with an answer.

How did teachers take ownership of the process of change and why was this seen as important?
All the programmes recognised the importance of beginning with teachers' individual needs and concerns and built opportunities for doing so into the programmes of activity.
How did teachers take ownership?

Teachers were given the opportunity to select their own focus for the CPD within the broad parameters set by the programme or school in most of the programmes studied. This often centred on their immediate needs and concerns, such as how to develop their own computer skills and integrate this technology into lessons or how to implement new approaches to mathematics. But it also extended to very broad aims such as raising reading achievement or extending inclusion. In some instances teachers and their schools initiated the CPD by approaching university research departments for help.

Teachers were encouraged to reflect on their practice and to study the research literature before deciding on a goal that was meaningful for their students and themselves (Parke and Coble). In other examples, teachers:

- selected strategies from a menu of learning interventions, suggested by a consultant, which had been shown by previous research to be effective in supporting low achievers. The strategies included co-operative group work, graphic transformations (for example, concept maps) and spelling strategies either in combination or separately. During the study the teachers tried various approaches, adapting them to suit their contexts as necessary (Brown)
- identified a particular strategy or approach for teaching a particular subject such as mathematics, for example, by trying to reduce the transmission element in their teaching or using problems written by students as a focus of the lesson (Britt).

Teachers also took ownership through control over the intervention timetable or professional development

sessions they attended. For example:

- teachers developed team schedules for introducing three literacy strategies - Collaborative Strategic Reading, Word Identification and Partner Reading - on a staggered basis (Bryant)
- participants elected to join in group discussion fora according to individual interests and time commitments (Kirkwood).

The consequences of working out from teachers' concerns
Many of the studies showed the benefits of "giving teachers a voice". Evidence reported in the studies highlighted:

- the creation of informal networks that teachers could call upon whenever a problem arose that they were not able to resolve independently. This allowed teachers to determine their own priorities and freed them from "dependence on centrally produced solutions, many of which are viewed by teachers as either poorly designed or inappropriate to the needs of their students." (Kirkwood)
- the harnessing of teachers' concerns about their own students as an instrumental factor in motivating teachers to focus on implementing new strategies which they thought would help their students read better (Bryant)
- the development of new teaching strategies aimed at changing the learning environment which teachers adapted to incorporate those aspects of the programme that most suited their teaching style and which they thought would best engage and benefit their students (Brown).

The review found that as teachers took ownership of the enquiry process their confidence grew and they became more committed to the CPD programme and their continued learning. For example, in Harwell's study teachers volunteered to extend the life of the programme and to design a new plan of action for the following year.

How did the CPD design and delivery take account of teachers' individual starting points?
Some of the studies reported on the ways in which the CPD had been able to take teachers' individual starting points into account. These included:

- using observation and feedback; this enabled colleagues or consultants to understand "where teachers were coming from". For example in Britt's study observation feedback helped establish the effects of one intervention before teachers moved on to try something else. Similarly when coaching was used an important first step was to identify how well teachers were tackling a particular problem unaided
- providing opportunities for deep professional conversations which offered the CPD provider the opportunity to receive formative feedback from teachers. This provided information about the CPD process, developed the teachers' control over their own learning and prompted them to make explicit their existing knowledge and beliefs. For example, Gersten noted pronounced differences in the thinking of the special needs teachers and general classroom teachers who worked together, which surfaced during professional conversations. It became obvious that "teachers' tacit knowledge and beliefs needed to be addressed and without this, such programmes could be at risk". As this study progressed, the special educators and project staff "began to practice what they preached. Just as they encouraged teachers to modify their instruction, to meet the individual needs of their students, so they learned the importance of modifying their coaching to the needs, desires, interests and abilities of the individual teachers."
- offering teachers' ownership of the focus for development; Kirkwood's study acknowledged that "teachers learn at an individual pace and have different starting points when approaching a new learning task." She made a positive effort to ensure that the more experienced participants did not always dominate proceedings and that everyone felt that their input would be valued
- creating action research programmes; these enabled teachers to start at a level of enquiry they felt comfortable with and to take on new areas of enquiry as they felt able. For example, Ross observed that: "Participation in collaborative research helped these teachers to add an item to their agendas for professional renewal and to determine when they would deal with that item."
- establishing more than one learning cycle; this offered teachers the opportunity to identify and refine what they wanted to research before implementing it. For example in one study, during Phase 1 teachers were able to reflect on their own practice, without lowering their confidence in their teaching ability, devise a framework for self improvement and learn how to conduct research. During Phase 2, teachers carried out their own research into effective ways of teaching students how to evaluate their own practice. (Ross).

Not surprisingly, problems emerged from such processes that needed to be tackled and responsiveness to

needs that surfaced during the programmes was important. One study (Gersten) found that teachers at the start of their careers needed extra mentoring as they had to cope simultaneously with induction into a new career and an action research project. In other studies, lack of time often inhibited full implementation, for example, where teachers felt that more time was needed to fully integrate technology opportunities into their planning.

Although teachers in six studies participated in some initial diagnostic assessment, it was not clear whether the results were used to inform the programme design. Such information could certainly be used to facilitate responsiveness.

How far can we trust these findings? What is a systematic review?
Systematic reviews are a means of informing practitioners, researchers and policymakers about best evidence which is available to help them with a particular interest or problem. Instant access to the findings of relevant studies makes this sort of review particularly useful to practitioners. Systematic reviews use detailed and rigorous research methods to ensure valid and reliable results and arrive at these results in transparent ways.

The CPD review which is the focus of this summary involved a diligent and consistent approach to:

- clarifying the aims and objectives of the review
- accessing all potentially relevant studies that might inform the review question
- filtering these potential studies against set criteria, to ensure they are reliable and contain enough detail to answer the review question
- highlighting core features of studies by using keywords
- examining the studies in depth and weighing up their potential to answer the review question
- analysing the results
- drawing conclusions and making recommendations.

Readers are offered as much transparency as possible and are reassured that the system is not open to undue bias or misinterpretation of data as reviewers have to report in great detail on every stage of the review process.

In summary the actual process of the review involves a number of stages including:

- a systematic search of the literature, using electronic databases, handsearching key journals, word of mouth, citations and websites
- the application of a set of initial inclusion criteria to the titles and abstracts thus uncovered (13,479 reports)
- retrieval of full reports (266), to which the criteria were re-applied to see if they were suitable for inclusion in a map of the literature
- keywording of all the included reports (72) by EPPI core keywords, such as type of study, type of setting, age, curriculum focus, in addition to a number of CPD specific keywords to distinguish finer detail between types of intervention, participants and outcomes
- the application of a second, narrower set of inclusion criteria to the keyworded reports, to ensure that only studies which contained data about the impact of the CPD on pupils were retained for in-depth review
- using EPPI data-extraction software to extract data from the studies (17, later reduced to 15) and to assess the weight of evidence they provided for answering the review question.

At all stages appropriate standardisation and moderation of the review process was carried out, involving specific training in, for example, the application of inclusion criteria and the assigning of keywords. In the data extraction stage at least two reviewers examined each study independently before agreeing a consensus on each of the 100 indepth questions about its aims, methods and capacity to help answer the review question.

What sorts of studies did the reviewers look at in detail?
The CPD interventions on which the review findings were based addressed a variety of teaching and curriculum issues. They included CPD, which focused specifically on:

- raising students' attainment in mathematics
- strategies to increase students' understanding and use of ICT
- questioning skills
- special needs teaching in mainstream classes

- investigations into the teaching of new curricula in science and mathematics
- designing new schemes of work in science and technology.

The review reported on studies from a worldwide base, over half being conducted in the USA. Somewhat surprisingly, only two originated in the UK. Primary and secondary schools were equally represented, with several cross phase settings. Mathematics and science were well represented as curriculum areas, as were literacy and ICT. Some research was cross-curricular and included subjects such as history or social studies. All the research was published between January 1988 and October 2001.

Studies ranged in scope and size from a project involving three teachers and their primary school students to larger projects in which twenty or more teachers participated. Sometimes projects expanded considerably - in one case the study began with eleven teachers and grew to involve over forty staff.

How reliable were the conclusions reported in the studies?
In general, both teachers and researchers were cautious in claiming direct links between the CPD and student outcomes because of the number of different activities and factors that influence the dynamic relationship between teaching and learning. All of the studies, when assessed through the rigorous EPPI data extraction process, were judged to provide relevant and systematic evidence of such links. The review team were careful to assess the weight of evidence about whether an intervention had an impact separately from how the impact took place.

What should teachers be looking for in CPD programmes offered by providers?
The review highlights observed features of successful CPD and suggests certain features to look out for when assessing the potential value of CPD activities. It suggests that effective CPD should take account of a number of key factors including:

Building on teachers' existing knowledge and taking account of teachers' individual learning needs.

- Does the programme either propose activities for establishing needs and starting points or provide a detailed description of its assumptions about what you know and can do already?
- Can teachers control the pace?
- Are the proposed activities flexible enough to change direction as the programme evolves or are the final goals pre-determined?
- Do the activities offer less experienced or confident teachers more support?
- Encouraging teacher ownership by using teachers' real concerns as a focus for enquiry.
- Are there activities designed to help the building of teachers' ownership of professional development?
- Will teachers be encouraged to find answers to "real classroom problems"?
- Where national or local initiatives demand re-training in new methods, will teachers be able to select relevant options or can strategies be modified to suit teachers' individual contexts?
- Can teachers choose the activities that feel like the right next step?

Sustaining the CPD over a period of time so that new approaches can be adapted, trialled and gradually embedded in teachers' practice.

It takes time before teachers are able use new methods as confidently and flexibly as they did previous ones and things often gets worse before they get better. Superficial change may result if new directives are hastily implemented.

- Does the programme extend over a suitable time scale to allow new activities to bed down (all these programmes lasted three or more months)?
- Do evaluation mechanisms extend beyond satisfaction sheets at the end of a day's intervention which may be misleading about potential impact given the time and challenge involved in deep professional learning?
- Providing opportunities for promoting "equal partnerships" between teachers and specialists where the knowledge and experience of teachers is valued.

In this way, professional conversations can become a means of self-reflection and a source of encouragement to teachers to explore viable alternatives. Teachers appeared to benefit from exploring previous research in the field and understanding the rationale behind new methods.

- Does the proposed CPD promote such links between LEA experts or university researchers and work in schools?
- Could clusters of schools arrange such support? Does your school know about the NCSL's networked learning communities (http://www.ncsl.org.uk/index.cfm?pageID=nlc) or Leading Edge Partnerships (http://www.standards.dfes.gov.uk/leadingedge/what_is_leading_edge/?version=1) where similar arrangements are now being developed across the country?

Providing opportunities to benefit from coaching.

Teachers in the studies were happy to invite sympathetic "outsiders" to observe their lessons and valued observing and explaining their colleagues' efforts, but only when trust had been established.

- Would teachers feel more comfortable about observation if it were established as a two-way learning process?
- Are there arrangements for enabling teachers to observe new strategies at work through watching external experts work with their own pupils before trying them out?
- Providing teachers with time to participate in collaborative professional development activities.
- Would it be possible to negotiate non-contact time with senior management to enable teachers to undertake, for example, collaborative lesson planning within workshops, peer coaching and observation and team teaching?

How might teachers go about undertaking their own professional development?

Individual teachers who may be wondering what they can do to further their professional development may find it helpful to consider the following scenarios:

- You may wish to engage in collaborative approaches to common issues with colleagues, such as peer observation and feedback. Are such opportunities available to you? If not, might such activities be something which your school would support?
- You may wish to consider whether schemes such as the NUT teacher2teacher programme or the NCSL network's 'Real Time Learning' programme might have something to offer
- Do colleagues in your school share a common desire to get to the bottom of a particular problem? Would you consider approaching a university research department for support for a small-scale enquiry into this issue? Would this entail more work or working more effectively?
- You may not want to engage in research activities, but, following a one-off course or intervention, would be happy to share new ideas from a recent course with a colleague by inviting him or her to join you in mutual observation of part of a lesson, or shared work with a group of students, as a basis for discussion on new approaches to teaching.
- You may be considering engaging in CPD activity but feel you would like to know more about it. The GTC website has hosted forums for discussing CPD and also offers the Teachers Professional Learning Framework as a framework for entitlement to CPD. . The GTC is also involved in CPD partnership projects with a number of local education authorities.

Your Feedback

Have you found this study to be useful? Have you used any aspect of this research in your own classroom teaching practice? We would like to hear your feedback on this study. Email us to share your views: research@gtce.org.uk

Which studies were included in the in-depth review?

Britt MS, Irwin KC, Ritchie G (2001) Professional conversations and professional growth. *Journal of Mathematics Teacher Education Netherlands 4*: 29-53 (study 351)

Brown DF (1992) *The Development of Strategic Classrooms in Two Secondary Schools.* Unpublished research report; Wellington, New Zealand: Ministry of Education (study 352)

Bryant DP, Linan-Thompson S, Ugel N, Hamff A (2001) The effects of professional development for middle schools general and special education teachers on implementation of reading strategies in inclusive content area classes. *Learning Disability Quarterly 24:* 251-264 (study 353)

Da Costa JL (1993) *A study of teacher collaboration in terms of teaching-learning performance.* Paper given at the American Educational Research Association Annual Meeting April 1993, Atlanta (study 355)

Ertmer PA, Hruskocy C (1999) Impacts of a university-elementary school partnership designed to support technology integration. *Educational Technology Research & Development 47*: 81-96 (study 357)

Gersten R, Morvant M, Brengelman S (1995) Close to the classroom is close to the bone: coaching as a means to translate research into classroom practice. *Exceptional Children 62:* 52-66 (study 359)

Harvey S (1999) The impact of coaching in South African primary science INSET. *International Journal of Educational Development 19*: 191-205 (study 360)

Harwell SH, Gunter S, Montgomery S, Shelton C, West D (2001) Technology integration and the classroom learning environment: research for action. *Learning Environments Research 4*: 259-286 (study 361)

Kimmel H, Deek FP, Farrell ML, O'Shea M (1999) Meeting the needs of diverse student populations: comprehensive professional development in science, math, and technology. *School Science and Mathematics 99*: 241-249 (study 362)

Kirkwood M (2001) The contribution of curriculum development to teachers' professional development: a Scottish case study. *Journal of Curriculum & Supervision 17*: 5-28 (study 363)

Kohler FW, Ezell HK, Paluselli M (1999) Promoting changes in teachers' conduct of student pair activities: an examination of reciprocal peer coaching. *The Journal of Special Needs 33*: 154-165 (study 364)

Parke HM, Coble CR (1997) Teachers designing curriculum as professional development: a model for transformational science teaching. *Journal of Research in Science Teaching 34:* 773-789 (study 366)

Ross JA, Rolheiser C, Hogaboam-Gray A (1999) Effects of collaborative action research on the knowledge of five Canadian teacher-researchers. *The Elementary School Journal 99*: 255-275 (study 367)

Saxe GB, Gearhart M, Nasir NS (2001) Enhancing students' understanding of mathematics: a study of three contrasting approaches to professional support. *Journal of Mathematics Teacher Education 4*: 55-79 (study 368)

Wilkins CW (1997) *Effects of a resident mentor teacher on student achievement in mathematics*. Unpublished report. Mississippi, USA (study 369)
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Case studies

The following case studies were selected to illustrate key points of the types of CPD which were identified as successful in the review. The first three are practitioner case studies which were independent of the review. The remaining two are based on studies which were used for in-depth study in the review.

Your Feedback
Have you found this study to be useful? Have you used any aspect of this research in your own classroom teaching practice? We would like to hear your feedback on this study. Click on the link below to share your views with us.
research@gtce.org.uk

How pupils' learning in Year 6 history and geography was affected by in-service training focused on teaching quality

This case study describes the work of four non-specialist teachers of history and geography in a middle school in Bradford. It highlights the effective use of teacher collaboration in order to improve their own teaching and their pupils' learning.

What did the CPD consist of?

The CPD was carried out by the four teachers with support from LEA subject specialists.

All staff attended six hours INSET which aimed to match generalised input on teaching quality with subject specific support. During the sessions teachers reflected on their own practice and discussed their shared understanding of effective teaching. The CPD involved a number of activities including:

- exploring summaries of relevant research findings and theories about teaching quality
- observing other teachers
- formally reflecting on specific teaching strategies
- carrying out research
- planning with supported from LEA subject specialists.

After these sessions teachers then watched each other teach, experimenting with new styles of teaching. They then discussed their observations, reflected on their practice and sought ways to improve.

What changes resulted from the INSET?

Discussion on best practice and reflection on their own teaching led teachers to redesign lessons to ensure that they:

- were more specific about learning objectives
- communicated these objectives more effectively to children
- structured activities in small steps
- differentiated more effectively
- used key questions to promote and extend learning and focus the lesson
- encouraged more pupil-pupil discussion.

Evidence collected through classroom observations, teachers' diaries, examination of pupils' work and before and after testing showed that teachers' development helped pupils:

- become clearer about what was expected
- become more involved and more on task
- show greater confidence about their learning
- become more focused in their discussions
- begin to form their own questions in order to carry investigations forward.

They reflected that:

- the risks involved in trying new techniques were rewarded by improvements in pupils' response. Teachers became more enthusiastic as they found the techniques working in practice
- that formal reflection on their own strategies was a vital factor in helping them improve their teaching
- opportunities to observe other teachers and to be observed themselves were extremely useful:
  "15 minutes observation is as useful as a day's INSET"
- collaboration with colleagues was a vital factor in improvement and increased confidence
- when support is given for risk taking and development it is much more likely that improvements will be sustained.#

Which factors helped to make the CPD effective?

The researchers suggest that optimum conditions exist where school culture supports innovation, reasoned

risk-taking and new learning. They conclude that collaboration with colleagues, involving formal reflection on teaching methods and pupil learning, appeared to be key factors linked to improving practice. They suggest that the following factors may support teacher development:

- quality planning and collaboration time was built into timetables at a structural level, not just slotted in
- INSET was organised in school, and undertaken by teams who supported each other collegially
- reciprocal observation of lessons by colleagues
- school leaders anticipation that the 'pain' that comes before the 'gain'
- change needs to be supported by adequate resources.

Reference: Clayton, Tina, Holmes, Susan, and Fox, David. Calversyke Middle School, Keighley , West Yorkshire. TRG no. 71 / 8-99

Using action research to raise children's attainment in mental mathematics

This case study shows how a head teacher, with collegial support, was able to develop a research strategy to tackle an identified issue concerning children's mathematical learning.

The research was initiated by the headteacher in response to problems that Key Stage 1 children were experiencing in computation. Following a pilot study in her previous school, the headteacher with teacher colleagues used action research to test out a new way of teaching mental maths. Collaboration was a key feature of the research enquiry. The research team involved a partnership between the head and teachers, in her own and a neighbouring school, supported by an initial teacher trainer from the local university. The use of a university 'expert' was seen as fundamental.

The research journey, how the project developed

The headteacher was concerned that pupils in her school did not really understand their maths and that teaching and learning activities were not successful in addressing pupils' needs. Initially the head worked with the maths co-ordinator at the school and a university colleague, each providing mutual support and complementary expertise. The research programme developed in this way:

- two reception classes and a Year 1 class became involved in the research, using structured apparatus to help them conceptualise their number work
- a further two reception classes followed traditional methods and acted as control group
- teachers used measurements before and after the intervention to progress made by pupils
- as evidence emerged that the experimental groups had made progress, in terms of their mathematical understanding, whereas the control groups had not, other teachers joined the project
- after two terms all teachers in the school were introduced to the strategy and were involved in its use.

A climate of trust and openness ensured that teachers were supported through the "initial pain of making change in their practice". The school went on to support similar changes in many other schools.

Developing a spirit of collegiality

Staff were spurred on partly by the improvements in children's learning and partly by being involved in 'the cutting edge of professional development'. The headteacher and staff were all part of a team exploring and developing their practice:

"We were all learning together - we created a climate where each of us was saying 'I don't know - let's find out.'"

There is still a questioning 'wanting to know and seek solutions' culture in the school. The head believes that enquiry based learning has to be modelled and that the process starts with initial teacher training and continues with the head and senior staff modelling reflective enquiry as part of a knowledge creating school.

Evidence from the school shows that teachers felt their engagement in the research helped them to explain mathematical ideas better, and led to increased understanding of mathematical language for pupils.

New staff are trained in the theory and practice of the new teaching methods and supported by the maths co-ordinator.

Spreading the word

This research project became a focus of considerable interest in the wider educational community as illustrated by dissemination, which included:

- a constant stream of visitors to the school, to find out how the new methods worked
- the headteacher and university tutor being invited to speak at workshops, conferences and seminars through the country
- a commercial company becoming involved in the manufacture of visual equipment (Numicon) to support the strategy
- promotion of the teaching methods by the Downs Education Trust
- a lot of interest from SENCOs about the use of the methods and materials.

Implications for other settings

Creating the right climate for change was an important factor in the ultimate success of the new methods. The headteacher of one school involved in the project indicated that teachers may seem reluctant to commit themselves to changing their practice due to unspoken fears of exposure or failure. With this in mind, the instigators of the new strategy worked hard to make teachers feel involved.

Specific features of the CPD which helped to bring about its success included:

- understanding the anxieties of teachers and creating a climate of trust where teachers were able to 'keep their self-respect'
- ensuring that teachers had a good understanding of the new strategies
- having plans in place that teachers could follow
- modelling and mentoring provided by the head and maths co-ordinator
- evidence of notable improvements in pupils' achievements
- financial support through a modest TTA grant
- the active support of an experienced university researcher.

Reference: Tacon, Romey and Atkinson, Ruth; Peacehaven Infant School, Peacehaven, East Sussex BN108JB. TRG No. 113/4-00

The nature and benefits of peer observation

This case study describes how peer observation and support helped to play a valuable role in research into teaching effectiveness as part of a consortium of six Leeds primary schools.

Each of the six schools in the consortium conducted a separate piece of research into teaching effectiveness. The focus of the research was the teaching of mathematics, with a particular emphasis on mental mathematics. Peer observation was used as part of the research approach in every school.

What happens in peer observation?

In peer observation teachers work together in pairs or small groups, using observation as a research tool to explore specific features of teaching and learning. Information gained in this way can be fed back to refine the research question and to inform teachers' practice.

In the Leeds consortium peer observation involved both the process of observation and the discussion that followed. It was agreed that:

- the observation framework would be based on research but developed and refined by the teachers involved
- everyone who observes was also observed
- the system used by a teacher when observing was the same as that used when they were being observed
- all teachers who were involved in the observations took part in the subsequent discussion and analysis.

Within this framework there were variations in, for example, the method and extent of note taking during observations.

What were the benefits of peer observation?

Peer observation led to benefits both in teacher knowledge and understanding, and in working relationships. Other positive outcomes included:

- a deepening of trust and empathy between teachers
- development of a meaningful shared language between teachers based on mutual experiences
- feelings of ownership in the change process, in a climate that valued all opinions and viewed all lessons as worth watching and talking about
- feelings of increased self-worth as colleagues reported positively on teaching and learning outcomes
- identification and analysis of real classroom issues as highlighted by observation of common practice rather than 'show lessons'.

What strategies were used to make the process easier?

The researchers acknowledge that the benefits were not achieved automatically and that a number of obstacles had to be overcome. To make the process of peer observation easier to implement the researchers suggest that the following strategies might be helpful:

- avoidance of subjective interpretations of events through the use of the 'target' method of observation. Writing of comments was limited to a series of one minute episodes, thus ensuring factual rather than qualitative comments; (Edwards and Talbot method)
- acknowledgement of the risk teachers take, in exposing their practice to observation and analytical discussion, through establishing mutually agreed 'ground rules'. For example, participants agreed to listen to what was said before jumping to conclusions
- deciding the focus of the observation and discussion in advance
- agreement that these observations, including notes taken, would not form the basis for any future performance management assessments
- ensuring teachers are able to participate in the peer observation process through reliable systems of cover, though not necessarily for whole lessons, sometimes a ten-minute 'window' of observation served the purpose
- an understanding that teachers were not expected to teach 'model' lessons helped to reduce strain and additional planning time
- an opt out option. If staff really feel anxious about the process requiring them to do so will not work. They may come to recognise that 'the benefits easily outstrip the initial costs of awkwardness and embarrassment'.

Implications for other settings?

The important thing is to set the wheels in motion. Peer observation can begin with a couple of teachers spending time in each other's room to explore an issue of mutual concern. Later they may wish to develop this process further.

Any observation and discussion of practice should be undertaken for the sole purpose of informing practice. Other agendas such as seeking accreditation or promotion can alter the emphasis of the exploration and affect motivation.

Be flexible, early observations may give rise to new questions for exploration. It is common to focus on a general area of interest initially which may eventually lead to enquiry into frequency of specific features. This may well, in turn, lead to decisions to use audio or visual recordings to ensure important data are not lost.

Reference: Edwards, A. and Talbot, R. Summary of research for TTA/DfES Teacher Research Conference, 7 March 2001. TTA publication TPU0576/2-01

A collaborative approach to science curriculum design

This study explores the impact of continuing professional development (CPD), which was collaborative and sustained, on teachers' practice and students' attitudes and achievement in science. It highlights the effective contribution to the CPD made by outside experts in the form of education staff from two universities and also illustrates CPD which takes account of teachers' starting points. The CPD was designed as an alternative to the constant stream of 'top-down' changes to education with which teachers in the US were faced. The research compared changes among project teachers and their students with those of a control group in seven schools covering inner-city, urban and rural settings. The students were aged eleven to fourteen and of both genders. In order to provide more specific and detailed information about students' attitudes and motivation, the researchers focused on nineteen project teachers and their 205 students and eleven teachers and 120 students who made up a control group.

Specifically the study aimed to implement a CPD model based on linking theory with practice through curriculum design and then to explore its impact on:

- teachers' practice
- students' attitudes, motivation and achievement.

Data were collected by interviews with individual teachers, student questionnaires and student end-of-grade tests.

What did the CPD consist of and how did it affect teachers?

The intervention involved collaboration between teachers and university science educators which aimed to change how teachers think about and teach science. It was designed to:

- offer the teachers the opportunity to share their views and experience about science teaching
- challenge the teachers' beliefs about practice
- invite the teachers to share and reflect on research literature about teaching and learning
- facilitate teacher collaboration in the design of new science curricula.

One teacher commented on how her approach to assessment had changed as a result of the CPD, in the following terms:

'It is easy to give definitions if you have memorised them, but now I ask my students, "Can you apply the

idea, can you think of an example, can you give me an analogy can you relate the idea to anything else other than just the definition?" That is what understanding means to me...that you can compare, contrast, change some aspect, make a prediction...'

Evidence from teacher interviews suggested that project teachers aimed to be more process orientated than content orientated. There was evidence that control teachers mapped their teaching to specific syllabus content while project teachers were more concerned to teach for understanding of science.

What were the characteristics of the new curricula?

Specifically the new curricula were built on:

- an incorporation of ideas from research
- an awareness of students' learning needs
- a readiness to accept students' ideas
- knowledge of the way students learn
- making connections among science concepts
- collaborative learning
- understanding of science rather than memorising of content.

Implicit in the approach adopted by the teachers was the idea that facts are disconnected and appear in isolation while understanding comes from a connectedness of ideas. There was also a conscious attempt to respond to students' individual learning needs and to involve their families in implementing the curriculum so that out of school experiences could support students' work in school.

Teachers began to rethink the purpose of assessment. They designed assessments that provided continuous feedback about their students' understanding, and embedded them in science lessons so that they became part of the learning process.

What impact did the new approach have on students?

Project students:

- worked collaboratively more often than control students did
- did more experiments and hands-on activities than control students did
- enjoyed science more and were more motivated by science than control students
- achieved results in mandatory state tests which matched the performance of control students even though the project teachers covered less science content.

Some project teachers observed that their students became more confident asking questions participating in discussion, volunteering explanations and using apparatus. Others observed that by the end of the course their students were much more prepared to engager in laboratory work and co-operative tasks than in the past.

Close analysis of the test performances of the students showed that control students performed slightly better on content while project students did slightly better on process.

What did the researchers conclude?

From the evidence collected during the study the researchers suggested that:

- the past experiences of teachers are a valuable resource for themselves and their colleagues

- introducing teachers to appropriate research encourages them to reflect on their own teaching
- curriculum development is both a means for the professional development of teachers and for bringing about sustained education reform
- professional development is more effective when it attempts to involve teachers in change rather than requiring them to simply to change their practice.

Reference: Parke HM, Coble CR (1997) Teachers designing curriculum as professional development: a model for transformational science teaching. *Journal of Research in Science Teaching* 34: 773-789 (EPPI review study 366)

Teacher collaboration to improve teaching and learning of computing

This case study highlights how a combination of peer support, the input of an outside expert and teacher ownership helped an initial small-scale project become a popular and self-sustaining continuing professional development (CPD) programme. The project grew out of a concern for the poor development of knowledge and understanding of computing, a lack of ability to solve problems and the low level of motivation among 14 to 16 year-old students in the final two years of secondary school in Scotland.

The outside expert was keen to avoid exerting an influence on the goals of the project. Instead she chose to work with teachers 'from the inside' in a number of ways including:

- sharing thoughts and ideas with them
- drawing teachers' attention to accessible and relevant reading material
- sharing in the work of the project.

How was the CPD organised and what part did teachers play in its development?

Initial planning was undertaken by a small group which consisted of a subject adviser, two teachers and the researcher/consultant. Its brief was to identify potential participants and to identify themes for the research and development activities.

The CPD began with 11 teachers in the first year - by the fourth year of the CPD there were 40 teachers and their classes. The CPD took the form of a research and development programme in which teachers identified problems in their classrooms and then sought together to develop appropriate strategies for tackling the problems.

Significant features of the research, which lent to its effectiveness, included:

- teachers engaging in disciplined inquiry into learning, teaching and assessment
- teachers experimenting within an agreed framework
- teachers sharing expertise.

All teachers from participating computing departments were invited to take part in group activities, such as planning meetings, workshops, peer observation of each other's lessons, working groups and writing teams. By operating a rota system, departments were able to offer all members of their departments the same opportunity to become involved. The nature and outcomes of individual or group investigations formed part of the agenda of project meetings.

Teachers were able to decide on the degree of involvement which suited them best - some teachers played a major role in decision making or development while others wanted to trial and give feedback about curriculum resources produced by the working groups.

As new departments joined the project they were paired with departments already participating in the programme, in order to provide them with support. The continued growth of the project over the four years and the fact that none of the participating teachers left the project suggests that the teachers felt comfortable with the CPD and that it was helping them tackle problems in their classrooms.

What effect did the CPD have on the teachers?

Evidence collected during the study suggested that teachers benefited in a number of ways including:

- improved capability for designing learning tasks their students
- experience of collaborative working which offered the teachers the opportunity to tackle problems together and to share project work out
- gaining skills in reflection, discussion and evaluation, and developing a research perspective in their classrooms
- continuing to have the opportunity to share problems and solutions with other teachers through informal networks created during the project
- improved self-confidence.

Teachers felt that by becoming learners themselves - by developing a greater capacity for thinking independently, reflecting critically, problem solving and working together with other teachers - they had also become better role models for the children they taught.

How did students benefit from new approaches adopted by their teachers?

A major outcome of the cpd was the preparation of new curriculum units, which were closely aligned to the ideas the teachers had shared and developed during the project. The teaching styles which teachers adopted in order to teach the new units led to a number of benefits for students including:

- building on what students know and can do already
- more independent learning styles enabling students to develop greater selfregulation of learning
- problems set at different levels to meet the different learning needs and abilities of students
- greater linking with other parts of the school curriculum
- more varied teaching styles from their teachers including scaffolding, more modelling of problem-solving strategies, coaching and targeted feedback.

Evidence from student questionnaires indicated that around 90% of the students, in each case:

- found the work interesting or very interesting
- reported that they could understand all or most of the work
- enjoyed being able to work at their own pace
- found the new answer booklet helpful
- were looking forward to the next unit.

Reference: Kirkwood M (2001) The contribution of curriculum development to teachers' professional development: a Scottish case study. *Journal of Curriculum & Supervision* 17: 5-28 (EPPI review study 363)
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Further reading

What else might I enjoy reading?

Da Costa J.L. (1993). *A study of teacher collaboration in terms of teaching-learning performance.* Paper presented at the Annual Meeting of the American Educational Research Association (Atlanta, GA, April 12-16, 1993).

Ertmer, P.A. and Hruskocy C. (1999) *Impacts of a university-elementary school partnership designed to support technology integration.* Educational Technology Research & Development, 47, pp.81-96.

Gersten R, Morvant M, Brengelman S. (1995) 'Close to the Classroom Is Close to the Bone: Coaching as a Means to Translate Research into Classroom Practice'. *Exceptional Children*, 62, 52-66.

Harvey S. (1999) 'The impact of coaching in South African primary science InSET'. *International Journal of Educational Development*, 19 (3), pp.191-205.

Kirkwood, M. (2001) 'The Contribution of Curriculum Development to Teachers' Professional Development: A Scottish Case Study.' *Journal of Curriculum & Supervision*, 17(1), pp.5-28.

Saxe, G.B., Gearhart M., Nasir N.S. (2001) 'Enhancing Students' Understanding of Mathematics: A Study of Three Contrasting Approaches to Professional Support'. *Journal of Mathematics Teacher Education*, 4(1), pp.55-79.

Britt M.S., Irwin K.C., Ritchie G. (2001) 'Professional Conversations and Professional Growth'. *Journal of Mathematics Teacher Education Netherlands*, 4(1), pp. 29-53.

Parke H.M. & Coble C.R. (1997) 'Teachers designing curriculum as professional development: A model for transformational science teaching'. *Journal of Research in Science Teaching*, 34(8), pp. 773-789.

Bryant, D.P., Linan-Thompson S., Ugel N., Hamff A. (2001) 'The Effects of Professional Development for Middle School General and Special Education Teachers on Implementation of Reading Strategies in Inclusive Content Area Classes.' *Learning Disability Quarterly*, 24, pp.251-264.

Harwell, S.H., Gunter, S., Montgomery, S., Shelton, C., West, D. (2001) 'Technology Integration and the Classroom Learning Environment: Research for Action'. *Learning Environments Research*, 4(3), pp. 259-286.

Kimmel, H., Deek, F.P., Farrell, M.L., O'Shea, M. (1999) 'Meeting the Needs of Diverse Student Populations: Comprehensive Professional Development in Science, Math, and Technology for Teachers of Students with Disabilities'. *School Science and Mathematics*,99, pp. 241-249.

Wellington, New Zealand: Ministry of Education (study 352)
Brown DF, (1992)

Ross, J.A., Rolheiser, C., Hogaboam-Gray, A (1999) 'Effects of Collaborative Action Research on the Knowledge of Five Canadian Teacher-Researchers'. *The Elementary School Journal*, 99 (3), pp.255-275.

Promoting Changes in Teachers' Conduct of Student Pair Activities
Kohler, F.W., Ezell, H.K., Paluselli, M. (1999) An Examination of Reciprocal Peer Coaching. Journal of Special Needs, 33(3), pp.154-165.

Wilkins, C. W. (1997) Unpublished report. Mississippi, USA.

Where can I find out more online?

DCSF: Standards site
http://www.standards.dcsf.gov.uk/
Provides information and materials about the professional development of teachers. There are many materials available about CPD on this site.

EPPI Centre: The impact of collaborative CPD on teaching and learning
http://eppi.ioe.ac.uk/cms/Default.aspx?tabid=136&language=en-US
The full study.

Teachernet: CPD http://www.teachernet.gov.uk/professionaldevelopment/

Related research

Timperley, H. Wilson, A. Barrar H. & I. Fung (2007) Teacher Professional Learning and Development: Best Evidence Synthesis
www.educationcounts.govt.nz/publications/series/2515/15341
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Appraisal

Robustness

This systematic literature review set out to identify and synthesise studies of collaborative continuing professional development (CPD) for teachers of the 5-16 age range, conducted since 1988. The study grew out of teachers' and their professional associations' interest in this subject and built on studies of how teachers acquire and use knowledge particularly in situations where there was collaboration with other professionals.

The researchers defined their research question and their terms clearly. For example, collaborative CPD was defined as teachers working together on a sustained basis and/or teachers working with professionals in local authorities, higher education institutions or other capacities. They were concerned to find out how collaborative CPD for teachers of the 5-16 age range affected teaching and learning. This was achieved by applying sets of inclusion and exclusion criteria to the studies searched. They systematically examined 13,479 titles and abstracts, identified 266 full studies of which seventy-two were found to be relevant and seventeen were selected for an in-depth review. These were subsequently narrowed down to fifteen. Full reports were keyworded and a second narrower set of criteria applied. EPPI data extraction software was used to assess the weight of the evidence.

The results of this synthesis enabled the researchers to draw conclusions about whether collaborative CPD had an impact on teaching and learning and how such an impact manifested itself and was realised. In all but one of the fifteen studies included, collaborative CPD was linked with improvements in teaching and learning. The researchers identified significant improvements in outcomes for teachers, their students, the CPD process and the research itself. For instance, there were improvements in teachers' behaviour, beliefs and approaches to teaching and the use of resources. These changes were influenced by collaborative practices such as joint planning and team teaching and required time for problems to be identified and overcome. As a result of these changes, students showed improvements in performance, approaches to learning, attitudes and levels of participation.

The review identified the positive contributions made by aspects of collaborative CPD, for instance, the use of expertise external to the school, peer observation, feedback and peer support rather than leadership by senior members of staff. Some other contributory factors of note were dedicated time, interventions that built on

what teachers already knew, opportunities for action research and use of research literature. The researchers dealt well with contradictory outcomes, for example, one study explored issues related to the introduction of new learning environments and increases in teachers use of ICT, but perceived little impact on students. The reviewers provided a realistic assessment of the strengths and weaknesses of their study. They stressed the positive close involvement of user groups and the focus on the impact of collaborative CPD. They acknowledged the limitations of their data particularly the tendency for the studies reviewed to focus on processes or outcomes but rarely both; the under reporting in the studies of process and the limitations of narrow range of subjects covered.

Relevance

This literature review is directly linked with teachers' professional associations' interest in CPD, the effect it has on teachers' professional expertise and knowledge and the influence this has on students' learning and performance.

Applicability

The review concludes by identifying a number of implications for practitioners, policy makers and research. For example they suggest practitioners explore collaborative options and where they are not available consider how non-collaborative CPD can be followed up back in school in collaborative ways. They encourage practitioners to build on what they already know, to link with external providers and to identify opportunities for coaching and peer support. They make a number of pertinent suggestions for policy makers, for example, that they fund collaborative CPD to improve teaching, learning and raising standards; develop CPD that takes account of teachers' needs; avoid an over-managerial approach; focus on collaborations both with external experts and between colleagues in school; consider how CPD and its impact can be measured and how support for collaborative processes, such as peer coaching, can be developed. Researchers, for example, are encouraged to report more fully on their methods; to differentiate between elements of the research process and the CPD process; to report on the impact on students as well as teachers and to cover a wider range of curriculum subjects.

Writing

This report distilled the main findings of a substantial literature review to highlight clearly the main messages from a large body of research. The report gave sufficient detail of the process for readers to make an assessment of the strength of the evidence base and reported well the main findings and implications for practitioners, policy makers and research.

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