REVIEW

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Evidence for Policy and Practice Information and Co-ordinating Centre

The impact of collaborative CPD on classroom teaching and learning

How does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?

Review conducted by the CPD Review Group

The EPPI-Centre is part of the Social Science Research Unit, Institute of Education, University of London

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Conflict of interest statement

Throughout the review process, we have tried to be consistently transparent in everything we did, working within the EPPI-Centre guidelines, methodology and quality assurance procedures for systematic reviewing. We wanted to ensure that the NUT's own pre-existing interest in collaborative CPD in no way influenced our working processes or findings. We can, however, record our keen interest in the outcomes of the review and acknowledge that this may have influenced the review in ways which are not apparent to us.

LIST OF ABREVIATIONS

BDI	Biblioscape Database
BEI	British Education Index
CERUK	Current Educational Research in the UK
CPD	Continuing Professional Development
CUREE	Centre for the Use of Research and Evidence in Education
DfES	Department for Education and Skills
EPPI-Centre	Evidence for Policy and Practice Information and Co-ordinating Centre
ERA	Education Research Abstracts
ERIC	Educational Resources Information Centre (US)
ESRG	Electronic Systems Research Group
GTC	General Teaching Council
HEI	Higher Education Institution
LEA	Local Education Authority
NCSL	National College for School Leadership
NUT	National Union of Teachers
OCLC	Online Computer Library Centre
OFSTED	Office For Standards in Education
REEL	Research Evidence in Education Library
SENCO	Special Needs Co-ordinator
UCET	The Universities Council for the Education of Teachers
TTA	Teacher Training Agency

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* This review has been updated since it was published originally. This update involves minor changes only and has not changed the substantive findings of the review.

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SUMMARY

This summary sets out the background and framework for the review, it then outlines the results in relation to the design, content methodology and context of the studies and concludes with implications for practitioners and policy-makers.

Background

This review grew out of established NUT initiatives in teachers' professional development. It was funded principally by NUT and additional resources were provided by the GTC and the DfES via registration with EPPI-Centre. A systematic approach to research in CPD is timely because many national and international initiatives depend upon significant advances in teacher learning. For example, the UK government's CPD strategy is aimed at enabling teachers to take more control of their own professional development and it also plans to give schools much more direct control of the funding for CPD. Teachers and schools need and want to know more about how professional development might help them develop professional knowledge, skills and careers at the same time as enhancing pupil learning.

The review was initiated in the context of an earlier, interpretative review of teachers' acquisition and use of knowledge (Cordingley and Bell, 2002) which drew extensively on evidence about the importance of teacher experimentation, feedback and coaching (e.g. Joyce and Showers, 1988). The review also drew on the work of various authors about the stages of teacher development, such as Hargreaves' (1993) modelling of the way in which teachers are able cumulatively to extend aspects of practice and the work of Rich (1993) on the learning of beginning and expert teachers.

Aims

Our aim was systematically to review the literature on CPD in order to discover evidence about sustained, collaborative CPD and its effect on teaching and learning. For this review, collaborative CPD included teachers working together; teachers working with LEA, HEI or other professional colleagues on a sustained basis.

Whilst the core purpose of CPD is enhancing student learning, it is crucially focused on teacher learning and teacher beliefs, knowledge, attitudes and behaviours as a means to that end. The review was therefore conducted with a strong focus on the expressed needs and interests of teachers in relation to their students' learning.

Review questions

The over-arching question for the review is:

How does collaborative CPD for teachers of the 5-16 age range affect teaching and learning?

This was unpacked into two interrelated sub-questions about

Whether collaborative CPD for teachers of the 5-16 age range has an impact on teaching and learning?

and if so,

How is this impact realised and manifested?

Rationale

The decision to pursue studies that attempted to relate teacher learning and pupil learning was a radical one given the number of intervening variables and the apparent paucity of studies in this area. However, this goal and the focus on sustained and collaborative CPD were driven initially by teacher interest. Early trial searches informed by the work on CPD outcomes of Harland and Kinder (1997), Joyce and Showers (1988) and Day (1999) gave us confidence that the question would generate studies likely to produce positive findings of interest to teachers. In particular, we wanted to be able to attend to teachers' interest in the nature of the CPD and the different ways in which it affected teachers and students.

Methods

Initially, the review protocol set out in detail the aims and scope of the review, the review question and the methods by which the review would be undertaken.

Identification of studies

For practical reasons, the review has focused on studies carried out since 1988, across the 5 to16 age range that were reported in English, although there were no geographical limits.

Collaborative CPD as defined in the review protocol included teachers working together on a sustained basis and/or teachers working with LEA or HEI or other professional colleagues. It did not include individual teachers working on their own and excluded one-off, one-day or short residential courses with no planned classroom activities as a follow-up and/or no plans for building systematically upon existing practice. Studies had to provide evidence about planned opportunities for teachers' learning prior to, during and/or after specific interventions to enable teachers to relate inputs to existing and future practice.

Methods of identifying studies for the systematic map and in-depth review comprised:

- *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;*
- *retrieval of full reports, to which the criteria were re-applied to see if they were suitable for inclusion in the mapping stage of the review;*
- *keywording all the included reports by EPPI core keywords, such as type of study, type of setting, age, curriculum focus, as well as a number of review*

specific keywords to distinguish finer detail between types of intervention, teachers and processes);
- *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 and to assess the weight of evidence they provided for answering the review specific question.*

Results

Mapping of all included studies

The Stage 1 inclusion criteria targeted studies that fell within review boundaries and contained sufficient contextual and methodological data to be a source of potential evidence for the review question. We sifted systematically 13,479 titles and abstracts, reviewed 266 full studies, identified 72 studies as relevant and so keyworded their content to create a map of the literature.

Studies selected for in-depth review

At Stage 2, the review group narrowed the focus further by restricting the review to CPD activities that explicitly set out to investigate impact upon teaching and/or learning processes and outcomes. Seventeen studies met a second set of inclusion criteria which were explored independently by two separate reviewers each using the EPPI data-extraction guidelines. Any irreconcilable differences between reviewers were referred to a third reviewer. Both the application of inclusion criteria, keywording and data extraction have been systematically cross-moderated by members of the review group and EPPI-Centre staff.

The majority of studies reviewed in-depth came from the USA (nine), with one each from Scotland and England, two from Canada, two from New Zealand and one each from South Africa and Namibia. The settings in which the studies took place were almost evenly divided between primary and secondary age phase. Mathematics and science featured strongly as the curriculum context (11 of the studies selected for in-depth review either focused on maths, and/or science or used these subjects as the vehicle for trialling the CPD intervention).

Thirteen of the studies were designed by researchers to test a particular hypothesis about one or more forms of CPD and two involved naturalistic evaluations of CPD activities. Two studies combined elements of both approaches.

Of the 17 studies that met the inclusion criteria for the in-depth review, two were judged to have low weight of evidence for assessing whether or not CPD had an impact, and one of these was also judged to have low weight of evidence for assessing how this impact was realised. One study (Gersten *et al.*, 1995 – study 359) was judged to have low to medium weight of evidence after data extraction was completed in relation to whether CPD had an impact. This complex study provided patchy evidence. In some areas evidence was of medium or even high quality in relation to our question: for example, it contained detailed evidence about impact upon teacher practice, although in some other areas it was of low quality. Although we excluded studies with uniformly weak evidence in relation to our question, we did not exclude Gersten because of this mixed pattern of

evidence - but we have used this study to illustrate findings only in areas where the evidence was judged to be of medium quality. Therefore our syntheses and conclusions are based on 15 studies that provided low/medium or higher weight of evidence to investigate *whether* CPD had an impact, and 15 studies that provided medium or higher weight of evidence to investigate *how* CPD had an impact.

The findings deal separately with the question of whether the CPD had an impact[1] and then with how such impact manifested itself and was realised.

Did the collaborative CPD have an impact?

In all but one of the 15 studies on which we based our findings, the collaborative CPD was linked with improvements in both teaching and learning; many of these improvements were substantial.

These can be separated into outcomes related to the teachers, to their students, to the CPD processes involved and the research itself. There was contradictory evidence in one study and from some comparisons of different types of CPD or cohort groups.

How was impact realised and manifested?

In relation to teachers…

The changes in teacher behaviours reported in the studies included:

- *greater confidence amongst the teachers;*
- *enhanced beliefs amongst teachers of their power to make a difference to their pupils' learning (self efficacy);*
- *the development of enthusiasm for collaborative working, notwithstanding initial anxieties about being observed and receiving feedback;*
- *a greater commitment to changing practice and willingness to try new things.*

Positive outcomes of the impact of collaborative CPD sometimes emerged only after periods of relative discomfort in trying out new approaches; things often got worse before they got better. Collaboration was important in sustaining change.

Time for discussion, planning and feedback, and access to suitable resources were a common concern in many of the studies.

Collaborative CPD was embedded in many studies in the development of collaborative practice such as joint planning and team teaching.

There was evidence in some of the studies that teachers changed their practice to make use of specific tools or interventions which introduced greater collaboration. Such collaboration related to *generic learning processes* such as activities to generate more effective and targeted dialogue between students, and to *specific teacher activities*, including, for example:

- *a conscious effort by teachers to use computers more for both instruction and collaborative planning; or*

[1] Most of the research evidence identified by this review was from studies reporting correlations between collaborative CPD and a range of outcomes. Throughout the report we use the term 'linked' to refer to such evidence.

- *a conscious effort to increase the range of teaching and learning strategies targeted at specific student needs.*

The focus of the interventions was broadly related to:

- *developing teachers' knowledge, understanding or skills (often in relation to a specific curriculum area); or*
- *developing teachers' beliefs, behaviours and/or attitudes targeted usually at increasing dynamic learning and teaching exchanges with students.*

Fifteen programmes set out explicitly to introduce highly specific programmes, curricula or activities or to test specific forms of CPD that could be tailored to any aspect of teaching. Such programmes, however, inevitably also embraced more generic changes and led to (positive) unforeseen outcomes, so our reporting concentrates upon outcomes.

In relation to students…

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;*
- *the development of a wider range of learning activities in class and strategies for students.*

There were some unanticipated pupil outcomes reported in relation to changes in attitudes and beliefs, including increased satisfaction with their work, enhanced motivation, increased confidence and increasingly active participation.

There was some evidence that where CPD aimed to increase collaborative working amongst pupils, the collaboration amongst teacher participants acted as a model.

In relation to the CPD processes…

Disappointingly, if understandably, given the complexity of the variables involved, studies tended to report in detail on *either* the outcomes *or* the CPD processes, rarely both. Nonetheless there were sufficient data from the synthesis across the studies to enable us to identify a number of core features of the CPD which were linked, in combination, to positive outcomes including:

- *the use of external expertise linked to school-based activity;*
- *observation;*
- *feedback (usually based on observation);*
- *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.*

Eleven studies reported specific arrangements for enabling teacher time to be dedicated to sustained development, for example by providing negotiated non-

contact time, including collaborative lesson planning within workshops and team teaching.

There was also evidence in many studies on how the interventions were designed to take account of what teachers knew and could do already.

Interesting but less widespread findings regarding processes included the following:

- *action research was used as the vehicle for CPD in five of the studies;*
- *research literature was used as a springboard for dialogue/ experimentation in six of the studies;*
- *providing paid or negotiated non-contract time for participating teachers was a feature in five studies;*
- *explicit and self-conscious modelling within CPD, the learning support/facilitation practices that the programme aimed to enable amongst students featured in three studies.*

Contradictory or negative outcomes

There was one study in which the collaborative and sustained CPD did not lead to the targeted improvements. This CPD simultaneously targeted changing the learning environment and increases in teachers' use of ICT. Student views that their learning environment had not changed led the teachers in this study to commit themselves to an additional, more specifically focused year of action research. Sustained and collaborative CPD was also less effective where:

- *a group in one study was not involved in direct classroom observation (compared with groups that were);*
- *one of two groups focusing on the most challenging pupils were novices and much less able to benefit from the programme than experienced colleagues;*
- *there was no subject input into an intervention intended to achieve subject specific changes.*

In relation to the research…

Information about context and process in relation to the CPD intervention tended to be under-reported, as were:

- *characteristics of teachers in the samples and how they were recruited; and*
- *methodological detail.*

This makes it difficult for practitioners and policy-makers who are making decisions about evidence-based change to respond to individual studies.

CPD processes and research processes were also sometimes confused; for example, it was sometimes difficult to ascertain whether observation was being used simply for data-collection purposes or as an integral part of the CPD process.

Conclusions

Implications for practitioners

Any implications are inevitably an interpretation of data by the review team. To identify implications for practitioners and policy-makers, we have worked in consultation with key individuals from each group.

There is evidence in this review that collaborative CPD is capable of supporting successful outcomes for teachers and pupils although further reviews will be needed to establish whether other forms of CPD are capable of similar impact.

In exploring potential CPD options, teachers may wish to identify whether CPD opportunities involve collaboration on a sustained basis.

If there are no programmes on offer which are relevant, teachers may wish to explore with colleagues whether non-collaborative CPD activities could be followed up collaboratively in a within school programme. This may be of particular interest to teachers who, while open to new approaches, are concerned about short-term fads.

The CPD programmes in this review involved quite a range of activities for ensuring that the CPD identified and built on what the teachers knew, believed or could do already.

Exploring how CPD programmes approach this or, if they don't do so explicitly, asking whether there are choices in the programme to enable individuals to find an appropriate focus and level may enable individuals both to identify their own needs and to ensure they are taken into account.

Collaboration and coaching highlighted in this review as being linked with positive effects for teachers and students are grounded in classroom observation and sustained support related to it. This is clearly an expensive process and such opportunities will need to be negotiated.

It may be better to seek fewer opportunities of this sort than several cheaper, more episodic opportunities.

All the CPD being studied involved a complex combination of activities; no one element worked on its own. Some CPD providers may find it difficult to offer such complex combinations.

Pairs and groups of practitioners may be able to combine several separate opportunities. It may therefore be important to consider how each individual opportunity can be connected to other activities and to let CPD providers know about established in-school coaching or peer coaching programmes so that they can help individuals plan to integrate course inputs with the coaching process.

In this review, alongside offering teachers a straightforward choice, observation and feedback or peer coaching and action research were used to enable teachers to work on their own needs and interests, albeit within a framework set by others.

Seeking professional development programmes that involve these activities may help to make sure that CPD that addresses school priorities are also able to respond to individual needs.

There is widespread use in these studies of a combination of external expertise and peer support mechanisms.

Practitioners may wish to consider carefully how to secure the benefits of external support highlighted in this review. Practitioners may wish to consider how far

peer support can be used as a means of supplementing external expertise cost effectively as well as the training in coaching/ consultancy that they may need in order to develop this.

There is evidence here that things get worse before they get better but that it is worth getting over initial discomfort or reluctance and shyness about being observed and sharing problems with colleagues. Indeed the benefits spread well beyond the areas targeted by the CPD to, for example, benefits in relation to enthusiasm about professional learning and to increases in confidence.

Implications for policy-makers

The Review Group consulted widely amongst the different policy stakeholders in the UK to help identify the main issues highlighted by the review which had implications for policy-makers involved in:

- *school leadership;*
- *local and national government;*
- *supporting teacher professional development;*
- *professional and subject representation.*

Impact

This review offers detailed evidence that sustained and collaborative CPD was linked with a positive impact upon teachers' repertoire of teaching and learning strategies, their ability to match these to their students' needs, their self-esteem, confidence and their commitment to continuing learning and development. There is also evidence that such CPD was linked with a positive impact upon student learning processes, motivation and outcomes.

This means that funding collaborative CPD that is sustained could be a powerful component of international, national, regional, local and school efforts to improve teaching, enhance learning and raise standards. Policy-makers at all levels may wish to consider reviewing their policies and resource strategies for CPD to explore whether sustained and collaborative CPD of the type illustrated by this review might increase their effectiveness.

The positive findings about the links between collaborative and sustained CPD and increased teacher confidence, self-esteem, enthusiasm and commitment to continuing to learn about teaching, all address important issues related to teacher retention and recruitment.

Policy-makers at international, national, regional, local and school level should consider whether current CPD programmes and activities could make a greater contribution to recruitment and retention if they were organised on a collaborative and sustained basis.

Teacher-focused CPD

All the CPD in the data-extracted studies was focused on the particular needs of the teachers and the impact of the CPD on their work and their students. The CPD was also located firmly in the school and classroom context. Most of the research reported here started with teachers' expressed learning needs, took account of different starting points for individual teachers at every level and involved activities to develop and sustain teacher ownership of CPD.

Policy-makers, at every level, responsible for developing CPD will wish to consider whether activities take full account of the specific needs and concerns of

teachers in their implementation strategies and put in place arrangements to develop and foster teacher ownership and avoid an over-managerial approach.

They may also wish to consider how far a focus on the needs of schools as a whole enables teachers and providers to connect school and individual needs and to explore how far a focus on the needs of the school inhibits or facilitates differentiation and responsiveness to the professional judgements of teachers.

Structured collaboration

The CPD reported in the review was not about naive discovery or 'curriculum tourism'. It was a structured way of working, involving considerable co-ordination built on clarity about the nature of adult and pupil learning processes.

A current interest in collaboration amongst policy-makers could be enhanced by a focus on the forms of collaboration. In particular, funding and provision mechanisms may need to take account of:

- *the need for specialist, expert input in relation to:*
  - the aspect of pedagogy being explored
  - working with teachers
  - coaching including, where appropriate, the development of peer-coaching skills;
- *arrangements for developing internal peer support complemented by specialist external inputs;*
- *arrangements for sustaining learning over time so that new approaches can be adapted, experimented with and integrated incrementally into existing;*
- *differentiation strategies that take account of individual teachers' needs;*
- *arrangements for creating a distinctive space where it is safe to admit need;*
- *the potential for collaboration between teachers to lead to collaborative ways of pupil working.*

Providers, at every level, may wish to start conceiving and describing CPD opportunities in terms of the messages from the research so that teachers and schools know exactly what they are buying into. For example, CPD providers could describe in more detail how they will:

- *respond specifically to the needs of teachers at different stages of development;*
- *encourage and support the development of in-school coaching;*
- *provide specialist input;*
- *sustain effort over time.*

Similarly, when policy intervenes in relation to pedagogy, the evidence from this review about the key issues outlined above should inform implementation strategies so that classroom teachers are helped effectively to enhance their practice and move beyond superficial adoption of strategies reflectively to embed new approaches into their practice.

The evidence from this review relating to effective support for teacher learning could also offer some texture to the 'dissemination' of best practice strategies.

Policy-makers, at every level, may wish to consider how far dissemination of best practice is conceived as a learning process that includes detailed and expert specification of excellence but embeds this in combinations of CPD activities specifically structured to meet the needs of the learners.

Accountability and accreditation
The CPD reported in this review consisted of a combination of complex activities in a context where it was safe to admit need and which was responsive to individual needs. At the same time, all the CPD programmes in our high or medium-rated studies had a clear focus and purpose. They incorporated measures for assessing effectiveness, including pupil impact. The CPD in these studies involved a strong sense of accountability to colleagues and to pupils.

Policy-makers, at every level, should consider whether accountability to fellow participants in CPD programmes and to pupils can or should be developed to create fit-for-purpose evaluation instruments where evidence collected contributes directly to the CPD.

Forms of support
Most of the studies in this review involved some form of coaching, including observation and feedback, and a combination of external and internal specialist and peer input.

Coaching as carried out in the programmes in this review is expensive, especially when initially building coaching skills but there is evidence that the initial investment is effective and self-sustaining.

Policy-makers, at all levels may wish to consider whether it is possible to encourage schools to buy into CPD programmes involving sustained collaborative working and coaching by:

- *encouraging schools to cluster together for different CPD inputs;*
- *achieving a critical mass of teachers with peer coaching skills so that all CPD can be sustained between external inputs;*
- *making links with existing ITT programmes to build on and embed coaching and mentoring skills.*

Implications for research

Our early priority has been to work on implications for practitioners and policy-makers. The 'implications for research' shown below will be considered more fully at a forthcoming conference of the British Education Research Association, hence the following implications are provisional:

- *researchers need to report information about the context and process of the CPD intervention including the characteristics of the samples, recruitment strategies and details of the methodology;*
- *researchers need to ensure clear differentiation between elements of the CPD process and those of the research process, so as to enable accurate interpretation of the results and processes;*
- *practitioners have indicated that they value research studies which include information considering both the impact on students and on the teachers completing the CPD process;*
- *research needs to encompass a variety of curriculum areas. The present research found that the majority of studies focussed on maths, ICT and science. It is important to know whether the effects of CPD are found across all curriculum areas;*
- *reviews are needed that look at other forms of CPD;*
- *study reports need to concentrate on both CPD processes and outcomes to ensure that practitioners know both whether an intervention is effective and how it was implemented;*

- *there is a need for much greater clarity in providing clear titles and abstracts for studies that will enable search enquiries to identify relaxant material.*

Strengths and limitations of the review

Strengths

- *A strength of this review is the close involvement of a number of user groups in setting and refining the questions and interpreting and disseminating the findings.*
    - The authors of the review went to great lengths to work with users and to work from their perspectives at every stage, and to explain the link between professional development, teacher practice and pupil learning (three important fields of activity that the system needs to be able to connect but that involve multiple, complex and dynamic interactions).
- *The CPD review group believes that it can build on both the findings and experiences of this first review. In particular:*
    - the review provides the basis from which to continue to unpack the specific processes involved in the CPD intervention and to establish those which appear to influence change in teacher practice;
    - the review details a range of approaches to the problematic issues of the measurement of student and teacher outcomes. These have the potential to inform approaches to CPD evaluation in policy and practice.

Our question focused on impact. Since our teacher reviewers and advisors were resolute about the importance of impact information, we have described in Chapter 2 of this review how we used the availability of such data as a filter for inclusion. For practitioners, knowledge about the positive impact of collaborative approaches to CPD simply generates a thirst for more information about how those approaches worked on the ground.

Limitations

We were conscious throughout of the limitations of the data. None of the studies was designed to answer our review question directly. In particular, we found:

- *a tendency for the study reports to concentrate on either inputs and CPD processes or outputs/outcomes (effects on teachers and students) but rarely on both these types of data;*
- *very few of the study designs were appropriate for assessing the effects of collaborative CPD. Hence conclusions about whether collaborative CPD 'works' are more tentative than those about how it works;*
- *a surprising lack of detail about important elements of the CPD processes, even where these were the main focus of the report;*
- *a lack of explicit definitions of core terms;*
- *a disappointing lack of detail about the teacher participants in some of the studies, the different aims and foci of the studies;*
- *many of the studies focussed on maths, ICT and science and so it is not known whether the findings also apply in other curriculum areas;*
- *many of the studies were conducted in the USA and so it not known whether the findings also apply in other geographical areas;*

- *there may well have been additional fruitful data in a number of Ph.D studies. However, we were unable to retrieve these within our timescale and note that these data remain unexplored.*

1. BACKGROUND

1.1 Aims and rationale for the review

Our aim was systematically to review the literature on CPD in order to discover evidence about sustained, collaborative CPD and its effect on teaching and learning. For this review, collaborative CPD included teachers working together and teachers working with LEA, HEI or other professional colleagues on a sustained basis.

Whilst the core purpose of CPD is enhancing student learning, it is crucially focused on teacher learning and teacher beliefs, knowledge, attitudes and behaviours as a means to that end. The review was therefore conducted with a strong focus on the expressed needs and interests of teachers in relation to their students' learning.

This initiative was based on NUT's concern:

- *teachers themselves have very little time to scour the learned journals and other resources of academia where most of the research on CPD is lodged;*
- *little is known about how much of this research actually evaluates what the outcomes of the CPD were;*
- *it is unclear how much evidence there is about how the impact of the CPD on the teachers affected their pupils' learning.*

By undertaking systematic reviews of the literature on CPD, the Review Group hopes to make some of this evidence available to practitioners in an accessible and meaningful way and to highlight the areas in which further research would make a valuable contribution to professional development strategies.

1.2 Definitional and conceptual issues

Continuing Professional Development

The Group has adopted the following definition of CPD, and keeps it under review:

> *'Professional development consists of all natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school and which contribute through these to the quality of education in the classroom. It is the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purposes of teaching; and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people and colleagues through each phase of their teaching lives'.*
> Day (1999)

Individual reviews conducted under the auspices of the Review Group will focus on different aspects of CPD within this broad definition.

CPD is fundamentally a third-order activity. That is, CPD is supported and undertaken in order to improve or enhance teaching that is itself undertaken to enhance students' learning. This is in itself a complex field because of the large number of variables that impact on individuals' learning and the way that learners' different starting points, preferences, skills, relationships and contributions to learning processes interact dynamically with each other – and with teachers' contributions.

The development of school teachers' learning about supporting this process is even more complex because it must also connect with:

- *the teachers' own learning in the context of the school and the community it serves;*
- *the learning of the students taught by the teachers involved.*

This complexity means that:

- *research into CPD embraces many, dynamically interacting people and a wide range of possible outcomes;*
- *such research is hard to conceptualise, construct and fund and so has usually to choose between the following:*
  - exploring specific aspects of CPD, for large numbers
  - tackling many aspects of CPD for smaller numbers of teachers and students
  - including many aspects of CPD more superficially.

The focus of the review

Whilst empirical studies in complex fields such as education inevitably select a specific focus in order to make research feasible, theory about CPD can and does address the issue holistically, taking due account of its complexity (Doyle, 1979; Fullan, 1991; Guskey and Huberman, 1995; Hargreaves, 1993). This modelling and scholarship is, however, able to draw on a rather more restricted evidence base than is the case for, say, student learning. The Review Group therefore enters this territory with some trepidation, mindful of the rich reflections in the literature but able to use them only indirectly within the review. The Group envisages a series of reviews, developing a picture that draws upon the breadth and richness of the literature and builds a much-needed cumulative portrait of the evidence over time. The theoretical literature has therefore been helpful in shaping our question and interpreting our data, even though the main thrust of our work has been a focus upon empirical studies and the pattern of issues highlighted by the data contained within them.

Tools to guide the analysis

The process of checking our analysis of the data was also informed by models of less tangible aspects of teacher development, including teacher beliefs, knowledge and understanding. For example, Askew's (1997) development of Shulman's 1986 typology of teacher knowledge helped us to explore connections between CPD and teachers' subject knowledge, their pedagogic knowledge and skills and their pedagogic content knowledge and pupils' responses to changes in teaching and learning activities. Similarly our analysis of the CPD activities was informed by the earlier work on CPD outcomes of Harland and Kinder (1997) and other typologies such as those put forward by Joyce and Showers (1988) and Day (1999).

1.3 Policy and practice background

Teacher development has been recognised as a national priority by the Government since 1997. The 2001 Government Strategy Document *Learning and Teaching – A Strategy for Professional Development* has committed new resources to CPD, focusing in on the needs and development priorities of individual schools and teachers. This follows a sustained period during which the Government and schools have been concentrating teacher development resources upon major educational initiatives such as the National Literacy and Numeracy strategies, individual school development plans and post-OFSTED action plans. The proposed reviews will provide a knowledge base in an area where little research evidence has been amassed.

Alongside this, the work of the Teacher Training Agency (TTA) and professional associations, such as the NUT and subject associations, has raised teachers' interest in research and their skills in interpreting the implications of findings for practice. In support of these initiatives, a good deal of preliminary searching has taken place to identify and interpret what is already known from research about how teachers use knowledge and try to develop their practice. For example, Cordingley, in 1999, incorporated a 'summary' of research into the strategic options paper for the NUT. However, the resources available have meant that the review work so far has had to be practical and tentative and has had to pursue an interpretive rather than a systematic methodology.

The national context outlined above does not mean that the work of the Review Group will be confined to a narrow, UK-centred perspective. On the contrary, the first review focuses on classroom teaching and is not specifically tied in any way to local or national policy initiatives. This means that the review findings may have implications for classroom teachers which are internationally applicable, although always mediated through specific classroom, school and policy contexts.

1.4 Research background

Our starting point in drawing on the literature was the interpretive review of teacher acquisition and use of knowledge prepared to inform the development of teaching as a research and evidence informed profession (Cordingley and Bell, 2002). The literature highlighted in this review helped us to refine our question to include a focus on sustained CPD. For example, the interpretive review worked particularly with evidence about the importance of a combination of teacher experimentation, feedback and coaching over time from authors such as Joyce and Showers (1988). The review also drew on the work of various authors about the stages of teacher development, such as Hargreaves' (1993) modelling of the way in which teachers are able to cumulatively extend aspects of practice and Rich's (1993) work on the learning of beginning and expert teachers. Similarly, Desforges' (1995) reflections on the tendency of classrooms to return to the status quo – and hence the difficulties of effecting lasting change – was influential in identifying the likelihood of sustained CPD being effective, as, of course, was the extensive literature about teacher enquiry and its benefits for teacher learning (Elliott, 1991; Stenhouse, 1980).

The literature also helps us to see the limitations of the studies in this review and of our first review question. For example, as Day's (1999) analysis of teachers'

personal and organisational environments and their career cycles illustrates, CPD is located in the context of complex school communities. It is a context-specific endeavour that takes place across personal, professional, individual, collective, organisational and cultural boundaries. Different bodies of theory and research traditions have the capacity to inform all these aspects in principle, but in practice our data were more limited. For example, whilst the work of researchers who explore teacher biographies may have helped us explore the affective aspects of teachers' personal contexts, we found no studies from this field that tackled our specific concerns with collaborative and sustained CPD and its impact upon teachers and students. Similarly, whilst the work of activity theorists, such as Engestrom *et al.* (1999), and the growing literature about professional learning communities helps us to understand the relationship between teacher development and dynamic and complex community forces within schools, we found no core studies that addressed such issues. The teachers' development is pursued in relation to their work with their students, with their co-learners and with those supporting or facilitating the CPD, rather than within their institutional context in the studies featured in this review.

1.5 Authors, funders, and other users of the review

This review grew out of established National Union of Teachers (NUT) initiatives in teachers' professional development in England. The Review Group believes that a systematic approach to research in continuing professional development is timely. Since 1998, the landscape of CPD for teachers in the UK in England has undergone significant change, both in the nature of CPD offered and in the funding mechanisms supporting it. The government's CPD strategy in England is aimed at enabling teachers to take more control of their own professional development; it also plans to give schools much more direct control of the funding for CPD. Teachers and schools deserve to know more about how professional development might help them develop their knowledge, skills and careers at the same time as it results in enhanced pupil learning. The NUT's own professional development programmes, especially its Teacher2Teacher programmes, are built as far as possible on the best current evidence about effective CPD. The union wants to continue to build on this evidence base and has been the major sponsor of the CPD Review Group. The Group has been supported by the General Teaching Council (GTC) in accordance with the Council's CPD policies and strategy and is also sponsored by the Department for Education and Skills (DfES) via registration with the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre), based at the Institute of Education in London. Although the roots of the review are firmly based in England, its conduct has not set geographical limits.

1.6 Review questions

The over-arching question for the review is:

> How does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?

This was unpacked into two interrelated sub-questions about

Whether collaborative Continuing Professional development (CPD) for teachers of the 5-16 age range has an impact on teaching and learning?

and:

How is this impact realised and manifested?

Rationale

Research evidence answering this question will contribute to a key strand of the DfES CPD strategy: to help teachers to 'select the development activities that are likely to have the greatest impact on their teaching' (DfES, 2001). The question is sufficiently broad to act as an umbrella for subsequent reviews, enabling them to focus on different areas of teaching and learning in school contexts. The initial review has focused on studies of *collaborative CPD across the 5-16 age range*. Following considerable discussion and preliminary exploration of texts, collaborative was defined as 'requiring more than a single or occasional shared effort'; collaboration implied 'sustained joint activity'. Our protocol therefore defined collaborative CPD as 'involving working on a sustained basis with one or more professionally relevant colleagues for the purposes of meeting identified learning objectives that have the potential to affect teaching and learning'.

2. METHODS USED IN THE REVIEW

The first stage of the review took the form of a systematic search of the literature in order to try and identify empirically-based research which might provide answers to the review question

How does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?

and its interrelated sub-questions about

Whether collaborative Continuing Professional development (CPD) for teachers of the 5-16 age range has an impact on teaching and learning?

and:

How is this impact realised and manifested?

The aim, at this stage of the review, was to identify studies which provided data about teacher outcomes and, if possible, pupil outcomes. Decisions concerning the language, location and timeframe for the studies were made by the group in the course of refining the question. The Group also drew up clear criteria in order to filter out from the search results those studies most likely to provide evidence which would help to answer the review question.

2.1 User involvement

2.1.1 Approach and rationale

In this report the term 'users' is defined as groups for whom the review findings are of potential interest or use. This includes teachers, policy-makers directly concerned in planning CPD resource allocation and strategies; heads, CPD co-ordinators and other 'practitioners' concerned to identify the most effective CPD in relation to specific desired outcomes; governors, local authorities and providers of CPD. Because CPD is a 'third-order' activity, it might be difficult to interest students and their parents in evidence about effective CPD, although the emergence of strong correlations between types of CPD activity and improvements in pupil learning may help to increase interest in teachers' professional development activities. We hope to be able to help foster such an interest through connections we have made during the consultation process for this report.

2.1.2 Methods used

Policy-makers, teachers and providers were all represented on the Review Group and took an active role in deciding and refining the review question and developing the protocol. Significant numbers of practitioners and one or two policy-makers also participated in the initial search processes and keywording. A small number of practitioners also helped with data extraction. Each EPPI workshop on aspects of the review process was followed by a day's training for

the rest of the Review Group members by those who had attended the workshop. This mix of perspectives amongst a group of people all using the same processes in pursuit of the same goal resulted in an ongoing process of engagement and re-interpretation.

The focus on collaborative CPD was strongly influenced by teacher input and teacher feedback, following an initial training and consultation day for teachers in summer 2001 and after discussions involving:

- *meetings of the Review Group;*
- *consultation with teachers;*
- *consultation with members of the Advisory Group;*
- *informal contact with specialists in the field of CPD.*

A distinctive feature of our review was the involvement of a team of practising and retired teacher-reviewers who were trained both in the application of inclusion/exclusion criteria and in the keywording of, full reports. Cross-sampling of abstracts among members of the review group led to a number of reports being excluded. We also cross-moderated the full reports with the assistance of the teacher-reviewers.

2.2 Identifying and describing studies

2.2.1 Defining relevant studies: inclusion/exclusion criteria

For practical reasons we needed to restrict the parameters of our search. We have included studies in English, which were published or reported after 1988, following the introduction of the national curriculum in England. We did not, however, set geographical limitations. On the contrary, the search strategy was designed to capture studies written in English from all parts of the world.

To ensure that studies met the initial conditions for inclusion in the review they had to meet the following criteria (see Appendix 2.1 for the full list):

- *focus on CPD which involves more than one teacher;*
- *have set out to measure impact on teaching and/or learning;*
- *continue over a period of time;*
- *clearly describe the methods of data collection and analysis;*
- *have clearly defined learning objectives;*
- *focus on teachers of pupils aged 5-16;*
- *have been conducted after 1988.*

The exclusion criteria were reciprocals of the inclusion criteria.

This initial set of criteria (see Appendix 2.1) was applied to the titles and abstracts uncovered in the search. Our inclusion and exclusion criteria allowed us to tighten the focus of the review and screen the studies for relevance to our CPD review question. In particular the criteria helped us identify those studies which involved teachers working collaboratively, extended over a period of time, were appropriately contextualised and reported on methods and data.

Other issues

The protocol defined collaborative CPD as including teachers working together; teachers working with LEA or HEI or other professional colleagues; it excluded

teachers working on their own. By specifying CPD on a *sustained basis*, one-off, one-day or short residential courses with no planned classroom activities as follow-up and / or no plans for building systematically upon existing practice, were excluded. The review group looked for studies providing evidence of planned opportunities for teachers' learning prior to, during and / or after specific interventions to enable teachers to relate inputs to existing and future practice.

We wrestled long and hard over whether or not to look for evidence of impact on students. We knew that such evidence was important in terms of credibility for teachers. Our teacher reviewers repeatedly told us so. However, we also knew about the difficulties in securing evidence about such an impact and the even greater difficulty in exploring causal relationships between the CPD interventions, and teacher and pupil outcomes. Our final decision was first to review the studies to assess whether or not the CPD interventions being reviewed were linked with positive impacts on students, and only then to go on to focus upon the detail of the CPD interventions and the ways in which they affected teachers since these seemed to be the variables most accessible to in depth review.

2.2.2 Identification of potential studies: search strategy

The search strategy for the review involved a number of methods; more details are presented in appendices 2 and 3 but in outline the approaches to searching for titles and abstracts included:

- *searching electronic databases (initially Ingenta, followed by ERIC and then BEI); other databases searched included ESRC (Regard), CERUK, Education-online and OCLC FirstSearch, ArticleFirst and Dissertation Abstracts;*
- *handsearching journals recommended by Review and Advisory Group members as being relevant to CPD;*
- *trawling websites (including BERA and AERA);*
- *following up recommendations from Review and Advisory Group members and knowledgeable researchers in the field;*
- *following up citations in published and unpublished research.*

Since the search strategy was limited by resource and time constraints, databases and journals were selected according to the closeness of their aims and focus to our review question.

The terms used for searching varied from database to database. The initial searching on Ingenta identified a relatively large number of studies relating solely or mainly to teachers in training, which were excluded. We found that successful search strings for Ingenta were 'teachers' in conjunction with professional knowledge', 'peer-coaching' and 'professional learning'. Relatively few studies were located on Ingenta using strings involving the terms 'professional development', 'reflective practice' or 'action research'.

Most of our search strings were generic and thus cross curricular. However as it became clear that English or literacy and maths and science were particularly fruitful subject areas, we also ran searches in these subject areas.

Later searches used the controlled vocabulary of the database and freetext strings. Overall productive search strings included 'teachers' continuing professional development', 'continuing education', 'collegiality', 'teacher collaboration'. Applying the search terms supplied by the database and therefore

used by the indexers of the database themselves produced the most productive search results.

The source for finding particular studies was keyworded (see below) as the first database in which it was encountered.

2.2.3 Screening studies: applying inclusion/exclusion criteria

We conducted the searching of databases and journals between September 2001 and May 2002. The cut-off date for articles and reports brought to light by the search process was October 31, 2001. All citations (titles and abstracts) identified in initial searches were subjected to stage 1 inclusion criteria. This stage was carried out on-screen. To be included, studies had to meet all the stage 1 criteria. We excluded reports which failed on any one of the stage 1 inclusion criteria. To minimise the risk of relevant studies being excluded at this stage, we adopted a policy of inclusion where there was any doubt.

The full reports of all studies included in this way were then retrieved and the stage 1 inclusion criteria were reapplied to the full reports.

The citation details for all full reports which we retrieved were entered into the web-accessible reference management software Biblioscape. Where a full report did not all the inclusion criteria for stage 1, reviewers recorded at least one of the exclusion criteria. This recording was not in any specified order or hierarchy within the seven criteria, and so we coded and entered the first criterion which they did not meet. We keyworded all reports which met our stage 1 criteria (see Appendix 2.1).

2.2.4 Characterising included studies

Reports meeting the stage 1 inclusion criteria were keyworded according to both EPPI generic and CPD review-specific keywords (see Appendix 2.4 for CPD review-specific keywords and Appendix 2.5 for their definitions) in order to enable users to:

- *search for studies, for example, using terms that are more familiar to practitioners in the UK education system;*
- *access a concise summary of the main features of individual studies;*
- *discriminate between studies in ways not offered by the categories presented in the main educational databases.*

Core keywording: EPPI-Centre Educational Keywording system

These keywords classify reports so that answers can be produced to the following questions:

- *Identification of the report: how was the report located?*
- *What is the status of the report (published or unpublished)?*
- *Which language is the report written in?*
- *Is the report linked to any other reports of the same study?*
- *In which country/countries was the study carried out?*
- *What is/are the topic focus/foci of the study?*
- *Is the study linked to a specific, formal programme and, if so, what is its name?*
- *What is/are the population focus/foci of the study?*

- *What are the demographic features of the study in relation to the age and gender of participants?*
- *What is/are the educational setting(s) of the study?*
- *What is the broad methodological approach? Specifically is the study:*
    - descriptive;
    - an exploration of relationships;
    - an evaluation (of naturally occurring or researcher-manipulated intervention);
    - about the development of methodology;
    - a review?

CPD review-specific keywords

The Review Group also devised a list of review-specific keywords to allow practitioners to interrogate the data or pursue specific searches according to their particular interests and using familiar language.

For example, the keyword 'teaching staff' might be too broad. We thought practitioners would be interested to know whether studies involved specific sub-groups of practitioners such as 'class teachers', 'EAL teachers' 'heads of department', 'SEN teachers' and 'subject co-ordinators'.

The CPD specific keywords were designed to add context to answers about the topic focus and the population focus identified by EPPI. We also added a new category to enable users to search the studies by type of professional development intervention, including, for example, peer coaching and action research. The review-specific keywords and their definitions are provided in Appendix 2.4 and Appendix 2.5 respectively.

2.2.5 Identifying and describing studies: quality assurance process

During the first phase of searching databases, the Review Group attended an EPPI workshop on the application of inclusion/exclusion criteria to titles, abstracts and full reports. The Review Group then provided training for all members of the reviewing team including a group of serving and retired teachers. As the search process developed, we internally moderated the process of applying criteria to abstracts by cross-sampling in the ratio of 1 in 5 abstracts. Full reports were then distributed to the teacher reviewers and to members of the Review Group for cross-moderation. EPPI-Centre members also applied these criteria to a sample of titles and abstracts and compared these with those of the Review Group. Any differences were resolved through discussion.

When full reports met the stage 1 criteria, members of the review group, including teacher-reviewers, keyworded them and entered the keywords into the bibliographic record we maintained on the Biblioscape database. The keywording was cross-moderated by other members of the review team, including two members of EPPI team for quality assurance purposes. A useful feature of this phase of the review was that some teacher-reviewers carried out the task of keywording remotely using the internet. They were able to do this via Biblioweb, which they accessed using a new CPD Review Group Website hosted by the NUT. By viewing the keywords and exclusion criteria that others had applied, they were thus able to cross-moderate. This resulted in an increasingly

standardised approach and, as a result, several changes to the definitions for review specific keywords were made.

2.3 In depth review

2.3.1 Moving from broad characterisation (mapping) to in-depth review

For the in-depth review, the review team narrowed the focus further by applying a second set of criteria (also see Appendix 2.1):

- *studies which can show how they have used what is known already (e.g. by including a literature review);*
- *clearly stated aims and objectives;*
- *clearly identified learning objectives for teachers;*
- *clear description of context;*
- *clear description of methods, including approaches to data collection and data analysis;*
- *evidence of attempts made to establish the reliability and validity of data analysis;*
- *evidence of impact on teacher practice (i.e. teacher knowledge/ behaviours/understanding/skills/attitudes);*
- *information either positive or negative, about student learning gain.*

While the first set of criteria had been designed to filter out studies which were on topic for the review question, in the right timeframe, school age group and language, this second filter was aimed more narrowly at identifying studies by the focus of their outcomes data and selecting also those which were most likely to provide the data we were targeting. Hence the criteria allowed us to focus on CPD activities that explicitly set out to have a direct impact upon teaching and / or learning processes and outcomes. Studies had, in addition, to show that they had been informed by previous research, have a clear description of learning objectives for teachers, included a description of context, and describe the methods of data collection and analysis.

In order to be included for in-depth review, full reports had to meet all the Stage 2 criteria. At each stage, the process of selecting studies was governed by the specific review questions. Studies were excluded or included strictly according to their relevance to the review criteria. Those reports judged to meet both stage 1 and stage 2 inclusion criteria then went forward for in-depth review and data extraction.

As a footnote to the sifting process, readers may wish to note that ten studies which met criteria 1 to 14 (as listed in Appendix 2.1) but which had no pupil impact data, were examined by the Review Group and the consensus was that they had the capacity to lend weight to the review findings despite their lack of pupil impact data. We did not want to 'lose' these studies which will now form a ‘secondary cluster’ of data extractions, which report on teacher but not pupil outcomes. Work is currently in progress to review these studies, with the assistance of colleagues from the NCSL Networked Learning Communities Group.

2.3.2 Detailed description of studies in the in-depth review

In order to focus on the included studies consistently and in some depth, data were extracted using standardised guidelines. The EPPI-Centre guidelines for extracting data and quality assessing primary studies in educational research version 0.9.5 (EPPI-Centre, 2002) is a set of questions enabling a reviewer to draw out details of the aims of the study, the phenomena being explored, the nature and characteristics of the sample, the methods of analysis of the study, the outcome measures, results and conclusions. The guidelines were applied using EPPI-Reviewer software.

Because we believe that practitioners would want to know the answer to 'how' as well as 'whether' questions about CPD, our Review Group was particularly interested in details of the type of intervention received, its processes and implementation. The EPPI-Centre generic data-extraction guidelines ask: 'Please describe in more detail the specific phenomena, factors, services or interventions with which the study is concerned'. Given the complex nature of education interventions and pupil responses, we wanted very detailed descriptions. This need was reinforced by the third order nature of CPD. We therefore felt there was a need to complement the methodological rigour of the EPPI-Centre guidelines with an equally uncompromising and integrated approach to content, at each stage of the data extraction process. This required us to answer many questions from both methodological and content perspective, and to go through the process several times before we had a complete picture across all studies. We also combined the generic information with our review-specific keywords to provide detail and texture regarding the nature of the intervention including: training, professional training, INSET, workshops, coaching, peer-coaching and action research.

2.3.3 Assessing quality of studies and weight of evidence for the review question

Reviewers were required to make a judgement on the following four questions:

- *weight of evidence A: Taking account of all quality assessment issues, can the study findings be trusted in answering the study questions?;*
- *weight of evidence B: Appropriateness of research design and analysis for addressing the question, or sub-questions, of this specific systematic review;*
- *weight of evidence C: Relevance of particular focus of the study (including, conceptual focus, context, sample and measures) for addressing the question or sub-questions of this specific systematic review;*
- *weight of evidence D: Taking into account quality of execution, appropriateness of design and relevance of focus, what is the overall weight of evidence this study provides to answer the question of this specific systematic review?*

- *weight of evidence A aims to assess the quality of execution of a study for answering its own 'study' question. Reviewers were reminded of their previous responses, automatically highlighted as part of the EPPI on-line process, to the following issues:*

- *the context of the study was adequately described;*

- *the aims were clearly reported;*
- *there was an adequate description of the sample used in the study and how the sample was identified and recruited;*
- *there was an adequate description of the methods used in the study to collect data;*
- *there was an adequate description of the methods of data analysis;*
- *the study was replicable from the report;*
- *the authors avoided selective reporting bias;*
- *students and/or parents were appropriately involved in the design or conduct of the study;*
- *there was sufficient justification for why the study was done the way it was*
- *the choice of research design was appropriate for addressing the research question(s) posed;*
- *sufficient attempts had been made to establish the reliability of data-collection methods and tools;*
- *sufficient attempts had been made to establish the validity of data-collection tools and methods;*
- *sufficient attempts had been made to establish the reliability of data analysis;*
- *the research design and methods employed was able to rule out other sources of error/bias;*
- *the study results were generalisable;*
- *were there ethical issues about the way the study was done.*

This process proved useful in ensuring that reviewers reflected on all the relevant information which had been extracted in relation to specific questions before arriving at decisions regarding weight of evidence.

Weights of evidence B and C are review-specific questions, assessing the appropriateness of the research design and the relevance of focus of the study in relation to the 'review' question.

Weight of evidence D is again a review-specific question, allowing an overall judgement of the weight of evidence each study provides for answering the question of this systematic review. Reviewers examined their responses to weight of evidence questions A, B and C to form an overall judgement of the study, weight of evidence D in pairs following the review reconciliation process, in accordance with guidance provided by the EPPI-Centre team members linked to our review.

- *In many cases, reviewers felt it necessary to provide more than one answer to some of these questions since studies may have been of high weight of evidence in respect of impact, but low or medium weight of evidence in relation to the CPD processes, or vice versa. In this context, it was necessary to add review-specific questions to the core EPPI-Centre questions to allow assessment for both parts of the review questions.*

The preliminary judgements about overall weight of evidence D were therefore reviewed by a sub group of reviewers specifically to differentiate between judgements about the weight of evidence relating to whether the intervention had an impact and judgements about how the nature of the intervention process.

2.3.4 Synthesis of evidence

The EPPI software facility provided a flexible electronic tool for reviewers to interrogate the data from the extracted studies, according to responses to the question included in the framework. The data-extraction process required the reviewers to consider the study in specific terms, identifying, for example, the aims, findings, conclusions, study rationale, study design, type of intervention and process of data collection and analysis. The software tools then enabled the review team to run comparisons according to themes such as teacher and pupil attitudes, behaviours, values, and skills that were highlighted in the data or had been identified for testing by the Advisory Group.

In the review protocol, data about interventions that we wished to target specifically included:

- *inputs (data about teachers' knowledge, beliefs, attitudes and understanding; teacher learning needs; skills and knowledge of facilitators and providers);*
- *processes involved in the CPD, such as observation and feedback; and coaching;*
- *design (plans, implementation, strategies);*
- *outcomes (pupil evaluation or assessment of knowledge, skills, performance or attitudes; pre- and post assessments of changes in teacher skills/attributes/behaviours/knowledge).*

2.3.5 In-depth review: quality assurance process

To prepare for the process, all nine of the reviewers and two members of the EPPI-Centre did two data extractions in common, which were then compared and any discrepancies addressed.

Each member of the group ten reviewed between two and eight additional studies. For each study in the in-depth review, two members of the review team independently completed the procedures of data extraction and assessment of weight of evidence. A moderation exercise was then carried out between the two reviewers to deal with any disagreements and establish consistency in application of the guidelines.

Two members of the EPPI-Centre also data-extracted a sample of papers as part of the quality assurance process. We also conducted a cross moderation exercise involving a sample of the data extractions of each reviewer in relation to overall quality assessments against an annotated benchmark analysis from the EPPI team.

3. IDENTIFYING AND DESCRIBING STUDIES: RESULTS

This section of the report presents the results of the search, the successive application of the two sets of inclusion criteria and a description of the characteristics of the included studies. It is intended to provide a detailed portrait of the aims, methods and findings of included studies and of the quality of the studies.

3.1 Studies included from searching and screening

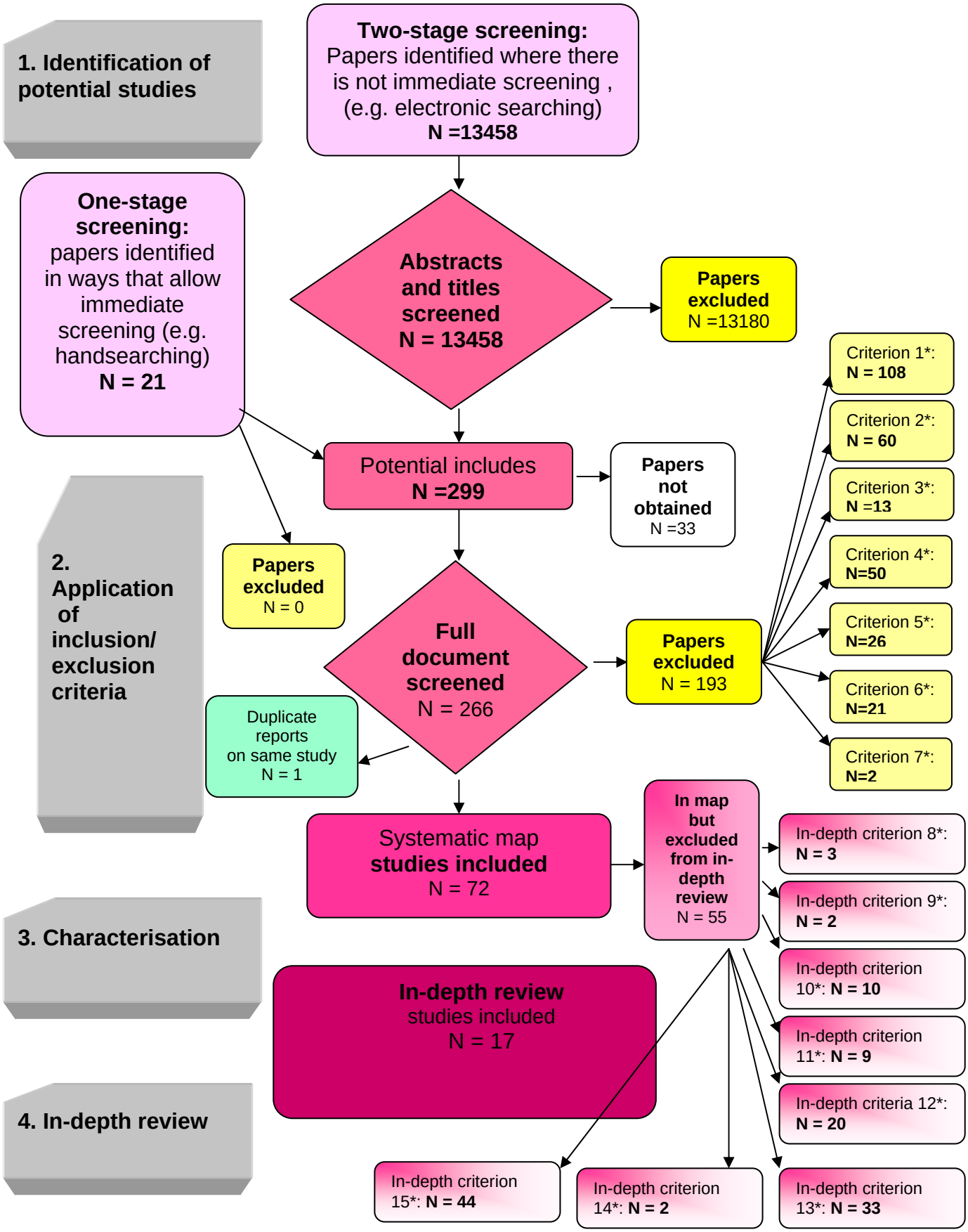
Table 3.1: Studies included from searching and screening

Studies	N
Total number of titles, abstracts and reports identified	13,479
Number of abstracts meeting final inclusion criteria	299
Number of full reports retrieved by the cut-off date*	266
Number of full reports meeting all seven Stage 1 inclusion criteria** and therefore keyworded	73
Number of studies meeting all 15 Stage 1 and Stage 2 inclusion criteria and going on for in-depth review.	17
Number of studies meeting all inclusion criteria except criterion 15 and being reviewed separately for a follow-up synthesis (see section 2.3.1)	10

* The difference between the number of abstracts meeting the inclusion criteria and the actual number of full reports retrieved is largely accounted for by US PhD theses which were difficult to access.
** Two of the 73 reports identified in the search process referred to the same study.

The flowchart provided enables the reader to track the process of searching through to inclusion and exclusion of studies.

Figure 3.1: Studies included from searching and screening
***** studies could be excluded on the basis of more than one of the criteria



3.2 Characteristics of the included studies (systematic map)

The detailed characteristics of the 72 studies included at Stage 1 are included in the tables within this section of the report.

The majority of reports judged to meet the Stage 1 inclusion criteria were found by searching electronic databases (51: 71%), the most productive of which was ERIC.

Table 3.2: Numbers of studies identified by different databases (N=51)

Database	N
Ingenta	13
ERIC	33
BEI	5

The other databases searched did not produce further studies that were included in the systematic map or in-depth review.

A further 21 studies were identified from a combination of handsearching journals, personal contacts, and citations.

Countries in which the studies were conducted

Most studies were carried out in the US (40: 56% of the total). A total of 10 studies (14%) came from the UK, the vast majority of which (nine) were from England. New Zealand, Australia and Canada supplied six, four and two studies each respectively. Single numbers of studies came from other countries including Brazil, China, Singapore, South Africa and Pakistan. The relatively large number of studies originating in the US prompts speculation about the possible reasons for this, such as more funding for research.

Table 3.3: The countries in which the studies were conducted (N=72)

Country	N
USA	40
UK: England	9
New Zealand	6
Australia	4
Canada	2
Taiwan	2
Brazil	1
China	1
Namibia	1
Netherlands	1
Pakistan	1
Singapore	1

Country	N
South Africa	1
UK: Scotland	1
West Indies	1

Educational settings of the studies

Some studies (mainly from the USA) were carried out in more than one educational setting. Thirty-seven of the 72 studies were set in the primary phase, and a similar number (38) in the secondary phase.

Table 3.4: Educational setting of the studies (N=72)

Educational setting	N
Secondary school	38
Primary school	37
Higher education institution	12
Independent school	2
Local education authority	1
Nursery school	1
Other	2

Note: Some studies had more than one setting.

Topic focus/foci

Given our focus on the impact of CPD on teaching, all studies related to teaching and learning, and/or teacher outcomes. Whilst pupil outcomes were of high importance to the review, because our teacher participants were convinced that such data are crucial to practitioners, we recognise the difficulties of pursuing the impact of CPD on pupils in terms of the length of time over which studies must collect data and the number and complexity of intervening variables. In fact, 19 reports did provide these data. Development in a specific curriculum area was a focus of 30 studies.

Table: 3.5: The topic focus of the studies (N=72)

Topic focus	N
Teaching and learning	47
Teacher outcomes*	41
Curriculum	30
Teacher careers	20
Pupil outcomes*	19
Assessment	9
Methodology	7
Classroom management	6
SEN*	6
Equal opportunities	4
Organisation and management	3

Topic focus	N
Ethnicity*	3
School improvement*	3
Formative assessment*	3
EAL*	2
Numeracy*	2
Key skills*	2
Disaffection*	2
Behaviour management*	1
Other	2

Note: Many studies had more than one focus.
*Indicates CPD review-specific keywords (All the CPD review-specific keywords and their definitions are presented in appendices 2.4 and 2.5 respectively.)

The topic foci of the studies include both those which were described using EPPI generic keywords and those which were classified using our CPD review-specific keywords. For the 30 studies with a focus on curriculum, the specific curriculum areas are also presented in Table 3.6 below. Science and mathematics were the predominant subjects in 15 and 12 studies, respectively. The high proportion of studies in which the mathematics and science areas of the curriculum were a major focus contrasts sharply with the low numbers of studies (five) which focused on literacy (first language).

Table 3.6: Curriculum focus of the studies (N=30)

Curriculum area	N
Science	15
Mathematics	12
Literacy – first language	5
ICT	5
Literacy – further language	3
Design and technology	2
Hidden	1
Cross-curricular	1
History	1
Other	1

Note: Some studies focus on more than one curriculum area.

Types of study

As might be expected, since the review was aimed at uncovering CPD which had an impact on teaching and learning, most of the reports involve studies in which the researchers sought to describe and evaluate the effects of specific CPD interventions on teachers and in some cases pupils. Of the 72 studies, 10 were evaluations of naturally occurring interventions and 50 were evaluations of researcher-manipulated interventions. 'Researcher-manipulated' is defined by EPPI as: 'where there is an attempt on the part of the researcher(s) to change

people's experience and as a consequence have control over which groups of people are 'introduced' or 'exposed' to the experience'.

Table 3.7: Description of the type of study (N=72)

Type of study	N
Evaluation – researcher-manipulated	50
Evaluation – naturally occurring	10
Description	11
Development of methodology	4
Exploration of relationships	2
Systematic review	1
Other review	2

Note: Some research combines more than one type of study.

Types of intervention

Finally a breakdown of the types of intervention implemented in the research is shown in the table below. Many studies combined different elements in the CPD processes they described. Analysis of the types of intervention undertaken in the research shows that coaching was used in 18 of the 72 studies, with peer coaching in 22 studies. Over a quarter of the 72 studies involved action research.

Table: 3.8: Type of intervention in the studies (N=72)

Type of intervention	**N**
Peer coaching	22
Action research	19
Workshops	18
Coaching	18
INSET	16
Training	16
Professional training	8
Counselling	3
Post-graduate qualification	3

Note: Some research combines more than one type of intervention.

Full definitions of all the CPD review-specific professional development interventions can be found in Appendix 2.5. Professional development interventions were categorised according to a number of characteristics including:

- *the nature of the intervention – for example, coaching, where the intervention involves classroom coaching through observation and feedback by colleagues or by external CPD providers;*
- *additional purposes the intervention might have – for example, in which the interventions are provided through the process of updating teachers after their initial qualification;*
- *the provider of the intervention – for example, peer-coaching, where the advice or support is provided by a peer.*

3.3 Identifying and describing studies: quality assurance results

The quality assurance processes resulted in the clarification of a number of ambiguities, most notably as to which groups constituted the ‘learners’ in the studies which were interrogated using EPPI software. It was decided to include teachers and pupil groups in this category with the result that both the pupil ages and ‘over 21’ (for the teachers) were keyworded. The other main keyword change was in the study type. In-depth review provided greater insight into the design of the studies than at first reading with the result that several studies were re-keyworded after discussion with reviewers.

4. IN-DEPTH REVIEW

The focus of this chapter is on the characteristics of the studies which were reviewed in-depth and the results of the synthesis. We begin by presenting descriptive information about the studies which met all the criteria for in-depth review. Our two-part review question ('*Does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?' a*nd '*How does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?')* inevitably surfaced studies that focused on aspects of teaching and learning and provided an evaluation of the CPD involved. Data relating to our CPD review question are reported in tables and described in the text, under separate sub-headings. We then discuss the studies in more depth and explore the implications of the synthesis.

4.1 Selecting studies for the in-depth review

Nineteen studies were initially identified as meeting all stage 1 and stage 2 criteria. One was later removed because different aspects of the project were reported on in a number of separate reports and because the project as a whole comprised numerous discrete, case-based mini-projects. A second study had to be withdrawn from the included studies at the last minute. It had been assumed that the pupil impact data referred to in the abstract had been reported on elsewhere, but we were unable to find any such report and the author, at a late stage, confirmed that pupil data had not been collected sufficiently systematically to enable detailed analysis.

Appendix 4.1 provides a list of the 17 studies which were finally included in the review. Studies are also given an identification number which refers exclusively to this review, which are used to reference the studies in the descriptive section of our report.

As our specific review question concerned the outcomes of CPD for teachers and pupils, most studies were, unsurprisingly, evaluations. Studies were then further classified as evaluation: naturally occurring (four studies), or evaluation: researcher-manipulated (14 studies). One study (Saxe *et al*., 2001 – study 368) involved both researcher-manipulated and/or naturally occurring evaluation design. The majority of the studies which met the stages 1 and 2 criteria for inclusion were based in the USA, with only two UK studies meeting the review-specific criteria for in-depth extraction.

4.2 Comparing the studies selected for the in-depth review with the total studies in the systematic map

Tables reporting features of the studies reviewed in-depth are provided in the text which follows and in Appendix 4.2, and may be compared with those reporting on the initial field of 72 studies which passed the Stage 1 criteria, in Appendix 2.1.

While the field was narrowed from 72 studies to 17, the study characteristics remained consistent with those displayed in the initial map, as indicated in the examples below.

Countries of included studies

The majority of studies reviewed in-depth (nine) came from the USA (which compares approximately with the percentage of USA studies meeting Stage 1 inclusion criteria.

Table 4.1: Countries in which the included studies were conducted (N=17)

Country	N
USA	9
New Zealand	2
Canada	2
UK	2
South Africa	1
Namibia	1

The educational setting of the study

Similar numbers of studies took place in primary schools (10) and in secondary schools (13), with several cross-phase settings.

Table 4.2: Type of educational setting of the studies (N=17)

Type of educational setting	**N**
Government department	1
Higher education institution (in addition to the school)	6
Nursery school	1
Primary school	10
Secondary school	13
Other educational setting	1

Note: Some research combines more than one type of educational setting

Topic focus of the studies in the in-depth review

All the studies reviewed focused on aspects of teachers' careers or teaching and learning. A significant number also focused on aspects of the curriculum (13).

Table 4.3: Topic focus of the studies in the in-depth review (N=17)

Topic focus of the studies	**N**
Assessment	3
Classroom management	5
Curriculum	13
Equal opportunities	4
Methodology	2
Teacher careers	4

Topic focus of the studies	N
Teaching and learning	17
Other (pupil motivational outcomes)	1

Note: Some research combines more than one type of focus.

Curriculum focus of the studies in the in-depth review

Mathematics and science remained the predominant curriculum areas. Eleven of the studies selected for in-depth review used either maths or/and science lessons as the context for the delivery and implementation of the CPD.

Table 4.4: Curriculum areas of the studies in the in-depth review (N=17)

Curriculum area of the studies	N
Cross-curricular	2
General	1
History	1
ICT	4
Literacy – first languages	2
Literacy – further languages	2
Maths	6
Science	5
Other (language/arts/social studies)	2

Note: Some research combines more than one curriculum focus.

The CPD in the studies subjected to in-depth review broadly echo the types of interventions noted in the initial systematic map. Peer coaching and/or coaching feature in eight of the studies, while five of the studies involved action research.

Table 4.5: Types of interventions included in the studies in the in-depth review (N=17)

Type of Intervention	N
Training/ professional training programmes	8
Workshops	9
Coaching	6
Peer coaching	2
Action research	5

Note: Some research combines more than one type of intervention.

Study design of the studies in the in-depth review

Appendix 4.9 provides information on which studies conducted pre- and post-test comparisons, which studies included comparison with control groups and which studies compared different types of collaborative CPD. Information on whether each study was an evaluation of an intervention that was researcher-manipulated or naturally occurring is given. It should be noted that none of the studies reviewed involved randomised controlled trials and most of the studies reported correlations between collaborative CPD and a range of outcomes. Throughout the report we use the term 'linked' to refer to such evidence. Appendix 4.9 sets

out features of study measurement and design, how data-collection addressed the issue of comparison of intervention outcomes, together with key information on student outcomes.

4.3 Further details of studies included in the in-depth review

Building on existing knowledge: use of research literature to inform the studies

As part of our second screening process, all the studies included for in-depth review had to demonstrate that: 'they have used what is known already' (e.g. by including a literature review). When we examined how the research evidence base affected study design, the process of intervention and specific teaching strategies, we found the following:

- *all the studies reported previous research findings which addressed the 'how' aspect of our collaborative CPD review;*
- *in addition, seven studies examined research literature relating to specific pedagogical interventions: for example, Parke and Coble (1997 – study 367) reflected on the work of Vygotsky (1980) 'applying scientific concepts to real life situations and incorporating real experiences into a scientific conceptual frame work are both difficult tasks';*
- *there was evidence that six studies directly used research literature as a springboard for dialogue/experimentation with the teachers, as reported in the Gersten et al. (1995 – study 359): 'our objective was to introduce research-based teaching strategies to help participating teachers succeed with students with learning disabilities'.*

Studies that reflected on previous research evidence to explore 'how' to conduct their process of intervention cited research that addressed the following issues:

- *teacher ownership in the process of change (six studies);*
- *use of collaborative support, either internal or external (nine studies);*
- *barriers to change (seven studies);*
- *teachers' beliefs and attitudes to change (ten studies);*
- *need for sustained change (seven studies);*
- *specific models of CPD for example peer coaching/ mentoring/ action research (six studies).*

Studies that reported on research as informing specific pedagogical strategies explored the following approaches:

- *creation of connectionist/ constructivist/ collaborative working environments for pupils (three studies);*
- *general learning strategies for pupils, including problem solving/ graphic transformations/ paraphrasing/ support frames (two studies);*
- *specific teaching strategies, for example transformational science (one study);*
- *specific reading strategies (three studies);*
- *children's understanding of mathematics (two studies).*

Studies that used research literature as a direct springboard for dialogue/ experimentation with teachers, reported previous research directly informed the following practices:

- *use of specific learning strategies for pupils (three studies);*

- *use of specific teaching strategies (direct instructional model) (one study);*
- *exploration of research findings with teachers as part of the CPD process (one study);*
- *use of pre-designed survey for pupils to assist teachers in their reflection process (one study).*

Study aims and rationale

The aims of the studies fell broadly into three main categories. They aimed to explore:

- *how CPD changed or affected teaching behaviours and pupil learning (three studies);*
- *the effects of the introduction of specific pedagogic strategies in addressing specific pupil learning objectives (six studies);*
- *the effects of particular kinds of CPD on teaching and learning (seven studies).*

Only one study (Saxe *et al.*, 2001 – study 368) aimed directly at providing 'bottom-line evidence of the influence of professional development programmes on student learning as the primary focus'.

Most of the CPD in these studies did not explicitly target teachers' attitudes and beliefs, or at least not in the aims of the studies as they were reported. However, as the Review Group had explicitly targeted data on attitudes and beliefs, we looked for and found reported changes in attitudes and beliefs in all the extracted studies.

Four studies used existing models or programmes as their starting points; they evaluated an existing professional development programme, a prescribed model of CPD, or the implementation of a new curriculum (Flecknoe, 2000 - study 358; O'Sullivan, 2001 - study 365; Parke and Coble, 1997 - study 366; Wilkins, 1997 - study 369).

CPD explored in the other studies tended to take teachers' needs and concerns as their starting point, in some instances when teachers themselves were the instigators of the research (Harwell *et al.*, 2001 - study 361), thus influencing the choice of research design or research questions. Evidence from the data-extractions indicates (either implicitly or explicitly) that in 10 studies the teaching staff were consulted in the research design.

Appendix 4.7 reports on study aims, designs and findings.

Focus of the studies

All the studies focused on both teaching and learning, as this was built into the Stage 2 criteria. Where there was a curriculum focus, it tended to be a subsidiary to the main aims of the study, acting as a vehicle for trialling the CPD. Although the majority of the studies did not set out to explore the emotional dimension of change, this was often reported in terms of impact on teachers' motivation, morale and attitude to change. Findings that emerged on teachers' attitudes and beliefs are reported in section 5 of this review.

As indicated in Appendix 4.2, the most common curriculum areas were maths (six studies) and/or science (five studies). Four studies focused on ICT, one on literacy and one on English as a second language.

Description of types of intervention

Fuller details of the interventions are provided in Appendix 4.3. The interventions ranged from pre-designed, formal training delivery linked to support for implementation, to wrap-around programmes of structured peer support. Most of the studies involved a combination of 'expert' input followed by a variety of collaborative support programmes. Four of the studies involved action research where teachers took ownership of part of the research process by conducting small scale research studies within their classrooms.

Because of its practitioner focus, the Review Group was interested in the details of the CPD processes. Disappointingly, these were not extensively reported on in many of the studies.

The broad characteristics which did emerge from this process are reported below and commented on in greater detail in section 4.4.

Training

Five studies involved pre-designed training programmes (Bryant *et al.*, 2001 - study 353; Ertmer and Hruskocy, 1999 - study 357; Harvey 1999 - study 360, O'Sullivan, 2001 – study 365; Saxe *et al.*, 2001 - study 368) and subsequently sought to measure the effectiveness of the training. A feature of all these studies was the follow-up support that was offered to teachers in the form of workshops, partnering or professional coaching. Workshops provided instructional support and enabled teachers to adapt the intervention to suit their context and to incorporate aspects of the programme which suited their teaching style, in addition to providing 'trouble-shooting' assistance.

Context-based

There was a distinction between those studies which involved a 'pre-packaged' training element and those which were evolved in consultation between researchers and teachers. Such studies sought to measure the impact of a particular intervention on teaching and learning, but the intervention was evolved in collaboration with the researchers and teachers. Eight studies involved some degree of consultation with the researchers in the identification of areas for research, strategies for intervention or implementation (Britt *et al.*, 2001- study 351; Brown, 1992 - study 352; Gersten *et al.*, 1995 - study 359; Harwell *et al.,* 2001 - study 361; Kimmel *et al.,* 1999 - study 362; Kirkwood, 2001 – study 363; Ross *et al.*, 1999 – study 367; Wilkins, 1997 - study 369).

These studies all focused strongly on the process of the intervention, with emphasis on teacher feedback and close monitoring. Four of the studies in this group explored the effectiveness of classroom observation and feedback to support the implementation of new strategies.

Action research

In five of the studies (Britt *et al.*, 2001 - study 351; Flecknoe, 2000 - study 358; Ross *et al.*, 1999 - study 367; Kirkwood, 2001- study 363), teachers and researchers co-operated in action research studies within the teachers' own schools. This research built on teachers' observations and ideas to develop improved strategies for teaching and learning, where the research process itself was part of the CPD intervention.

Range of samples

Defining the samples emerged early on in the data-extraction process as a problem, related to the dual nature of the outcomes which the research was exploring. In all cases, the CPD intervention (X) was designed to have an effect on teachers (Y) which, in turn may have an impact on pupil learning (Z). To accommodate this we included both teachers and pupils in the sample **X → Y → Z** even where it was clear that it was the teachers who had been recruited to the sample and their pupils became involved only because of their teachers involvement.

Another complication related to the fact that CPD is a 'third-order intervention' was the keywording of the term 'learners'. Clearly the teachers involved in CPD are learners, but we were also targeting data about their pupils.

Table 4.5 below provides data on the age ranges of the sample in the included studies. As the review was looking both at teacher and pupil outcomes, all the samples included the age band 21 and over, which referred to the teachers.

Table 4.5: Ages of participants in the studies in the in-depth review

Age of the study participants	N
0 to 4	1
5 to 10	9
11 to 16	14
17 to 20	3
21 and over	17

Note: Some of the participants were categorised in more than one age group.

In many cases, the sampling frame and planned sample size were not reported on in any detail by the authors of the study papers and, in some of the reports, it was not evident how the sample had been recruited. However, it was reported in nine of the studies, that teachers had been invited to participate and in only one study (O'Sullivan, 2001 - study 365) were teachers required to participate as part of a government reform programme.

The size of the sample varied from a small scale peer coaching intervention involving two teachers, four pupils and a peer coach, to two large scale programmes involving over 100 teachers and their pupils (Harvey, 1999 - study 360; O'Sullivan, 2001 - study 365). For details of actual study samples see Table 4.5 (Appendix 4).

Methods of data collection and analysis

In the majority of studies, there was evidence of triangulation of data collection, with as many as seven different methods of collection. Details are provided in Appendix 4.5 (i), with further information on specific studies provided in Appendix 4.6. The most frequently cited methods of data collection were:

- *one to one interview (11 studies);*
- *observation (12 studies);*
- *self-completion questionnaire (11 studies);*
- *report /diary (10 studies).*

It should be noted however, that the CPD intervention itself may have involved direct classroom observation or other forms of data collection even if it were not built directly into the research design.

The nature of the methods of data collection tended to provide qualitative data which in many cases (Britt *et al.*, 2001 - study 351; Da Costa, 1993 - study 355; Ertmer and Hruskocy, 1999 - study 357; Flecknoe, 2000 - study 358; Gersten *et al.*, 1995 - study 359; Harvey, 1999 - study 360; Harwell *et al.*, 2001 - study 361; Ross *et al.*, 1999 - study 367; Saxe *et al.*, 2001 - study 368), researchers attempted to quantify for analysis, for example, by codifying responses to interviews or creating categories from observational data and then applying standardised procedures for statistical analysis.

Quality of the reporting

Most of the studies were clear about the aims, rationale, broad contexts and theoretical underpinning for the research. There was a surprising lack of detail in some studies about the sampling strategy which in some cases meant that little or no information was available about either the teachers or the pupils involved. This made it difficult, for example, to extrapolate information which might lead to greater understanding about the importance of levels of experience in relation to particular types of CPD; or the degree of teacher readiness in terms of their willingness to embrace change and hence the degree to which collaboration really meant simply co-operation. The studies also varied in the extent to which they reported on data collection and analysis. Over half of the studies did not provide sufficient detail about the nature of the intervention and its implementation to enable replication of the study. (It may be that further details were reported elsewhere which were not picked up through the initial search strategy).

Weight of evidence

Reviewers were required to make a judgement about the trustworthiness of each study for answering its own study questions (weight of evidence A). The list of criteria is to be found in Appendix 2.1.

Table 4.6: Weight of evidence (A)

High	0
Medium/High	2
Medium	12
Medium/Low	2
Low	1

The majority of the studies (16) were judged by the reviewers to provide 'medium' weight of evidence provided by the research. For the purposes of our review this means that the studies were judged to be sound but with some limitations (based on what was actually reported). The remaining study was judged to be of low weight of evidence. Further details for each study are given in Appendix 4.8.

Review-specific weight of evidence

Teaching and learning are complex activities for adults and for children. Our review question specifically addressed the nature of the impact of the CPD on both. We wanted to know how or in what ways the collaborative CPD affected them. We therefore faced two questions – did the collaborative and sustained CPD affect the teachers and through them their students and in what ways did it

do so? Although all the studies explore both questions to a degree, some are stronger in their approach to 'whether' than 'how' and vice versa. For example all save two studies (Gersten *et al.*, 1995 - study 359, Parke and Coble, 1997- study 366) involved pre- and post comparisons and as has been noted there is a mix of comparisons between different forms of CPD and between different groups. We have considered how much weight the evidence from each study contributes to the review separately for both components of the review question.

The first review-specific question (weight of evidence B) concerns the *appropriateness of the research design and analysis* for addressing the questions and sub-questions of our specific review. In response to this question, the reviewers responded as follows.

Table 4.7: Weight of evidence (B)

'Whether'		**'How'**	
High	1	High	2
High/medium	0	High/medium	1
Medium/high	1	Medium/high	0
Medium	7	Medium	13
Medium/low	3	Medium/low	0
Low/medium	1	Low/medium	0
Low	4	Low	1

Studies judged to be highly appropriate in design and analysis for answering both elements of the review-specific questions included details of the implementation processes, comparative data and clear evidence of student outcomes. Papers judged as medium in this regard were nonetheless still considered to be of value in answering the question, with identified limitations in one or more areas of design and analysis.

The review further asks about the *relevance* of the particular focus of the study, (including conceptual focus, context, sample and measures), for addressing the specific review question. Responses were as follows:

Table 4.8: Weight of evidence (C)

'Whether'		**'How'**	
High	3	High	5
High/medium	1	High/medium	0
Medium	10	Medium	10
Low/medium	1	Low/medium	0
Low	2	Low	2

Finally, the reviewers were asked to consider the overall weight of evidence that the studies provided in answering our specific review question, considering trustworthiness of the study, appropriateness of research design, and relevance of the study focus. Reviewers examined their responses to weight of evidence questions A, B and C to inform their overall judgement of the study, weight of evidence D. The findings are given below; further details are available in Appendix 4.8.

Table 4.9: Weight of evidence (D)

'Whether'		**'How'**	
High	0	High	1
High/medium	0	High/medium	1
Medium/high	1	Medium/high	0
Medium	10	Medium	13
Medium/low	3	Medium/low	0
Low/medium	1	Low/medium	1
Low	2	Low	1

For this review, the classifications of high and high/medium were amalgamated as 'high'. Similarly, medium/high, medium, and medium/low were considered 'medium' and low/medium and low were considered as low. Using these amalgamated categories, the synthesis for the 'whether' and the 'how' elements of our question were carried out separately, concentrating on those studies that had been graded medium or higher in terms of weight of evidence (D).

4.4 Synthesis of evidence

Once data extraction had been completed and weight of evidence assessed, we synthesised information from the studies using reports and cross tabulations generated by EPPI Reviewer and by cutting and pasting additional details about the interventions into tables.

Common patterns were identified in the data and these are set out below. We also analysed the treatment in the data of particular questions highlighted by our advisory group as being likely to be relevant to the review.

The two studies which were judged to be of high weight of evidence in relation to the 'how' question provided substantial evidence about how collaborative CPD had contributed to positive changes in teachers' practice and positively affected pupil learning. Those studies in the medium category all contributed evidence towards answering the review question but tended to under-report either the processes involved in the intervention or the sample and/or data collection and analysis. Of the two studies judged to be of low weight in answering the 'how' question, one was felt to have been inappropriately designed for the purpose of our review, offering a complex but patchy mix of data from across the project as a whole and from the action research of the teachers involved, neither of which could easily be related to the other. The other focused on teachers in Namibia who were either unqualified or under-qualified and therefore contributed little to the review question which was explicitly targeted at practising teachers who were assumed to be fully qualified.

From the studies of medium or higher weight of evidence, we sought to identify common threads or patterns, although we were mindful of the distinctive nature of the studies, in particular:

- *the complexity of the models of CPD being explored;*
- *the number of intervening variables;*
- *the time it took for CPD work with teachers to feed through into practice and to impact on students;*

- *the different goals and focus of the CPD interventions being studied;*
- *the different goals of each of the research teams;*
- *the unique settings, or contexts in which the CPD took place.*

There were not, in fact any studies that were graded as of high weight in relation to the 'whether' element of the question. Studies classed as providing high and medium weight of evidence in answering our specific review question about *how* the CPD affected teaching and learning have been treated as one dataset for synthesis purposes, although we have noted any demonstrable differences between them. Those studies classed as low weight of evidence have been used to add texture or as illustration only.

The analysis is based first and foremost on the patterns which emerged from the data-extraction process. We used the capacities of the data extraction software to identify common patterns across the studies. We also tried to identify data which were missing and which we had expected to find. Finally, the Advisory Group identified a range of areas of interest from their own experience and research for which we collected comparative data across the studies.

Overall outcome in relation to whether collaborative CPD affected teaching and learning

In all but one of our in-depth studies which were judged to be of medium or higher weight of evidence in relation to the review question, the collaborative CPD was linked with improvements in teaching *and* learning as measured over the period of the intervention; many of these were significant. In the case of the exception, the teachers involved were nonetheless inspired by the power of working with student perceptions about their learning and decided at the end of the first year to undertake another year of action research in order to tackle their agenda in a more focused way (Harwell *et al.*, 2001 - study 361).

Where there were reported variations in effectiveness of the CPD, these related to problems for specific groups of teachers and to specific features of the intervention. For example:

- *there was no direct classroom observation involved; less effect was reported for teachers experiencing collegial coaching without direct classroom observation than for those who received it (Da Costa, 1993 – study 355);*
- *there was no subject input into interventions intended to achieve subject-specific changes; less effect was reported for those teachers who did not experience specific subject input (Saxe et al., 2001 – study 368);*
- *the CPD targeted working with the most challenging pupils within whole class settings and involved beginning and established teachers. The beginning teachers were not as able as their experienced peers to benefit from CPD focused on pupils with extreme difficulties (Gersten et al., 1995 – study 359).*

How does CPD affect teaching and learning?

Themes and clusters

Given the distinctive, if related, aims of the CPD or the research encompassed by our studies, unsurprisingly, few factors were universally linked with all studies. However we did identify a number of themes or patterns in the study data which we think could be meaningful and useful to practitioners and policy-makers. These fall into two clusters:

- *the aims and outcomes of the CPD in relation to teachers attitudes and beliefs, the actions they took in their classrooms and the pupil outcomes;*
- *the processes and characteristics involved in the CPD itself.*

Aims and outcomes

Some interventions of the CPD explicitly targeted generic changes in teachers' knowledge, understanding or skills (often in relation to a specific curriculum area or changes in teachers' beliefs or attitudes). These were often targeted at promoting dynamic learning and teaching exchanges with students. Others set out first to introduce highly specific programmes or activities, or to test specific forms of CPD that could be tailored to any aspect of teaching. Several more specifically targeted programmes also focused on generic changes. All studies report a range of outcomes beyond those they specifically set out to achieve. In this section of the report we therefore start by exploring reported changes in:

- *teacher and pupil attitudes, beliefs and behaviour;*
- *pupil performance;*
- *teacher knowledge and understanding.*

We also explore, because these are details practitioners will want to know, the different types of collaboration, topic foci or CPD processes linked in combination with positive outcomes which have emerged from the in-depth studies, including:

- *observation;*
- *feedback (usually based on observation);*
- *the use of external expertise;*
- *processes to encourage, extend and structure professional dialogue;*
- *scope for teacher participants to identify their own focus;*
- *an emphasis on peer support rather than leadership by supervisors.*

Teachers' attitudes and beliefs: aims of the studies

All but one of the studies reported changes in teacher attitudes, and some in pupil attitudes, as a result of participating in the CPD process. However only five studies specifically addressed teacher or student attitudes or beliefs in their aims, and attempted to measure them as intended outcomes:

- *exploring the essential nature of changing beliefs and links with changes in practice (Britt et al., 2001 – study 351);*
- *exploring the reconciliation of tensions between pre existing and post programme beliefs (Park and Coble, 1997 – study 366);*
- *exploring the impact of a specific programme on teacher and pupil beliefs and practices (Brown, 1992 – study 352);*
- *exploring connections between beliefs about collaboration, teachers' efficiency and teacher and pupil behaviours (Da Costa, 1993 – study 355);*
- *exploring changes in use of technology and accompanying attitudes and beliefs (Ertmer and Hruskocy, 1999 – study 357).*

Britt's study was based on research evidence for the proposition that a change in teacher beliefs is crucial to the process of pedagogical change. It tried to find out whether a programme of professional development in which teachers engaged in extensive professional conversations would affect their beliefs and practices about mathematics teaching, and whether change in beliefs and practices might result in improved understanding for their students. Park and Coble's collaborative curriculum design programme aimed to find out 'how middle grade science teachers manage tensions that arise with personal beliefs about teaching and learning when presented with the opportunity to change practice aligned with

current research on teaching and learning'. A second aim was to measure the impact of the CPD on student attitudes and achievement.
Brown's New Zealand based study also explicitly set out to measure the effects of a series of intervention strategies on pupils' and teachers' attitudes, behaviour and achievement. Da Costa examined connections between a range of teacher components, including beliefs, attitudes and behaviours, and pupil attitudes, behaviours and attainment. Ertmer looked for evidence (inter alia) of teachers' attitudes towards and implementation of changes in technology use in classrooms. The study was concerned with evaluating the impact of a school-university training partnership both on teachers' skills and confidence, and on the integration of technology in their classrooms.

The stated aims and methods of the remaining studies appeared to focus more specifically on teachers' behaviour, skills and knowledge, and effects on pupil achievement. As a result, information about changes in attitudes, beliefs and behaviours tended to emerge as unforeseen outcomes or more informal indications of success and thus were not included as part of the reported intended outcomes of the study. This meant that they did not feature in the data extractions as reported 'findings' from the research. Hence, the reviewers had to revisit all the articles, after the data-extraction process was complete, to search for reported changes in teacher attitudes, beliefs and behaviour which had not been included by the authors as part of their 'findings' yet had emerged from the interviews, observations and questionnaires as direct outcomes of the CPD processes undergone by the teachers.

Teachers' attitudes and beliefs: outcomes

Despite differences between the aims of the studies and the way in which they reported their findings, the instruments used for data collection seemed to be broadly similar (mainly observation, interviews, questionnaires and use of teacher reports or diaries, sometimes within an action research model). So too were the changes that were reported:

- *greater confidence, particularly where the teachers were coached in the implementation of new teaching strategies or in tackling new technology;*
- *enhanced self-efficacy beliefs;*
- *an increased enthusiasm for collaborative working, including overcoming anxiety about being observed and sharing problems;*
- *greater commitment to changing practice/increased willingness to try out new practices.*

Self-efficacy

Self-efficacy is the perceived ability of individuals to effect change: to be an agent for changing either their own or others' lives in some way. Six of the studies in this review indicated that teachers shared a stronger belief in their own power to make a difference to learning at the end of the collaborative CPD. In one study (Da Costa, 1993 – study 355), self-efficacy was found to split into two groups: teachers who believed that the profession as a whole had a power to make a difference (general efficacy) and those who believed they personally could make a difference (personal efficacy).

Differences in the two subsets of beliefs were linked with different models of collaboration: specifically, the groups of teachers using CPD modes that involved collaboration based on classroom observation were better able to effect changes to enhance their pupils' attainment. Interestingly, one group of teachers, this time working with a supervisory rather than peer-based model of collaboration and

without opportunities for feedback based on direct classroom observation, were significantly less able to make changes and showed a less developed sense of personal or general professional efficacy.

In a separate study (Bryant *et al.*, 2001 – study 353), teachers initially felt overwhelmed by issues such as the high social economic deprivation of their students and the extreme range of differentiation needed for their classes, but subsequently their overall opinions of the CPD project were positive and there was substantial evidence of changes in practice using the knowledge and skills acquired by teachers and in their students' academic attainment. Ross *et al.*, (1999 – study 367) also reported that teacher-researchers overcame initial feelings of anxiety to reach greater self-efficacy beliefs in the light of their work with exemplary teachers. Kimmel *et al.*, (1999 – study 362) found continuing growth in desired teacher performance to be consistent with the research hypothesis that effective modelling and successful experience resulted in favourable self-efficacy for effective science teaching. In particular, he confirmed the common sense assumption that direct and successful work with children served to enhance teachers' self-efficacy.

Greater commitment to changing practice, more willing to try new things

Eight of the 15 studies in our synthesis reported an increase in teachers' willingness to take risks, try new things or try things they had previously thought to be too difficult. These quotes from teachers in the Ertmer and Hruskocy's (1999 – study 357) study helps to illustrate the feelings of teachers across the studies. 'Stephen noted, "I'm less apprehensive about trying new things and I'm more willing to explore"! Lara summed it up "I think everyone at first had a lot of reservations, a lot of trepidation. I think (now) we're all in a learning mode"'.

An increased enthusiasm for collaborative working, including overcoming anxiety about being observed and sharing problems

There were reports in seven studies of increased teacher enthusiasm for professional development through collaborative working. This was despite having to overcome sometimes extreme initial anxiety about being observed and sharing problems.

It would appear that the positive impact of collaborative CPD on teachers' motivation, enthusiasm for enhancing their practice and for learning, sometimes emerged only after periods of relative pain and anxiety. For example, Gersten *et al.*, (1995 – study 359) offers this teacher's comment which is representative of many: "the experience has been well worth the initial pain and has left me, at the end of the year, more positive than I was previously". Ross *et al.*, (1999 – study 367) describes how 'anxiety, guilt and uncertainty' were replaced by greater self-confidence. Ertmer and Hruskocy (1999 – study 357) found that teachers moved from a perceived need for support to greater confidence and less apprehension. Such changes unfolded gradually during the CPD programmes or even after they were completed. Britt *et al.*, (2001 – study 351) reports that 'one teacher who did not believe she had changed much, was later put in charge of the Mathematics Programme in her school. Given this responsibility, she revised her thoughts about the benefits of the project and used many procedures from the project in her school'.

Teacher morale

The Advisory and Review Groups were particularly interested to know whether there was evidence about impact on teacher morale. Although many of the studies illustrated specific findings with examples of positive attitude changes, greater enthusiasm and confidence and greater commitment to developing practice, none of them directly addressed the issue of teacher morale. These outcomes, whilst not explicitly presented as related to morale, all point indirectly to improvements likely to enhance morale.

Student outcomes

A summary of reported student outcomes matched to features of study measurement and design is provided in Appendix 4.9.

The research findings in the data-extracted studies tended to report either measured increases in student performance (seven) or demonstrable changes in student behaviour (eight) or both. There were also reported Improvements which related to student attitudes and beliefs. The latter included reports that changes in their teachers' behaviours:

- *helped support their learning (Brown, 1992 – study 352);*
- *increased their satisfaction with their work (Brown, 1992 – study 352);*
- *enhanced motivation, enthusiasm (Brown, 1992 – study 352; Kimmel et al., 1999 – study 362; Kirkwood, 2001 – study 363; Gersten et al., 1995 – study 359; Harvey, 1999 – study 360);*
- *increased confidence/self-esteem (Ertmer and Hruskocy, 1999 – study 357);*
- *increased active participation (Gersten et al., 1995 – study 359; Kohler et al., 1999 – study 364).*

Since the original focus of the majority of the studies was on pupil learning, improvements in student motivation were not always explicitly included in the reported aims of the studies. However, such improvements were reported as outcomes linked to the CPD intervention. Overall, all but two of the studies reported observable improvements in attitudes to learning for pupils.

In two cases, however, the pupil outcome picture is more complex. In Da Costa's (1993 – study 355) research, students whose attainment was high and who were taught by teachers with a strong belief in their own personal efficacy were found to hold negative attitudes toward themselves, peers, teachers, school, learning in general and core curriculum subjects. In the same study, students with less high attainment scores who were taught by teachers with a strong belief in the general efficacy of the profession, reported more positive attitudes. Harwell's (2001 – study 361) study set out to use an action-research model to help teachers integrate technology into their classroom teaching. At the same time, it sought actively to influence pupils' perceptions of their learning environment for the better. Students' perceptions of their learning environment, however, failed to change, despite the teachers' CPD programme. It should be noted, in this context, however, that the teachers found the student feedback sufficiently powerful to motivate them to enter a second round of action research to address their goals and bring about changes that would be noticed by their students.

Teacher classroom behaviours

For the purposes of this review, ‘behaviours' is used to describe actions taken by teachers in the classroom, informed by teacher knowledge and beliefs and their interactions with pupils. There is some evidence in the studies that teachers' experiences of collaborative CPD – the first time, for many of them, that they had worked in this way – also affected both their own and their pupils' classroom

behaviours in similar ways. They appeared to have encouraged increased collaborative working between students or between students and teachers. They also appear to have influenced patterns of student learning. For example, students began to question each other, evaluate each others' work and to show an interest in the process of their own learning as the teachers modelled collaborative learning.

A number of the outcomes of the CPD related to such efforts to increase active student learning, including the following:

- *teachers developed more assignments with in-built opportunities for assessment and feedback (Parke and Coble, 1997 – study 366);*
- *teachers were trying to teach with less telling, and getting students to write problems that form the focus for class discussion (Britt et al., 2001 – study 351);*
- *teachers were promoting co-operative learning between students (Brown, 1992 – study 352);*
- *teachers provided more feedback to students; ensured all students had an opportunity to learn; set tasks with an appropriate level of difficulty; became learning rather than task oriented (for those with a belief in general as opposed to personal efficiency) (Da Costa, 1993 – study 355);*
- *teachers used strategies which enabled pupils to contribute more of their own knowledge (Harvey, 1999 – study 360);*
- *teachers adopted a less didactic/more research oriented approach (Kirkwood, 2001 – study 363);*
- *teachers increasingly used suggestions and promoted questions to facilitate student interaction with peers (Kohler et al., 1999 – study 364).*

Six studies also reported that teachers changed their practice to make use of specific tools or interventions including:

- *a conscious effort to use computers more for both instruction and professional activities such as planning (Ertmer and Hruskocy, 1999 – study 357);*
- *more effective planning for pupils with specific educational needs (Kimmel et al., 1999 – study 362);*
- *clearer planning and use of a wider range of strategies/increased versatility (Harwell et al., 2001 – study 361);*
- *increased knowledge of mathematics and as a consequence more effective implementation of a reform curriculum (Kirkwood, 2001 – study 363);*
- *more adaptation of academic material (Kohler et al., 1999 – study 364);*
- *more use of advance organisers and graphic transformation (Brown, 1992 – study 352).*

The different ways in which collaboration influenced teacher outcomes was reported in many studies. For example:

- *six studies reported on the importance of collaboration in providing moral support to teachers as they work through making difficult changes which are often reported as stressful;*
- *four studies reported on the usefulness of collaboration for sharing effort and/or making more effective use of their own and/or their students' time;*
- *two separate studies set out specifically to explore the importance of collaborative ways of working for teachers in modelling and therefore supporting collaborative and active learning for students.*

The detail involved can be exemplified as follows:

- *teachers became more committed to coaching (because it modelled learning); it provided contextualised counselling on implementation problems and increased motivation for teachers and pupils (Harvey, 1999 – study 360);*
- *although in the first year the students did not notice the targeted changes in their learning environment or much increase their use of ICT, the teachers found working with the pupil data very useful and so undertook a second cycle of action research targeted at deeper change (Harwell et al., 2001 – study 361);*
- *teachers developed a more research-oriented perspective, built informal networks, worked together for cross-facilitation of ideas and worked at a more individual pace (Kirkwood, 2001 – study 363).*

Given the predominance of a curriculum focus on maths and science in our studies, the limited amount of pedagogical detail was disappointing for the purposes of our review question and there were no discernible patterns or trends relating to the subject areas that we could find.

Teacher knowledge and understanding

Due to our focus on CPD that has affected practice, our studies included CPD which enhanced teacher knowledge, but mainly focused on supporting and exploring the use of that enhanced knowledge in classrooms.

Thirteen of the studies explicitly explored aspects of how teachers' knowledge and/or understanding developed in relation to their use of such knowledge in classrooms (Britt *et al.*, 2001 – study 351; Brown, 1992 – study 352; Bryant *et al.*, 2001 – study 353; Gersten *et al.*, 1995 – study 359; Harvey, 1999 – study 360; Harwell *et al.*, 2001 – study 361; Kimmell *et al.*, 1999 – study 362; Kirkwood, 2001 – study 363; Kohler *et al.*, 1999 – study 364; Parke and Coble, 1997 – study 366; Ross *et al.*, 1999 – study 367; Saxe *et al.*, 2001 – study 368; and Wilkins, 1997 – study 369).

Nine of these (Kirkwood, Parke, Kohler, Wilkins, Britt, Brown, Bryant, Kimmell, and Ross) related to enhancing teachers' knowledge and understanding of a wider range of strategies for supporting and encouraging more active learning, such as making stronger connections between ideas, developing co-operative learning strategies between students, enhancing problem-solving and involving students in designing learning activities.

Three separate studies (Britt, Da Costa, 1993 – study 355 and Kimmel) report improvements in teachers' understanding of/ ability to make connections between learning strategies and the curriculum. Three studies report teachers' development in relation to specific subjects (Britt, Brown and Harvey) and three report enhancements in teachers' understanding of/ knowledge about and ability to support student self evaluation.

Processes and characteristics of the CPD: patterns of intervention

To help understand the implications of the review findings for practitioners, we wanted to try to identify common features of the collaborative CPD that has been explored in the review. Analysis of the interventions has, as has been noted, been inhibited by:

- *the tendency of many of the studies that provide evidence about impact to offer little data about the CPD process;*
- *the tendency of the data-extraction process to concentrate on methods and outcomes.*

Nonetheless some prominent features of the collaborative CPD included in the review emerged from an analysis of the data extraction, backed up by further scrutiny of full reports. The key features identified in combination were:

- *observation;*
- *feedback (usually based on observation);*
- *the use of external expertise;*
- *processes to encourage, extend and structure professional dialogue;*
- *scope for teacher participants to identify their own focus;*
- *an emphasis on peer support rather than a managerial approach.*

These activities all feature in seven or more studies. Building collaboration and exploratory lesson planning into CPD workshops features almost as frequently.

Other activities highlighted specifically in more than one but fewer than six studies include the following:

- *use of research literature as a springboard for dialogue/experimentation;*
- *providing pay or negotiated non contract time for participating teachers;*
- *modelling within CPD the learning support/facilitation practices that the programme aims to enable amongst teachers;*
- *action research.*

Observation and feedback

Observation and feedback feature in nine studies. The extent of these interventions varied from being an integral part of both the CPD and the data collection to informal, ad hoc reciprocal visits between teachers, followed by feedback and the exchange of ideas. In one study (Britt *et al.*, 2001 – study 351), where the processes of observation and feedback were highly structured, audio and video tapes from lesson observations enabled researchers and teachers to explore together factors such as:

- *whole class versus group teaching;*
- *use of teaching materials;*
- *participation of students;*
- *use of students' existing knowledge.*

Another researcher, Gersten *et al.*, 1995 – study 359, based the coaching process on three principles:

- *classroom observation and feedback should be ongoing and intense, including informal discussions of how instructional principles relate to observed teaching and learning situations;*
- *coaching sessions should highlight observed impact of suggested practices on target studies;*
- *suggestions should be concrete and practical and should fit the realities of the classroom.*

This is consistent with a range of prominent theoretical writing such as Joyce and Showers' (1988) proposition that feedback, based on direct observation of practice in classrooms with pupils, is an important element in sustained and embedded learning. This outcome is also consistent with Da Costa's (1993 – study 355) findings that pupils' whose teachers were involved in models of peer coaching that did *not* include direct observation did not achieve as highly as pupils' whose teachers were exposed to observation as well as coaching.

External expertise and peer support

All the studies reported in the review feature the use of specialist, external expertise in the collaborative CPD although the extent and nature of these partnerships between 'experts' and teachers varied greatly. In one study (Saxe *et al.*, 2001 – study 368), comparisons between collaborative CPD where there was specialist input and collaboration where the teachers simply supported each other found that the group with specialist input in subject knowledge made significantly more changes than the group without and their pupils shared stronger increases in attainment too.

This does not mean that we found a simple story of outsiders riding to the rescue of ignorant teachers. The majority of the studies (13) reported CPD which combined external, specialist input with internal, collaborative peer support.

Ten studies emphasised this as a partnership between teachers and 'outside experts'. Acknowledgement of the expertise and the essential contribution of the participating teachers to this partnership was evident in many studies. For example:

- *Kirkwood (2001 – study 363) reported that engaging and developing teachers' interest, expertise and energy may be enhanced by the collaborative nature of the CPD. Although traditional professional development would have 'an impact on future reform programmes', such measures would only 'scratch the surface of what is possible to achieve when the energy, talents and experiences of classroom teachers are properly harnessed in order to share curriculum and pedagogy';*
- *Harwell et al., (2001 – study 361) concluded that 'professional development for practicing teachers must combine the expertise of researchers and the knowledge of practicing teachers in a collaborative effort to inform instructional decision making if educators want to create learning environments conducive to effective learning among students';*
- *Bryant et al., (2001 – study 353) argued that 'time must be allocated for teachers to share their own personal knowledge about their students and teaching and to receive guidance from experts on topics';*
- *Brown (1992 – study 352) reported that the consultant went to considerable lengths to establish working processes and relationships that enabled him to become an insider, at least in the eyes of an internal peer coach;*
- *Parke and Coble (1997 – study 366) described teachers and researchers as 'partners in advancing the knowledge base of teaching and learning';*
- *Kirkwood built on Hugh Coolican's notion of the 'outside expert' as playing the leading role at the beginning of the project, with participants gradually taking on a more central role as the research progresses.*

The use of an outside consultant was frequently cited as a source not only of technical expertise, but as an agent of change. For example:

- *principals and teachers in Brown's study were clear about the benefits of outside expertise – the knowledge base and skills, the freedom from administrative constraints and the ready access to information not easily available to schools and teachers;*
- *Ross et al., (1999 – study 367) argued that 'the benefits of collaborative action research may not accrue to teachers who engage in action research independently of support from academics. The main contribution of the academic researchers in this study was only partly related to the training in research methods they provided'. More important was the sharing of decision-making with the teachers.*

Acknowledging the resource implications of the outsider/insider CPD model, some studies addressed the issue of sustainability as follows:

- *Brown's (1992 – study 352) findings led to the suggestion of engaging an outside consultant to work with a number of schools, allowing half or full day consultations to eight or nine schools over a two-week cycle;*
- *Wilkins (1997 – study 369) found that a mentoring model was effective, using an expert to train mentors who are then used as a training resource in individual schools;*
- *Kirkwood (2001 – study 363) reported that once the teachers saw the benefits of the collaborative CPD in terms of student motivation and success, they began to take ownership of the project and by the end of the project they were 'routinely adopting a research perspective on their classrooms';*
- *Parke and Coble (1997 – study 366) argued that 'focusing on a common mission, connecting with other professionals, collaboratively reflecting about their practice…opens up greater possibilities for continuous improvement in the science curriculum...A major ingredient of educational reform becomes the extent to which the change process goes beyond involving only a few representative teachers and begins to involve all teachers, administrators and communities in all districts school by school'.*

One study (Harvey, 1999 – study 360) considered that lead teachers and peer coaching might have to be considered as a replacement for outside expertise in the resource-stretched South African environment.

There were two CPD programmes in which the process of peer support was reported explicitly as excluding external specialist input. Here the CPD took the form of collaboration between peers, and probing dialogue prompted by, for example, videos, evidence from observation or from the research literature. In one case, it took the form of explicit peer coaching so that observation and feedback was separated from accountability or supervisory functions.

Six studies explicitly mentioned the use of initial and follow-up workshops, one noted that teachers who did not participate in the initial workshop made significantly fewer changes than their peers.

In at least eight of the studies, the teachers were enabled/encouraged to undertake collaborative exploratory lesson planning within workshop or coaching contexts as a means of helping them interpret and test the implication of new strategies for their own practice and/or the needs of their own students.

Teacher readiness

The Review Advisory Group was also interested in finding out about teacher readiness in relation to the CPD intervention and about how the CPD strategies took account of differentiation.

Seven studies explicitly reported CPD with teachers being given an opportunity to select their own focus. Researchers tended to emphasise this as a means of building teacher ownership and/or a means of ensuring that the CPD built upon what teachers know and could do already (i.e. as a means of supporting/enabling differentiation).

There was not enough data reported in the studies to enable any synthesis of information about teacher readiness. We were therefore unable to report on teacher readiness in the sense of the degree of orientation and enthusiasm

amongst participants towards the learning opportunities on offer. There was also insufficient information about the recruitment of teachers into the projects to throw any real light on the problem of how much of the work was truly collaborative as distinct from merely co-operative.

However the reports do show that not all the teachers who participated in the different CPD programmes described in the studies were volunteer recruits:

- *in six studies, it was unclear from the report how the sample had been recruited into the research;*
- *nine studies selected volunteers by invitation; one study involved the teachers inviting the researchers to participate and one required teachers to participate as part of a government reform programme. It seems that not all the teachers were initially willing partners in the CPD and some studies (Gersten et al., 1995 – study 359; Bryant et al., 2001 – study 353; Ertmer and Hruskocy, 1999 – study 357; Ross et al., 1999 – study 367) pointed out that teachers had high initial anxieties about the collaborative processes involved, such as observation, open and honest feedback and problem-sharing.*

The extensive reporting of a positive impact on attitudes is consistent across the studies, hence the degree of willingness to participate.

Some reports do not describe ways of formally establishing teacher readiness but do report teacher comments related to their readiness when there is a safe space for admitting need. For example, Bryant *et al.*, (2001 – study 353) state that early on all the teachers involved agreed that they 'felt overwhelmed by issues such as the effects of low socio-economic status of students' learning the academic need of English language learners'. They commented too on their feeling (with the exception of one English language teacher) that they were not 'reading' teachers and so had doubts about their ability to provide instruction in reading strategies. This group of teachers explicitly identified shared and quite specific needs at the start of the CPD.

Differentiation: building on what teachers know and can do already

Many of the patterns emerging from the studies echo much of the more abundant evidence and theory about students' learning. For example, the emphasis on collaboration echoes the work of Vygotsky (1980) and others on the social construction of knowledge. The emphasis on feedback could be seen as reflecting work on formative assessment set out in Black and Wiliam's extensive research review (1998) and the emphasis on dialogue could be seen as reflecting work on metacognition by authors such as Adey and Shayer (1994). One strong feature of learning theory in relation to students' learning that we expected to find does not emerge, at least straightforwardly, from the data: the importance of building upon what teachers as learners know and can do already as reflected, for example, in Vgotsky's work on the zone of proximal development. We therefore re-scrutinised our data to analyse how, if at all, the different interventions approached this.

There was, of course, a significant range; if this were not the case, the issue would have emerged as a pattern in the data earlier on. Furthermore, although there was extensive analysis of what is known already at the start of each article, this was sometimes instrumental and focused on whether processes worked rather than why they worked. This may help to explain the lack of explicit reflection on teacher readiness. An exploration of how the various CPD

interventions approached the issue therefore involves a degree of interpretation, so we offer the following analysis rather tentatively.

In the context of these caveats, we have identified the following aspects of the various interventions as being, to different degrees, concerned with identifying what teachers know and can do already in order to support them in moving beyond that:

- *observation and related feedback (see earlier comments on this very strong feature of the interventions);*
- *enabling teachers to select their own focus for development - researchers tended to emphasise this as a means of building teacher ownership and/or a means of ensuring that the CPD built upon what teachers know and could do already (i.e. as a means of supporting/enabling differentiation);*
- *establishing a secure space so that teachers can identify what isn't going well (three studies, see example below);*
- *establishing more than one, preferably several, learning cycles (three studies)*
- *establishing a base line assessment.*

The establishment of more than one learning cycle was highlighted in three studies as having the effect of enabling individual teachers to build on what they knew and could do already. One study built learning cycles through periodic workshops followed by observation and coaching in schools. The other two involved action research as the CPD mediums. All action-research approaches involve teachers in an initial cycle of identifying and refining their research questions within their working contexts so that differentiation is integrated into the action research cycle. The remaining two action-research studies were also likely to have involved this type of activity and to have established starting points appropriate to the teachers involved, although this was not reported.

Six studies include pre- and post assessments or questionnaires in the research design to provide a baseline needs assessment. Unfortunately it is not clear how many of these were used formatively within the CPD to enable the teachers and those who support them to ensure that activities build on previous knowledge, skills and beliefs/or practices. The baseline may have been used by researchers simply as an external evaluative mechanism; alternatively, it may have been a mechanism to establish both a baseline for measurement of progress and a tool for diagnosing teacher needs. What is not clear is whether the baseline assessments were kept confidential in order to enable researchers to explore the effects of the CPD without 'contaminating' them with the effects of the research process. Be that as it may, if all these measures are taken together as genuinely being used to enable diagnostic assessment for formative purposes, this emerges as very strong characteristic of the work indeed. However, we must repeat our concerns about interpretation of the available information here.

There is also some evidence from two of the studies of the importance of paying particular attention to teacher readiness for beginning teachers. Gersten *et al.*'s study (1995 – study 359) makes it clear that beginning teachers needed more support and possibly a different kind of CPD altogether, if successful change in practice is to be achieved when tackling the most challenging aspects of teaching. O'Sullivan's (2001- study 365) study was rated as low in relation to the weight of evidence it provided for our review because it targeted unqualified or under-qualified teachers (teaching in Namibia) – our review involved practising teachers – by implication in a developed economy, qualified teachers. However it is interesting to note that an established model of CPD had to be considerably

modified for teachers with these limited qualifications, suggesting that both training and experience are essential prerequisites for collaborative professional development.

Resources

Only three reports (Britt *et al.*, 2001 – study 351; Brown, 1992 – study 352; and Harvey, 1999 – study 360) specifically address the issue of cost effectiveness in relation to models of CPD involving expert input and peer support.

Brown compares in considerable detail the costs and benefits of involving internal and external support for collaborative CPD. He reports that the use of external consultants creates a need for cash resources which can be considerable in relation to school budgets. He reports too that there are benefits from using internal peer-coaching. He concludes, however, that 'teachers would need considerable additional training to reach an autonomous level of consulting skill'. He suggests that the balance of cost effectiveness lies with a combination of the two.

Harvey also explores cost-effectiveness in some detail. The report explores a study of the effectiveness of expert coaching but concludes that this model is too expensive and labour intensive given South Africa's current budgetary limitations. Instead the paper concludes that lead teaching and peer coaching will need to be explored further.

Britt's study explored the development and support of professional dialogue. He argues that the question for an education system that cannot afford long-term professional development programmes is how such professional conversation can be encouraged and sustained. He concludes that it is important for teacher time to be secured that is defended from discussion of administrative matters.

Although other studies do not specifically explore costs, many refer to resources and in particular to teacher time. Five studies report arrangements for securing non-contact time. Ten studies refer to arrangements for building classroom planning time into workshops or to sharing development work between teachers to make effective use of time. The emphasis on the importance of opportunities for teachers to observe practice and to be observed have significant resource consequences.

Funding

Support in terms of funding for the research was particularly well documented, in all but four studies. Where the source of funding was stated, authors reported the following:

- *six studies involved government or national awards or grants;*
- *two studies involved state or LEA awards or grants;*
- *two studies were sponsored by research grants;*
- *one study involved a combination of all three.*

In almost all cases, the implication was that funding covered both the research and the CPD intervention, thus providing a greater resource input than might normally be possible. In relation to CPD, funding typically secured teacher release time for consultations, collegial discussions or training. Teachers appreciated such support, as reported in:

- *Bryant et al. (2001 – study 353): 'We believe that a project of this magnitude could not have occurred without this level of support';*

- *Kirkwood (2001 – study 363): 'It was important to secure continued funding on an annual basis and release teachers from schools for ongoing participation in project events'.*

While shortage of funding was cited in three studies (Ertmer and Hruskocy, 1999 – study 357; Harwell *et al.,* 2001 – study 361; and Ross *et al.,* 1999 – study 367) as being a limiting factor to effectiveness, other studies reported that teachers, once engaged in the programme, were motivated to meet informally with colleagues. It should be noted, that many of the studies were not based in UK and some were over five years old. The authors of the recent Kirkwood (2001 – study 363) study argue that the limited time that Scottish teachers have 'free of teaching, preparation, marking and administration to share their knowledge with each other and develop the curriculum is a major impediment (to professional development)'.

Three projects approached the issue of limited funding by using various types of apprenticeship models:

- *In the Ross action research study, the authors reported that 'teacher involvement is also limited by lack of time to do research, a problem that can be reduced if collaboration with professional researchers brings additional resources to the exercise'. This study adopted a two-step approach in which 'teacher-researchers first learn how to study practice in a particular domain by apprenticing with academics and then use the results of the inquiry to design individual action research projects to improve their teaching'.*
- *In the Ertmer study, the researchers not only trained the teachers in computer skills, but also 18 students were trained as 'experts' as an additional technical resource to staff. An additional benefit was that the self-esteem and skills of these students increased.*
- *A mentoring model was used in the Wilkins (1997 – study 369) study, where an expert teacher trains resident mentor teachers who are then available as a professional development resource in individual schools. It was reported to be an effective way of offering teacher training to large numbers of teachers.*

4.5 In-depth review: quality assurance results

Following initial moderation, most differences between reviewers and between reviewers and the EPPI-Centre were of a trivial kind, such as in responding 'no', based on reviewer's judgement, as opposed to 'not stated' or 'implicit'. There were also a few differences in judgement, especially in assigning the weight of evidence. The differences were reconciled by discussion, often with a third person. The details supplied by the different reviewers were combined in producing the final data extraction for each study.

4.6 Nature of actual involvement of users in the review and its impact

Involving users (see section 2.1, definition of users) in the complex and time-consuming data-extraction process was problematic as well as beneficial. The need to organise follow-on training for practitioner reviewers added to the pressures caused by the late production of the software and training for the core group. Some users were understandably unused to the statistical terms and techniques and needed support in the initial stages of the process. However the

mix between the practitioner perspective and that of experienced academic researchers, including the EPPI reviewers, was a healthy one and contributed to the rigour of the review process as a whole. For example, studies which might have been judged as high on purely methodological grounds were valued more cautiously by users in relation to our specific review question because of lack of information about the school/teacher contexts and about the processes and strategies used in the intervention. Teachers were not interested in knowing whether an intervention was effective without also knowing the details of the design, delivery and implementation of the intervention. This is what helps practitioners to get a grip on the scale and nature of the work and to relate it to their own professional contexts.

Similarly, studies which users may find particularly relevant and helpful in exploring the practical implications of the review may have failed to meet the more exacting methodological assessments of the researchers. This mixture of perspectives probably contributed to the high number of studies which were judged to be of 'medium' weight of evidence in relation to the review specific question.

Four of the data-extraction team had teaching experience: two had retired and two had pursued other education-related careers. Time was a key restricting factor for practising teachers. It is difficult to judge what the benefits of participation would have been to serving practitioners, although all the retired and former teachers found the process intellectually rewarding and beneficial to their understanding and potential use of research processes and techniques.

5. FINDINGS AND IMPLICATIONS

In conclusion**,** the key features of the review questions, processes and findings can be summarised under the following headings:

- *what we wanted to find out;*
- *how many studies the review included*
  - in relation to teachers
  - in relation to students
  - in relation to processes;
- *results;*
- *implications for practitioners;*
- *implications for policy-makers;*
- *implications for research.*

5.1 Summary of principal findings

This Review Group is sponsored by a practitioner organisation and is concerned with identifying and making accessible research that has a capacity to have a positive impact on teaching and learning.

In considering the interests of a practitioner audience, we particularly have in mind school CPD or staff development co-ordinators together with LEAs, HEIs, professional and subject associations and others who design and deliver professional development programmes.

The first review was therefore constructed not as an open-ended prospecting task to explore, for example, what is known about CPD but as a targeted mining of resources; our interrogation of the study data reflects this. Our question was 'How does collaborative CPD for teachers of the 5-16 age range affect teaching and learning?' We had a two parts to this review question: '*Does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?' a*nd '*How does collaborative Continuing Professional Development (CPD) for teachers of the 5-16 age range affect teaching and learning?'*

We defined collaborative CPD as sustained activity with explicit learning goals for teachers working collaboratively with each other and / or advisory teacher, researcher or mentor.

We targeted collaborative CPD for two reasons:

- *practitioners believed it to be relevant and practical;*
- *influential theoretical and empirical work identified by our advisory group and highlighted in previous interpretive*[2] *reviews endorsed this preference as being likely to be fertile, particularly if coupled with a search for evidence about CPD that is sustained over time.*

[2] e.g. Guskey, 1989; Mitchell, 1999; Joyce and Showers, 1988; Fullan,1991; Slavin,1996; Sainsbury et al 1998; Cordingley, 2000

The link between teachers' beliefs, knowledge or skills, their actions in classrooms in relation to their pupils' actions and pupil learning is complex, dynamic and often not directly observable. This makes the exploration of the nature and impact of the CPD processes even more complicated. Different studies in our review took different paths in exploring these connections. Most studies noted changes in beliefs and some, but by no means all, set out directly to study such changes. Connected or coherent responses to questions about *how* positive impact is achieved must trace evidence through this complex path and, usually, restrict themselves to identifying associations rather than cause and effect. In the context of such caveats, does the review provide any insights into the changes in teachers' actions which precede the positive impact upon pupils?

5.1.1 Identification of studies

Methods of identifying studies for the systematic map and in-depth review comprised:

- *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;*
- *retrieval of full reports, to which the criteria were re-applied to see if they were suitable for inclusion in the mapping stage of the review;*
- *keywording all the included reports by type of study, type of setting, age, curriculum focus, etc. (at this point a number of review specific keywords were also attached to each study, distinguishing in finer detail between types of intervention, teachers and processes);*
- *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 teachers and pupils were retained for in-depth review;*
- *using EPPI data-extraction software to extract data from the studies and to assess their likely trustworthiness in answering the review specific question.*

5.1.2 Mapping of all included studies

The Stage 1 inclusion criteria targeted studies that fell within review boundaries and contained sufficient contextual and methodological data to be a source of potential evidence for the review question. We sifted systematically 13,479 titles and abstracts, reviewed 266 full studies, identified 72 studies as relevant and so keyworded their content to create a map of the literature.

5.1.3 Nature of studies selected for in-depth review

At Stage 2, the Review Group narrowed the focus further by restricting the review to CPD activities that explicitly set out to investigate impact upon teaching and/or learning processes and outcomes. Seventeen studies met this second set of inclusion criteria. The majority of studies reviewed in-depth came from the USA (nine), and were almost evenly divided between primary and secondary age phase. Mathematics and science featured strongly as the curriculum context.

5.1.4 Synthesis of findings from studies in in-depth review

The syntheses and conclusions are based on 14 studies that provided medium weight of evidence to investigate 'whether' CPD had an impact, and 15 studies

that provided high or medium weight of evidence to investigate 'how' CPD had an impact.

Collaborative CPD was linked with improvements in both teaching and learning; many of these were substantial.

In relation to teachers…
The changes in teacher behaviours reported in the studies included:

- *greater confidence amongst the teachers;*
- *enhanced beliefs amongst teachers of their power to make a difference to their pupils' learning (self-efficacy);*
- *the development of enthusiasm for collaborative working, notwithstanding initial anxieties about being observed and receiving feedback;*
- *a greater commitment to changing practice and willingness to try new things.*

In relation to students…
The positive outcomes for students concentrated either on measured improvements in student performance and/or on:

- *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;*
- *the development of a wider range of learning activities in class and strategies for students.*

In relation to processes…
There were sufficient data from the synthesis across the studies to enable us to identify a number of core features of the CPD which were linked, in combination, with positive outcomes including:

- *the use of external expertise linked to school-based activity;*
- *observation;*
- *feedback (usually based on observation);*
- *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.*

5.2 Strengths and limitations of this systematic review

Strengths

- *A strength of this review is the close involvement of a number of user groups in setting and refining the questions and interpreting and disseminating the findings;*
    - the authors of the review went to great lengths to work with users and to work from their perspectives at every stage, and to explain the link between professional development, teacher practice and pupil learning (three important fields of activity that the system

needs to be able to connect but that involve multiple, complex and dynamic interactions).

- *The CPD review group believes that it can build on both the findings and experiences of this first review. In particular:*
  - the review provides the basis from which to continue to unpack the specific processes involved in the CPD intervention and to establish those which appear to influence change in teacher practice;
  - the review details a range of approaches to the problematic issues of the measurement of student and teacher outcomes. These have the potential to inform approaches to CPD evaluation in policy and practice.

Our question focused on impact. Since our teacher reviewers and advisors were resolute about the importance of impact information, we have described in Chapter 2 of this review how we used the availability of such data as a filter for inclusion. For practitioners, knowledge about the positive impact of collaborative approaches to CPD simply generates a thirst for more information about how those approaches worked on the ground.

Limitations

We were conscious throughout of the limitations of the data. None of the studies was designed to answer our review question directly. In particular, we found:

- *a tendency for the study reports to concentrate on either inputs and CPD processes or outputs/outcomes (effects on teachers and students) but rarely on both these types of data;*
- *very few of the study designs were appropriate for assessing the effects of collaborative CPD. Hence conclusions about whether collaborative CPD 'works' are more tentative than those about how it works;*
- *a surprising lack of detail about important elements of the CPD processes, even where these were the main focus of the report;*
- *a lack of explicit definitions of core terms;*
- *a disappointing lack of detail about the teacher participants in some of the studies, the different aims and foci of the studies;*
- *many of the studies focussed on maths, ICT and science and so it not known whether the findings also apply in other curriculum areas;*
- *many of the studies were conducted in the USA and so it is not known whether the findings also apply in other geographical areas;*
- *there may well have been additional fruitful data in a number of Ph.D studies. However, we were unable to retrieve these within our timescale and note that these data remain unexplored.*

5.3 Implications

Any implications are inevitably an interpretation of data by the review team. In responding to EPPI's requirement that we identify implications for practitioners and policy-makers, we have worked in consultation with key individuals from each group.

5.3.1 Policy

The Review Group consulted widely amongst the different policy stakeholders in the UK to help identify the main issues highlighted by the review which had implications for policy-makers.

There is evidence that collaborative and sustained CPD can be clearly linked to positive effects for students and for teachers.

- *Policy-makers at all levels may wish to consider reviewing their policies and resource strategies for CPD to explore whether sustained and collaborative CPD of the type illustrated by this review might increase their effectiveness.*

The positive findings about the links between collaborative and sustained CPD and increased teacher confidence, self esteem, enthusiasm and commitment to continuing to learn about teaching, all address important issues related to teacher retention and recruitment.

- *Policy-makers at international national, regional, local and school level should consider whether current CPD programmes and activities could make a greater contribution to recruitment and retention if they were organised on a collaborative and sustained basis.*

Teacher-focused CPD

Most of the research reported here started with teachers' expressed learning needs, took account of different starting points for individual teachers at every level and involved activities to develop and sustain teacher ownership of CPD. Participation in the CPD and the research was also located firmly in the school and classroom context although some expert inputs took place in other contexts.

- *Policy-makers, at every level, responsible for developing CPD should consider whether activities take full account of the specific needs and concerns of teachers in their implementation strategies and put in place arrangements to develop and foster teacher ownership and avoid an over-managerial approach.*

They may also wish to consider how far a focus on the needs of schools as a whole enables teachers and providers to connect school and individual needs; whether a focus on the needs of the school inhibits or facilitates differentiation and responsiveness to the professional judgements of teachers.

Structured collaboration

The CPD reported in the review was not about naive discovery or 'curriculum tourism'. It was a structured way of working, involving considerable co-ordination built on clarity about the nature of adult and pupil learning processes.

A current interest in collaboration amongst policy-makers could be enhanced by a focus on the forms of collaboration. In particular, funding and provision mechanisms may need to take account of the following:

- *the need for specialist, expert input in relation to:*
  - the aspect of pedagogy being explored
  - working with teachers
  - coaching including, where appropriate, the development of peer coaching skills;

- *arrangements for sustaining learning over time so that new approaches can be adapted, experimented with and integrated incrementally into existing practices;*
- *differentiation strategies that take account of individual teacher's needs;*
- *arrangements for creating a distinctive space where it is safe to admit need as there is often a period of pain and anxiety for teachers in risking new strategies and in opening up their practice to observation;*
- *the potential for collaboration between teachers to lead to collaborative ways of pupil working.*

Providers, at every level, may wish to start conceiving and describing CPD opportunities in terms of the messages from the research so that teachers and schools know exactly what they are buying into. For example, CPD providers could describe in more detail how they will:

- *respond specifically to the needs of teachers at different stages of development;*
- *encourage and support the development of in-school coaching;*
- *provide specialist input;*
- *sustain effort over time.*

Similarly, when policy intervenes in relation to pedagogy, the evidence from this review about the key issues outlined above should inform implementation strategies so that classroom teachers are helped effectively to enhance their practice and move beyond superficial adaptation of practice.

The evidence from this review relating to effective support for teacher learning could also offer some texture to the 'dissemination' of best practice strategies.

- *Policy-makers, at every level, may wish to consider how far dissemination of best practice is conceived as a learning process that includes detailed and expert specification of excellence but embeds this in combinations of CPD activities specifically structured to meet the needs of the learners.*

Accountability and accreditation

The CPD reported in this review consisted of a combination of complex activities in a context where it was safe to admit need and which was responsive to individual needs. At the same time, all the CPD programmes in our high or medium rated studies had a clear focus and purpose. They incorporated measures for assessing effectiveness, including pupil impact. The CPD in these studies involved a strong sense of accountability to colleagues and to pupils.

- *Policy-makers, at every level, should consider whether accountability to fellow participants in CPD programmes and to pupils can or should be developed to create fit for purpose evaluation instruments where evidence collected contributes directly to the CPD.*

Forms of support

Most of the studies in this review involved some form of coaching including observation and feedback. Models included:

- *experts working with teachers and coaches and/or consultants,* coupled with;
- *teacher to teacher (peer) coaching;*
- *training mentor teachers who then provided mentoring in-house;*
- *HEI researchers working with teachers.*

Coaching as carried out in the programmes in this review is expensive, especially when initially building coaching skills but there is evidence that the initial investment is effective and self-sustaining.

Policy-makers, at all levels, may wish to consider whether it is possible to encourage schools to buy into CPD programmes involving sustained collaborative working and coaching by:

- *encouraging schools to cluster together for different CPD inputs;*
- *achieving a critical mass of teachers with peer coaching skills so that all CPD can be sustained between external inputs;*
- *making links with existing ITT programmes to build on and embed coaching and mentoring skills.*

5.3.2 Practice

In exploring potential CPD options, teachers may wish to identify whether CPD opportunities involve collaboration on a sustained basis.

- *If there are no programmes on offer which are relevant, teachers may wish to explore with colleagues whether non collaborative CPD activities could be followed up collaboratively in a within-school programme. This may be of particular interest to teachers who, while open to new approaches, are concerned about short-term fads.*

The CPD programmes in this review involved quite a range of activities for ensuring that the CPD identified and built on what the teachers knew, believed or could do already.

- *Exploring how CPD programmes approach this or, if they don't do so explicitly, asking whether there is a range of choice in the programme to enable individuals to find an appropriate focus and level, may enable individuals both to identify their own needs and to ensure they are taken into account.*

Collaboration and coaching highlighted in this review as being linked with positive effects for teachers and students is grounded in classroom observation and sustained support related to it. This is clearly an expensive process and such opportunities will need to be negotiated.

- *It may be better to seek fewer opportunities of this sort than several cheaper, more episodic opportunities.*

All the CPD being studied involved a complex combination of activities; no one element worked on its own. Some CPD providers may find it difficult to offer such complex combinations.

- *Pairs and groups of practitioners may be able to combine several separate opportunities. It may therefore be important to consider how each individual opportunity can be connected to other activities and to let CPD providers know about established in-school coaching or peer coaching programmes so that they can help individuals plan to integrate course inputs with the coaching process.*

In this review, alongside offering teachers a straightforward choice, observation and feedback or peer coaching and action research were used to enable teachers to work on their own needs and interests, albeit within a framework set by others.

- *Seeking professional development programmes that involve these activities may help to make sure that CPD that addresses school priorities are also able to respond to individual needs.*

There is widespread use in these studies of a combination of external expertise and peer support mechanisms.

- *Practitioners may wish to consider carefully how to secure the benefits of external support highlighted in this review. Practitioners may wish to consider how far peer support can be used as a means of supplementing external expertise cost effectively and the training in coaching/ consultancy that they may need in order to develop this. There is evidence here that things get worse before they get better, but that it is worth getting over initial discomfort or reluctance and shyness about being observed and sharing problems with colleagues. Indeed the benefits spread well beyond the areas targeted by the CPD to, for example, benefits in relation to enthusiasm about professional learning and to increases in confidence.*

5.3.3 Research

Our early priority has been to work on implications for practitioners and policy-makers. The 'implications for research' shown below will be considered more fully at a forthcoming conference of the British Education Research Association, hence the following implications are provisional:

- *researchers need to report information about the context and process of the CPD intervention including the characteristics of the samples, recruitment strategies and details of the methodology;*
- *researchers need to ensure clear differentiation between elements of the CPD process and those of the research process, so as to enable accurate interpretation of the results and processes;*
- *practitioners have indicated that they value research studies which include information considering both the impact on students and on the teachers completing the CPD process;*
- *research needs to encompass a variety of curriculum areas. The present research found that the majority of studies focussed on maths, ICT and science. It is important to know whether the effects of CPD are found across all curriculum areas;*
- *reviews are needed that look at other forms of CPD;*
- *study reports need to concentrate on both CPD processes and outcomes to ensure that practitioners know both whether an intervention is effective and how it was implemented;*
- *there is a need for much greater clarity in providing clear titles and abstracts for studies that will enable search enquiries to identify relaxant material.*

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APPENDIX 1.1: Members of the Advisory Group

Practitioner reviewers

Janet Thomsen	Peter Barnett
Fiona Thomas	Pam Delamere
Gerald Clarke	Howard Stevenson
Helen Cunningham	Ann Aldred
	Philip Chaikin

NCSL reviewers

Julie Temperley	NCSL
Gail McDonald	NCSL
Matthew Horne	NCSL / DEMOS
John Craig	NCSL / DEMOS

Advisory Group membership

Anne Edwards	University of Birmingham
Michael Eraut	University of Sussex
David Jackson	Director for Research, National College for School Leadership
Richard Harrison/ Carolyn Holcroft	DfES CPD team
Campbell Russell	Teacher
Ray Waterhouse	Teacher
Chris Day	University of Nottingham

EPPI-Centre Reviewers

James Thomas
Diana Elbourne

APPENDIX 2.1: Inclusion and exclusion criteria

Stage 1 criteria
To ensure that studies met the initial conditions for inclusion in the review, they had to meet the following criteria (Stage 1):

- *1. Focus on CPD which involves more than one teacher.*
- *2. Have set out to measure impact on teaching and/or learning.*
- *3. Continue over a period of time.*
- *4. Clearly describe the methods of data collection and analysis.*
- *5. Have clearly defined learning objectives.*
- *6. Focus on teachers of pupils aged 5-16.*
- *7. Have been conducted after 1988.*

Stage 2 criteria
In order to identify potentially sound studies for in-depth review the following criteria (Stage 2) were applied:

- *8. Studies showing how they have used what is known already (e.g. by including a literature review)*
- *9. Clearly stated aims and objectives*
- *10. Clearly identified learning objectives for teachers*
- *11. Clear description of context*
- *12. Clear description of methods, including approaches to data collection and data analysis*
- *13. Evidence of attempts made to establish the reliability and validity of data analysis*
- *[*]14. Evidence of impact on teacher practice (i.e. teacher knowledge/ behaviours/understanding/skills/ attitudes)*
- *15. Information either positive or negative, about student learning gain*

The Review Group's initial knowledge of the literature led it to expect that there would be relatively few studies of CPD which went beyond the teacher to examine the impact on pupil learning. Careful consideration was therefore given to whether to include studies that only explored impact upon teachers and/or teaching. However, teacher reviewers and members of the Review Group were adamant that evidence about impact on pupils' learning was of paramount importance. We therefore decided to include only those studies for in-depth review which set out to measure impact on both teachers' and pupils' learning. This meant separating the pupil learning gain component out of the last criterion (number 14) to create a fifteenth criterion. The Review Group retained the option of relaxing this criterion if it excluded too many studies.

[*] initially, criteria 14 and 15 were one criterion (14) (see above).

APPENDIX 2.2: Search strategy for electronic databases

The following databases were searched for potential studies:

Ingenta
ERIC
BEI
ERA
OCLC Article First
OCLC Dissertations
Index to Theses
Education –line
SIGLE

(OCLC Dissertations also covers US theses.) The following search terms (or their equivalent from the individual databases' thesauri) were most productive. Some, such as 'teacher morale', 'motivation' or 'attitudes' were not productive. The terms were combined and grouped to indicate (i) cpd activity areas (ii) age range 5–16 and (iii) outputs:

continuing
professional development
collaborative
peer coaching
mentoring
action research
reflective practice
collegiality
teacher research
professional education
science education
mathematics education
curriculum
in-service training
English education

schools
primary school
middle school
elementary school
secondary school
high school

teachers
teachers knowledge
teachers skills
teachers understanding
teachers networks
teachers practice

A large number of searches of electronic databases was necessarily carried out because of the broad scope of the review. Most of our search strings were generic and thus cross curricular. However as it became clear that English or literacy and maths and science were particularly fruitful subject areas, we also ran searches in these subject areas. The following table summarises the combinations of terms used to create search strings:

Database	Search terms	Initial no. titles
Ingenta	continuing + professional + development + teachers	28
	professional + development+ collaborative + teachers	20
	professional + development + collaborative + schools	19
	teachers + peer + coaching	25
	teachers + mentors	60
	professional + teachers + networks	8
	professional + teachers + knowledge	132
	professional + teachers + learning	203

Database	Search terms	Initial no. titles
	professional + teachers + skills	73
	professional + development + teachers + knowledge	85
	action + research + school + teachers	54
	action + research + school + teachers + knowledge	9
	reflective + practice + teachers + knowledge	77
	reflective + practice + teachers + understanding	19
	reflective + practice + teachers + understanding	13
	teacher + research + practice	197
ERIC	'teachers continuing professional development' and 'continuing education'	250
	'collegiality' and 'teacher collaboration'	185
	'teachers collaborative professional development'	144
	'mentors' and 'professional development'	774
	primary + school + teachers + professional + development	436
	elementary + school + teachers + professional + development	3285
	secondary + school + teachers + professional + development	3109
	'professional development' and 'secondary school teachers'	366
	'professional development' and 'elementary school teachers'	435
	'inservice education' and 'collegiality'	12
	'peer coaching' and 'teacher research'	4
	'professional education' and 'science teachers'	58
	'curriculum' and 'collaborative professional development'	318
	'teacher collaboration' or 'teamwork' and 'professional development'	525
	'collegiality' and 'professional development'	149
	mathematics teachers + professional + development + schools	366
	(English or English Curriculum or English instruction or English or Native language instruction) + professional + development + schools	60
OCLC First search dissertats	'secondary teachers professional development'	618
	'primary (or elementary) school teachers professional development'	700
	'middle and high school teachers professional development'	157
OCLC Firstsearch Article first	'school teachers professional development'	14
BEI	'teacher research'	28

Database	Search terms	Initial no. titles
	'school teachers professional development'	39
	'coaching' and primary school teachers'	3
	'professional development' and 'secondary school teachers'	14
	'collegiality' and 'teacher collaboration'	206
	'teachers professional development'	234
ERA	'school teachers professional development'	39
SIGLE	'teachers' and 'professional development'	34

6 sample searches to illustrate the search strategy

The following comprises a small representative selection of the 45 searches conducted by the review team:

```
Database: Eric <1985 to March 2002>
Search Strategy (Your Citations from Set 11):

1     exp mentors/
3697
2     "MENTOR*".mp.
1940
3     "MENTORING".mp.
2957
4     "PEER COACHING".mp.
340
5     "TEACHER RESEARCH".mp.
334
6     3 and 5
7
7     3 and 5
7
8     4 and 5
4
9     from 8 keep 1-4
4
10    from 8 keep 1-4
4
11    from 8 keep 1-4
4


Database: Eric <1985 to March 2002>
Search Strategy (Your Citations from Set 6):

1     (mentors and professional development).mp. [mp=abstract,
774
      title, headings word, identifiers, full text]
2     limit 1 to yr=1988-2002
702
3     from 2 keep
14
      1,51,74,106,175,183,249,316,358,372,432,473,492,514
4     primary school teachers professional development.mp.
0
      [mp=abstract, title, headings word, identifiers, full text]
```

```
5     limit 4 to yr=1988-2002
0
6     from 3 keep 1-14
14



Database: Eric <1985 to March 2002>
Search Strategy (Your Citations from Set 6):

1     Education/ and Professional education/
6
2     Education/ or Professional education/
5064
3     exp science education/ or exp science teachers/
19291
4     2 and 3
67
5     limit 4 to yr=1988-2002
58
6     from 5 keep 2,23
2

Database: British Education Index (BEI) <1986 to December 2001>
Search Strategy (Your Citations from Set 7):

1     coaching.mp. [mp=title, edition statement, abstract,
69
      heading word]
2     "COACHING".mp.
69
3     exp primary school teachers/
953
4     2 and 3
4
5     limit 4 to yr=1988-2002
4
6     from 5 keep 1-3
3
7     from 6 keep 1-3
3


Database: British Education Index (BEI) <1986 to December 2001>
Search Strategy (Your Citations from Set 6):

1     exp professional development/
1019
2     exp secondary school teachers/
609
3     1 and 2
16
4     limit 3 to yr=1988-2002
14
5     from 4 keep 2
1
6     from 5 keep 1
1


Database: British Education Index (BEI) <1986 to December 2001>
Search Strategy (Your Citations from Set 7):
```

```
1     school teachers.mp. [mp=title, edition statement, abstract,
1571
      heading word]
2     professional development.mp. [mp=title, edition statement,
837
      abstract, heading word]
3     exp professional development/
1019
4     1 and 3
42
5     limit 4 to yr=1988-2002
39
6     from 5 keep 1-39
39
7     from 5 keep 1-39
39
```

APPENDIX 2.3: Journals handsearched

The following journals were handsearched at the University of Warwick library (years are indicated next to title of journal):

American Education Research	2001 – 1997
American Journal of Education	2000 – 1998
British Journal of Educational Psychology	2001 – 1990
British Journal of In-Service Education/Journal of In-Service Education	2001 – 1992
British Educational Research Journal	2001 – 1990
Cambridge Journal of Education	2001 – 1990
Curriculum Inquiry	2001 – 1995
Curriculum Journal	2001 – 1995
Education Journal	2001 – 2000
Educational Research	2001 – 1994
Educational Researcher	2001 – 1999
Educational Review	2001 – 1990
Educational Studies	2001 – 1990
European Education	1999
European Journal of Education	2001 – 1995
Harvard Educational Review	2001 – 1992
International Journal of Educational Research	2001 – 1995
Journal of Curriculum Studies	2000 – 1995
Journal of Education for Teaching	2001 – 1993
Journal of Research and Development in Education	2000 – 1994
Journal of Teacher Education	2001 – 1993
Mathematics Teaching	2001 – 1992
Oxford Review of Education	2001 – 1990
Research in Education	1998 – 1990
Research Papers in Education: Theory and Practice	2000 – 1990
Review of Research in Education	2000 – 1993
Review of Educational Research	2000 – 1997
School Science Review	2001 – 1992
Teachers' College Record	2001 – 1999
Teacher Development	2001 – 1997
Teachers and Teaching: Theory and Practice	2001 – 1995
Teaching and Teacher Education	2001 – 1990

APPENDIX 2.4: EPPI-Centre keyword sheet including review-specific keywords

EPPI-CENTRE EDUCATIONAL KEYWORDING SHEET v0.9.5 LTSN Bibliographic details and/or unique identifier……..

1. Identification of report
Citation
Contact
Handsearch
Unknown
Electronic database
(*please specify*)
……

2. Status
Published
In press
Unpublished

3. Linked reports
Is this report linked to one or more other reports in such a way that they also report the same study?

Not linked
Linked *(please provide bibliographical details and/or unique identifier)*
……
……
……

4. Language *(please specify)*

……

5. In which country/countries was the study carried out? *(please specify)*

……

……

6. What is/are the topic focus/foci of the study?
Assessment
Classroom management
Curriculum*****
Equal opportunities
Methodology
Organisation and management
Policy
Teacher careers
Teaching and learning
Other (please specify)……

***6a Curriculum**
Art
Business Studies
Citizenship
Cross-curricular
Design and Technology
Environment
General
Geography
Hidden
History
ICT
Literacy – first language
Literacy further languages
Literature
Maths
Music
PSE
Phys. Ed.
Religious Ed.
Science
Vocational
Other *(please specify)……..*

7. Programme name *(please specify)*

8. What is/are the population focus/foci of the study?
Learners*****
Senior management
Teaching staff
Non-teaching staff
Other education practitioners
Government
Local education authority officers
Parents
Governors
Other *(please specify)……*

***8a Age of learners (years)**
0-4
5-10
11-16
17-20
21 and over

***8b. Sex of learners**
Female only
Male only
Mixed sex

9. What is/are the educational setting(s) of the study?
Community centre
Correctional institution
Government department
Higher education institution
Home
Independent school
Local education authority
Nursery school
Post-compulsory education institution
Primary school
Pupil referral unit
Residential school
Secondary school
Special needs school
Workplace
Other educational setting *(please specify)…*

10. Which type(s) of study does this report describe?

A. Description
B. Exploration of relationships
C. Evaluation
   a. Naturally occurring
   b. Researcher-manipulated
D. Development of methodology
E. Review
   a. Systematic review
   b. Other review

Please state here if keywords have not been applied from any particular category (1-10) and the reason why (e.g. no information provided in the text)

……
……
……
……
……
……
……..

PTO to apply review-specific keywords (if applicable)

Review specific keywords

Note: Please refer to the CPD Keywording Strategy Document for definitions and guidance for this section.

CPD Specific Keywords Reviewers please note that the CPD Review Group has identified a list of additional keywords to complement the EPPI core keywords. The purpose of the additional keywords is to enable end users to search more precisely according to their area of specific interest. It also means that we can map the field more precisely if we need to. Please use as many keywords as apply to the report which you are coding. Full definitions are attached, together with the EPPI keyword definitions. The CPD Review-specific keywords apply only in EPPI categories 6 (Topic) and 8 (Population focus). A CPD specific-category (Type of intervention) has been added as category 11.	**6. What is/are the topic focus/foci of the study?** Disaffection EAL Ethnicity Gender Teacher outcomes Pupil outcomes School improvement Special education needs Key Skills Numeracy Behaviour Management Formative Assessment	**8. What is/are the population focus/foci of the study?** Asylum and refugee children Boys Girls Class teachers EAL teachers Ethnic minority children Learning support assistants NQT SENCO Foundation stage SEN teachers Subject co-ordinators Heads of Department	**Type of Intervention** Action research Coaching Counselling INSET Peer Coaching Post Graduate Training Workshops Professional training

APPENDIX 2.5: Definitions of CPD review-specific keywords

What is the topic focus/foci of the study?

Disaffection
Use this keyword for studies which focus on pupils who are alienated from their educational experiences, resulting in demotivation or other negative learning outcomes.

EAL
Use this keyword if the study focuses on any aspect of the teaching and learning of English as an additional language.

Ethnicity
Use this keyword for studies which focus on any aspect of the teaching and learning concerning those who form a minority because of race, culture, country of origin or religion.

Gender
Use this keyword if the focus is on any aspect of gender whether boy, girl or mixed populations.

Teacher outcomes
Use this keyword if the focus is on the acquisition by teachers of knowledge, attitudes or skills from study, instruction or experience.

Pupil outcomes
Use this keyword if the focus is on the acquisition by pupils of knowledge, attitudes or skills from study, instruction or experience.

School improvement
Use this keyword if the focus is on best value approaches to improving pupil attainment.

Special educational needs
Use this keyword if the study focus addresses the needs of pupils who have learning difficulties or disabilities which significantly affects access to the curriculum and who appear on the school's special needs register at all stages.

Key skills
Use this keyword if the study's focus is on any of the key skills curricula e.g. the application of number, communication and ICT at Key Stage 4.

Numeracy
Use this keyword if the focus is on the teaching of the use of numbers and basic competencies in Mathematics from Key Stage 1 to Key Stage 3.

Behaviour management
Use this keyword if the intervention was provided through support or policies introduced promoting behaviour management.

Formative assessment

Use this keyword if the intervention involves the use of evidence about pupil learning to develop more effective teaching and learning.

What is/are the population focus/foci of the study?

Asylum and refugee children
Use this keyword if the population focus is asylum or refugee children.

Boys
Use this keyword if the population is boys.

Class teachers
Use this keyword if the population focus is on teachers in the class teaching role.

EAL teachers
Use this keyword if the population focus is teachers of English as an additional language.

Ethnic minority children
Use this keyword if the population focus is children who are in a minority because of differences in race, culture, country of origin or religion.

Girls
Use this keyword if the population focus is girls.

Heads of department
Use this keyword if the population focus is heads of faculties, departments or major subject areas.

Learning support assistants
Use this keyword if the population focus is ancillary staff supporting pupils' learning on a group or individual basis.

NQT
Use this keyword if the population focus is newly qualified teachers still in their probationary period of teaching.

SENCO
Use this keyword if the population focus is co-ordinators of special education in one or more phases or Key Stages.

Foundation Stage
Use this keyword for children aged 4-5 who may be in either Reception or Year 1.

SEN teachers
Use this keyword if the population focus is teachers of special educational needs in mainstream or special schools.

Subject co-ordinators
Use this keyword if the population focus is co-ordinators of a subject in one or more phases or Key Stages.

Type(s) of Intervention

Action research
Use this keyword if the intervention was provided through systematic enquiry within the establishment which was designed to yield practical results that are applicable to a specific situation or problem.

Coaching
Use this keyword if the intervention involves *classroom coaching* through observation and feedback by colleagues or by external CPD providers.

Counselling
Use this keyword if the intervention involves providing advice or support on a *personal basis*, by someone who has been trained to provide that support.

INSET
Use this keyword if the interventions are provided through the process of updating teachers and professionals after their initial qualification e.g. short course, day conferences, secondments etc.

Peer coaching
Use this keyword if the intervention involves providing advice or support on a personal or group basis, by *a peer.*

Post graduate
Use this keyword if the intervention involves providing advice or support as a direct result of preparing for a post-graduate qualification.

Professional training
Use this keyword if the intervention involves provision of training through courses and workshops that emphasise the practical, information and skills which may lead to *professional accreditation or academic awards.*

Training
Use this keyword if the intervention involves provision of information or materials on specific aspects of teaching /learning.

Workshops
Use this keyword if the intervention involves provision of information or materials provided through workshops with the aim of imparting knowledge which can be cascaded to various groups (e.g. students, teachers, governors, parents).

APPENDIX 4.1: Details of studies included in the in-depth review

Study ID number	List of included studies
351	Britt MS *et al*: Professional Conversations and Professional Growth
352	Brown DF: The development of strategic classrooms in two secondary schools
353	Bryant DP *et al*: The effects of professional development for middle schools general and special education teachers on implementation of reading strategies in inclusive content area classes
355	Da Costa JL: A study of teacher collaboration in terms of teaching-learning performance
357	Ertmer PA, Hruskocy C: Impacts of a university-elementary school partnership designed to support technology integration
358	Flecknoe, M: Can continuing professional development for teachers be shown to raise pupils' achievement?
359	Gersten R *et al*: Close to the classroom is close to the bone: coaching as a means to translate research into classroom practice
360	Harvey, S: The Impact of Coaching in South African primary science INSET
361	Harwell SH *et al*: Technology Integration and the Classroom Learning Environment: Research for Action
362	Kimmel H *et al*: Meeting the needs of diverse student populations: comprehensive professional development in science, math and technology
363	Kirkwood, M: The contribution of curriculum development to teachers' professional development: a Scottish case study
364	Kohler FW *et al*: Promoting changes in teachers' conduct of student pair activities: an examination of reciprocal peer coaching
365	O Sullivan MC: Communicative approaches to teaching English in Namibia: the issue of transfer of Western approaches to developing countries
366	Parke HM, Coble CR: Teachers designing curriculum as professional development: a model for transformational science teaching

Study ID number	**List of included studies**
367	Ross J *et al*: Effects of collaborative action research on the knowledge of five Canadian teacher-researchers.
368	Saxe GB *et al*: Enhancing students' understanding of mathematics: a study of three contrasting approaches to professional support
369	Wilkins CW: Effects of a resident mentor teacher on student achievement in mathematics

APPENDIX 4.2: Focus of studies

	Topic focus	Curriculum area
Britt MS *et al.*	Teacher careers Teaching and learning	Maths
Brown DF	Classroom management Equal opportunities Methodology Teaching and learning	Cross-curricular
Bryant DP *et al.*	Curriculum Equal opportunities Teaching and learning	History Literacy, first language Literacy, second language Maths Science
Da Costa JL	Teacher careers Teaching and learning	General
Ertmer PA, Hruskocy C	Curriculum Teaching and learning	ICT
Flecknoe M	Teacher careers Teaching and learning	Other
Gersten R *et al.*	Classroom management Equal opportunities Teaching and learning	Literacy First language
Harvey S	Curriculum Teaching and learning	Science
Harwell SH *et al.*	Classroom management Curriculum Teacher careers Teaching and learning	ICT Maths Science Language arts
Kimmel H *et al.*	Classroom management Curriculum Equal opportunities Teaching and learning	ICT Maths Science
Kirkwood M	Assessment Curriculum Methodology	ICT
Kohler FW *et al.*	Classroom management Teaching and learning	Cross-curricular
O'Sullivan MC	Curriculum Teaching and learning	Literacy, second language
Parke HM, Coble CR	Assessment Curriculum Teaching and learning Pupil motivation	Science
Ross J *et al.*	Assessment Teaching and learning	Other

	Topic focus	Curriculum area
Saxe GB *et al*:	Curriculum Teaching and learning	Maths
Wilkins CW	Curriculum Teaching and learning	Maths

APPENDIX 4.3: Type of intervention

Report	Intervention and type of collaboration
Britt MS *et al.*	The study was concerned with the impact of teacher conversations on teacher behaviour, beliefs and subject understanding as manifested through increased pupil achievement. Two-year programme when teachers met researchers each month and worked in groups of two or more in their schools. Researcher observed teachers and gave feedback
Brown DF	A consultant was engaged to work with teachers offering options of strategic interventions which were appearing in the current professional literature. The consultant outlined a number of options teachers could follow and worked with teachers in developing these options into practical and effective teaching strategies, with mutual support. The study looked at how teachers took up the opportunity; the effects of the programme on their beliefs and practices; effects on student beliefs and practices; changes in student academic and social behaviour; costs of implementing such a programme on a wider basis.
Bryant DP *et al.*	Four-month professional development programme for sixth grade middle school teachers and some special education teachers to enhance reading outcomes of struggling students in content area classes. Teachers' professional knowledge of the following reading strategies was developed: word identification; fluency and comprehension skills. Implementation was monitored and findings of pupil progress and teacher perceptions of the effectiveness of each strategy reported. Each team consisted of a language, arts, science, social studies, mathematics and special education teacher. The teachers in each team shared planning and advisory periods and worked collaboratively to address their students' needs. Implementation was monitored and findings of pupil progress and teacher perceptions of the effectiveness of each strategy reported.
Da Costa JL	All the teachers in this study implemented over one year, an approach to collaborative professional development based on a Local School District training course. The teachers were split into groups according to their specific plans for intervention. These groups included pairs of teachers working by collaborative consultation (peer-based using direct observation); collaborative consultation in a team teaching environment; collaborative consultation direct observation by a teaching partner; and collegial consultation of one teacher by a non-reciprocating supervisor.
Ertmer PA, Hruskocy C	The study describes the START programme which involved professional support, instructional support and technical support to teachers and students to enhance their own skills and confidence and help integrate technology in their classrooms. Support was provided through monthly meetings, technology inservice workshops and 'on-call' technical support from university personnel. Selected students also received training in an after-school technology programme.
Flecknoe M	This report describes the evaluation of a teacher CPD programme run by Leeds Metropolitan University. The study addresses school effectiveness and school improvement issues through action research. Teachers undertook an intervention in their own schools to raise pupil achievement. Fundamental to the research programme was the belief that local research by teachers is more likely to improve teaching than by applying external research to teachers.
Gersten R *et al.*	The study is concerned with understanding the process of change in teaching practice and describes the outcomes when coaching is introduced to support teachers who are implementing change. Two project staff with extensive experience in classroom consultation and special education teaching worked with two special

Report	Intervention and type of collaboration
	educators in the process of coaching 12 classroom teachers. The special educator and project staff member usually began the coaching process by conducting classroom observations, focusing on several aspects of the students' learning environments. As soon as possible after each observation, the special educator would share perceptions of the observed instructional interactions with the teacher, including, where possible, pupil data. Teachers and coaches repeated the weekly cycle of observation, feedback and planning for a period ranging from 3 to 30 weeks.
Harvey S	The intervention is concerned with the provision of effective INSET to teachers of primary science in South Africa by the Primary Science Project. A consultant outlined a number of options teachers could follow and worked with teachers in developing these options into practical and effective teaching strategies. The study looked at how teachers took up the opportunity; the effects of the programme on their beliefs and practices; effects on student beliefs and practices; changes in student academic and social behaviour.
Harwell SH *et al.*	Learning environments research and constructivist learning environments. Action research as catalyst to improve professional practice within schools aimed at enhancing use of technology in the classroom. A collaborative action-research effort between practicing teachers and university researchers was the focus for an investigation into the nature of the classroom learning environment prior to technology integration and after technology integration.
Kimmel H *et al.*	The programme was designed to bring general and special education teachers together for collaborative participation in professional growth activities. Teachers were given access to appropriate instructional materials, educational technologies and hands-on experiences. As well as workshops during the academic year, teachers were invited to summer 'practicum' experiences. Built into the programme were opportunities to work collaboratively, at seminars and in workshops, with regular opportunities for reflection, and discussion of alternative practices together with observation and feedback of the implementation process.
Kirkwood M	Teachers collaborated on a wide variety of development evaluation and dissemination activities in a variety of forums, such as regular planning meetings, workshops, reciprocal visits to exchange ideas and observation, small working groups and writing teams, preparing INSET sessions and presentations at conferences.
Kohler FW *et al.*	The study explores the impact of peer coaching by teachers on attempts to enhance pupils' learning through pair activities developed within the Integrated Instructed Approach (IIA) Framework. The three teachers received half a day of instruction, then met during the course of the study for mutual observation and discussion.
O'Sullivan MC	The study involved a three-year INSET programme which took place over four training circuits, each of 6-8 months' duration. Each circuit included the following stages: needs assessment, determination of training content within the capacity of the teachers, workshops, follow-up support at the schools and evaluation.
Parke HM, Coble CR	The teachers collaborated with university science education specialists in the design of a new curriculum based on teaching strategies which incorporated: ideas from research, students' learning needs, the way students learn, understanding rather than content. Emphasis was placed upon the ability of teachers to design curriculum and classroom environments collaboratively.

Report	Intervention and type of collaboration
Ross J *et al.*	The effect on teachers' practice – and hence on pupil learning – of collaborative action research supported by academic involvement. The approach of this study was to build on teachers' prior observation of other teachers to develop through action-research improved strategies for their own practice in promoting student self-evaluation during group learning activities.
Saxe GB *et al.*	The study compared three interventions: two initiated by the researchers and one in current practice. Group 1 worked on implementation of the Integrated Mathematics Assessment (IMA) which aimed to meet four areas of need: teachers' understanding of the maths they teach, of children's maths, of children's achievement motivations in maths and the opportunity for teachers to work with other professionals concerned with effective implementation of reform. A five-day summer institute was followed by fortnightly meetings during the school year focused on the four sets of activities. Group 2 The Support Programme (SUPP) provided opportunities for collaborative exploration of how to implement the two new curriculum units. Teachers met nine times a year, sharing approaches, curriculum materials and discussing students' work. Group 3 Traditional Classrooms with no professional development activity.
Wilkins CW	The researcher trained one teacher specialist in each of two schools in the strategies and teaching techniques. The specialist then taught colleagues in these techniques and gave them prepared units of instruction. The teacher specialists practised with the units and used the information gained to prepare a second unit. Each resident specialist used regularly scheduled staff development sessions in the local school to train fellow teachers in performance instruction and assessment.

APPENDIX 4.4: Details of actual study sample and design

Report	Type of study	Sample size	Sample details: how groups differ	Recruitment and consent
Britt MS *et al.*	Evaluation Naturally occurring	Two groups Number of participants unclear	Different phases of students	Invitation to participate
Brown DF	Evaluation Researcher-manipulated	Two groups 27 teachers and their pupils	Each group from a different school, but well balanced in terms of gender mix, qualification and experience. However School 1 teachers received more previous in-service training.	Invitation to participate
Bryant DP *et al.*	Evaluation Researcher-manipulated	One group 10 teachers and their pupils	N/A 1 group	Not stated / unclear
Costa JL	Evaluation Naturally occurring	Four groups 35 teachers and their pupils (some dropped out)	Groups differed according to participants' preferences for particular types of collaboration.	Invitation to participate
Ertmer PA Hruskocy C	Evaluation Researcher-manipulated	Two groups 13 teachers and their classes,18 student-trainers also received intervention	One group of teachers One group of student – trainers, each receiving different forms of intervention.	Not stated / unclear for teachers By selection according to given criteria for students
Flecknoe M	Evaluation Naturally occurring	One group 31 teachers	N/A One group	Not stated / unclear
Gersten R *et al.*	Evaluation Naturally occurring	One group 14 teachers	N/A One group	Invitation to participate (implicit) for teachers Special educators selected by district administrators
Harvey S	Evaluation Researcher-manipulated	Three groups 108 teachers	One group received no INSET One group received a workshop programme One group had additional classroom support	Not stated / unclear
Harwell SH *et al.*	Evaluation Researcher-manipulated	One group compared over two time periods Four teachers plus the principal	Same group compared over two time periods, therefore possibly secular changes. Group divided into maths, science and humanities subject specialisms.	Teachers invited the researcher to participate in their action research.
Kimmel H *et al.*	Evaluation Researcher-manipulated	Three groups 84 teachers	Groups varied according to period of CPD intervention: group 1 received three years of intervention, groups 2 and 3 added in subsequent years. Thus teachers in cohort 1 were more experienced by the end of the programme. Similar demographic details for each	Not stated / unclear

Report	Type of study	Sample size	Sample details: how groups differ	Recruitment and consent
			group, except for nature of grade level and responsibilities.	
Kirkwood M	Evaluation Researcher-manipulated	Four or more groups 11 teachers initially 40 teachers finally	N/A One group	Invitation to participate
Kohler FW *et al.*	Evaluation Researcher-manipulated	One group Three teachers	N/A One group	Invitation to participate
O'Sullivan MC	Evaluation Researcher-manipulated	One group 145 teachers	N/A One group	Required to participate as part of government reform programme
Parke HM, Coble CR	Evaluation Researcher-manipulated	Four or more groups 30 teachers initially plus additional participants	One group of 19 teachers from one school received CPD. One group of 11 teachers from another school acted as a control group. There were also a further six project schools and six control schools who provided test data.	Not stated / unclear
Ross JA *et al.*	Evaluation Researcher-manipulated	One group Five teachers	N/A One group	Invitation to participate
Saxe GB *et al.*	Evaluation Naturally occurring Evaluation Researcher-manipulated	Three groups 23 teachers (reviewers' inference)	Two groups selected randomly to receive different types of CPD (IMA and SUPP) One group self-selected which did not receive CPD (TRAD) TRAD group had more years of teaching experience. SUPP group had rather more children who were not fluent in English (accounted for in the analysis)	Invitation to participate
Wilkins CW	Evaluation Researcher-manipulated	Four groups Number of teacher participants unclear	Each group came from a different school.	Invitation to participate (Two teachers were volunteers and hence their schools and pupils were recruited into the study.)

APPENDIX 4.5: Methods of data collection

Method	Number
Curriculum-based assessment	8
Focus group	2
Group interview	4
One to one interview (face to face or by phone)	11
Observation	12
Self-completion questionnaire	11
Self-completion report or diary	10
Exams	1
Practical test	3
Psychological test	1
Hypothetical scenario including vignettes	1
School/college records (e.g. attendance records, etc.)	3
Other documentation	7
Not stated/unclear (please specify)	2

APPENDIX 4.6: Methods of data collection and analysis

Study	Which methods were used to collect the data?	Which methods were used to analyse the data
Britt MS *et al*: Professional Conversations and Professional Growth	Curriculum-based assessment Group interview One to one interview (face to face or by phone) Observation Self-completion questionnaire Self-completion report or diary School/college records Other documentation	Reform-oriented teaching practice and belief scores for each teacher were obtained by summing the converted teaching practice or belief ratings from a scale based on weighted questionnaire items.
Brown DF: The development of strategic classrooms in two secondary schools	Curriculum-based assessment One to one interview (face to face or by phone) Observation Self-completion questionnaire Self-completion report or diary	The questionnaires were examined by three people to establish scoring categories for the open-ended questions. The author and one other scorer drew up the definitions and independently scored items with a third person as mediator. Interview question responses were categorised in order to reduce the data to a manageable level. Teacher diaries served as a permanent for retrospective analysis of the exchanges.
Bryant DP *et al*: The effects of professional development for middle schools general and special education teachers on implementation of reading strategies in inclusive content area classes	Curriculum-based assessment One to one interview (face to face or by phone) Observation Self-completion questionnaire	The authors followed the guidelines recommended by Miles and Huberman (1994) for data analysis purposes. First the interview and support meeting notes were transcribed, analysed and coded. Second, descriptive statistics were calculated for the inservice evaluation forms, the IVCs and the promoters and barriers checklists. A mean implementation rating score for each IVC item was computed across teachers, and mean percentage scores were recorded for the inservice evaluation forms and the promoters and barriers checklists.
Da Costa JL: A study of teacher collaboration in terms of teaching-learning performance	One to one interview (face to face or by phone) Observation Self-completion report or diary Psychological test School/college records (e.g. attendance records, etc.) Other documentation	Data analysis was carried out in four phases. Three phases of data analysis used MANOVA multivariate analysis. (1) Comparisons of differences within and between the sample with other samples and populations on the basis of five variables. (2) Comparisons of the four groups with each other on the basis of pre-measures data. (3) Comparisons of the four groups on the basis of the post-measures data. A post-hoc discriminant analysis (DA) was used to determine how the collaboration groups differed'
Ertmer PA, Hruskocy C: Impacts of a university-elementary school partnership designed to support technology integration	One to one interview (face to face or by phone) Self-completion questionnaire Practical test	Data (e.g. student surveys, teacher interviews, workshop questionnaires) were analysed using a constant comparative method of analysis which established categories of teacher use: curriculum support, management, and instructional uses. These categories were modified and refined and codes established.

Study	Which methods were used to collect the data?	Which methods were used to analyse the data
Flecknoe M: Can Continuing Professional Development for teachers be shown to raise pupils'' achievement?	Curriculum-based assessment One to one interview (face to face or by phone) Observation Self-completion questionnaire Self-completion report or diary School/college records Other documentation	" NUD*IST programme for analysis. I coded each interview using 26 categories in a three-tier hierarchy." A few hints at the methods the teachers used for analysis are given (chi-square test), but not in a comprehensive way.
Gersten R *et al*: Close to the classroom is close to the bone: coaching as a means to translate research into classroom practice	Curriculum-based assessment One to one interview Observation Self-completion report or diary	Two complementary methodologies directed the analysis. The first was Glaser's and Strauss' concept of grounded theory; the second was Miles' and Huberman's approach to hypothesis generation and verification."
Harvey S: The impact of coaching in South African primary science INSET	Group interview One to one interview (face to face or by phone) Observation Self-completion questionnaire Not stated/unclear (please specify)	Standard statistical tests of significance were used to compare the pooled data from six separate observation groups, namely chi-squared test, McNemar test, counts or percentages; t-test for significance of change in unpaired scores, t-test for significance of change in paired scores. These were used to filter out significant differences between groups. For each of the group comparisons listed a significance test was computed for each of the 200 items on the SCOS observation schedules. All results were interpreted in context with the ethnographic evidence.
Harwell SH *et al*: Technology Integration and the classroom Learning Environment: Research for Action	Group interview Self-completion questionnaire Self-completion report or diary Other documentation	The researchers stated that they used one way ANOVA with Bonferroni adjustments to analyse the data. Additionally, teacher logs and field notes from observations and collaborative discussion groups were used to clarify incongruencies of qualitative data obtained from the CLES surveys.
Kimmel H *et al*: Meeting the Needs of Diverse Student Populations: Comprehensive Professional Development in Science, Math, and Technology	Observation Self-completion questionnaire Hypothetical scenario including vignettes Other documentation	Written responses were examined for three specified criteria. There is no detail of how observations were analysed.
Kirkwood M: The contribution of curriculum development to teachers' professional development: a Scottish case study	Curriculum-based assessment Focus group Observation Self-completion questionnaire Self-completion report or diary Practical test Other documentation	Although the study refers to the collated data from student questionnaires, we are not informed as to how this or any other data were analysed. We are told that the wide ranging evaluation tools encompassed process and end-product measures, qualitative and quantitative data, cognitive and affective outcomes and perspectives of all participants.
Kohler FW *et al*: Promoting Changes in Teachers' Conduct of Student Pair Activities: An Examination of Reciprocal Peer Coaching	One to one interview (face to face or by phone) Observation Self-completion report or diary	Tape recordings of teacher interaction with their students were transcribed and coded. Teachers' interviews were also tape recorded and transcribed. A ten second partial interval system was used to analyse students' interaction with their peers. All occurrences of pupil talk were coded. A similar interval code was

Study	Which methods were used to collect the data?	Which methods were used to analyse the data
	Other documentation	then used to examine students' active engagement with materials and teachers were asked their opinion of the refinements made during the lesson using a 1-5 Likert rating.
O'Sullivan MC: Communicative approaches to teaching English in Namibia: the issue of transfer of Western approaches to developing countries	Curriculum-based assessment Group interview One to one interview (face to face or by phone) Observation Other documentation	Data on pupils' knowledge of English were analysed and 'banded' into level descriptors. Percentages of pupils whose learning fell into each band, before and after the intervention were tabulated.
Parke HM, Coble CR: Teachers designing curriculum as professional development: a model for transformational science teaching	One to one interview (face to face or by phone) Self-completion questionnaire Exams	The interview questions were clustered into two main categories: (a) In what ways are school programs different? (b) Does the type of school program make a difference in student attitudes to and in liking science? Student data were further analysed into more specific categories of attitudes and classroom experiences in science. Simple numerical comparison of state- mandated science test scores of project and control students. Simple qualitative comparison of teacher attitudes in project and control schools.
Ross JA *et al*: Effects of collaborative action research on the knowledge of five Canadian teacher-researchers	Focus group Group interview One to one interview (face to face or by phone) Observation Self-completion questionnaire Self-completion report or diaries	Descriptive and inferential statistics (t tests and effect sizes using Glass, MGaw and Smith, 1981); verbatim transcription of interviews; in vivo notes of team meetings; interpretation of qualitative data using analytic induction, comparison and triangulation; organisation of data around broad themes to create the case reports and the cross-case analysis (data matrices)
Saxe GB *et al*: Enhancing students' understanding of mathematics: a study of three contrasting approaches to professional support	Curriculum-based assessment Observation Practical test	Statistical analysis of children's fractions test. (1) Analysis pre- to post-test gain in achievement for all classrooms. (2) Examination of students'' post-test scores associated with teachers' professional development group. Comparison of IMA, SUPP, and TRAD classrooms
Wilkins CW: Effects of a resident mentor teacher on student achievement in mathematics	Curriculum-based assessment Self-completion report or diary	Simple analysis of the percentage change in school tests over time. Variance analysis using 1995 mean scores as a covariate independent t-test used to determine prior differences in ability on the subtests for rural schools.

APPENDIX 4.7: Study aims, designs, findings and conclusions

REPORT	Broad aims of the study	Study design summary	Findings and conclusions
351 Britt MS *et al.*	To enable teachers to make lasting changes to their teaching. To evaluate the usefulness of professional conversations on classroom practices and student learning.	CPD programme for 18 teachers and their pupils age 11-16, over two years. Use of teachers themselves as a professional development resource, through collaborative exploration of new ideas and strategies by means of professional conversations. Some input from the researchers. Data on teachers were assessed through observations, audio and videotapes, meeting notes, questionnaires and diaries. The effect of the CPD on students' mathematics and attitudes to mathematics was measured by comparing achievement tests and attitude questionnaires in the cohort taught during the second year with that taught in the first year.	All teachers believed they had made marked changes. Changes in practice included: greater focus on the plenary session; less emphasis on 'telling'; use of students own problems as a teaching point. Teachers showed more insight into students' thinking. Students' mathematical performance showed improvement. Secondary teachers made the greatest changes, but this could have been because the intermediate teachers were already using a student-centred approach and so there was less room for change. More experienced teachers were significantly more likely to affirm beliefs consistent with reform orientated pedagogy.
352 Brown DF	To investigate the effects of introducing a number of new strategies for learning to students and their teachers in two New Zealand Secondary schools, and whether such interventions would raise the standard of learning for the lower achievers in each class.	Study focused on 27 teachers and their pupils (age 13-18). Consultant adopted a co-worker approach. Teachers were coached in a variety of intervention strategies and then chose options that best suited their classes. Classroom observation and feedback from consultant. Data was collected by one-to-one interviews, observation, questionnaires, diaries and curriculum-based assessment.	Teachers were enthusiastic, valued opportunities to develop new skills through collaborative working. They adopted strategies to suit their classes. High use of co-operative learning, advance organisers and graphic transformations. Students demonstrated increased ability in the use of learning strategies as well as academic progress. They felt better prepared for exams and more confident. Report concluded that this style of programme is highly successful in improving student performance and highly satisfying to both teachers and students.
353 Bryant DP *et al.*	To examine general and special education teachers' personal knowledge about their struggling readers and reading strategies, to learn about the views of the professional development activities and to examine the implementation of three reading strategies in context area classes	Study focused on 10, sixth grade teachers and their pupils (age 11-12). All ten teachers received training in three specific reading strategies over a period of four months, including in-class modelling. Data was collected by means of interviews, observation, questionnaires and curriculum-based assessments. The researchers evaluated each of the strategies in terms of whether they were manageable in the classroom context and their affect on pupil achievement.	Teachers were concerned about their struggling readers and valued the CPD in terms of time to share personal knowledge, receiving guidance from an expert and opportunity to work collaboratively with their colleagues. Teachers developed knowledge of and skills in implementing word identification, partner reading and collaborative strategic reading. The CPD resulted in improvements in low-achieving students' decoding skills and reading fluency. Concluded that teaming was an effective model for CPD in this context, but time was a major issue.
355 Costa JL	To compare four teacher consultation approaches, the goal of which was to permit teachers to make sense of their	Study involved 26 teachers and their pupils age 5-16. Teachers were allocated to one of four groups with reference to baseline data about their intended	Teachers with a belief in personal efficacy were more likely to be teaching pupils with higher levels of attainment, but these pupils sometimes had negative

REPORT	Broad aims of the study	Study design summary	Findings and conclusions
	classroom behaviours through their own values and norms. The study then proposed to examine the effects of these interventions on students' learning.	approaches to collaboration. Study implemented over one year and compared four types of collaborative CPD: – between teacher dyads teaching in separate classrooms – between team teacher dyads teaching in one double-sized classroom – without observation with dyads teaching in separate classrooms – without direct observation Data were collected through interviews, observation, diaries, pupil report cards, psychological tests.	attitudes towards school. Teachers with a belief in general efficacy were more likely to change their behaviour in response to CPD. Teachers that used CPD involving classroom observation were more likely to effect changes to enhance pupil attainment. Students of these teachers generally had positive attitudes to school. Teachers using a supervisory model of CPD without classroom observation and feedback, were significantly less able to make changes.
357 Ertmer PA, Hruskocy C	To support teachers' technology integration efforts at Midland Elementary School	Instructional and technical training sessions were planned for both teachers and students. Study involved 13 teachers and their pupils (age 4-11). 18 students also received intervention training. University personnel provided ongoing professional support. Qualitative methods (interviews and questionnaires) were used to examine changes in teachers', students' and the schools' uses of technology before and after the CPD intervention.	CPD had a positive impact on teachers confidence and attitude towards technology. Teachers used computers more for their own professional use and for instructional purposes, but needed more time to fully integrate technology into their curriculum planning. Some student trainers were able to serve as effective training resources for the teachers. The 'at risk' students who were part of the training group excelled, showing increased self confidence and esteem. Concluded that CPD had initiated some important changes, but further research needed to examine whether this could be sustained.
359 Gersten R *et al.*	To explore how coaching could be used to support research-based teaching practices in general education classrooms to improve the quality of reading instruction offered to students with learning disabilities	This was an action-research project in which researchers trained two special educators who then worked with 12 class teachers in the skills of effective teaching. (Pupils aged 5-16) Coaches were selected for their ability to interact with teachers in a collegial, sensitive manner in addition to their instructional skills. Outcomes were evaluated in terms of change in teachers' practice and improvements in student performance noted through structured classroom observations. The special educators provided specific and constructive feedback to the teachers. Data were also collected by means of interviews, diaries and curriculum-based assessment.	The process of change in teachers' practice was slow and irregular although there was evidence of more instructional time spent on specific reading strategies as the project continued. Teachers experienced some anxiety in the process of observation and feedback, but about half of them reported more positive feelings at the end of the project. Beginning teachers had special needs and needed extra mentoring. Lack of time sometimes limited communication and therefore understanding between researchers and teachers. Students were able to read more fluently, demonstrated greater understanding of subject content and were better motivated.
360 Harvey S	To present evidence relevant to the development of more effective models of INSET where activity based	The project involved two groups of ten primary schools plus a control group of ten schools for each year of a three-year study. It was an observational study cross-referenced with a number of	PSP teachers were more focused in their aims, more versatile in their approaches, more responsive to pupils' contributions and more able to plan relevant lessons. Teachers who had participated in both

REPORT	Broad aims of the study	Study design summary	Findings and conclusions
	teaching methods are being introduced. To compare the teaching methods of primary science teachers who were provided with coaching with those who received only centre-based workshops and a control group who received no INSET.	ethnographic instruments including interviews and diaries. Three hypotheses were framed for testing: – that teachers who have participated in the Primary Science Programme (PSP) use different methods to those who have not – teachers change methods more readily if they receive support both in the classroom and in workshops – changes in teaching methods are sustainable after support is withdrawn	classroom support and workshops were more ready to change their practice. Teachers valued counselling on contextual implementation of new methods and curriculum content, advice on specific problems and modelling of new techniques. Pupils were more likely to learn through self-activity and contributed more to lessons. Report concluded that effective INSET needs to offer an appropriate social context for the collaborative testing, validation and adoption of new teaching methods.
361 Harwell SH *et al.*	To initiate action to make classroom learning environments more representative of a constructivist epistemology while integrating technology into learning activities. Intervention aimed to enhance the use of technology in the classroom.	Action research project, designed as a university–school partnership, involving four teachers and their pupils (aged 11-12). Researcher assumed the role of 'critical friend' acting as a catalyst and stimulus to change. Teachers collaborated in the selection of an interdisciplinary content theme and engaged students in the development of related objectives in science, maths, language arts and social studies. Core to the study design was concept that by modelling shared ownership and control of the project between researchers and teachers, this would promote a similar pattern of shared ownership between teachers and students. CPD was evaluated by means of group interview, questionnaires and diaries.	Engagement in action research led to reflective practice and acted as a powerful catalyst for educational change. Teachers showed greater competence and confidence in both in technology use and the constructivist viewpoint of teaching and learning. Commitment to change led to the construction of an action plan for the next academic year. There were no statistically significant changes in students' perceptions of the classroom learning environment after technology integration. Report concludes that CPD should combine the expertise of researchers and the knowledge of the teachers collaboratively, to create learning environments conducive to effective student learning.
362 Kimmel H *et al.*	To bring general and special educators together for collaborative participation to develop and implement a model of CPD to improve their knowledge and skill in mathematics and science and to address the needs of special education students in general education classrooms.	The study involved three cohorts of 28 teachers and their pupils (age 8-14). I2 students with special needs were involved in the summer school programmes. The professional development programme was delivered in the form of academic year workshops and summer practicums where teachers gained supervised experience of implementing what they had learnt. The effects of the interventions were measured both during and after the programme by means of observation, questionnaires and practical tests during workshops. Core to the design was opportunity to provide reflection time and discussion with peers, plus regular feedback from the researchers.	The greatest improvement in planning for, and teaching, special needs pupils within general education classrooms was noted in those teachers who had been involved for longest in the programme. Direct and successful work with special needs children served to enhance teacher efficacy. Modelling was seen as an effective means of support. Teachers needed help to bridge the gap between an understanding of the adaptations needed for SEN students and putting those needs into practice. Students showed more enthusiasm, participated more in lessons and their test scores increased. Greater logical thinking and organisation of work enhanced the quality of students' work.
363 Kirkwood M	The project was established in response to substantial concerns voiced by teachers in one Scottish secondary	Study began with 11 teachers and their pupils (age 14-16) and grew to involve over 40 teachers. Researcher chose to work with the teachers from the	Collaborative approach led to cross-fertilisation of ideas, promoted effective use of time, supported honest and open discussions. Leadership in driving

REPORT	Broad aims of the study	Study design summary	Findings and conclusions
	school and aimed to assess the impact of teachers' professional development on the teaching and learning of computer programming skills.	'inside' sharing her thoughts and ideas, but allowing the project to develop in accordance with the needs and interests of the teachers. Project focused on the production of four new curriculum study units. The impact of the CPD on teaching and learning was measured by means of lesson observation, questionnaires, diaries, evaluation workshops, and field testing of student units.	project forward was also shared. The new curriculum units ensured appropriate pace, offered opportunities for problem-solving in technology and allowed students greater independence. Students were motivated by the new units, reporting that they enjoyed working at their own pace and felt confident. The report concluded that the three main aims for teacher learning – engaging in disciplined enquiry, experimenting within an agreed framework and sharing expertise – were clearly met.
364 Kohler FW *et al.*	To examine the effectiveness of reciprocal peer coaching for promoting changes in kindergarten teachers' conduct of pupils paired activities.	The study involved three teachers and their primary school pupils. A multiple baseline design was dependent upon the sequential and staggered application of four different conditions. Both teachers in a pairing began baseline immediately after in-service training. Teacher 1 entered a second phase after six sessions while teacher 2 remained in baseline. After critical level performance was reached with teacher 1, phase 2 was introduced with the second teacher. In this way, the two teachers entered the various experimental stages in a staggered manner. Observation of lessons, interviews and teacher diaries provided data on outcomes.	Results indicated that coaching produced two changes in teachers' methods. First, both teachers increased their use of suggestions, prompts and questions to facilitate students' interaction with their peers. The second coaching phase enabled teachers to adapt teaching materials, skills or social interaction roles according to their students needs. These changes were sustained during a maintenance phase. Pupils increased their levels of social interaction and talk. The report concluded that reciprocal peer coaching was a viable method of individualised instruction, but that further more extensive research was needed to investigate the effect of coaching.
366 Parke HM, Coble CR	To examine the impact of practice of a professional development model which focused on linking theory and practice through collaborative curriculum design. A further broad aim was to evaluate the influence of the model on students attitudes and achievements.	The study involved 14 schools, but this sample consisted of two schools, involving 30 teachers and their pupils (aged 11-14). The teachers collaborated with the university science education specialists in the design of a new science curriculum which addressed the following components: – ideas from research – students learning needs – the way students learn The new curriculum was them implemented and its impact on teaching and learning measured in a number of project and control schools. Data were collected by means of interviews, student questionnaires and exams.	Collaborative CPD promoted mutually informed conversations, clarification of core values and commitment to the ongoing process of reflection. Teachers designed assessments to provide feedback on pupils understanding. Project teachers were more process-orientated than content-orientated in their planning in comparison with teachers in control schools. Students in project school s were better motivated and were given more opportunities to work collaboratively. They also participated more actively in both practical activities and lesson discussions. These students covered less of the curriculum, but achieved the same results as those in the control schools. The report concluded that teachers were helped to become architects for change by building on their current concepts instead of trying to remediate them.
367 Ross J *et*	To examine whether studying peers helped teachers to conduct enquiries	The study design was to evaluate changes in the practice of five teachers (pupils age 6-8 and 11-13)	Participation in CPD led to greater self-efficacy for teachers. The exemplary teachers while confident in

REPORT	Broad aims of the study	Study design summary	Findings and conclusions
al.	into their own practice. To explore effective methods of evaluating individual student progress in collaborative learning situations.	resulting from their involvement as action researchers in phase one of the project and the resulting impact on their own changing practice in the second phase. Action research teachers and researchers worked as equal partners to study the methods used by 13 'exemplary' teachers. Data were collected by means of group interviews, one to one interviews, student observations, questionnaires and diaries.	collaborative learning techniques were less confident about methods of student evaluation. Professional conversations were valued in reassuring teachers about areas of mutual concern. Data provided evidence that teachers were able to improve their evaluation of students. Repeated feedback on their effectiveness fuelled increased aspirations. Students supported the changes that their teachers made. They believed that self-evaluation was fairer and appreciated having an opportunity to state their case to the teacher. The report supported this two-step approach to action research, one in which teacher researchers first learn how to study practice with academic support and then use the results to design their own action research.
368 Saxe GB *et al.*	To provide bottom line evidence of the influence of professional development programmes on student learning	The 23 teachers from upper elementary schools had all experienced a specific mathematics reform programme. The resulting sample was split into three groups to explore three distinctive forms of professional development interventions. One group was identified on the basis of interview data about their preferences for traditional approaches. The remaining group were allocated randomly into two separate groups. Group 1 received outsider expertise to develop both their own mathematical understanding and that of their students (IMA). Group 2 were not given outside support, but identified topics for mutual discussion and conducted their own support group(SUPP). Group 3 remained a control group using traditional methods (TRAD). Data were collected by means of tests.	Every classroom, regardless of intervention, showed gains on the conceptual and computational scales. The reform programme when supported by IMA programme proved effective and was associated with greater student achievement on the conceptual items. However, there was no significant difference between computational scores of students in the IMA and TRAD classrooms. Achievement on the computational scale was greater for students who had received traditional teaching than for students who were part of the teacher support programme (SUPP). The study concludes that the use of reform curricula when implemented with focused support for teachers may lead to gains in students' conceptual understanding.
369 Wilkins CW	To determine the effects of a resident mentor teacher on student achievement in mathematics	Two teachers volunteered to receive instruction from the researcher in performance teaching and analysis and in the creation and use of rubrics. An initial teaching unit was prepared by the researcher and presented to the teachers. Using this unit as a model, the teachers created three more units and trained teachers in four local schools. Measurements of student achievements were obtained by comparing test scores from project and non-project schools.	Teachers reported an increase in their enthusiasm for teaching, an improvement in their teaching skills and an increase in their feelings of confidence. All the teachers viewed the use of portfolios and journals as beneficial practice in mathematics instruction and planned to continue using these assessment techniques. All schools demonstrated improved scores from first to second year in the project. Project school students had higher scores in graphing and computation. However, scores were not significantly different in problem-solving in the rural project and non-project schools. All schools showed a decrease

REPORT	Broad aims of the study	Study design summary	Findings and conclusions
			for scores in measurement.

APPENDIX 4.8: Weight of evidence for the studies

REPORT	Weight of evidence A	Weight of evidence B	Weight of evidence C	Weight of evidence D
Britt MS *et al*: Professional Conversations and Professional Growth	Medium	HOW – Medium WHETHER – Medium/ low	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium
Brown DF: The development of strategic classrooms in two secondary schools	Medium/High	HOW – High/ medium WHETHER – Medium	HOW – High WHETHER – High	HOW – High/medium WHETHER – Medium/high
Bryant DP *et al*: The effects of professional development for middle schools general and special education teachers on implementation of reading strategies in inclusive content area classes	Medium	HOW – Medium WHETHER – Medium/high	HOW – High WHETHER – High/Medium	HOW – Medium WHETHER – Medium
Costa JL: A study of teacher collaboration in terms of teaching-learning performance	Medium	HOW – High WHETHER – Medium	HOW – High WHETHER – Medium	HOW – High WHETHER – Medium
Ertmer PA, Hruskocy C: Impacts of a university-elementary school partnership designed to support technology integration	Medium	HOW – Medium WHETHER – Medium/low	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium/low
Flecknoe M: Can continuing professional development for teachers be shown to raise pupils' achievement?	Low	HOW – Low WHETHER – Low	HOW – Low WHETHER – Low	HOW – Low WHETHER – Low

REPORT	Weight of evidence A	Weight of evidence B	Weight of evidence C	Weight of evidence D
Gersten R *et al*: Close to the classroom is close to the bone: coaching as a means to translate research into classroom practice	Medium	HOW – Medium WHETHER – Low/medium	HOW – Medium WHETHER – Low/medium	HOW – Medium WHETHER – Low/ medium
Harvey S: The Impact of Coaching in South African Primary Science INSET	Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium
Harwell SH *et al*: Technology Integration and the classroom learning environment: Research for Action	Medium	HOW – Medium WHETHER – Medium/low	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium
Kimmel H *et al*: Meeting the needs of diverse student populations: comprehensive professional development in science, math and technology	Medium/Low	HOW – Medium WHETHER – Low	HOW – High WHETHER – High	HOW – Medium WHETHER – Medium
Kirkwood M: The contribution of curriculum development to teachers' professional development: a Scottish case study	Medium/Low	HOW – Medium WHETHER – Low	HOW – High WHETHER – High	HOW – Medium WHETHER – Medium/low
Kohler FW *et al*: promoting changes in teachers' conduct of student pair activities: an examination of reciprocal peer coaching	Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium/low
O'Sullivan MC: Communicative approaches to teaching English in Namibia: the issue of transfer of Western approaches to developing countries	Medium	HOW – Medium WHETHER – Low	HOW – Low WHETHER – Low	HOW – Low/ Medium WHETHER – Low

REPORT	Weight of evidence A	Weight of evidence B	Weight of evidence C	Weight of evidence D
Parke HM, Coble CR: Teachers designing curriculum as professional development: a model for transformational science teaching	Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium
Ross J *et al*: Effects of collaborative action research on the knowledge of five Canadian teacher-researchers.	Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium
Saxe GB *et a*l: Enhancing students' understanding of mathematics: a study of three contrasting approaches to professional support	Medium/High	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium
Wilkins CW: Effects of a resident mentor teacher on student achievement in mathematics	Medium	HOW – High WHETHER – High	HOW – Medium WHETHER – Medium	HOW – Medium WHETHER – Medium

APPENDIX 4.9: Features of study, measurement and design, and student outcomes

Study	*Pre- and post-intervention comparison*	*Use of control groups / schools*	*Comparison of different types of collaborative CPD*	*Type of study*	*Features of measurement and design*	*Student outcomes*
351 Britt MS *et al.*	✓			Evaluation Researcher Manipulated	One group of 18 teachers participated in 2 yr. CPD programme. Results measured by comparing pupils' achievement and attitudes between 1st and 2nd years.	Students' mathematical performance showed improvement between the first and second year of the project. Improvements in students' work habits also improved- more discussions, and ability to explain mathematics in their own words.
352 Brown DF	✓			Evaluation Researcher Manipulated	1 group of 27 teachers from 2 schools received CPD intervention over a period of 2 terms. Data were collected from a wide range of sources on a weekly basis.	Students reported positively on the use of the new learning strategies in preparation for exams. Before and after test results showed that in mathematics individual topic results were greatly enhanced. Substantial increases were also evident in English work. Teachers reported gains in other subjects such as economics. They enjoyed cooperative work and improvement in progress led to greater self efficacy.
353 Bryant *et al.*	✓			Evaluation Researcher Manipulated	1 group of 10 teachers received CPD intervention over a period of 4 months. Results were measured by comparison of pre and post intervention interviews, and pre/ mid and posttests of pupils.	Results indicated improvements in low-achieving pupils' ability to break down multisyllabic words and recognise prefixes and suffixes. Improvement in lower readers' fluency ability was evident.
355 Da Costa JL	✓		✓	Evaluation Naturally Occurring – also Evaluation Researcher Manipulated	4 groups of teachers, totaling 26 in all received CPD intervention over a period of one school year. Results of the 4 different models of CPD were assessed by comparison of data collected at the beginning and end of the school year.	The study show provided evidence of a positive link between teacher efficacy and pupil achievement. Pupils of teachers receiving Collaborative Consultation intervention had higher achievement than pupils in the other cohorts.
357 Ertmer PA	✓			Evaluation Researcher Manipulated	I group of 13 teachers plus a group of 18 students received training over a period of one school term. Results measured by data collected pre and post	Evidence indicated that 'at risk' students who were part of the training group had excelled in the program. Student-trainers showed increased confidence and self-esteem. Students in the teachers' classes also showed

Study	*Pre- and post-intervention comparison*	*Use of control groups / schools*	*Comparison of different types of collaborative CPD*	*Type of study*	*Features of measurement and design*	*Student outcomes*
					intervention.	improvement in technology skills and greater use of word processing, graphics applications and drill and practice progs.
359 Gersten R *et al.*	*			Evaluation Naturally occurring Sample frame unclear	Researchers trained two specialist teachers who then coached a group of 12 class teachers over a two-year period. Data were collected throughout the period of intervention through structured classroom observations, interviews, diaries and curriculum-based assessment.	Pupil outcome data included the observation that students showed increasing sophistication in their responses to questions. Teachers also reported that their students understood the ideas in the texts better and that their reading became more fluent. Teachers reported that their students became more motivated and that their participation in lessons increased.
360 Harvey S	✓	✓	✓	Evaluation Researcher Manipulated	Study involved 2 groups of 10 primary schools receiving intervention plus a control group of 10 primary schools over a period of three years. Results measured by comparison of data before, during and after the intervention .	There was evidence that pupils of teachers receiving the intervention contributed more of their own experience and knowledge to lessons than those not involved in the PSP programme. They had more opportunity to talk and write in English. However, there were some limitations to pupil contributions noted. When teachers were also supported in their classrooms, in addition to workshop intervention there was evidence that their pupils were more likely to speak English in whole sentences and more likely to engage in written work. Pupils were involved in more active learning and more likely to manipulate apparatus. Pupils of those teachers receiving workshop intervention alone did not make significant changes.
361 Harwell *et al.*	✓			Evaluation Researcher Manipulated	Group of 4 teachers received CPD. over a period of an academic year. Results compared by data collected before and after first stage of intervention.	It was recognised that results do not appear too quickly when teachers were simultaneously learning to use technology and incorporating new practices. Results indicated that students' perceptions of the classroom learning environment remained essentially the same.
362 Kimmel	✓			Evaluation Researcher-manipulated	Study involved three cohorts of 28 teachers over a period of three years. Data were collected both	Evidence indicated that resulting from the intervention students whose teachers had received the intervention participated more in lessons, had

Study	*Pre- and post-intervention comparison*	*Use of control groups / schools*	*Comparison of different types of collaborative CPD*	*Type of study*	*Features of measurement and design*	*Student outcomes*
					during and after the intervention.	improved test scores, demonstrated better organisation of work and a more logical approach and showed greater enthusiasm.
363 Kirkwood	✓			Evaluation Researcher-manipulated	Study developed over a period of several years, involving 11 teachers initially but finally 40. Data were collected throughout the period of the intervention.	Data provided evidence that the majority of students involved in the programme enjoyed a very positive learning experience and were motivated by the new units and associated pedagogy.
364 Kohler FW *et al.*	✓			Evaluation Researcher-manipulated Sample frame unclear	Study involved three teachers. Results of intervention were assessed by peer evaluation from a measured baseline after two INSET interventions and a maintenance period.	Evidence indicated that pupils involved in the programme increased their levels of social interaction and talk.
366 Parke and Coble	*	✓		Evaluation Researcher Manipulated	Detailed data were collected from a group of 19 teachers who received intervention and compared with data from a control group of 11 teachers. A further 6 project schools and 6 control schools provided additional evidence.	Data indicated that student achievement in the project schools matched that of the control students even though the project teachers covered less science content. There was evidence that project students enjoyed science more and were more motivated than control students, worked more collaboratively, did more experiments and hands-on activities than control students Some project teachers observed that their students became more confident asking questions, participating in discussion, volunteering explanations, and using equipment.
367 Ross J *et al.*	✓			Evaluation Researcher Manipulated	Study involved a group of 5 teachers plus a group of 13 exemplary teachers. Results were measured through data collected mainly during the intervention but there were also before and after student surveys.	Students believed that the new process of self-evaluation was fairer and appreciated being given a 'voice'.
368 Saxe *et al.*	✓	✓	✓	Evaluation Naturally Occurring – (group 3)	Study compared 3 interventions, all involving collaborative CPD, 2 initiated by the researchers and one which was current practice.	Pupils in every group showed gains in conceptual and computational skills. The IMA programme was associated with greater student achievement on conceptual items than the

Study	*Pre- and post-intervention comparison*	*Use of control groups / schools*	*Comparison of different types of collaborative CPD*	*Type of study*	*Features of measurement and design*	*Student outcomes*
				Evaluation Researcher Manipulated (groups 2and 3)	Total sample size was 23 teachers. Results were measured by comparing children's understanding of fractions through pre and post tests.	other two groups, but was not any more effective than the traditional methods in terms of computational results. Those students in the group which did not receive outside support, but conducted their own support group through discussions, made the least progress.
369 Wilkins CW	✓	✓		Evaluation Researcher-manipulated Sample frame unclear	Study involved two target schools and two control schools. Effectiveness of the intervention was measured by collecting data pre-, mid- and post-intervention on pupils' mathematics scores.	All schools demonstrated marked improvement in scores from school year 94-95 to school year 95-96. Mean score differences in both treatment schools were statistically significantly higher in graphing and computation. Mean score differences in the rural schools were not statistically different in problem-solving. All schools showed a statistically significant decrease in mean scores in measurement. At the end of the replacement unit, traditional testing of the skill revealed that 100% of the students in the suburban school and 98% of the students in the rural school demonstrated mastery at or above the 70% level.

* Regular assessment during the period of the intervention