Continuing Professional Development (CPD)

What do specialists do in CPD programmes for which there is evidence of positive outcomes for pupils and teachers?

Review conducted by the Continuing Professional Development Review Group

Report written by Philippa Cordingley, Miranda Bell, Colin Isham, Donald Evans, Antonia Firth

EPPI-Centre
Social Science Research Unit
Institute of Education
University of London

The results of this systematic review are available in four formats:

SUMMARY	Explains the purpose of the review and the main messages from the research evidence
REPORT	**Describes the background and the findings of the review(s) but without full technical details of the methods used**
TECHNICAL REPORT	Includes the background, main findings, and full technical details of the review
DATABASES	Access to codings describing each research study included in the review

These can be downloaded or accessed at **http://eppi.ioe.ac.uk/reel/**

CONTENTS

List of abbreviations

AERA	American Educational Research Association
AAER	Association for the Advancement of Educational Research
ACER	Australian Council for Educational Research
AST	Advanced skills teacher
BD	Biblioscape Database
BEI	British Education Index
BERA	British Educational Research Association
CERUK	Current Educational Research in the UK
CfBT	Centre for British Teachers
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 Center (US)
ESRG	Electronic Systems Research Group
FE	Further education
GTC	General Teaching Council
HE	Higher education
HEI	Higher education institution
IOE	Institute of Education, University of London
IPDA	International Professional Development Association
ITT	Initial teacher training
LA	Local authority
LSA	Learning support assistant
NC	National Curriculum
NCSL	National College for School Leadership
NFER	National Foundation for Educational Research
NLC	Networked learning communities
NLG	Network learning group
NTRP	National Teacher Research Panel
NUT	National Union of Teachers
OCLC	Online Computer Library Centre
OFSTED	Office for Standards in Education
PNS	Primary National Strategy
REEL	Research Evidence in Education Library
SCRE	Scottish Research in Education Centre
SENCO	Special needs co-ordinator
TDA	Training and Development Agency for Schools
UCET	Universities Council for the Education of Teachers
WoE	Weight of evidence

Abstract

What do we want to know?

This review aims to explore and describe the role of the specialist in CPD programmes that provide evidence of positive outcomes for pupils as well as teachers within a broad range of indicators, including (for pupils) achievement, attainment, motivation and attitudes; and (for teachers) behaviours, knowledge, understanding and a range of affective outcomes, such as beliefs, attitudes and motivation.

Who wants to know and why?

The issue of how best to support teachers in their CPD is of interest to teachers, professional associations and agencies responsible for the quality and provision of teacher training.

What did we find?

- Pupil impact data was reported in the areas of learning and achievement, and affective development, including attitudes to learning and self-esteem.

- Changes in teacher practice resulted from teachers learning more about teaching strategies, learning theories, the use of technology, educational policy and subject knowledge.

- Specialists supported teachers through modelling, workshops, observation, feedback, coaching, and planned and informal meetings for discussion. Nearly all specialist support took place on school premises. More than half the CPD involved the specialists in observing teachers and providing feedback and debriefing. They discussed pupil needs, examined test results, reviewed the results of interviews conducted with and by pupils, and observed pupil interaction in the classroom. The quantity of formal 'input' was extensive and sustained.

- Peer support was a consistent feature.

- Specialists encouraged teachers to take on a degree of leadership in their CPD.

What are the implications?

- The interventions involved a complex mix of skills on the part of the external specialists. Similarly, when teachers were asked to support their colleagues following support from external specialists, they were also given the opportunity to develop their own skills in doing this. Understanding of adult learning was an important part of the mix.

- Specialists helped teachers connect their CPD with their students' learning and understand its impact. There was extensive evaluation of impact on students, which was often integrated into the CPD.

- The CPD programmes had a strong core of common elements, but also took into account the teachers' learning needs, the contexts in which they worked, and the difficulties of developing specific types of new knowledge and skills.

- Staff from schools who participated benefited from the CPD and so did their pupils. In some cases, people who were involved had an important and positive contribution to make to their colleagues' CPD by taking on a lead teacher role. However, it was clear that, in the majority of studies, not all eligible teachers were included.

- The CPD was led by, and dependent on, the input of external specialists. In two programmes, they also set out to develop internal specialists to support practitioner learning. Another programme involved the input of a lead teacher.

- The specialists described in the review studies brought with them an array of skills and specialist knowledge.

- The programmes aimed to encourage and facilitate professional learning: for example, by encouraging peer support, collaborative learning and experimentation. This complemented the formal instruction in new information and approaches provided by the specialists (professional development) and created a robust model to enable change in teacher practice.

How did we get these results?

A systematic map found 76 studies, of which 22 met the criteria for in-depth review and 19 were synthesised.

CHAPTER ONE
Background

1.1 Aims and rationale for the review

This is the fourth review of the impact of continuing professional development (CPD) on classroom teaching and learning conducted by the CPD Review Group. One of the common findings of the previous three EPPI-Centre reviews was that all relevant CPD programmes for which there is research evidence of positive outcomes include substantial contributions by specialists. The first review by this group identified 'the use of external expertise linked to school-based activity' as a core feature of the CPD which was linked to positive outcomes. The second review in the series found that all the studies on effective CPD involved input from specialists, whether the CPD was individually oriented or collaborative, and that external / expert input was sustained throughout the life of the intervention in all but one of the collaborative studies. The third review highlighted the importance of content or subject oriented specialist contributions to CPD programmes, where student outcomes have been evaluated, as compared with more generic CPD contributions in programmes where only teacher outcomes are evaluated.

In the fourth review, we have set out to explore and describe in further detail the role of the specialist in CPD programmes that provide evidence of positive outcomes for pupils as well as teachers within a broad range of indicators, including (for pupils) achievement, attainment, motivation and attitudes; and (for teachers) behaviours, knowledge, understanding and a range of affective outcomes, such as beliefs, attitudes and motivation. In particular, the review aimed to unpack the ways in which specialists:

- facilitate professional learning

- enable independence and capacity-building

- contribute to embedding CPD within school goals and leadership

- mediate the effects of changing practice on practitioners

- facilitate practitioners' access to the public knowledge base

- make explicit links between professional learning and pupil learning

In addition, the review aimed to provide context details in which CPD takes place, in particular location and time. In light of the recent growth in in-school specialists, such as advanced skills teachers (ASTs), gifted and talented co-ordinators etc., the review also explored possible differences between external and internal specialist contributions.

1.2 Definitional and conceptual issues

Continuing professional development (CPD)

For consistency, we continued to use the definition of CPD we adopted for the first three reviews.

> 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, p 4)

Sustained CPD

All the included studies in the review were designed to span at least 12 weeks. From this point on, for reasons of brevity, when we refer to CPD in this report, we mean that the CPD is sustained.

Collaborative CPD

In the light of evidence from the first EPPI-Centre review of the impact of CPD, we have defined CPD as collaborative where there were specific plans to encourage and enable shared learning and support between at least two teacher colleagues on a sustained basis. Nineteen of the studies included in the in-depth review match this definition.

Individually oriented CPD

In the light of evidence from the first EPPI-Centre review of the impact of CPD, we have defined CPD as individually oriented where there were no explicit plans for the use of collaboration as a significant learning strategy and/or no activities explicitly designed to support and/or sustain such collaboration. Three of the studies included in the in-depth review match this definition.

1.3 Policy and practice background

In addition to the specific requests and changing interests that led to the review (set out in section 1.1), a range of other policy and practice issues provide an important context for this review.

Concern about the nature and adequacy of teachers' subject expertise and knowledge is a longstanding one. The Primary National Strategy (PNS) and Key Stage 3 (KS3) Strategy were both constructed specifically to address teachers' needs for deeper and more up to date subject knowledge. Support was provided both in person (via specialist consultants) and with materials (e.g. via lesson plans, videos and learning resources, including DVDs). The Qualifications and Curriculum Agency (QCA) has also sought to define and illustrate the curriculum in increased detail to help address such needs. However, the process of transferring knowledge and skills from specialist to practitioners is not well understood. Parallel with this sits the consistent emphasis, in studies of effective practice from previous reviews, on the role of specialists alongside peer support. The latter message from previous impact of CPD reviews has been readily recognised by practitioners. The increasing interest in school-based CPD, however, has often been interpreted as an alternative rather than complementary approach to specialist support.

The introduction of AST grades within the English school system has meant an expansion of the pool of professionals upon whom schools can call to act as specialists in CPD programmes. As this is a relatively recent innovation, however, the likelihood of identifying a large quantity of research on such internal specialists at the present time is low, and this has been the experience of this review.

In terms of policy, responsibility for CPD has been transferred from the Department for Education and Skills (DfES) to the Teacher Development Agency (TDA), although both the government and the national agencies - such as the General Teaching Council (GTC), the Specialist Schools and Academies Trust (SSAT) and the National College for School Leadership (NCSL) - continue to place a high priority on CPD in enhancing teaching and learning. The SSAT is developing a CPD network in which specialist teachers provide training and support to colleagues, while the Teacher Learning Academy (TLA) has been specifically established by the GTC to provide recognition for teachers' learning through supportive learning communities. The TLA model of CPD encourages teachers to draw on knowledge from research and other colleagues, take on leadership of their own learning, draw on expert support, and experiment.

A significant number of different Government initiatives have been taken forward with an emphasis upon the importance of collaboration and networking in teacher development. Examples include the Networked Learning Communities (NLCs), Leading Edge Partnerships, Design Collaboratives, the Primary Entitlement to Collaboration, Federations and the Leadership Improvement Grant Initiative. The findings of the previous EPPI-Centre reviews on the positive outcomes of collaborative CPD have played a part in building this policy commitment to collaboration. Examples include the interest in coaching and mentoring stimulated by the findings of the first review, and the guidance to schools from both PNS and KS3 strategies which include a statement based upon and related to EPPI-Centre review findings. This work, and in particular the findings about CPD processes, also led to the development of a national framework for coaching and mentoring, commissioned by the DfES and carried out by CUREE. The framework has been endorsed by all the National Policy agencies and the accompanying resources are currently being piloted by the TDA in conjunction with CUREE. In addition, the GTC has published a 'Teachers Professional Learning Framework' which has been informed by previous CPD systematic reviews.

In this context, there has been a significant increase in in-school, peer-supported professional development. This has, in turn, generated a desire from policy-makers, practitioners and providers for more detailed specification of the contributions of external specialists to CPD in order to map how the two might be articulated in the new contexts.

1.4 Research background

There is an extensive literature on teachers' professional development, although this predominantly comprises theoretical scholarship and (often small scale) evaluations of specific CPD programmes. There are also a number of more substantial evaluation studies of change programmes in which CPD features and is researched as a key intervening variable. The best evidence for reviews of the impact of CPD to date derives from these studies. Here the key unit of analysis is the CPD programme rather than the professional context in which the professional learning process and the outcomes of the CPD are put to work. As a result, more ecological, empirical studies of how professional learning communities are facilitated and developed are urgently needed (for example, Bolam *et al.,* 2005). Over a longer timescale, we hope that the CPD systematic reviews will also encourage researchers and research funders to start to fund and design studies that explore the impact of CPD and the design of effective CPD programmes in context and in more depth. As the first review points out, CPD is a third-order activity and research in this field has to encompass an extended chain of dynamically interacting variables, including student learning, teacher practice and teacher learning.

This fourth CPD review itself arises directly from the findings of the first three reviews, in all of which the role of the 'specialist' or professional adviser was a prominent feature in conjunction with peer support. This finding has recently been echoed in a best evidence synthesis carried out in New Zealand (Timperley *et al.,* 2006), which identified the utilisation of external expertise as a feature of the professional learning environment in studies which demonstrated outcomes of educational significance for students. The review by Timperley *et al.* (2006) also highlights the distinction between professional development and professional learning which implies a dual role for the specialist: in the first instance, providing new information to teachers in an accessible form; and, in the second, facilitating the internal processes through which teachers understand, interpret, adapt and internalise the skills involved in putting such knowledge to work in the service of their students' learning. The emerging and coalescing evidence base about the need for specialist contributions, not only in making new knowledge available to teachers, but also in supporting them in putting it to work, echoes the findings of previous EPPI-Centre reviews and is reflected in the synthesis of the evidence in this review.

This review therefore, like its predecessors, draws not simply on the self declared CPD literature. In framing our questions and definitions, we have drawn on a range of related research and scholarship findings, including the following:

- the research field which informed and stimulated the first three reviews, and in particular, in the UK, on evaluations of large scale initiatives such as the National Literacy Strategy (Earl *et al.,* 2003; Sainsbury, 1998) and large-scale initiatives, such as CASE (Adey and Shayer, 1994) and CAME (Shayer *et al.,* 1999) where the input of consultants and advisers was a consistent characteristic of programmes linked to positive changes in teacher behaviour and enhanced student learning

- a large body of literature, including that around teaching as a research and evidence informed profession (Cordingley and Bell, 2002), and around teacher enquiry and its benefits for teacher learning (Elliott, 1991; Stenhouse, 1980)

- the reflections by Desforges (1995) on the tendency of classrooms to return to the status quo – and hence the difficulties of effecting lasting change – also being influential in persuading us to focus on sustained CPD

- the substantial literature on CPD interventions (Bolam 2003) that helped us to frame our review questions about the nature of 'specialist' expertise in the light of evidence about the importance of combining teacher experimentation, feedback and coaching over time (Joyce and Showers, 1988)

- the work by Hargreaves (1993) on teacher development and the way in which teachers are able to expand the horizons of their attention as their confidence and skills expand

- the work by Rich (1993) on the learning of beginning and expert teachers

- the development by Askew *et al.* (1997) of Shulman's (1986) typology of teacher knowledge that helped us to explore, as in previous reviews, links between CPD and teachers' subject knowledge, their pedagogic knowledge and skills, and their pedagogic content knowledge, as well as students' responses to changes in teaching and learning activities

We have also explored the literature about the transfer of good practice (Fielding *et al.,* 2005) and about support for professional learning by school leaders (Cordingley *et al.,* 2003; National College for School Leadership, 2004). In view of the fact that few studies of CPD carry out significant evaluation of its impact, we have also found Guskey's (2000) concept of five levels for evaluating CPD helpful.

There has been an increasing amount of activity in the UK in relation to the Government's national CPD strategy, and we have explored this literature too. One development of this has been a growth of interest in the evaluation of CPD strategies. Researchers have recently completed a two-year project (Goodall *et al.,* 2005) which

investigated the evaluation of CPD in schools, focusing particularly on the range of evaluative practices for CPD use in schools and on materials which would aid schools in evaluating CPD in the future. In addition, a recent review of research into school networks (Bell *et al.*, 2006) found that collaborative CPD was the principal means of effecting transfer, knowledge and practice within networks. Specialists involved here included HEI research partners, CPD providers and others, ranging from people in business, to teacher mentors and to parents. Our aim in this review was to explore the nature of specialist expertise in effective CPD. 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. Several of our sub-questions were therefore designed to help us explore the specialists' contributions to this working context. We have not, however, been able to explore the context of the CPD in much depth because, although we sought evidence about such factors, few studies explored what might be described as the ecology of the CPD in any depth.

1.5 Authors, funders and other users of the review

The Review and Advisory Groups continue to be passionately interested in effective CPD and committed to supporting the development of research and evidence informed CPD. They have constructed the fourth review question to flow from, and build cumulatively upon, evidence from the first, second and third reviews which produced consistent evidence of specialist input in effective CPD interventions.

Information about the contribution of specialists/ advisers to effective CPD is likely to be of interest to the following:

- CPD co-ordinators and other fundholders of devolved resources for in-school CPD programmes

- the General Teaching Council (GTC), especially its network of CPD coordinators and those involved in developing the teacher

- school leaders, mentors and others with an interest in teacher morale and retention

- CPD providers in local authorities, schools districts, higher education Institutions and government agencies

- professional associations

In this context, and in accordance with their CPD policies and strategy, the GTC and the Training and Development Agency for Schools (TDA) have

sponsored the fourth review. Additional financial support has been generously provided by Esmée Fairbairn Foundation; each of the three sponsors has provided reasons for supporting the review.

Esmée Fairbairn Foundation

High quality continuing professional development refreshes teachers' skills, encourages innovation and supports school improvement. The Esmée Fairbairn Foundation is delighted to have supported this study, which will give policy-makers, LEAs and schools a more informed understanding of the role that external specialists might play in meeting teachers' development needs.

GTC

The GTC is committed to supporting professional development and growth for teachers at all stages of their career, and to ensuring that CPD approaches are well-conceptualised and grounded in the best available evidence. These reviews are helping CPD to have optimal impact on teachers' practice and pupils' outcomes. The GTC has used the evidence and insights from the three previous reviews to underpin its policy work on CPD, to generate a series of leaflets on teachers' professional learning, and, crucially, to inform the design of the Teacher Learning Academy. The findings from this fourth review continue to highlight the importance of understanding the processes and activities that make teachers' professional learning satisfying and effective. Evidence about the role that external expertise plays in teachers' learning, and about the characteristics of effective input, will be a further major contribution to the GTC's work.

TDA

This review is extremely helpful in providing the TDA with strong evidence that supports the distinctive and beneficial role that specialists can have on teachers' professional development. It is important to build and develop our knowledge base about CPD as we, in collaboration with other stakeholders, move forward in our work to stimulate the demand for high quality CPD on the one hand and ensure that the supply of high quality CPD meets this demand on the other. This report will be particularly useful in helping us and others to clarify what 'high quality' might mean in this context.

The National Union of Teachers (NUT) also supported the review through providing hospitality for meetings, and in-kind support and advice. A team of colleagues from higher education institutions (HEIs) and local authorities (LAs) volunteered to help with keywording and data extraction. All members of the Advisory Group

made an active contribution to the review.

The core team for the fourth CPD review comprised the following:

- employees of CUREE

- teachers

- CPD practitioners from higher education

- members of the Review and Advisory Groups

- a colleague from the Network Learning Group (NLG) of the National College for School Leadership

- members of the EPPI-Centre team

Additional information regarding the users can be found in Section 2.1, and about members of the Review and Advisory Groups, in Appendix 1.1.

1.6 Review questions

The original question for this review was as follows:

> *How do specialist inputs in CPD affect teachers, their learning and their pupils' learning?*

During the course of the review, we came to realise that the original phrasing of the question was an inaccurate reflection of the aims and rationale for the review as set out in Section 1.1. The Review Group wanted to use the consistent evidence (from the first three CPD reviews) about specialist input in successful CPD programmes to find out more about the actual role of such specialists: what did they do in CPD programmes that were effective for teachers and students? In the detailed range of sub-questions, only one (see sub-question 3 below) addresses impact, for the purposes of establishing the outcomes of the CPD. This was due to our focus on the role and activities of the specialist in CPD with positive outcomes. All the other sub-questions address the issue of what people do, in the context of CPD programmes with positive outcomes. We therefore reframed the question to provide a more accurate indication of the focus of the review. The over-arching review question therefore became as follows:

> *What do specialists do in CPD programmes for which there is evidence of positive outcomes for pupils and teachers?*

The change in the phrasing of the question did not affect the search or filtering strategies which remained consistent with the aims and focus of the review.

Our aim was to explore how specialist contributions work in contexts where there is evidence of a positive impact on students' experiences and learning, as can be seen from the sub-questions

set out below. These were designed to flesh out and unpack our central question and to frame our interrogation of the studies in detail. They were:

Sub-questions

1. What is the nature of the specialist contribution?
1.1 How much, how often, when, where, for how long?
2. How do specialists enhance the professional development of teachers to improve pupil learning?
2.1 Designing, leading, brokering, and sustaining CPD
2.2 Facilitating and growing independence/ capacity building
2.3 Making the public knowledge base and local evidence base available to teachers
2.4 Changing practice of teachers (starting points, emotional content of professional development, self-directing peer support, experimentation)
2.5 Making explicit links between professional learning and pupil learning
2.6 Embedding CPD within school goals and leadership
3. What is the impact of specialist contributions to CPD on teachers, teaching and pupils?
3.1 Impacts on teachers and teaching
3.2 Impacts on pupils (achievement, attainment, motivation, behaviour)
4. Are there factors that can change the nature of or impact of the contributions of specialists?
4.1 Are there differences between the contributions of internal and external specialists?
4.2 Are there differences between the contributions of specialists who are also researching the CPD reported here and those who are not, either in relation to process or input?

In developing such a detailed series of questions, the reviewers aimed to establish the features of specialist contributions which characterised CPD that has been shown to be effective.

While the development and use of a series of sub-questions has been useful in enabling the Review Group to maintain a tight focus on those factors that are of most interest and use to practitioners and policy-makers, it is worth noting that they have also created operational difficulties for the review. Firstly, the number of questions led to large quantities of data requiring the development of a fine-grained framework for the synthesis. Secondly, the data itself once analysed, suggested the need for a dual approach to exploring the ways in which specialists attended to both the initial creation of understanding of new ideas and approaches, and the ongoing embedding, interpretation and adaptation of those approaches. This made the synthesis process longer and more complex than had been anticipated.

CHAPTER TWO
Methods used in the review

This chapter describes the methods used in completing the review. Initially it outlines the questions, describes the approach and methods of involving users; it later considers the detail of each of the steps of the review process.

2.1 User-involvement

2.1.1 Approach and rationale

The Review Group is committed to maintaining active teacher and policy-maker involvement at an advisory and consultative level, and has explored with funding partners the best ways in which this could be achieved. The NUT, Department for Education and Skills (DfES) and GTC networks were once again used to encourage input from practitioners, parents and governors, and TDA networks were also included.

We adopted a number of methods to encourage a wide and inclusive base of user involvement. In this report, the term 'users' is defined as groups for whom the review findings are of potential interest and/or use. This included teachers, policy-makers directly concerned in planning CPD resource allocation and strategies, headteachers, CPD coordinators and other 'practitioners' who were concerned with identifying effective CPD in relation to desired outcomes. The term also covers academics, governors, local authorities and providers of CPD. We further built upon our links with the National Teacher Research Panel (NTRP) and the NUT, DfES and GTC networks to encourage input from practitioners, parents and governors.

The final report and summaries are available on the EPPI-Centre website. However, the Group has never been confident about this as the sole means of dissemination and, as with the first three reviews, is taking a number of other steps to bring the messages from the review to a wider audience, including, for example, the development of a GTC Research of the Month feature and workshops

to test review findings with groups of interested practitioners from within the Networked Learning Communities.

2.1.2 Methods used

Policy-makers, academics, teachers, initial teacher training (ITT) practitioners and providers were all represented on the Review Group and contributed to selecting the topic of focus, deciding and refining the review question, and developing the protocol. Some members of the Review Group and a small number of academics also made suggestions as to the initial search process, participated in keywording and helped with data extraction.

Training was held for data extraction and keywording in October 2005 to encourage the widest possible participation and to ensure consistency. The days were planned specifically to engage the interest of practitioner and policy-maker reviewers.

We offered training in EPPI-Centre methods via day-long training sessions and workshops on inclusion criteria, keywording and data-extracting as refresher courses for those members of the Review and Advisory Groups who wanted them, and as 'introduction to' courses for new members of the Groups and other interested users. These proved to be productive sessions and the opportunities were generally taken up by academic user groups whose support was invaluable throughout the review process.

We proposed that participating academic reviewers should commit time to helping with undertaking three data extractions, in exchange for participation in a training session.

As in the first three reviews, the focus on sustained and collaborative (or individual) CPD was strongly influenced by teacher input and teacher feedback and discussions involving meetings and

consultations with members of the Advisory and Review Groups, and with teachers and informal contact with specialists in the field of CPD. A user group of teachers was specifically organised in order to obtain teacher feedback in relation to the implications of the findings.

2.2 Identifying and describing studies

2.2.1 Defining relevant studies: inclusion and exclusion criteria

For practical reasons, we needed to restrict the parameters of our search. This section details the rationale behind the inclusion and exclusion criteria. The criteria in the fourth review were similar to those used in the first three reviews for purposes of consistency. However, a small number were refined and re-prioritised as a result of lessons learned from the previous reviews. For example, some criteria were moved from Stage 2 to Stage 1 in order to save time and resources by filtering studies out earlier.

One of the common findings of the previous three EPPI-Centre reviews was the role played by specialists in CPD programmes. The first review by this group identified 'the use of external expertise linked to school-based activity' as a core feature of the CPD, which was linked to positive outcomes. The second review in the series found that all the studies on effective CPD involved input from specialists, whether the CPD was individually oriented or collaborative, and that external/expert input was sustained throughout the life of the intervention in all but one of the collaborative studies. The findings of the third review provided further evidence concerning the importance of specialist input as an integral factor in effective collaborative CPD. The protocol defined specialists as including both internal and external specialists. As in the previous reviews, we focused on CPD that was sustained (lasting at least 12 weeks or one term) and we included studies where the CPD was designed to span at least 30 hours. This meant that we again excluded 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.

We limited the search chronologically to capture studies that had been published after 1994. This would include studies conducted after the introduction of the National Curriculum (NC) in England, which led to the development of teacher CPD and research into NC areas.

Many other constraints of the review were repeated as they had been in the previous three reviews to ensure comparability and for other practical reasons. The review confined itself, for practical reasons and because we wanted to engage the interest of both primary and secondary practitioners, to teachers of the 5-16 age group.

While this excluded further education (FE) and sixth-form college practitioners, it did not exclude those who taught within the 11-18 age range.

Due to the costs of translation, the review only included studies written in English, but did not limit the search geographically. From past experience we expected to retrieve most of our studies from outside the UK, specifically from the USA.

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

- Studies focus on CPD which involves specialist input.
- Studies have set out to measure impact on teaching and/or pupil learning.
- Studies focus on CPD designed to sustain learning for three months, one term, or more.
- Studies clearly describe the methods of data collection and analysis.
- Studies focus on CPD which is designed to meet explicit learning objectives.
- Studies focus on teachers of the 5-16 age range.
- Studies were published after 1994.
- Studies are written in English.
- Studies report on the aims and objectives for the research.
- Studies can show how they have used what is known already.

The exclusion criteria were the opposite of the inclusion criteria.

All studies which met the stage 1 criteria were keyworded and included in the map. Appendix 2.1 contains the full list of criteria applied in the fourth review.

2.2.2 Identification of potential studies: search strategy

The purpose of this review was to identify and data extract studies of CPD which explicitly described the role of the specialist. Our previous reviews of collaborative and individually oriented CPD had already shown that specialist input was an important feature of these interventions, so studies used in the previous CPD reviews were automatically subjected to the first stage criteria for the fourth review. Those that met the additional inclusion criteria for the review were included in the synthesis.

We conducted the searching of databases and journals between August 2005 and October 2005. The cut-off date for articles and reports brought to light by the search process was 10 October 2005. It should be noted that this search period was

shorter than those used in our previous EPPI-Centre reviews, but a head start was gained through our experience of related searching for CPD studies, and through easy access to the references and copies of studies included in previous CPD reviews.

Search terms and search strings used in the review are given in Appendix 2.2.

The search strategy to identify studies of CPD with specialist input involved a number of methods (more details are presented in Appendix 2.2) but in summary, the approaches to searching for titles and abstracts included the following:

- Searching electronic databases (including Educational Resources Information Centre (ERIC), the British Education Index (BEI), Current Educational Research in the UK (CERUK), and Ingenta). Once again, we chose not to search Index to Theses as we found in the first review that we spent considerable time and effort in searching for theses from overseas which could not be procured in time for the review. We retrieved some theses from our overall search strategy.

- Handsearching the editions of *Teachers and Teaching: Theory and Practice* which appeared between 1995 and 2000, as these were not available electronically. (We found it unnecessary to handsearch other journals we had identified as regularly covering CPD research as they were available on electronic databases.)

- Trawling websites, including the American Educational Research Association (AERA) and the Association for the Advancement of Educational Research (AAER) websites. Other websites included the Australian Council for Educational Research (ACER), the Scottish Research in Education Centre (SCRE), the National Foundation for Educational Research (NFER), the Office for Standards in Education (OFSTED), DfES, British Educational Research Association (BERA), and selected LA and university websites.

- Scanning previous CPD EPPI-Centre reviews. We checked that any studies not picked up in the searches for the fourth review were considered for inclusion. We found that the electronic searching for the current review had not retrieved many studies from our previous CPD reviews. Possible reasons for this include changes in the databases beyond our control, but also the different nature of the question for the fourth review. The keywords and search strings used were formulated more specifically to identify studies which reported on CPD with specialist input.

- Reviewing those studies which had not met criterion 1 (focus on collaborative or individual CPD) in the first and second reviews.

- Following up recommendations from Review and Advisory Group members and knowledgeable researchers in the field, as well as approaching overseas researchers for advice. Citations brought up in CUREE's internal current awareness service were also included.

- 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 as each had its own preferred terms (due to ERIC being an American-based database and BEI being a British-based database, for example). The searches identified a large number of studies relating solely or mainly to teachers in pre-service training, which were excluded. A combination of a few broad searches (e.g. 'collab$ AND professional development') and many narrow searches (e.g. 'advisor AND professional development') was a productive strategy. We also found that specialists, experts, and advisors were not always explicitly mentioned in the titles and abstracts of studies, so we had to use more general search terms related to those used in the first and second reviews, and the people doing the filtering often had to infer from the title and abstract whether the study had made use of internal or external specialists.

It is not possible to state which search string was the most productive, as many strings retrieved duplicate returns, which were not counted in the collated results. Similarly, it is difficult to say which database was the most productive as the further the search progressed, the more duplicate studies were retrieved, and hence not counted.

As the previous CPD reviews had stimulated the need for the fourth review, we already had many studies which were suitable for inclusion. We ensured that all studies included in the previous three reviews were scanned and subjected to the inclusion criteria for the fourth review, and that those which met the criteria were included. Some of the studies were published outside the date parameters for the fourth review, and so were excluded. Most of our search strings were generic and cross-curricular. It was decided that creating more specific search strings using CPD terminology would be more productive than concentrating on particular curriculum areas.

Search strings from the first and second review were repeated in each database in order to update them with research added in the last couple of years and also to cover any studies which may not have been covered by the databases at the time of our previous searches. We found that applying the search terms supplied by the database (subject headings), and therefore used by the indexers

of the database themselves, produced the most productive search results. The full list of search strings used can be found in Appendix 2.2.

2.2.3 Screening studies: applying inclusion and exclusion criteria

Our inclusion and exclusion criteria allowed us to screen the studies for relevance to our review question. All citations (titles and abstracts) identified in initial searches were subjected to the application of Stage 1 inclusion criteria. In order to be included in the next stage of the review, by which we mean the retrieval of the full-text document, studies had to meet all the Stage 1 criteria. We excluded reports that did not meet any one of the Stage 1 inclusion criteria. As only a limited amount of information was presented in the title and abstract, to minimise the risk of relevant studies being excluded at this stage, we erred on the side of caution and adopted a policy of inclusion where there was any doubt. Once the full-text document was retrieved, which was not possible in all cases, the Stage 1 inclusion criteria were reapplied to the full reports.

The citation details for all the full reports which we retrieved were entered into a reference management tool (Reference Manager® v11). Where a full report did not meet 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 Stage 1 criteria, so we coded and entered the first criterion, which they did not meet. Once abstracts and studies had been screened, the studies passing stage 1 criteria were imported into the EPPI-reviewer database for keywording and data extraction.

We then proceeded to keyword all reports which fulfilled our Stage 1 criteria.

2.2.4 Characterising included studies

Reports meeting the Stage 1 inclusion criteria were keyworded according to both the EPPI-Centre Core Keywording Strategy (2002) and CPD review-specific keywords. (Appendix 2.3 presents the CPD review-specific keywords and Appendix 2.4 their definitions). Studies were keyworded in order to provide a broad descriptive map of the topic area. All the keyworded studies were added to the larger EPPI-Centre database (EPPI-Reviewer) for others to access via the website.

Core keywording: EPPI-Centre educational keywording system

Keywords, as defined by the EPPI-Centre, classify reports so that answers can be produced for a number of key areas, including language, country, topic, curriculum, sample population, characteristics of learners, educational settings and study type.

CPD review-specific keywords

CPD TYPE

For the purposes of this review, we keyworded the studies according to the type of specialist intervention used (definitions are given in Appendix 2.4; this was broadly split between 'internal' and 'external' expertise, and more specifically by their title (AST, CPD co-ordinator) or where they were from (HEI or local authority).

CPD PROCESSES AND OUTCOMES

The CPD specific keywords were also designed to add detail about the nature of the intervention(s) and the type of practice(s) involved. This included processes such as coaching, peer support, teacher research, mentoring, modelling, external expertise and observation. From our recent work on the National Mentoring and Coaching Framework, we had learnt to refine the terms for coaching (as peer coaching and specialist coaching), and also for different types of observation (dissemination specialist / peer and exploratory specialist / peer). We also keyworded the studies according to the outcomes of the intervention recorded and referred to in the study. This included terms such as teacher attitudes, behaviour, understanding, knowledge, and skills, and student/pupil achievement, motivation and learning. These areas required a high level of cross-moderation to ensure consistency through the review.

For each of the review-specific keyword types, we had an 'Other – please specify' option for any keywords that we had not anticipated being needed.

2.2.5 Identifying and describing studies: quality-assurance process

For the first, second and third CPD reviews, the Review Group had attended EPPI-Centre workshops or refresher courses on the application of inclusion/exclusion criteria to titles, abstracts and full reports. For the fourth review, training was provided for new members of the Review Group by more experienced members.

As the search process developed, we internally moderated the process of applying criteria by cross-sampling 100 titles and abstracts internally and with EPPI-Centre staff.

Full reports were then distributed to the Review Group to apply the Stage 1 criteria and these were cross-moderated by other Review Group members and EPPI-Centre staff. Another reviewer then examined reports to the ratio of 1 in 3 and any differences were resolved through discussion, prior to being uploaded to the database. A third reviewer was occasionally brought in to cross-moderate decisions, as required.

If full reports fulfilled the Stage 1 criteria, members of the Review Group and EPPI-Centre staff keyworded the studies using EPPI-Centre guidelines (EPPI-Centre, 2002) and recorded the keywords on a cover sheet. The details were then inputted onto EPPI-Centre software (EPPI-reviewer) which was available to members of the team for cross-moderation and reconciliation purposes. Through this and general discussion between reviewers, consistency and agreements were reached and understanding shared, resulting in a standardised approach to the keywording.

2.3 In-depth review

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

In the first three reviews, studies for in-depth review had to:

- describe the processes of the CPD intervention in some detail, including the nature and content of the CPD activities and classroom interventions; and

- describe the data analysis process as well as data collection.

For the current review, in addition to meeting the above requirements, studies for the in-depth review had also to meet a second set of criteria (see Appendix 2.1).

At Stage 2, the review included studies which:

- provided evidence of impact on teacher behaviour and/or pupil learning (positive or negative);

- described the processes of the CPD intervention in some detail including the nature and content of the CPD activities, the role of the specialist and classroom interventions; and

- provided evidence of attempts made to establish the reliability and validity of data analysis.

We aimed to base the in-depth review on studies that demonstrated the impact of specialist input on pupil learning as well as teacher change. In order to identify studies in this category, all studies that passed the stage two criteria were subjected to the following additional criterion at stage three:

- Studies must provide evidence of impact on pupil learning (positive or negative).

If this had left us with too few studies to include in the in-depth review, we would have been able to fall back on the studies that demonstrated the impact of specialist input on teachers.

The second set of criteria aimed to filter studies

that were more likely to provide the data we were targeting for the purposes of the review. This set of criteria allowed us to focus on CPD activities that explicitly set out to report on impact upon teaching and learning processes and outcomes.

In order to be included in the in-depth review, full reports had to meet all three sets of criteria. At each stage, the process of selecting studies was shaped by the specific review questions through the application of selection criteria. Studies were excluded or included strictly according to their match with the review criteria. Those reports judged to meet all three sets of inclusion criteria then went forward for data extraction and in-depth review.

2.3.2 Detailed description of studies in the in-depth review

We believed that practitioners would want to know the answer to specific questions about the nature and design of the CPD and the specialists themselves, and the Review Group was particularly interested in details of the type of intervention received, its processes and implementation. For this reason, and building on what we learnt through the process of the previous CPD reviews, we decided to complement the methodological rigour of the EPPI-Centre data extraction guidelines with a set of review-specific, data-extraction questions in order to pinpoint the detail of the CPD (see Section 1.6).

For previous reviews, we had found that even using additional data-extraction questions, combined with the generic information with our review-specific keywords, we still needed to revisit the studies to mine further information. To avoid having to do this and, in response to suggestions from the EPPI-Centre, we designed the questions for this review to be much more specific and reviewers were trained to give as much detail as possible in their answers to the questions. In practice, however, the attempt to base the synthesis on a broad range of sub-questions proved problematic for the reviewers. The large number of questions tended to obscure, rather than reveal, the main messages from the data and to add to the time taken for synthesis. This complicated the process of writing the synthesis. In future, we would be unlikely to use so many sub-questions, allowing the synthesis to flow from the patterns in the data rather than try to predict this through a series of sub-questions.

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

The EPPI-Centre guidelines for assessing the quality of studies required us to judge the weight of evidence according to the internal validity and reliability of each study, and according to the value for our particular review.

- Weight of evidence A (WoE A) refers to the internal consistency of the study and whether the reported findings can be trusted in answering the study question.

- Weight of evidence B (WoE B) is concerned with the appropriateness of the research design for this particular review question.

- Weight of evidence C (WoE C) is concerned with the focus of the study for the review question.

- Weight of evidence D (WoE D) is concerned with the overall weight of evidence when A, B and C are combined.

In making our judgements about the trustworthiness of each study in terms of its own aims and focus, we took into account whether the study was adequately described, whether it had clear aims, and the appropriateness of the study design for the research focus. We considered the adequacy and appropriateness of the data-collection and analysis methods for the study focus. Overall, we rated a study as being of high, medium or low soundness.

Weight of evidence A (WoE A)

For studies to be assigned a high WoE A rating, they had to report triangulated evidence and, normally, a benchmark for comparison: either through the use of a comparison group or, where no comparison group existed, by means of pre- and post-intervention assessments. They also had to report explicitly on the implementation of the intervention and on attempts to establish validity and reliability – both areas in which reviewers exercised their judgements.

Weight of evidence B (WoE B)

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. The reviewers responded to this question as follows.

We rated the studies as high, medium or low, according to the extent to which we judged that the research design was appropriate to the review question. Studies judged to be highly appropriate in design and analysis for answering the review-specific question had to include details of the implementation processes, contextual detail about the nature and design of the intervention, and of the settings and sample. Studies judged as medium in this regard were nonetheless still considered to be of value in answering the question, but were likely to have reported less of the process-based information with which our review was concerned.

Weight of evidence C (WoE C)

In order to establish the relevance of the particular focus of each study for our review questions (WoE C), we systematically compared the number of sub-questions for which any individual study was capable of providing answers and took into account the quality and detail of information on the specialist input they contained. We judged how well the data collected helped to answer the review questions.

Low WoE C was assigned to those studies which provided answers to fewer than half the review-specific questions. It must be stressed, that this is not a comment on the quality of the studies, but in all cases of low WoE C studies, the main focus of the study was not the nature of the CPD.

Weight of evidence D (WoE D)

Reviewers assigned WoE D judgements based on consideration of:

- WoE A

- weight of evidence judgements A-C taken together

If a study was found to have low WoE A (on whether the reported findings could be trusted to answer the study questions), we considered that it would not be suitable for the review, and so assigned it overall low WoE D. If a study was found to have medium or high WoE A, we combined all weight of evidence judgements to arrive at an aggregate WoE D judgement, which is the mode of the WoE judgements A-C. So, for example, if a study had two medium WoE judgements, it was assigned medium WoE D. Similarly, if a study had two high and one medium, or three high WoE judgements, it was assigned high WoE D. If a study had high, medium and low WoE A-C, it would have been allocated medium WoE D.

2.3.4 Synthesis of evidence

The data-extraction process, using the EPPI-Reviewer database, 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 and, in addition, the review-specific, data-extraction questions. The software tools then enabled the review team to run comparisons between studies according to themes that were highlighted in the data or had been identified for testing by the Advisory Group. Building on the work on outcomes of Harland and Kinder (1997) and Day (1999), keywords were applied and data was extracted from the studies for the two analytic categories: outcomes of CPD, and CPD processes and characteristics.

Outcomes of CPD

Effects of specialist intervention on teachers and teaching, including any or all of:

- teacher attitudes, beliefs, commitment, self-efficacy, job satisfaction, morale

- teacher knowledge

- teacher approaches to learning

- teacher behaviours

Effects of specialist intervention on students and learning, including any or all of:

- student attitudes and motivation

- student achievement, including attainment in nationally accredited assessments

- student behaviour

- student learning strategies including their organisation of their learning

CPD processes and characteristics

The characteristics of the CPD that led to the above effects:

- What was the nature of the specialist contribution? How much? How often? When? Where?

- How did specialists enhance the development of teachers? This includes designing and leading the CPD, sharing knowledge with teachers, building on what teachers know and can do already, changing teachers' practice and making explicit links between professional learning and pupils' learning.

- Were there any factors that changed the nature of or impact of contributions by specialists, such as the involvement of internal specialists or whether the specialists were also the researchers?

Analysis of specialist contributions

The EPPI-reviewer software allowed reviewers to interrogate the data from the extracted studies, according to the range of questions in the generic data extraction and the review-specific, data-extraction questions set. However, we found that in many cases we had to return to the primary source to collect additional information.

The results of the analysis are presented in Chapter 4. We present the data extracted from the individual studies following a systematic interrogation using the EPPI-Centre data-extraction tools and processes.

In Section 4.2, we present a series of descriptive tables of data which compare the studies selected for in-depth review with the total studies in the systematic map. Section 4.3 describes the results of the detailed data extractions and begins to identify clusters and patterns in the data. In Section 4.4, we synthesise across the data. We started with a list of user-driven questions which emerged directly from the concerns of users in the review advisory group. These were largely process based and concerned with the role of the specialists in the design of the CPD programmes and the nature of their input in terms of new knowledge and skills. However, when we looked at the data, we found that ongoing specialist support also played a significant role and we have reflected this in the synthesis.

2.3.5 In-depth review: quality-assurance process

Following cross-moderation, those studies identified as meeting the inclusion criteria were analysed in depth using the EPPI-Reviewer software. Data were extracted by two reviewers working independently and any irreconcilable differences were subject to third party arbitration. The *EPPI-Centre Guidelines for extracting data and quality assessing primary studies in educational research* (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. Training was provided for all reviewers who were working on data extraction. A common study was used for the training day and this was compared and discussed in order to deepen understanding and develop a consensus about dealing with studies. Each member of the group completed data extraction on between two and five studies. Each data extraction and assessment of the WoE was conducted by pairs of reviewers working first independently, and then comparing and reconciling their decisions before the study was uploaded. Members of the EPPI-Centre also assisted in applying criteria, keywording and data-extracting studies for a sample of papers as part of the quality-assurance process.

CHAPTER THREE
Identifying and describing studies: results

3.1 Studies included from searching and screening

This section of the report presents the numerical results of the search and the application of the first two sets of inclusion criteria (see Appendix 2.1). We also describe the characteristics of all the studies included after the application of the stage 1 criteria and which were keyworded, in order to provide an overview of the research in this field. As shown in Table 3.1, a total of 3,421 titles, abstracts and reports were identified in the preliminary searches of the review. Screening by title and abstract using stage 1 inclusion criteria narrowed this down to 255, of which 239 full reports were retrieved. We applied both sets of inclusion criteria to the full reports. Of these 239 studies, the number judged to have met all stage 1 criteria was 76, of which 33 studies passed stage 2 filtering. At this point, we applied the additional inclusion criterion that the final selection should contain only studies which contained teacher and pupil data or pupil data only, in order for the evidence to relate to both teachers and learners. The final number of studies for in-depth review thereby fell to 22.

The flowchart provided in Figure 3.1 enables the reader to track the process of searching through to inclusion and exclusion of studies for this second review.

3.2 Characteristics of the included studies (systematic map)

In this section, we report on the characteristics of the 76 studies that comprise the systematic map (i.e. studies included after the application of stage 1 criteria). These are presented in the tables within this section of the report and in the accompanying commentary.

From EPPI-Centre keywords

Identification of the studies

The majority of reports judged to meet the stage 1 inclusion criteria were found by searching electronic databases (N=35), the most productive of which was ERIC (N=31). However, because ERIC was the first database used in the searching process, and subsequent databases retrieved duplicate studies, which were not counted in the collated results, it is impossible to make a reliable comparison of the effectiveness of different databases. Table 3.3 notes that most studies retrieved were American, as is ERIC, which tends

Table 3.1 Studies included from searching and screening for this review

Stage	Number at each stage
Total number of titles, abstracts and reports identified	3,421
Number of abstracts meeting final inclusion criteria	255
Number of full reports retrieved by the cut-off date	239
Number of full studies meeting stage 1 inclusion criteria and therefore keyworded	76
Number of studies meeting stages 1 and 2 inclusion criteria and going on for in-depth review.	33
Number of studies meeting the additional criterion re: pupil outcomes	22

Figure 3.1 Filtering of papers from searching to map to synthesis

STAGE 1
Identification of potential studies

STAGE 2
Application of exclusion criteria

STAGE 3
Characterisation

STAGE 4
Synthesis

One-stage screening
papers identified in ways that allow immediate screening, e.g. handsearching

Two-stage screening
Papers identified where there is not immediate screening, e.g. electronic searching

3,421 citations identified

Title and abstract screening

Citations excluded
Total = 3,171

5 citations identified

250 citations

255 citations

4 duplicates excluded

251 citations identified in total

Acquisition of reports

16 reports not obtained

235 reports obtained

Full-document screening

Reports excluded
Total = 159

76 studies included

Systematic map
of 76 studies

In-depth review
of 22 studies

Studies excluded from in-depth review

Criterion 11	12
Criterion 12	24
Criterion 13	7
Criterion 14	11
TOTAL	**54**

to suggest that this database was relatively more productive than the others.

Unsurprisingly, our searches identified studies already revealed in searches conducted in our earlier reviews of CPD because of overlaps in the search strings. However, new search terms relating to specialists and the more recent upper date limit for this review revealed other studies not yet reviewed. In total, 36 studies identified for the fourth review did not feature in the previous three reviews.

Countries of included studies

As in our three earlier reviews of CPD most studies were from the USA (N=57), followed by England. The criterion that the studies should be written in English had a major selection effect on the origin of studies but not, we believe, on the findings.

Educational settings of the studies

Primary schools followed by secondary schools were the most frequent settings of the study with some cross-phase studies. Higher education settings also played a part in some studies (N=13). A significant number of studies were keyworded as 'other' educational setting (N=24), of which 23 were middle schools, a relatively more common type of educational institution in the US than it is in the UK.

Topic focus of the studies

All the studies were keyworded 'teacher careers' as the whole focus of the review was teachers' professional development. Similarly, as the inclusion criteria required a clear focus on teaching and learning, this too became a keyword for all the studies. About 75% of the studies (N=54) had specific curriculum themes, which are displayed in Table 3.5.

Curriculum focus of the studies

As in the earlier CPD reviews the main curriculum areas in which the CPD was conducted were the core subjects, with nearly 50% of the studies involving science (N=23). With the exception of ICT (N=9), there was a low spread across other subjects.

From review-specific keywords

Type of CPD

In our second review, we had compared CPD studies in which collaboration was a specific feature with CPD which was designed for individual learners. In that review, we found that studies of individually oriented CPD were much fewer in number relative to those designed around collaboration. In this fourth review the picture is similar.

Status of specialist

All the studies involved specialists working with teachers. Of these, the majority came from outside the schools in the studies, mostly from higher education institutes (HEI) (N=53). Other specialists came from local authorities (N=13) and other backgrounds, such as consultancies and specialist CPD providers in, for example, science or literacy (N=15). Far fewer internal specialists featured in the studies. The most frequent type of internal specialist was coded 'other', which in practice turned out in most cases to be teachers in mentoring or coaching roles who had been trained previously (N=9).

Type of practice/intervention

Based on the experience of previous reviews, we compiled and applied a comprehensive series of keywords to capture the practices of specialists. The definitions for these can be found in Appendix 2.4. The CPD processes described in the studies can be allocated to five broad categories: specialist mentoring/coaching; formal specialist input; peer support / coaching; implementing new practice; and research activities.

Specialist provision of mentoring or coaching support (N=65) and formal input sessions (N=64) both featured in the majority of studies. Of the specific mentoring/coaching activities keyworded, under half of the studies reported on ways in which specialists modelled practice (N=31). Observations by specialists as part of the CPD featured in a similar number of studies (N=30). Reviewers needed to be careful only to apply this keyword to studies in which specialists used observation in order to feedback to teachers on their performance, rather than solely as a means of data collection for the research.

By definition, all the collaborative studies (N=58) described CPD which had elements of peer support. Reviewers found more evidence of peer support (N=33) in the studies, than of the more substantial processes of peer coaching (N=7).

In addition to carrying out observation and feedback, specialists helped teachers implement new strategies by encouraging experimentation (N=29) and joint planning of schemes of work (N=18).

Involving teachers in research processes, either as part of an action research project (N=8) or as participants in a post-graduate course (N=3), was a feature of 11 studies.

Outcomes

About 70% of the studies reported on teacher behaviours (N=49), which is not surprising since

Table 3.2a
Identification of studies (N = 76*)

Source	
Citation	41
Electronic database	35

* Codes are mutually exclusive.

Table 3.2b
Identification of database (N = 35*)

Electronic database	
ERIC	31
Ingenta	4

* Codes are mutually exclusive.

Table 3.3
Countries in which the studies were conducted (N = 76*)

Country	
USA	57
UK: England	6
Canada	3
Taiwan	3
China	1
Costa Rica	1
Jamaica	1
Korea	1
Netherlands	1
Singapore	1
South Africa	1
Turkey	1
UK: Scotland	1

* Codes are not mutually exclusive; two studies were carried out in two countries.

Table 3.4
Type of educational setting (N = 76*)

Educational setting	
Primary school	52
Secondary school	27
Higher education institution	13
Special needs school	4
Nursery school	3
Residential school	1
Independent school	1
Other educational setting	24

* Codes are not mutually exclusive; some studies had more than one setting.

Table 3.5
Topic focus (N = 76*)

Topic focus	
Teacher careers	76
Teaching and learning	76
Curriculum	54
Classroom management	8
Assessment	5
Equal opportunities	5
Organisation and management	1
Other topic focus	11

* Codes are not mutually exclusive; some studies had more than one topic focus.

Table 3.6
Curriculum areas covered (N = 54)

Attribute	
Science	23
Mathematics	17
Literacy - first language	12
ICT	9
General	4
Cross-curricular	2
Design and Technology	1
History	1
Literacy further languages	1
Literature	1
Physical Education	1
Vocational	1
Other curriculum	1

* Codes are not mutually exclusive; some studies involved more than one curriculum area/subject.

Table 3.7
Type of CPD (N = 76*)

Type of CPD	
Collaborative	58
Individually oriented	18

* Codes are mutually exclusive.

Table 3.8
Status of specialist (N = 76*)

Specialist	
External: HEI	53
External: LA	13
External: commercial not LA	2
External: other please specify	22
Internal: subject specialist	4
Internal: senior manager	2
Internal: CPD co-ordinator	2
Internal: SEN co-ordinator	1
Internal: other	11

* Codes are not mutually exclusive; some studies involved more than one type of specialist.

Table 3.9 Status of specialist (N = 76*)

Practice/intervention

Specialist mentoring/coaching		65
Including:	Modelling	31
	Observation	30
Formal specialist input		64
Including:	Workshops	39
	Introduction to the literature/ previous evidence	13
Peer support/coaching		58
Including:	Peer support	33
	Sharing practice	25
	Observation	12
	Team teaching	8
	Peer coaching	7
	Study groups	7
Implementing new practice		41
Including:	Experimenting	29
	Planning schemes of work	18
Research activities		11
Including:	Action research	8
	Postgraduate education	3

* Codes are not mutually exclusive; most studies involved more than one method of intervention.

the inclusion criteria dictated that the included studies should include a focus on pupil outcomes. A relatively high proportion described enhanced teacher knowledge (N=44) and skills (N=41) as outcomes of the intervention. Comparatively few of the studies appeared to explore affective impact on teachers, such as their beliefs (N=18), motivation (N=17) or their morale (N=10). This is very much in line with the patterns of studies in our third EPPI-Centre review of CPD. In this review, studies focusing solely on teacher outcomes were more likely than those with pupil data to look for and provide evidence of impact on affective qualities in addition to impact on teacher behaviour. All the final included studies going forward to synthesis contained data about students. The most common area of impact was students' learning (N=27), with 18 studies reporting gains in achievement and 14 indicating improvements in knowledge. There was an impact on students' motivation in a moderate number of studies (N=18).

3.3 Identifying and describing studies: quality assurance

The quality-assurance methods used for screening and keywording are described in section 2.2.5. Quality assurance procedures were implemented at a number of points:

- cross moderation of initial screening of abstracts against stage 1 criteria in the ratio of 1:34

- cross moderation of application of stages 1 criteria to full reports of studies in the ratio 1:3

- cross-moderated of all keywords

In problematic cases, other members of the Review Group were consulted.

3.4 Summary of results of map

- Of the 3,421 studies identified in the search, 76 passed stage 1 criteria and were keyworded, and 22 were included in the in-depth review.

- The majority of the studies (N=57) were from the USA; six were from the UK.

- Most studies (N=54) had curriculum as their topic focus; the most common curriculum areas were science (N=23), mathematics (N=17), and literacy – first language (N=12).

- Fifty-eight of the studies described CPD which was collaborative in nature; 18 studies focused on individually oriented CPD.

- In the majority of studies (N=53), the specialist was HEI-based; 20% of studies described CPD

Table 3.10 Outcomes (N = 76*)

Outcomes	
Teacher outcomes	
Teacher behaviour	49
Teacher knowledge	44
Teacher skills	41
Teacher attitudes	33
Teacher understanding	28
Teacher beliefs	18
Teacher motivation	17
Teacher morale	10
Student/pupil outcomes	
Student/pupil learning	27
Student/pupil motivation	18
Student/pupil achievement	16
Subject knowledge	14
Student/pupil self-esteem	4
Other (Please specify.)	15

* Codes are not mutually exclusive; most studies had several outcomes.

which involved an internal specialist.

- On the whole, specialists based their CPD on both formal input (N=64) and ongoing mentoring/coaching support (N=65). There were also elements of peer support/coaching in the majority of programmes (N=58).

- The most common teacher outcomes were changes in behaviour (N=49), knowledge (N=44) and skills (N=41).

- The most common pupil outcomes were changes in learning (N=27), motivation (N=18), and achievement (N=16).

CHAPTER FOUR
In-depth review: results

The first part of this chapter presents descriptive information about the 22 studies which were judged to have met all the criteria for inclusion and which were subsequently reviewed in-depth (sections 4.1 to 4.3). In section 4.4, we report our synthesis of the main findings. Data which provide evidence relevant to the review question are presented in tables and described in the text under a series of separate headings and subheadings.

4.1 Selecting studies for in-depth review

The studies that were subjected to in-depth review had met, successively, three sets of inclusion criteria (Appendix 2.1). These were designed to ensure the studies were of sufficient quality and able to provide evidence of impact as well as details about the role of the specialist in CPD processes that was relevant to our review question and sub-questions. Tests for relevance and quality included analyses of information about the study designs and the processes involved in the CPD described in the studies. We based the in-depth review on studies that demonstrated the impact of specialist input on pupil learning as well as teacher change.

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

In this section, we describe the broad characteristics of the 22 studies, which were reviewed in depth, and compare them with the characteristics of the studies in the systematic map as a whole (including the studies reviewed in-depth, N=76).

From EPPI-Centre keywords

Identification of the studies

Most studies in the in-depth review were identified

through citations in other research. Of those that came to light through searching databases, the majority came through ERIC. A similar situation was found regarding the identification of studies for the systematic map (i.e. those studies which were judged to have met the stage 1 inclusion criteria).

Countries of studies in the in-depth review

In line with the high proportion of the studies from the USA (75%) in the systematic map, the majority of studies in the in-depth review came from the USA too (73%).

Educational settings of the studies in the in-depth review

As in the systematic map, primary schools were the main setting for the studies. Secondary schools were also frequent sites for the CPD (18%) but not to the same extent as in the systematic map (35%). Middle schools were the setting for the CPD in a similar proportion of studies in both the map and the in-depth study (about 27%). In most cases, secondary based studies failed to be included in the in-depth study either because there was a lack of evidence of the steps taken to ensure the validity and reliability of the data analysis (N=10), or because they did not describe the CPD processes in sufficient detail for this review (N=9).

Topic focus of the studies in the in-depth review

Due to the nature of the review, 'Teacher careers' and 'Teaching and learning' were topic foci of all the studies. The spread of other topic foci were similar in the in-depth review and the systematic map. 'Curriculum' formed the majority of other areas of interest in both the map (69%) and in the in-depth review (82%).

Table 4.2.1a
Identification of the studies
(N = 22*)

Identification	
Citation	15
Electronic database	7

* Codes are mutually exclusive.

Table 4.2.1b
Studies identified though database
searching (N = 7*)

Electronic database	
ERIC	5
Ingenta	2

* Codes are mutually exclusive.

Table 4.2.2
Countries of studies (N = 22*)

Country	
USA	16
Canada	1
China	1
Korea	1
South Africa	1
Taiwan	1
UK: England	1
UK: Scotland	1

* Codes are not mutually exclusive.

Table 4.2.3
Educational settings (N = 22*)

Educational setting	
Primary school	15
Secondary school	4
Special needs school	2
Independent school	1
Other educational setting	7

* Codes are not mutually exclusive; of the 'Other' category, six were middle schools.

Table 4.2.4
Topic focus (N = 22*)

Topic focus	
Teacher careers	22
Teaching and learning	22
Curriculum	18
Classroom management	2
Assessment	1
Equal opportunities	1
Other topic focus	5

* Codes are not mutually exclusive.

Table 4.2.5
Curriculum (N = 22*)

Subject/curriculum area

Literacy - first language	7
Science	5
ICT	5
Mathematics	3
General	2
Special educational needs	2
Literacy - further languages	1

* Codes are not mutually exclusive.

Table 4.2.6
Types of CPD reported in the studies in the in-depth review (N = 22*)

Type of CPD

Collaborative	19
Individually oriented	3

* Codes are mutually exclusive.

Table 4.2.7
Types of specialist in the CPD in the studies reported in the in-depth review (N = 22*)

Status of specialist

External: HEI	15
External: LA	5
External: commercial not LA	1
Internal: CPD co-ordinator	1
Internal: other	3

* Codes are not mutually exclusive.

Table 4.2.8
Types of CPD practice/intervention in the studies in the in-depth review (N = 22*)

Practice/intervention

Experimenting	22
Specialist coaching	15
Modelling	13
Workshops	11
Observation with specialist feedback	12
Action research	1

* Codes are not mutually exclusive.

Table 4.2.9
Types of peer support in the studies in the in-depth review (N= 22*)

Practice/intervention

Peer support	19
Planning schemes of work	6
Peer observation	6
Sharing practice	6
Peer coaching	3
Study groups	2
Team teaching	2

* Codes are not mutually exclusive.

Curriculum focus of the studies in the in-depth review

Of the curriculum areas in the studies in the in-depth review, the most frequently occurring were Literacy – first language, Science, Mathematics and ICT in both the map and the in-depth review. These subjects made up approximately 78% of the curriculum areas. The proportion of studies with a science curriculum focus dropped to 28% in the in-depth review from 43% in the map. This is because five of the science studies provided teacher impact data only, and therefore failed the stage 3 criterion. Only one study with Literacy – first language as its curriculum focus failed this criterion, and this curriculum area became the most frequent in the in-depth review.

From review-specific keywords

Types of CPD

Consistent with the findings from the second EPPI-Centre review of CPD, the proportion of collaborative to individually oriented CPD reported increased from the map to the in-depth stage. By 'individually-oriented studies', we mean those in which the CPD designs had no explicit inbuilt opportunities or strategies for teacher to teacher support. In the map, 74% of the studies focused on collaborative CPD; this rose to 86% of the in-depth studies. The three studies of individually oriented CPD are Fortino *et al.* (2002), Mink and Fraser (2002), and Sawka *et al.* (2002). In order to clarify differences and similarities in the role of the specialist in collaborative and individually oriented CPD, studies of individually oriented CPD are asterisked (*), and commented on separately where appropriate.

Status of specialist

In the systematic map, 81% of the specialists were external. A similar situation existed in the in-depth studies, where, of 31 specialists, 87% were external. The proportion of internal specialists explicitly identified was therefore 13% in the in-depth studies. In two cases, the internal specialists were other teachers who were trained as specialists during the intervention, and, in one case, a lead teacher who was also an MA graduate.

Type of practice/intervention

Experimenting, modelling, training, workshops and specialist coaching were prominent features in the in-depth review. One point noted by the reviewers is that the proportion of studies that explicitly described the CPD as 'action research' fell from 10% to 4% from the systematic map to the in-depth review stage. However, several of the included studies described CPD interventions that included core features of action research, such as teachers exploring the evidence about questions of interest to them.

Specialists modelled practice, either in workshops or in the classroom, in over half of the studies (N=13). Modelling was not a feature in several of the programmes which had a greater emphasis on practitioners developing their own teaching units, based on knowledge acquired during the CPD *(e.g. Cho, 2002; Lin, 2002; Swafford et al., 1999).*

In the majority of cases (N=10), workshops took place on school premises.

Peer support (including peer observation, sharing practice and peer coaching) was a feature of all the collaborative studies in the in-depth review (N=19; 86% of the total), although the nature of peer support varied among the studies. This ranged from joint activities, such as planning schemes of work within training sessions, to team teaching, and teachers themselves providing specialist input (Table 4.2.9).

Outcomes/impact

As a result of our interest in exploring specialist roles and activities in the context of positive teacher and student outcomes, the proportion of studies reporting both teacher and student outcomes rose sharply between the systematic map and the in-depth review stage. Improvements in pupil learning were an outcome of 36% of the mapped studies, but reported in 75% of the in-depth studies. Pupil impact data in the remaining studies reflected changes in motivation and self-esteem. Changes in teacher behaviour were reported in 67% of the mapped studies, whereas all but one of the in-depth studies reported on this outcome.

These differences reflect the nature of the inclusion criteria at stages 1 and 2. The stage 1 criteria refer to including studies, which set out to measure impact on students and teachers. Those in stage 2 stipulate that studies report robust findings in relation to student and teacher outcomes. All studies in the in-depth review had at least one student outcome. More details on teacher and pupil outcomes can be found in Appendix 4.1.

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

This section presents further details of the 22 studies that were reviewed in depth. As described in other parts of this report, in-depth reviewing was conducted through a data-extraction process facilitated by EPPI-Centre software. The data came from both the generic data extractions and the review-specific data extractions. The latter were designed specifically to generate information relevant to answering our review question and pre-specified sub-questions.

Table 4.3.1 Research literature informing the studies (N = 22*)

Type of literature	Number	Studies
Teaching and learning mainly	9	Bryant *et al*. (2001), Cho (2002), Fortino *et al*. (2002)*, Klingner *et al*. (2004), Lin (2002), Martin *et al*. (2001), Mink and Fraser (2002)*, Reis *et al*. (1998), Sawka *et al* (2002)*
CPD mainly	7	Boudah *et al*. (2003), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Harvey (1999), Jacobsen (2001), Sandholtz (2001), Wilkins (1997)
Both	6	Greenwood *et al*. (2003), Harwell *et al*. (2001), McCutchen *et al*. (2002), Rodrigues *et al*. (2003), Swafford *et al*. (1999), Zetlin *et al*. (1998)

* Codes are not mutually exclusive.

Table 4.3.2 Aims of the studies in the in-depth review (N = 22*)

Area which the study set out to explore/test	Number	Studies
Changes in students' performance or attitudes	22	Boudah *et al*. (2003), Bryant *et al*. (2001), Cho (2002), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Fortino *et al*. (2002)*, Greenwood *et al*. (2003), Harvey (1999), Harwell *et al*. (2001), Jacobsen (2001), Klingner *et al*. (2004), Lin (2002), Martin *et al*. (2001), McCutchen *et al*. (2002), Mink and Fraser (2002)*, Reis *et al*. (1998), Rodrigues *et al*. (2003), Sandholtz *et al*. (2001), Sawka *et al*. (2002)*, Swafford *et al*. (1999), Wilkins (1997), Zetlin *et al*. (1998)
Impact on teaching and learning of introducing specific pedagogic strategies	19	Boudah *et al*. (2003), Bryant *et al*. (2001), Cho (2002), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Greenwood *et al*. (2003), Harvey (1999), Harwell *et al*. (2001), Jacobsen (2001), Klingner *et al*. (2004), Lin (2002), Martin *et al*. (2001), McCutchen *et al*. (2002), Mink and Fraser (2002)*, Reis *et al*. (1998), Sawka *et al*. (2002)*, Swafford *et al*. (1999), Wilkins (1997), Zetlin *et al*. (1998)
Impact of a specific teacher development model / programme	18	Boudah *et al*. (2003), Bryant *et al*. (2001), Cho (2002), Fine and Kossack (2002), Fortino *et al*. (2002)*, Harvey (1999), Jacobsen (2001), Klingner (2004), Lin (2002), Martin *et al*. (2001), Mink and Fraser (2002)*, Reis *et al*. (1998), Rodrigues *et al*. (2003), Sandholtz *et al*. (2001), Sawka *et al*. (2002)*, Swafford (1999), Wilkins (1997), Zetlin *et al*. (1998)
Impact of CPD which aimed to develop teachers' knowledge, understanding or skills	16	Boudah *et al*. (2003), Bryant *et al*. (2001), Cho (2002), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Harvey (1999), Jacobsen (2001), Klingner *et al*. (2004), Lin (2002), Martin *et al*. (2001), McCutchen *et al*. (2002), Reis *et al*. (1998), Sandholtz *et al*. (2001), Sawka *et al*. (2002)*, Swafford (1999), Zetlin *et al*. (1998)
Changes in teachers' beliefs, attitudes, motivation, morale	5	Boudah *et al*. (2003), Bryant *et al*. (2001), Cho (2002), Klingner *et al*. (2004), Zetlin *et al*. (1998)

* Codes are not mutually exclusive.

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

One of the inclusion criteria stipulated that the included studies should show 'how they have used what is known already', through descriptions of the main literature sources they used. An analysis of the background literature revealed that researchers tended to focus their review of existing research either on CPD theory and practice or on teaching and learning issues.

As in our previous reviews, we identified two broad fields of literature: CPD and pedagogy. Fifteen studies referred to research literature on specific strategies and interventions in relation to teaching and learning. These ranged from research about literacy learning to student behaviour. For example:

- Cho (2002) drew on literature related to constructivist approaches in the teaching of science.

- Fortino *et al.* (2002) described research into literacy skills and enquiry-based science methods.

- Klingner *et al.* (2004) made reference to work into effective reading comprehension strategies.

- Reis *et al.* (1998) cited research about pedagogy aimed at models of enriching the education of gifted and talented students.

- Sawka *et al.* (2002)* drew on evidence from several sources in reference to effective behavioural interventions.

Thirteen reports referred to studies that made specific reference to the theoretical and empirical literature about CPD. For example:

- Boudah *et al.* (2003) constructed their research on what is known about content enhancement instructional strategies, critical barriers to accessing teacher friendly research reports, and matching teacher needs with in-service topics and instructional formats.

- Greenwood *et al.* (2003) described research on increasing the collaboration between researchers and teachers through coaching.

- Rodrigues *et al.* (2003) explored the theory and practice of effective CPD and models of pedagogic content knowledge.

- Swafford *et al.* (1999) drew on research on teacher reflection on 'newly acquired content and pedagogical content knowledge in an atmosphere of peer collaboration and support'.

- Sandholtz (2001) was informed by previous research about how technology use is acquired and transmitted among teachers.

- Wilkins (1997) referred to research that showed the benefits of teacher-teacher mentoring in the subject area of mathematics.

Two studies of individually oriented CPD (Fortino *et al.*, 2002*; Mink and Fraser, 2002*) referred almost entirely to literature on teaching and learning. Sawka *et al.* (2002)* drew on teacher surveys and National Staff Development and Training Association (NSDTA) material.

4.3.2 Study aims

As in the previous reviews, we were able to allocate the studies in the in-depth review into five main categories according to the aims of the studies (as opposed to the aims of the CPD itself). The studies primarily aimed to explore and/or test: changes in students' performance or attitudes; the impact on teaching and learning of introducing specific pedagogic strategies; the impact of a specific teacher development model / programme; the impact of CPD which aimed to develop teachers' knowledge, understanding or skills; and changes in teachers' beliefs, attitudes, motivation and morale.

None of the studies of individually oriented CPD set out to explore the impact of programmes which aimed to bring about changes in teachers' beliefs, attitudes, motivation and morale. Only one of the studies of the individually oriented CPD set out to explore the impact of CPD on teacher knowledge and skills.

4.3.3 Who were the specialists?

All the studies involved inputs from external specialists (Table 4.3.3). Most frequently external specialists came from institutes of higher education (N=15). In two cases, some of the external specialists were teachers from other schools (Jacobsen, 2001; Sandholtz *et al.*, 2001). The remaining studies (N=5) were unclear as to who the specialists were.

Internal specialists were less likely to play a major role in the strategic direction of the CPD. In the small number of cases (N=3) where they were explicitly mentioned, internal experts in two studies were other teachers, and in one study were other teachers and pupils (Ertmer and Hruskocy, 1999). No studies reviewed in depth, therefore, described headteachers, heads of department or subject co-ordinators as specialists.

None of the individually-oriented CPD involved the contribution of an internal specialist.

Table 4.3.3 The status of specialist (N = 22*)

Status of specialist	Number	Studies
External specialist	22	Boudah *et al.* (2003), Bryant *et al.* (2001), Cho (2002), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Fortino *et al.* (2002)*, Greenwood *et al.* (2003), Harvey (1999), Harwell *et al.* (2001), Jacobsen (2001), Klingner (2004), Lin (2002), Martin *et al.* (2001), McCutchen *et al.* (2002), Mink and Fraser (2002)*, Reis *et al.* (1998), Rodrigues *et al.* (2003), Sandholtz *et al.* (2001), Sawka *et al.* (2002)*, Swafford *et al.* (1999), Wilkins (1997), Zetlin *et al.* (1998)
Internal specialist	3	Ertmer and Hruskocy (1999), Lin (2002), Wilkins (1997)

* Codes are not mutually exclusive.

Table 4.3.4 Design and leadership of the CPD (N = 22*)

Design and leadership of the CPD	Number	Studies
The specialist was involved in designing the CPD	20	Boudah *et al.* (2003), Bryant *et al.* (2001), Cho (2002), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Greenwood *et al.* (2003), Harwell *et al.* (2001), Jacobsen (2001), Klingner *et al.* (2004), Lin (2002), Martin *et al.* (2001), McCutchen *et al.* (2002), Mink and Fraser (2002)*, Reis *et al.* (1998), Rodrigues *et al.* (2003), Sandholtz *et al.* (2001), Sawka *et al.* (2002)*, Swafford *et al.* (1999), Wilkins (1997), Zetlin *et al.* (1998)
The specialist led the CPD	17	Boudah *et al.* (2003), Bryant *et al.* (2001), Cho (2002), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Greenwood *et al.* (2003), Klingner *et al.* (2004), Lin (2002), Martin *et al.* (2001), McCutchen *et al.* (2002), Mink and Fraser (2002)*, Reis *et al.* (1998), Rodrigues *et al.* (2003), Sawka *et al.* (2002)*, Swafford *et al.* (1999), Wilkins (1997), Zetlin *et al.* (1998)
Specialist(s) encouraged practitioners to take on leadership of their own CPD.	14	Boudah *et al.* (2003), Cho (2002), Fine and Kossack (2002), Greenwood *et al.* (2003), Harvey (1999), Harwell *et al.* (2001), Jacobsen (2001), Klingner *et al.* (2004), Lin (2002), Martin *et al.* (2001), Rodrigues *et al.* (2003), Sandholtz *et al.* (2001), Wilkins (1997), Zetlin *et al.* (1998)

* Codes are not mutually exclusive.

Table 4.3.5 Methods of data collection (N = 22*)

Method	
Pre- and post-intervention	15
Control group	7

* Codes are not mutually exclusive.

4.3.4 Design and leadership of the CPD

Twenty studies described CPD in which the specialists in the study were involved in designing the programmes (Table 4.3.4). In one study the programme had been designed elsewhere (Harvey, 1999).

4.3.5 Nature of the CPD

We used a set of review-specific keywords to code the types of interventions, which formed the basis of the CPD. In the 22 studies in the in-depth review, we found the following:

- Nineteen programmes involved specialists in encouraging and organising peer support as a learning strategy. One of the individually oriented CPD programmes seemed to involve the specialists in proving a similar level of in school support. Teachers discussed and planned together, shared practice, observed lessons and fed back to each other, and undertook peer coaching.

- In 14 studies, peer support becomes strategic since there was evidence that the specialist(s) encouraged self-directed peer support in which teachers acted independently but within the strategic framework of the CPD in order to identify their professional learning needs and to support each other (Bryant *et al.*, 2001; Cho, 2002; Fine and Kossack, 2002; Harvey, 1999; Harwell *et al.*, 2001; Klingner *et al.*, 2004; Lin, 2002; Martin *et al.*, 2001; McCutchen, *et al.*, 2002; Rodrigues *et al.*, 2003; Sandholtz *et al.*, 2001; Swafford *et al.*, 1999; Wilkins, 1997; Zetlin *et al.*, 1998).

- All the studies explored CPD in which the specialists presented teachers with knowledge about teaching and learning strategies followed by various types of support, such as modelling, workshops, observation and feedback, coaching, and planned and informal meetings for discussion.

- All the CPD programmes described activities that offered teachers the opportunity to experiment in terms of trying out and evaluating methods and/or materials which were new to them.

- Sixteen of the programmes reported explicitly efforts to support relationship building as part of specialists' contribution to creating an effective professional learning environment.

- Eleven of the programmes also reported efforts by specialists to align programmes with the views of school leaders.

- In nine studies, the specialist(s) supported teachers' engagement in activities that would help to sustain the CPD in the longer term (Boudah *et al.*, 2003; Cho, 2002; Greenwood *et al.*, 2003; Harvey, 1999; Jacobsen, 2001; Klingner *et al.*, 2004; Sandholtz, 2001; Sawka *et al.*, 2002; Wilkins, 1997).

- The ways in which specialists went about these common clusters of activities varied, depending on the specific contexts or goals of the programme.

4.3.6 Weight of evidence (WoE)

Given the broad fields of research from which we drew relevant studies, the methodologies adopted across the in-depth studies showed surprisingly consistent features. Most of the studies used a form of pre- and post-intervention data collection, and seven studies made use of a control group.

Nonetheless a condition of a medium or high weight of evidence judgement was that the study made use of multiple sources of data. These included teacher and student questionnaires, teacher monitoring diaries, interviews and tests. Classroom observation (using observation protocols and instruments) was the most common form of data collection, closely followed by teacher interviews.

Weight of evidence A

Of the five high WoE studies, two used comparison groups and two used pre- and post-tests and observations. The fifth study (Reis *et al.*) involved an intervention spanning two entire schools which had integral monitoring and evaluation processes which captured impact data, including student and teacher outputs, throughout the life of the intervention. The researchers clearly explained the steps taken to ensure that both data analysis and data collection were reliable and valid, and they used a wide range of independently collected and well-reported qualitative and quantitative data to support their findings.

The majority of the studies were categorised as medium WOE, either because although the design looked robust there was insufficient information about aspects of the methodology to make a wholly reliable judgement about trustworthiness, or because there were difficulties in certain areas, such as an element of the study design (e.g. sample size) or a degree of reliance on teacher perception data to determine student impact.

Low WoE A was assigned to two studies: (i) many of the data-collection tools were being piloted but not fully tested in the study by Rodrigues *et al.* (2003); and (ii) it was felt by Fortino *et al.* (2002) that the research question required further detailed description of the teaching strategy and actual teacher practice to be answered effectively.

Table 4.3.6
Methods of data collection (N = 22*)

Method	
Classroom observation	15
Teacher interview	13
Teacher diaries	10
Teacher questionnaire	9
Student assessment	8
Teacher tests	6
Student interview	4
Student questionnaire	4
Student journals	1

* Codes are not mutually exclusive.

Table 4.3.7 Design and leadership of the CPD (N = 22*)

Item	WoE A	WoE B	WoE C	WoE D
Boudah et al. (2003)	Medium	Medium	Medium	Medium
Bryant et al. (2001)	Medium	High	Medium	Medium
Cho J (2002)	Medium	Medium	High	Medium
Ertmer and Hruskocy (1999)	Medium	Medium	High	Medium
Fine and Kossack (2002)	Medium	Medium	Low	Medium
Fortino et al. (2002)*	Low	Low	Low	Low
Greenwood et al. (2003)	Medium	Medium	Medium	Medium
Harvey (1999)	Medium	Medium	Medium	Medium
Harwell et al. (2001)	Medium	Low	Low	Low
Jacobsen (2001)	Medium	High	High	High
Klingner et al. (2004)	High	Medium	Medium	Medium
Lin (2002)	Medium	Medium	Medium	Medium
Martin et al. (2001)	Medium	High	Medium	Medium
McCutchen et al. (2002)	High	High	High	High
Mink and Fraser (2002)*	Medium	Medium	Low	Medium
Reis et al. (1998)	Medium	Medium	Low	Medium
Rodrigues et al. (2003)	Low	High	High	Low
Sandholtz (2001)	Medium	Medium	Medium	Medium
Sawka et al. (2002)*	High	Medium	High	High
Swafford et al. (1999)	High	High	Medium	High
Wilkins (1997)	Medium	Medium	High	Medium
Zetlin et al. (1998)	Medium	High	High	High

* Codes are not mutually exclusive.

Weight of evidence B

The seven studies assigned high WoE B consistently provided detail across all aspects considered in section 2.3.3: specifically, the implementation processes, contextual detail about the nature and design of the intervention, and of the settings and sample. Where a study was assigned medium WoE B, we considered that certain of this information was lacking. Cho (2002), for example, while setting out the background of their Science-Technology-Society (STS) programme and its transference to the Korean context, described in less detail the sample and settings in which it was carried out.

Weight of evidence C

All studies included in the in-depth review provided a certain amount of detail on specialist input, as this had been a stage 2 inclusion criterion. However, when we compared the contents of the reports, it was clear that the quantity and quality of this information varied a great deal. Medium weight of evidence was assigned to those studies which yielded unambiguous information relating to at least half the review-specific questions. Boudah *et al.* (2003), for example, described in detail how specialists involved practitioners in planning, the nature of the input sessions, and the type and frequency of follow-up support, but yielded little or no information on some of the other review-specific questions.

Some of the review-specific questions were answered in only a minority of studies, such as those relating to the following:

- embedding CPD within school goals and leadership

- taking steps to sustain professional development beyond the intervention

- making the local evidence base available to teachers

Studies which were given high WoE C typically provided answers to these in addition to the majority of the remaining questions. Wilkins (1997), for example, described in detail the context of the CPD, the strategies and support put in place by the specialist, and where the CPD fitted within the context of wider district objectives.

Weight of evidence D

Of the 22 studies in the in-depth review, three were excluded from the synthesis because of low WoE D ratings. Fortino *et al.* (2002)* was rated low WoE according to WoE criteria A-C. Harwell *et al.* (2001) was rated low in terms of WoE B and C. Rodrigues *et al.* (2003) was excluded in relation to its own trustworthiness (WoE A).

4.4 Synthesis of evidence

4.4.1 How do specialist inputs in CPD affect teachers, their learning and their pupils' learning?

Once data extraction had been completed and WoE assessed, we synthesised information from the included studies using reports and cross-tabulations generated by EPPI-Reviewer, supplemented by forays into the full reports to glean additional details about the interventions in the data tables. Only those studies with a medium to high overall weight of evidence rating were included in the synthesis, which meant that three of the studies in the in-depth review were excluded. The number of studies included in the synthesis is therefore 19, two of which are studies of individually oriented CPD (Mink and Fraser, 2002; Sawka *et al.*, 2002).

The studies which were scrutinised for this review were individually designed to identify the effects of CPD programmes as a whole on their target populations, including negative effects. The review itself, however, has been designed to isolate and report in detail on what we have found about the role of the specialist(s) within effective CPD programmes. In section 4.3, we presented the data extracted from the individual studies following a systematic interrogation using the EPPI-Centre data-extraction tools and processes. In this section, we have looked across the data in some detail to identify and cluster the specialist inputs.

The search strategy employed in this fourth review (see Chapter 2) by necessity bore similarities to the search strategies in the previous three CPD reviews. Unsurprisingly, therefore, a number of studies which formed the evidence base for earlier findings, have also provided data for the synthesis in this review. In total, 13 studies which appeared in the syntheses of the previous reviews were also included in the synthesis for the fourth review, having met the inclusion criteria of all three stages of the fourth review: Boudah *et al.*, 2003; Bryant *et al.*, 2001; Ertmer and Hruskocy, 1999; Fine and Kossack, 2002; Harvey, 1999; Jacobsen, 2001; Lin, 2002; Martin *et al.*, 2001; McCutchen *et al.*, 2002; Mink and Fraser, 2002; Sandholtz, 2001; Wilkins, 1997; Zetlin *et al.*, 1998.

In addition, six new studies passed the three stages of inclusion and were considered to contain sufficient weight of evidence to be included in the synthesis: Cho, 2002; Greenwood *et al.*, 2003; Klingner *et al.*, 2004; Reis *et al.*, 1998; Sawka *et al.*, 2002; Swafford *et al.*, 1999.

We would also draw the reader's attention to the fact that this review revealed only studies of CPD in which positive impacts are demonstrated, in spite of inclusion criteria which stipulated that included studies provide pupil outcome data, whether positive or negative.

Table 4.4.1 Aim of the CPD

Author(s)	Aim of the CPD
Boudah *et al*. (2003)	To support teachers in addressing the needs of academically diverse pupils using a specifically designed CPD model
Ertmer and Hruskocy (1999), Jacobsen (2001), Sandholtz (2001)	To advance teachers' use of ICT for professional and instructional support
Bryant *et al*. (2001), Fine and Kossack (2002), Greenwood, *et al*. (2003), Klingner *et al*. (2004), Zetlin *et al*. (1998)	To introduce and support teachers in the implementation of literacy teaching strategies
Fine and Kossack (2002)	To introduce coaching strategies to assist teachers in their development of a range of aspects of teaching and learning
Cho (2002), Harvey (1999), Lin (2002), Mink and Fraser (2002), Wilkins (1997)	To enable science/mathematics teachers to develop and implement activity-based teaching methods
Martin *et al*. (2001), Sawka *et al*. (2002)	To introduce and support teachers in the implementation of teaching strategies to support SEN pupils
McCutchen *et al*. (2002)	To increase teachers' knowledge of orthography and phonology, and the links between the two in a broader context of literacy instruction
Reis *et al*. (1998)	To introduce and support teachers in the implementation of gifted education pedagogy enrichment clusters to urban elementary schools
Swafford *et al*. (1999)	To enhance teachers' knowledge of mathematics and mathematics teaching and learning

The synthesis addresses four main areas:

What was the aim of the CPD described in the studies?   *4.4.2*

What was the impact of the CPD on teachers and on pupils?   *4.4.3*

What was the nature of the specialist contribution to the CPD programmes with positive outcomes?
4.4.4

Studies in the review

Nine of the studies were designed by the researchers to explore the effectiveness both of a particular pedagogical approach and of the CPD programme. Six studies were primarily concerned with investigating the impact of the pedagogical approach on student learning outcomes; the efficacy of the CPD per se was explored as an intervening variable. Four studies focused specifically on exploring the CPD programmes in terms of their impact on teacher behaviour, knowledge and skills.

All the studies were evaluations and included a range of measures. Pre- and post-tests were the most common form of student assessment (15 studies). Classroom observation also featured in 15 studies. Interviews, questionnaires and teacher

diaries were all used in over half the studies. Seven studies were controlled experiments.

A full list of the studies and their aims can be found in Appendix 4.1.

4.4.2 What was the aim of the CPD described in the studies?

Regardless of whether the researchers were primarily interested in exploring their CPD models or whether they were setting out to examine the impact of a particular pedagogical approach, all the CPD in the studies was designed to bring about changes in teachers' classroom practice. Student outcomes then provided an indication of how successful those changes were.

Of the studies included in the synthesis, eleven had a strong subject focus and seven were cross-curricular, including the three studies designed to improve teachers' use of ICT in their practice.

It was clear from the aims of the CPD that the specialists intended from the outset that their input would extend well beyond imparting new knowledge or introducing new skills. In these CPD programmes, the teachers' own professional learning – their ability to make the changes required for successful implementation of the new knowledge and skills - was clearly regarded,

to different degrees, as an integral part of the CPD design and of the specialists' own role. In section 4.4. therefore we have used the helpful distinction of Timperley *et al.* (2006) between teacher development and teacher learning to distinguish between the role of the specialist in introducing new knowledge and/or skills (the most prevalent form of teacher professional development in the UK) and their role in supporting and enabling professional learning (which is more rare in CPD generally but a strong feature in this work). Whatever the aims of the CPD programmes, they were all intended to be evaluated for their impact on teachers and students. The specialists therefore paid attention to the teachers' learning with varying degrees of explicitness in order to maximise the likelihood of their implementation of the new approaches. They wanted to be sure the teachers were able to put what they had learned into practice and that the experiences and/or outcomes for the teachers' students would be capable of evaluation by the research teams.

4.4.3 What was the impact of the CPD on teachers and on pupils?

All the CPD programmes in studies in the in-depth review report positive outcomes for students and for teachers. Only those whose assessment of the weight of evidence was medium or high (see Table 4.3.7) were included in this synthesis.

Beyond establishing the nature of the impact on teachers and pupils resulting from the programmes reported in the studies included in the synthesis, we wanted to see if it was possible to identify the extent of the changes which resulted from the CPD in relation to the specialist inputs. We therefore attempted to calibrate the impact of the intervention on both teachers and students, as we have done in previous reviews, and aimed to explore whether there were correlations between these and variations between sub-groupings of the approaches. In the event, neither the extent of the impact or the weight of evidence assessment could be connected with distinctions between subsets of specialist inputs. Broadly speaking, the specialist inputs had more in common than distinguishing characteristics. The distinctions in impact seemed to relate more to factors such as scale of the aims of the CPD, than to particular variations in subsets of specialist inputs per se.

We were similarly frustrated in our attempts to provide an adequate answer to the fourth review question on whether there were differences between the type of specialist and the nature of their contributions to CPD. This was due to the way in which CPD was reported in the included studies, The distinction between the inputs of internal and external specialists (question 4.1) was difficult to discern, in that all studies described CPD with external specialist facilitation. The three studies which reported on CPD involving internal specialists (Ertmer and Hruskocy, 1999; Lin, 2002; Wilkins,

1997) did not provide enough detail on their role and activities for us to draw any meaningful distinctions between the input of external and internal specialists

Equally, the studies failed to set out in sufficient detail the differences between the contributions of the researcher-specialist as against those of other specialists involved in the programme. Furthermore, we were not able to find categorical evidence in any of the studies that the researcher was not also involved in some capacity as a specialist in the programmes, making an adequate response to question 4.2 also difficult.

Pupil outcomes

Eighteen of the 19 studies set out to identify changes in pupil learning and achievement as a means of assessing the impact of new practice. Changes in learning and achievement were reported in the following areas of:

- improved knowledge of scientific concepts and problem solving (Cho, 2002)

- improved mathematical skills (Wilkins, 1997)

- improved literacy skills (Bryant *et al.,* 2001; Fine and Kossack, 2002; Greenwood *et al.,* 2003; Klingner *et al.,* 2004; McCutchen *et al.,* 2002)

- improved engagement with classroom activities (Boudah *et al.,* 2003; Harvey, 1999; Jacobsen, 2001; Lin, 2002; Martin *et al.,* 2001; Sawka *et al.,* 2002; Zetlin *et al.,* 1998)

- improved reasoning and problem solving skills (Jacobsen, 2001; Martin et al; Reis *et al.,* 1998; Swafford *et al.,* 1999)

- increased use of ICT (Ertmer and Hruskocy, 1999; Sandholtz, 2001)

Affective changes among pupils also featured in several studies and was the core focus of the Mink and Fraser study (2002). Improved pupil engagement in classroom activities were interpreted as an outward manifestation of an increase in motivation, but studies also referred explicitly to changes in pupil confidence and self-esteem (Ertmer and Hruskocy, 1999; Wilkins, 1997; Zetlin *et al.,* 1998), and improved attitudes to learning (Mink and Fraser, 2002).

Teachers

One benefit of attempting to calibrate variations in the extent of impact was that we developed a fine-grained portrait of the outcomes CPD programmes were aiming at and in fact realised. This helped us map the nature of the outcomes. These are described below in order to set the processes we describe later in this section in context.

The teachers embedded the targeted changes in their practice in every case in ways that were sustainable. For the purposes of the review, we have defined the embedded changes as changing practice – as distinct from acquiring knowledge and/or understanding. As we shall see in section 4.4.4, the distinction is important in terms of our understanding of the nature of the specialist contribution. Changes in teacher practice resulted from one or more of the following:

- learning more about their subject – for example, McCutchen *et al*. (2002), where teachers learnt phonology and orthography and, with support from the specialist and from each other, changed their teaching accordingly

- learning more about learning – for example, Cho (2002), where teachers learned about constructivism and cognitive theories and implemented new teaching approaches with support from the specialist and from each other

- learning new ways of teaching – for example, Lin (2002) or Swafford *et al*. (1999), where, with support from the specialist and from each other, teachers' approaches in the classroom became more problem-focused and inquiry oriented

Seven studies reported changes in teacher practice following the use of specific strategies designed to meet the needs of teachers and learners in a particular curriculum area; for example, in Klingner *et al*.'s study (2004), teachers aimed to improve literacy learning through collaborative strategic reading.) In 12 studies, the teachers implemented more 'generic' teaching practices, with potential for application in other curriculum areas, even when these were introduced within a specific curriculum context. For example, teachers in the study by Reis *et al*. (1998) used advanced thinking skills, such as problem-solving and creative thinking and they also used more strategies within their classroom for differentiation and tasks that encouraged students in the classroom.

The range of knowledge and understanding explored

Measurement of the acquisition of new knowledge was often closely linked with change in practice. In Ertmer and Hruskocy (1999), for example, teachers completed questionnaires describing how they employed ICT in the classroom. When analysing these statements, the researchers were able to establish improved knowledge of software packages and their use. Teacher change was reported in the following areas:

- *Teaching strategies* (eight studies). The teaching strategies to which the teachers were introduced varied. They ranged from specific techniques - e.g. Bryant *et al*. (2001) and Klingner *et al*. (2004) where teachers were taught collaborative strategic reading – to more general approaches.

Examples of the latter include Harvey (1999) where teachers developed their questioning skills and Sawka *et al*. (2002) where teachers increased their knowledge of classroom management strategies.

- *Learning theories* (five studies). Teachers increased their theoretical knowledge of aspects of teaching and learning such as constructivism and cognitive theories (Cho, 2002; Lin, 2002; Martin *et al.,* 2001; Swafford *et al.,* 1999; Zetlin *et al.,* 1998).

- *The use of technology (particularly ICT) in the classroom* (three studies). Teachers gained a greater understanding of how technology could be used to enhance teaching and learning (Ertmer and Hruskocy, 1999; Jacobsen, 2001; Sandholtz, 2001).

- *Educational policy* (two studies). In Cho (2002), teachers reported that their awareness of science education reforms increased through the programme; in Swafford *et al*. (1999), teachers increased their knowledge of curriculum standards

- *Subject knowledge* (two studies). In McCutchen *et al*. (2002), teachers improved their phonological knowledge; in Swafford *et al*. (1999), teachers extended their knowledge of probability, statistics, geometry and algebra.

Teachers' beliefs, attitudes, motivation, morale

Consistent with the findings from previous reviews was the positive impact of the CPD on a range of affective factors. Chief amongst these (eight studies were explicitly identified and reported on it, but we can infer more from the experimental approach found in so many of the studies, see section 4.3) were increased teacher confidence and a greater willingness to take risks. Teachers in all the studies demonstrated an increased willingness to try new approaches to teaching. Teachers also reported that CPD left them more open-minded about new approaches to teaching and less afraid to let go of control in the classroom.

Examples of the different ways in which teachers developed new confidence ranged from the use of new technology (Jacobsen, 2001) to moving away from textbook-based teaching (Cho, 2002). New confidence also extended to collaborative working and exposure to peers. For example, Fine and Kossack (2002) reported the professional growth they identified included:

- increased comfort with/or trust in peer assessment

- greater tolerance for environmental 'messiness' for group work

- the ability to be open-minded and accept

Table 4.4.2 Contact time in days and length of intervention

	Contact time	Point at which intervention by specialist(s) was completed
Mink and Fraser (2002)*	5 days	After one term
Sawka *et al.* (2002)*	> 10 days	After one term
Boudah *et al.* (2003)	4 days	Between one and two terms
Bryant *et al.* (2001)	> 10 days	Between one and two terms
Fine and Kossack (2002)	> 10 days	Between one and two terms
Martin *et al.* (2001)	3 days	Between two and three terms
Klingner *et al.* (2004)	4 days	Between two and three terms
Wilkins (1997)	7 days	Between two and three terms (The external specialist trained teachers to take over the specialist training role – they then became the specialists.)
Cho (2002)	> 10 days	Between two and three terms
Ertmer and Hruskocy (1999)	> 10 days	Between two and three terms
Zetlin *et al.* (1998)	> 10 days	Between two and three terms
Lin (2002)	> 10 days	Between two and three terms
McCutchen *et al.* (2002)	> 10 days	Between two and three terms
Reis *et al.* (1998)	> 10 days	Between two and three terms
Sandholtz (2001)	> 10 days	Between two and three terms
Harvey (1999)	7-10 days	Beyond one year
Swafford *et al.* (1999)	> 10 days	Beyond one year
Greenwood *et al.* (2003)	> 10 days	Beyond one year
Jacobsen (2001)	> 10 days	Beyond one year

Table 4.4.3 Timing of specialist support

Attribute	Number	Study
During school hours	5	Harvey (1999), Jacobsen (2001), Lin (2002), Mink and Fraser (2002), Sawka *et al.* (2002)
Outside of school hours	4	Cho (2002) (The CPD consisted of two one-week workshops during vacations and a series of semester meetings. During the programme, teachers had opportunities to develop the STS units, to work together and teach units in their classroom and to reflect their teaching using videotapes and comments from peer teachers. Moreover, the university science educators provided additional enrichment of content, including new trends in science during the workshops.) Ertmer and Hruskocy (1990), Fine and Kossack (2002), Swafford *et al.* (1999)
During and out of school hours	8	Boudah *et al.* (2003), Bryant *et al.* (2001), Greenwood *et al.* (2003), Klingner (2004), McCutchen *et al.* (2002), Sandholtz (2001), Zetlin *et al.* (1998), Wilkins (1997)

suggestions

We also found evidence in six studies (Boudah *et al.,* 2003; Ertmer and Hruskocy, 1999; Fine and Kossack, 2002; Jacobsen, 2001; Sandholtz, 2001; Wilkins, 1997) that teachers changed their attitude to the need for professional development, and towards their own ability to make a difference to their students' learning. For example, in Fine and Kossack (2002) the researchers stated that one teacher felt at the beginning of the study that experienced teachers had no need to plan in great detail for lessons, but that, over the course of the CPD, she found the peer coaching helped her to think how she could plan lessons better. Sandholtz (2001) found that 'informal teacher networks emerged that involved teachers communicating by phone, online, or in regular meetings to share success stories, demonstrate new skills and receive additional training'.

A summary of findings for each of the studies can be found in Appendix 4.1.

4.4.4 What was the nature of the specialist contribution to the CPD programmes with positive outcomes?

Our initial framework for analysis was shaped by our sub-questions, and was largely process-based. It was concerned with the role of the specialists in the design of the CPD programmes and the nature of their input in terms of new knowledge and skills.

However, when we looked at the data, it became clear that all of the specialists used a CPD model which combined 'new' specialist inputs with an ongoing programme of support for the teachers as they began to implement changes in their own classrooms. It also emerged that many of the specialists spent a considerable amount of time on this support, both in formal scheduled sessions and in 'on call' back-up. A core of common practices emerged, which included the following:

- modelling
- workshops
- observation
- feedback
- coaching
- planned and informal meetings for discussion

It was also clear that the specialists encouraged and guided the teachers in supporting each other in the majority of studies, although there were two studies of individually oriented CPD (Mink and Fraser, 2002*; Sawka *et al.,* 2002*) in which there were no structured opportunities for teacher collaboration. The time specialists spent with teachers was in most instances divided between input sessions and support sessions. Input sessions involved introducing teachers to new knowledge

and to new ways of doing things. Support sessions involved specialists in working with teachers to interpret and implement this knowledge or skill and to make the consequent changes to their practice. We therefore added to our analytic framework the dimensions of new inputs and ongoing support.

4.4.4.1 Timing and location

The amount of time most specialists spent with practitioners was extensive. In the majority of studies (N=13), the specialist met with teachers on ten occasions or more (see Table 4.4.2). The times stated in the studies need to be treated with care. As far as possible, reviewers recorded amounts of time spent in formal activities with teachers. What was not clear in the studies was the amount of informal or support or 'on call' support provided by the specialists. The most common amount of formal contact time was in excess of ten days.

In most of the studies (N=15), specialist intervention took place over one year or less (see Table 4.4.2). This is probably because research which lasts longer than one year means either following a cohort through into a new school year or working with different student cohorts – both of which are more complicated, and expensive projects.

In terms of the length of contact time, we found that, in the majority of cases, researchers reported sessions between specialist(s) and practitioner(s) lasting longer than two hours (Boudah *et al.,* 2003; Bryant *et al.,* 2001; Cho, 2002; Ertmer and Hruskocy, 1999; Martin *et al.,* 2001; McCutchen, *et al.,* 2002; Mink and Fraser, 2002; Sandholtz, 2001; Sawka *et al.,* 2002; Swafford *et al.,* 1999; Wilkins, 1997). In two studies (Harvey, 1999; Zetlin *et al.,* 1998), the length of the sessions was reported as being between one and two hours; and, in one study (Reis *et al.,* 1998), it was reported as one hour. In the remaining five studies, the length of the sessions was unclear.

As Table 4.4.3 shows, the majority of the studies (N=15) refer to activities held during school hours. This enabled the specialists to support the teachers as they implemented real time changes in their practice and to be in close connection with their students' responses.

Nearly all the specialist support took place on school premises (Boudah *et al.,* 2003; Bryant *et al.,* 2001; Cho, 2002; Ertmer and Hruskocy, 1999; Greenwood *et al.,* 2003; Jacobsen, 2001; Klingner *et al.,* 2004; Lin, 2002; McCutchen *et al.,* 2002; Mink and Fraser, 2002; Sandholtz, 2001; Sawka *et al.,* 2002; Wilkins, 1997; Zetlin *et al.,* 1998). One study (Martin *et al.,* 2001) was unclear about the site. Specialist support in one study (Fine and Kossack, 2002) took place in the HEI but with inbuilt and structured in-school peer support. More than half the CPD involved the specialists in

observing the teachers and providing feedback and debriefing. In only two studies (Fine and Kossack, 2002; Swafford *et al.*, 1999) was the CPD located entirely in an institute of higher education or other training centre.

4.4.4.2 Designing, leading and sustaining CPD

The studies show that the central role of the specialist at the design stage was a common feature of the CPD. In all but one of the studies, the specialist was involved in designing the CPD – in this study (Harvey, 1999) it was not clear whether this was the case.

The specialists also took the lead in getting CPD underway, but thereafter, in the majority of cases and to varying degrees, the specialist made efforts to distribute leadership among the practitioners.

Initially the specialist led the CPD in 16 of the studies (see Table 4.3.4). The type of leadership ranged from a directive, hands-on approach, in relation to the actions teachers should take in their classrooms (for example, Klingner *et al.*, 2004; Martin *et al.*, 2001; Mink and Fraser, 2002*; McCutchen *et al.*, 2002), to a more flexible model of CPD in which the specialists encouraged practitioners to take on leadership of their own CPD (for example, Lin, 2002; Fine and Kossack, 2002; Jacobsen, 2001).

Following the initial inputs in 14 studies, there were practical illustrations of steps specialists took to encourage practitioners to take on leadership of their own learning as the CPD progressed, including the following:

- teachers choosing their own teaching strategy (Boudah *et al.*, 2003; Fine and Kossack, 2002; Greenwood, 2003)
- teachers choosing the extent to which they were involved in CPD (Jacobsen, 2001)
- teachers developing original resources (Lin, 2002)
- teachers identifying their own objectives and goals (Boudah *et al.*, 2003)
- teachers creating their own teaching units based on specialist input (Cho, 2002; Martin *et al.*, 2001; McCutchen *et al.*, 2002; Reis *et al.*, 1998; Wilkins, 1997)
- teachers determining the content of their weekly meetings (Zetlin *et al.*, 1998)

In Jacobsen (2001), the teachers themselves determined the type and extent of CPD they wanted from an early stage. In this study, the specialists responded to teachers' needs and interests and facilitated relationship building, rather than took a direct lead themselves.

In the CPD described by Sandholtz (2001), the leadership of the CPD was shared between centre staff, researchers, outside experts and participants, who set the agenda together.

There was little evidence in the two studies of individually-oriented CPD that the specialist encouraged practitioners to take leadership of their own CPD.

Nine studies described the steps specialists took to ensure the CPD was sustained beyond the intervention (Boudah *et al.*, 2003; Cho, 2002; Greenwood *et al.*, 2003; Harvey, 1999; Jacobsen, 2001; Klingner *et al.*, 2004; Sandholtz, 2001; Sawka *et al.*, 2002*; Wilkins, 1997). Approaches to developing a culture of CPD in the school included the following:

- additional follow-up meetings at the beginning of the following school year (Boudah *et al.*, 2003)
- building schools' capacity to lead technology integration and new ways of teaching by working at all levels of an organisation in collaboration with school-based staff, parents, students and district personnel (Jacobsen, 2001)
- preparing teams of teachers who could become technology leaders in their own schools (Sandholtz, 2001)
- creating a self-sustaining system whereby an internal specialist was developed in each school (Wilkins, 1997)

While other studies made no explicit reference to specialists taking steps to sustain the CPD after the intervention, it could be inferred that CPD which contained a strong element of peer working had this as an implicit aim. For example, Zetlin *et al.* (1998) reported that the specialists encouraged several colleagues from the same school to become involved in the programme. They set up weekly meetings in which the teachers took an active part in setting the agenda.

4.4.4.3 Specialist inputs: making the public knowledge base available to teachers

In all the studies, specialists were instrumental in making teachers aware of available theoretical and empirical knowledge about particular aspects of teaching and learning. The following examples illustrate the range of the specialist inputs.

- Theory and evidence on subject-related strategies
    - Literacy (Bryant *et al.*, 2001; Greenwood *et al.*, 2003; Klingner *et al.*, 2004; Zetlin *et al.*, 1998)
    - Science-technology-society (Cho, 2002)
    - ICT (Jacobsen, 2001)

Table 4.4.4 Frequency of contact

Frequency of contact	Number	Study
Less than once a term	1	Martin *et al.* (2001)
Termly	1	Wilkins (1997) (The external specialist trained teachers who then became specialists -to train colleagues.)
Weekly to Monthly	11	Boudah *et al.* (2003), Bryant *et al.* (2001), Cho (2002), Harvey (1999), Ertmer and Hruskocy (1999), Fine and Kossack (2002), Klingner *et al.* (2004), Lin (2002), McCutchen *et al.* (2002), Mink and Fraser (2002), Swafford *et al.* (1999)
Weekly	3	Jacobsen (2001), Sawka *et al.* (2002), Zetlin *et al.* (1998)
Daily	1	Greenwood *et al.* (2003)
Unclear/Not stated	2	Reis *et al.* (1998), Sandholtz (2001)

- – Mathematics (Mink and Fraser, 2002*; Swafford *et al.,* 1999)

- Theory and evidence on cross-curricular strategies
  - – Unit Organiser Routine (Boudah *et al.,* 2003)
  - – Constructivist learning (Lin, 2002; Cho, 2002)
  - – Cognitive theory for deaf learners (Martin *et al.,* 2001)
  - – Enrichment strategies (Reis *et al.,* 1998)
  - – Emotional and behavioural disorders (Sawka *et al.,* 2002*)

As far as the input ('delivery') of new knowledge and skills was concerned, the studies varied considerably.

- Four studies reported mainly front-loaded inputs: Boudah *et al.* (2003) one day plus observation of trainer modelling the teaching strategy; Bryant *et al.* (2001) three in-service training days; Klingner *et al.* (2004) one-day workshop and multiple in-class demonstrations for teachers; Martin *et al.* (2001) three-hour in-service training sessions per day over three days.

In others, the inputs were more widely spread.

- Cho (2002) two one-week training sessions (winter and spring); Ertmer and Hruskocy (1999) two half-day in-service workshops (October and February); Harvey (1999) teachers had access to seven one-day workshops per year; Greenwood *et al.* (2003) a full faculty in-service in the spring of year 1 and in subsequent years; McCutchen *et al.* (2002) two-week in-service on knowledge development and lesson resource planning and three follow-up sessions; Mink and Fraser (2002) in-service courses for five full days during a 10-week period; Sandholtz (2001) five practicums held over the course of the academic year, plus a 20-day summer institute; Sawka *et al.* (2002)

four training days over a period of three months; Swafford *et al.* (1999) four-week training sessions, eight one-hour research seminars and six half-day seminars per year for three years.

4.4.4.4 Specialist support: facilitating changing practice

One of the sub-questions about the nature of the specialist contribution in which the review group was interested was the extent to which the contributions of specialists were oriented towards facilitation and capacity building. The answer appears to be that inputs of new knowledge and skills included strategies for communicating information as an element within initial workshop-based instruction. However, even this element of instruction or 'transmission' was consistently contextualised and brought to life (for example, through demonstrations and modelling). Eleven studies referred specifically to specialists modelling the teaching strategies as part of their input. All the studies reported ways in which the specialists provided follow-on support, intended to be enabling and facilitative, to support teachers in putting what they had learned into practice and directed towards growing teacher autonomy and control.

Contact time with the specialist was spread across the programme, but in the support sessions (as distinct from their inputs of 'new' knowledge) the specialist was concerned with providing teachers with the tools and environment for learning, rather than prescribing the content for learning.

Also consistent was the pattern of frequency: in 15 studies, the specialists met the teachers at least monthly across the life of the intervention (see Table 4.4.4). In some studies (Jacobsen, 2001; Greenwood *et al.,*2003; Ertmer and Hruskocy, 1999) the availability of call-up support from the specialists was explicitly mentioned but it is not clear how many of the researchers in the other

studies provided this level of support.

All the studies either reported regular meetings or scheduled workshops for group discussions and debriefings. Nine studies involved one-to-one sessions between the specialists and the teachers.

4.4.4.5 Core features of specialist support

It is clear from the range of their activities and the extent to which they tailored inputs to contexts that the specialists were 'experts' in more than a particular knowledge field. The data shows them to have an array of skills, ranging from specialist content knowledge to in-depth knowledge of effective professional development programmes and of evaluation and monitoring. They also acted as coaches and mentors, and in all but the two individually-oriented CPD programmes (Sawka *et al.*, 2002*; Mink and Fraser, 2002*), they encouraged and enabled teachers to support one another.

The examples below illustrate some of the different ways in which the specialists continued to support teachers as they changed their practice.

Jacobsen (2001) Specialists worked with the teachers in three schools in the following ways:

- carrying out observations and working alongside teachers, using new methods and discussing the results with them afterwards

- working with teachers to design appropriate assessments of student work

- gathering, organising and sharing resources with teachers and students

- leading professional conversations to build and extend teachers' understanding of fundamental teaching and learning issues

- providing scholarly and intellectual mentorship

- supplying ongoing, on-site support, both pedagogical and professional, for risk-taking and innovative practice

Boudah *et al*. (2003) The trainer returned and observed teachers practising the use of the instructional strategy in which they had been trained. In after-school meetings, the trainer provided group and individual feedback to teachers about their implementation. After several weeks, teachers met again with the trainer individually and in small groups to share successes, to troubleshoot problems, and to create necessary instructional modifications. Additional follow-up meetings were held at the beginning of the subsequent school year.

Greenwood *et al*. (2003) At least one external specialist (from a team comprising a researcher, two associates and two PhD students) was at the school between four and six hours daily. 'The current findings support the effectiveness of professional development approaches that extend beyond in-service work to include sustained classroom consultation to effect changes in classroom practice.'

Zetlin *et al*. (1998) Specialists developed peer teams as collegial supports to facilitate integrating new knowledge, behaviours, and materials into their daily teaching repertoires, and to share knowledge and resources of comprehensive language arts programme with other teachers at their school sites. Ongoing mentoring support of peer teams was provided by university faculty.

FACILITATING AND GROWING INDEPENDENCE

The degree to which specialists encouraged and promoted teacher independence in implementing change varied across the studies, and ranged from providing a framework in which practitioners take on responsibility for their own learning, to closely controlling input and testing for fidelity of implementation or effective learning.

At one end of the spectrum, the specialists introduced the CPD and provided the framework in which professional learning could take place, but the programme itself was designed so that teachers took on leadership of the CPD at an early stage. Jacobsen, for example, reported on a model of CPD, the Galileo Educational Network, based on relationship building. In this model, individual teachers determined the extent to which they wished to be involved in the programme's initiatives and on-site professional development and support. Eleven studies (Boudah *et al.*, 2003; Cho, 2002; Ertmer and Hruskocy, 1999; Fine and Kossack, 2002; Greenwood *et al.*, 2003; Harvey, 1999; Jacobsen, 2001; Klingner *et al.*, 2004; Lin, 2002; Martin *et al.*, 2001; Sandholtz, 2001) explicitly reported a CPD design in which participants could take on leadership of their own professional learning through choice of which practice would form the focus of the CPD and/or the type and degree of support they received.

In contrast, the main aim of the programmes described by Bryant *et al*. (2001), McCutchen *et al*. (2002) and Sawka *et al*. (2002) was to improve teacher knowledge of a subject area/ teaching strategy defined by the specialist. The CPD research design in these studies focused on specialists supporting teachers in faithfully assimilating new knowledge/ strategies which the specialists had prescribed.

CHANGING PRACTICE OF TEACHERS: STARTING POINTS AND EMOTIONAL CONTENT OF LEARNING

Thirteen studies explicitly reported that the CPD described approaches which took into account teachers' individual starting points: Boudah *et al.*, 2003; Bryant *et al.*, 2001; Cho, 2002; Fine and Kossack, 2002; Greenwood *et al.*, 2003; Jacobsen, 2001; Klingner *et al.*, 2004; Lin, 2002; Martin *et al.*, 2001; Sandholtz, 2001; Sawka *et al.*, 2002;

Wilkins, 1997; Zetlin *et al.*, 1998.

Ertmer argued that, in addition to first order barriers to professional improvement, such as lack of access to computers or inadequate technical support, programme design needed to address second order barriers, such as beliefs about teaching, established classroom practice or reluctance to change. In another study (Bryant *et al.*, 2001) teachers were specifically asked to specify barriers they thought would impede their ability to implement the strategy successfully. In nine studies, the specialist(s) had clearly paid attention to the teachers' different starting points with regard to the knowledge, skills and/or beliefs they brought with them to the CPD programme. In three cases (Bryant *et al.*, 2001; Greenwood *et al.*, 2003; Jacobsen, 2001) the specialists interviewed teachers before the CPD to get a sense of their personal knowledge about their students, their skills and beliefs about their teaching. In three programmes (Boudah *et al.*, 2003; Klingner, 2004; Lin, 2002) specialists observed teachers implementing new strategies and communicated to them early on what they needed to focus on individually in order to improve their performance. In one study, Sandholtz (2001), project co-ordinators reviewed teachers' written reflections each morning and made adjustments to the day's training based on the teachers' expressed needs.

As reported above, the specialists in many studies formed collaborative partnerships among teachers, as well as fulfilled a coaching or mentoring role themselves. Relationship building was an explicit aim of several of the programmes. In this way, frameworks were established in which affective reactions to the CPD could be accommodated. Sandholtz (2001), for example, reported how one teacher gained confidence to start talking about technology in the classroom after realising, through peer observation, that other teachers were not necessarily better at using it. In other studies (Jacobsen, 2001; Klingner *et al.*, 2004), the specialist took care not to rush teachers into implementing change before they were ready.

CHANGING PRACTICE OF TEACHERS: EXPERIMENTATION

In 14 studies, there was explicit reference to specialists encouraging teachers to experiment in their practice and to use colleagues for additional support: Boudah *et al.*, 2003; Cho, 2002; Fine and Kossack, 2002; Greenwood *et al.*, 2003; Harvey, 1999; Jacobsen, 2001; Lin, 2002; Martin *et al.*, 2001; McCutchen *et al.*, 2002; Mink and Fraser, 2002; Reis *et al.*, 1998; Sandholtz, 2001; Wilkins, 1997; Zetlin *et al.*, 1998.

Experimentation fell into roughly four categories:

- Practitioners developing their own teaching units based on increased pedagogical awareness (Cho, 2002; Harvey, 1999; Lin, 2002; Martin *et al.*, 2001; McCutchen *et al.*, 2002; Zetlin *et al.*, 1998)

- Practitioner adaptation of classroom practices introduced by the specialist (Fine and Kossack, 2002; Greenwood *et al.*, 2003; Mink and Fraser, 2002; Sandholtz, 2001; Wilkins, 1997)

- Practitioners developing their own lessons and materials within a teaching framework provided by the specialist (Boudah *et al.*, 2003; Reis *et al.*, 1998)

- Practitioners using the help of specialists to identify and employ materials and approaches to address individual problems (Jacobsen, 2001)

Examples of experimentation include the following:

- Martin *et al.* (2001): The teachers tried out the new approaches in the classroom. Interestingly, there is evidence that the British teachers (but not the Chinese teachers) adapted the activities to specific children and contexts.

- Reis *et al.* (1998): The more time that teachers had to work on their clusters and to experiment with this more inductive way of teaching, the more advanced the content and the more the diverse the cluster products and services became.

- Jacobsen (2001): 'We're taking our teaching style, we're adapting it and implementing new curriculum ideas, new teaching methodology, but it's all based on where we want to grow from and what we want to do...Teachers were encouraged to prototype ideas and approaches "on the fly" through the onsite support of Galileo teachers.'

- Sandholtz (2001): Experimentation was modelled by trainers 'By working in actual classrooms, participants observed the realities of incorporating technology into classroom instruction. In addition to observing innovative teaching strategies that worked smoothly, they saw teachers improvising or abandoning their plans when equipment wouldn't work. A teacher commented, 'The ability to experiment is really critical. Two years ago, I would not have imagined that I would have the [technology] that I have and the freedom to play with it like I have.'

As these examples illustrate, programmes which encouraged experimentation enabled professionals to adapt the content of the CPD to their individual circumstances. The evidence here also suggests that teachers became more confident in their practice. Experimentation is therefore an important element in facilitating professional learning and connecting it with student learning.

In addition to the studies in which there was explicit emphasis on the specialist encouraging experimentation within the programme, scope for experimentation can be reasonably inferred as taking place in the other five since the CPD

involved trying out and evaluating methods new to the teacher (Bryant *et al.,* 2001; Ertmer and Hruskocy, 1999; Klingner *et al.,* 2004; Sawka *et al.,* 2002; Swafford *et al.,* 1999).

CHANGING PRACTICE OF TEACHERS: SELF DIRECTING PEER SUPPORT

Evidence was present in 17 studies that practitioners were working collaboratively within the programme: Boudah *et al.,* 2003; Bryant *et al.,* 2001; Cho, 2002; Ertmer and Hruskocy, 1999; Fine and Kossack, 2002; Greenwood *et al.,* 2003; Harvey, 1999; Jacobsen, 2001; Klingner *et al.,* 2004; Lin, 2002; Martin *et al.,* 2001; McCutchen *et al.,* 2002; Reis *et al.,* 1998; Sandholtz, 2001; Swafford *et al.,* 1999; Wilkins, 1997; Zetlin *et al.,* 1998.

Of these, it was evident in all but two (Boudah *et al.,* 2003; Ertmer and Hruskocy, 1999) that the specialist had taken steps to ensure practitioners built up a certain level of autonomy and independence from the specialist in developing their practice, by ensuring that the CPD was, in part at least, a collaborative process between practitioners. Peer support, encouraged and facilitated by the specialist, took place in a number of ways, including peer observation, sharing practice, peer coaching, planning schemes of work, joint study groups and team teaching.

The following examples illustrate some of the ways in which this was achieved:

- Bryant *et al.* (2001): Teachers developed team schedules for implementing the strategy. 'The teachers in each team shared planning and advisory periods and worked collaboratively to address students' needs.'

- Harvey (1999): The author describes how he facilitated group discussion and emphasised cooperative planning and team teaching.

- Lin (2002): The whole project was a collaborative action research effort in which teachers identified their own areas for development and support. The lead cognitive peer coaching procedures were self-directed as teacher pairs worked alone together in lessons, keeping reflective personal journals and preparing videotapes or teacher worked with the teachers to discuss the constructivist view of learning and generate teaching plans based on the teaching format.

- Sandholtz (2001): The ACOT programme required participants to attend in teams of two to four so that teachers could support one another when returning to their respective schools. 'The two projects designed their programmes in ways that would foster ongoing collaboration among participants. Three elements that enhanced collaboration in both programs were participant teams, teachers teaching teachers, and group reflection. The district also established formal

structures for collegiate support … teachers could choose from three options: a) to observe another teacher, b) to team teach with another teacher; or c) to stay in their classroom for peer coaching by a more advanced technology user.'

One study (Zetlin *et al.,* 1998), which successfully addressed a district-wide problem in the US, illustrates how peer support and specialist support were integrated in a CPD partnership between a HEI and several schools, supported at district level. It consisted of the following:

1. Approximately 10 hours of professional development to develop awareness of (a) the theories underlying a developmental, integrated language arts approach and (b) effective instructional practices for implementation of a comprehensive language arts programme

2. Visits to other school sites where model developmental primary programmes were successfully operating

3. Transformation of participating classrooms into demonstration sites at each school so teachers could alternate weekly meetings to observe and discuss new strategies, curricula and technologies being integrated into their instructional programmes

4. Development of peer teams as collegial supports to facilitate integrating new knowledge, behaviours, and materials into their daily teaching repertoires, and to share knowledge and resources of the comprehensive language arts programme with other teachers at their school sites

5. Ongoing mentoring support of peer teams by university faculty

MAKING EXPLICIT LINKS BETWEEN PROFESSIONAL LEARNING AND PUPIL LEARNING

A substantial minority of the studies reported explicitly and in detail on the ways in which specialists helped teachers understand and develop their own practice in the light of the impact it was having on their pupils' learning: Bryant *et al.,* 2001; Ertmer and Hruskocy, 1999; Jacobsen, 2001; Lin, 2002; McCutchen *et al.,* 2002; Sandholtz, 2001; Swafford *et al.,* 1999; Zetlin *et al.,* 1998. Several methods of enquiry were described in the studies by which teachers were able to gauge the effects of their practice from the pupil perspective including:

- Discussions with teachers about their students before the CPD gets underway

  – 'We were interested in learning about the teachers' personal knowledge of their struggling readers … as a foundation upon which to identify reading strategies that would help them address the needs of their students' (Bryant *et al.,* 2001).

- Student test results
  - The researchers shared data from the Word Identification strategy with the teachers at mid-point, as they felt it was important that the teachers were aware of their students' progress (Bryant *et al.*, 2001).
  - The teachers tested children on several occasions during the year and fed back results to teachers (McCutchen *et al.*, 2002).

- Interviews with, and by, students
  - There were training sessions for pupils to become IT experts. These pupil experts were interviewed and completed surveys on their own, their teachers' and their classmates' technology use (Ertmer and Hruskocy, 1999).
  - Each year participants interviewed a student at their grade level to evaluate the student's thinking with respect to that summer's content topic (Swafford *et al.*, 1999).

- Observation and reflection of practice
  - Teachers created observation checklists and videoed their lessons to monitor student attention, involvement, understanding or achievement. Teachers and the specialist then reviewed each instructional activity in the light of the sense the students had made of it and the problems they had encountered (Lin, 2002).
  - Teachers were given opportunities to observe small experimental classes and to reflect on their experiences in their own classes (Sandholtz, 2001).

In other studies, data about students was collected but no information is provided about the way or the extent to which this was fed into the CPD.

The link between professional learning and pupil learning may have been helped by the fact that a large proportion of professional development activity took place on school premises and during school hours, as reported below.

EMBEDDING CPD WITHIN SCHOOL GOALS AND LEADERSHIP

One of our review questions focused on whether the specialist made attempts to embed CPD within school goals and leadership. As reported in section 4.3, eight studies described ways in which this had taken place. Moreover, there were eight studies in which the specialists had aligned their interventions with broader national or regional priorities.

In some cases, the specialist sought the support of school leaders to act as facilitators, either by agreeing for the CPD to take place in their school, or by providing logistical support, such as cover for colleagues taking part in the programme: Boudah *et al.*, 2003; Bryant *et al.*, 2001; Ertmer and Hruskocy, 1999; Greenwood *et al.*, 2003; Mink and

Fraser, 2002; Sandholtz, 2001; Zetlin, *et al.*, 1998.

In some programmes, headteachers were also involved in the planning of the CPD: Boudah *et al.*, 2003; Bryant *et al.*, 2001; Ertmer and Hruskocy, 1999; Greenwood *et al.*, 2003; Mink and Fraser, 2002; Sandholtz, 2001.

However, few studies reported attempts by the specialist to embed CPD at a school policy level. Examples of where this did take place include the Primary Science Programme (Harvey) in which the specialist helped practitioners draft school science teaching policies, and the Galileo Network programme described in Jacobsen (2001). Project workers in this programme collaborated with school staff, parents, and local authority staff with the aim of creating a learning environment at the school based on improved use of technology. In two of the studies (Lin, 2002; Wilkins, 1997), the CPD design had echoes of our own AST system. The Galileo network involved trained teachers working in schools alongside the programme participants. In another study (Wilkins), the specialist trained teachers who then became resident mentors in their own schools, helping teachers to develop the new approaches to mathematics teaching.

National and regional priorities included new curriculum initiatives (Cho, 2002; Harvey, 1999; Mink and Fraser, 2002; Wilkins, 1997) concerns about literacy difficulties (McCutchen *et al.*, 2002, Zetlin *et al.*, 1998) and technological requirements (Jacobsen, 2001; Sandholtz, 2001).

4.4.4.6 Conclusions from the individual studies

Many authors reached conclusions from their individual study findings which were consistent with our findings from the review about the dual nature of the specialist contribution: that is, about the importance of input (new knowledge) and support (time, coaching, promoting self directed peer support, on-site activities, real life teaching and learning issues, etc). Indeed, the main conclusion authors came to was that for CPD to be successful, it was important to pay as much attention to teachers' learning needs as to the delivery of new knowledge. As at least two researchers pointed out, this may well represent a challenge for traditional 'business-as-usual' CPD programme providers as well as for schools.

Conclusions from these review studies relevant to the issues of CPD design are provided in Appendix 4.2.

4.5 In-depth review: quality-assurance results

The quality-assurance methods used for the in-depth review are described in section 2.3.5. Quality-assurance procedures were implemented at the following stages:

- Training was provided for all reviewers who were working on data extraction.

- Each data extraction and assessment of WoE was conducted by pairs of reviewers, working first independently and then comparing and reconciling their decisions.

- A member of the EPPI-Centre also assisted in data extraction.

In problematic cases, other members of the review team were consulted.

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

Policy-makers, academics, teachers, ITT practitioners and providers were all represented on the Review Group and contributed to selecting the topic of focus, deciding and refining the review question and in developing the protocol. Some members of the Review Group and a small number of academics also made suggestions as to the initial search process, participated in keywording, and helped with data extraction.

A training day was held for data extraction and keywording in October 2005 to encourage the widest possible participation and to ensure consistency. The days were planned specifically to engage the interest of practitioner and policy-maker reviewers.

We offered training in EPPI-Centre methods via day-long training sessions and workshops on inclusion criteria, keywording and data-extracting as refresher courses for those members of the Review and Advisory Groups who wanted them, and as 'introduction to' courses for new members of the Groups and other interested users. These proved to be productive sessions and the opportunities were generally taken up by academic user groups whose support was invaluable throughout the review process.

Once the in-depth review and synthesis had been drafted, these were presented in outline form to a user group comprising policy-makers, researchers, teachers, ITT practitioners and CPD providers. This enabled the Review Group to bring the review into the context of current practice and policy-making, and to involve the community most likely to make use of the review in identifying its implications.

CHAPTER FIVE

Implications

5.1 What can we learn from this about specialist contribution to effective CPD?

In nearly all the studies in this review, the specialists whose contribution we explored were also the researchers who evaluated the CPD in terms of its impact on students and teachers (Boudah *et al.*, 2003; Bryant *et al.*, 2001; Ertmer and Hruskocy, 1999; Fine and Kossack, 2002; Greenwood *et al.*, 2003; Harvey, 1999; Jacobsen, 2001; Klingner *et al.*, 2004; Lin, 2002; Martin *et al.*, 2001; McCutchen *et al.*, 2002; Mink and Fraser, 2002; Sawka *et al.*, 2002; Swafford *et al.*, 1999; Wilkins, 1997; Zetlin *et al.*, 1998). This may be a factor in the relatively high amounts of specialist time devoted to the CPD programmes. Clearly the researchers wanted what they were doing to work – after all, they were dedicating considerable effort to evaluating it. Not surprisingly, the programmes they designed paid close attention to what Timperley *et al.* (2006) call professional *learning* – as distinct from the delivery of information which so often characterises current models of professional *development*.

The design of the CPD programmes suggests that the specialists had paid considerable attention to the links between professional learning and pupil learning. All but the two individually-oriented CPD programmes (Sawka *et al.*, 2002 and Mink and Fraser, 2002) were designed to create specific opportunities both for teacher collaboration and peer support, and for sustained specialist coaching and monitoring. The results of their efforts had to translate into observable student outcomes which meant that the teachers had to make changes in their practice. In other words, because the CPD was designed with clearly stated aims in relation to teacher and student learning, and because the CPD was evaluated in terms of its success in meeting those aims, the take up and implementation of new knowledge and skills was regarded as an integral part of the CPD rather than something

which happened when the teachers returned to their classrooms. As one researcher concluded 'The project evaluation demonstrates that a combination of enhancing teachers' knowledge and providing an infrastructure for collaboration and reflection is a powerful change model' (Swafford, 1999).

Summary of findings

A total of 19 studies which described specialist contributions to CPD were included in the synthesis. All included studies contained pupil impact data. The number of studies supporting the finding is stated in brackets, along with the weight of evidence D rating – H=High WoE D, M=Medium WoE D. A summary of the results of the synthesis is set out below.

- Pupil impact data were reported in the areas of:
  - learning and achievement (18 studies: 5H/13M)
  - affective changes – including attitudes to learning and self-esteem (4 studies: 1H/3M)

- Changes in teacher practice reported in the studies resulted from teachers learning more about:
  - teaching strategies (8 studies:1H/7M)
  - learning theories (5 studies: 2H/3M)
  - the use of technology (3 studies: 1H/2M)
  - educational policy (2 studies: 1H/1M)
  - subject knowledge (2 studies: 2H)

In each case, the acquisition of this knowledge and understanding was supported by the specialists implementing additional processes that helped teachers to make sustainable changes to their classroom practice.

- Specialists supported teachers through modelling, workshops, observation, feedback,

coaching and planned and informal meetings for discussion (19 studies: 5H/14M).

- Peer support was a consistent feature. Specialists took steps to ensure practitioners built up a certain level of autonomy and independence in developing their practice, by ensuring that the CPD was, in part at least, a collaborative process between practitioners. (17 studies: 5H/12M)

- The quantity of formal 'input' was extensive (meetings with practitioners in most cases took place over 10 days or more (13 studies: 3H/10M), and sessions frequently exceeded two hours (11 studies: 2H/9M)) and sustained (in most cases longer than two terms (14 studies: 4H/10M)).

- Nearly all specialist support took place on school premises (14 studies: 4H/10M).

- More than half the CPD involved the specialists in observing teachers and providing feedback and debriefing (12 studies: 4H/8M).

- Specialists made explicit the links between professional learning and pupil learning in a variety of ways, including discussion on pupil needs, examining test results, reviewing the results of interviews conducted with and by pupils, videoing and observing pupil interaction in the classroom (8 studies: 4H/4M).

- In the majority of programmes, specialists encouraged teachers to take on a degree of leadership in their CPD by presenting them with choice in respect of content and/or support (14 studies: 3H/11M).

- Specialists made efforts to take account of teachers' starting points and create supportive systems, by mentoring/coaching teachers directly and/or encouraging peer support (13 studies: 3H/10M).

5.2 Strengths and limitations of this systematic review

Strengths

Despite the difficulties in studying the impact of CPD on both teachers and students, this review has managed to identify six new studies that provide evidence about the links between CPD and improvements in teaching and learning, and draw these together with 13 similar studies from previous reviews that also provide detailed descriptions of the specialist contribution. The studies encompass a wide variety of CPD contexts, foci and practices. The synthesis has established a consistent pattern of what is involved in specialists' contributions to professional development when there is evidence of positive outcomes for both teachers and students. The in-depth analysis of the nature of the specialist contributions deepens in particular our understanding of the dual nature of

the process in terms of input and ongoing support. The data on effective professional learning from the studies in this review also seems to complement emerging inspection evidence about CPD.

One strength of this review is the extensive detail it provides on the contribution of the specialist to effective CPD. In doing so, it creates a portrait of helpful practical issues relating to, for example, time and timing, of the array of specialist skills and knowledge necessary to facilitate effective CPD, and of the value added by external specialists to the programmes identified in these studies. A further strength is the involvement of policy-makers and practitioners at every stage. This has been especially helpful in enabling us to use data from mostly non-UK studies to identify clear implications for the UK context.

In particular, the CPD Review Group considers that the review has contributed to the following:

- increasing understanding about the distinction between professional development (content) and professional learning (processes), and the specialist's role in providing and facilitating both

- the development of the evidence base about specific processes involved in CPD which are connected with positive changes in teacher practice and improvements in pupil learning

Limitations

- CPD is a third-order activity and research in this field has to encompass an extended chain of dynamically interacting variables. This applies to almost all studies of CPD in education which attempt to assign direct causality between the CPD and ultimate student outcomes. The consistency of the patterns of specialist input to the CPD in the studies have led us to conclude that they are linked.

- As with previous reviews, we have been conscious of the limitations of the data provided in the studies we retrieved in regard to:

  – answering our review question (none of the studies was designed in a way which would answer our review question directly);

  – the fact that the majority of the studies were carried out in the USA;

  – the limited number of subject specific areas (Literacy, Science, Mathematics) in which the CPD of the majority (N=11) of the included studies took place. However, curriculum was not the only focus of the reported CPD, other more generic aspects of practice were covered, including classroom management, assessment, and teaching and learning. In addition the three ICT studies (Ertmer and Hruskocy, 1999; Jacobsen, 2001; Sandholtz, 2001) and the Boudah *et al.* (2003) and Reis

et al. (1998) studies were cross-curricular, as were the two studies with a special educational needs focus (Martin *et al.,* 2001; Sawka *et al.,* 2002).

- We can be fairly confident that we did find all studies on specialist CPD which reported teacher or student outcomes. It is surprising therefore that we did not identify any studies with negative outcomes. In a developing field such as this, we would expect to find examples where the specialist CPD intervention used had not led to the predicted positive outcomes. However, we do not yet think that this can be interpreted as evidence that all types of specialist CPD will achieve positive results with all types of teachers in all types of setting. Too few of the studies involved samples that were representative of the teaching population or of CPD providers as a whole; or controlled for the large number of confounding variables and, in most cases, the researchers were also part of the specialist CPD teaching teams. We would not, therefore, be confident in stating either, that the positive outcomes identified were entirely attributable to the specialist CPD intervention, or that the results of the studies are truly generalisable: that is, that anyone using these processes will experience the same impacts. The fact that these studies showed positive impacts should not, therefore, lead us to be overconfident or definitive about the effectiveness of the new practices or skills or knowledge described in those studies. The implication would appear to be that further rigorous research that controls for the range of possible confounding variables is needed to test this increasingly coherent pattern of findings.

- We also noted in the individual studies:
  - CPD specialists, who in the majority of cases were also the researchers, may have had access to additional resources for carrying out the programmes, not necessarily available to CPD programmes which are not the focus of research; the messages from the review need to be understood against this background
  - the small-scale nature of six of the studies included in the in-depth analysis

- There may well have been additional fruitful data in a number of PhD theses and other studies. However, we were unable to retrieve this within our timescale and note that this data remains unexplored.

5.3 Implications

The implications for policy and practice have been elicited through consulting policy-makers and practitioners about the review findings and what they might mean in their respective environments. We have shaped the implications of questions in order to encourage and enable policy-makers and practitioners to interpret the findings and implications for their own contexts.

5.3.1 Policy

The interventions described in the review studies involved a complex mixture of skills on the part of the external specialists. Similarly, when teachers were asked to support their colleagues following support from external specialists they were also given the opportunity to develop their own skills in doing this *(*e.g. Wilkins, 1997). Understanding of adult learning was an important part of the whole.

> *It is currently assumed that ASTs can coach others. But can they? How can programmes for colleagues who are asked to work at the cutting edge of practice and to support the work of others develop new knowledge, understanding and skills in adult learning? Should there be specific professional development for leading practitioners in training schools, ASTs and CPD leaders that recognises their role as leaders of adult professional learning?*

Eight of the studies in the synthesis reported explicitly and in detail on ways in which specialists helped teachers connect their CPD with their students' learning and understand its impact. All the studies involved extensive evaluation of impact on students which was often integrated into the CPD.

> *How can CPD be designed so that teacher evaluation of the impact on their pupils is an integral part of the process? Programme-wide evaluation is already a requirement of TDA funded postgraduate professional development. In England the GTC Teacher Learning Academy requires teachers to explore the impact of their learning on students. Is there a need for CPD to enable teachers themselves to acquire the basic tools for evaluating the impact of new practice, focusing on specific groups of pupils to make the task manageable?*

The CPD programme designs in the review were complex and variable. In each case, although there was a strong core of common elements, the programme was designed around the teachers' learning needs, the contexts in which they worked, and the difficulties associated with developing the particular types of new knowledge and skills on which the CPD was focused. The importance of tailoring CPD provision to practitioner needs has also been highlighted by Ofsted (2006). This raises some interesting issues for CPD funders and providers.

> *Do providers and funders need to consider how best to assure quality thresholds in funded programmes while refraining from imposing formulaic funding criteria? How can CPD funders and providers encourage or provide 'bespoke', fit-for-purpose and context-specific CPD*

programmes at the same time as pursuing their overall goals? How will they ensure that they include indicative indicators of successful adult learning?

5.3.2 Practice

Staff from schools who participated benefited from the CPD and so did their pupils. In some cases, people who were involved had an important and positive contribution to make to their colleagues' CPD by taking on a lead teacher role. But it was clear in the majority of studies that not all eligible teachers were included.

> *How do you decide which staff will benefit from the CPD? Which members of staff, having taken part in the programme, are best placed to support parallel or follow up professional learning for their colleagues?*

> *How as a practitioner do you ensure that your school CPD co-ordinator is aware of the skills you have to offer? Could you use the performance review process as a means of identifying your CPD skills, as well as your professional needs?*

In all the synthesis studies, the CPD was led by and dependent on the input of external specialists. In two programmes, they also set out to develop internal specialists to support practitioner learning. Another programme involved the input of a lead teacher.

> *Which CPD activities, arranged and implemented by the external specialists could be supported by the internal specialist you identify? In your context, how can and should the professional development of internal specialists be organised so that they are prepared for this role?*

> *What expertise in terms of content and pedagogical knowledge can the school draw on from its own staff, and how can CPD co-ordinators judge the quality of that expertise?*

> *In which situations is it more advisable to draw on external expertise to provide the content of CPD? What skills do personnel in leadership roles in schools need to develop in order to make informed judgements about engaging and deploying specialists in CPD programmes?*

The specialists described in the review studies brought with them an array of skills and specialist knowledge, including content knowledge; subject-specific pedagogic knowledge, knowledge of effective CPD; evaluation and monitoring skills; and coaching and mentoring skills. We also know from Ofsted (2006) that lack of in-school specialist expertise in some subject areas has led to weaknesses in identifying CPD needs.

> *How can schools work with potential providers*

to identify and bring together the skills and resources to optimise professional development opportunities? What fora already exist where this kind of collaboration can take place?

> *Does your school have an up-to-date network of external experts on which to draw? Would it help to consult subject leaders about the recognised specialists in their field?*

> *How can providers and schools work together to identify in what areas CPD needs to take place, and to prioritise programmes to achieve the biggest return for limited funding?*

The studies in this review described CPD programmes which paid a lot of attention to encouraging and facilitating professional learning, for example, by encouraging peer support, collaborative learning and experimentation. This complemented the formal instruction in new information and approaches provided by the specialists (professional development) and created a robust model to enable change in teacher practice.

> *What should the balance be between formal input (content) and activities which sustain ongoing professional learning in a given CPD programme? What will providers that you are considering working with do to ensure that teachers are able to take control over their own learning following their input?*

> *What resources (such as designated time and/or supply) are available to ensure professional learning activities, such as peer observation, shared interpretation and joint planning etc, can take place?*

5.3.3 Research

The amount of detail the studies provided on CPD processes varied greatly. For example, some studies described ways in which specialists shared the data they collected with teachers, or provided detail on workshop activities which clarified the nature of the specialist input and peer support. However, in several studies whether and how data was shared remained ambiguous.

> *Are there important aspects of an intervention programme and/or the interaction between the research process and the intervention which go unreported because the researcher is focusing on the content or impact of a programme? What steps can researchers take to ensure that appropriate information about an intervention, including their parallel roles as researchers and CPD specialists, reaches all potential audiences?*

The effectiveness of the CPD in the various studies was evaluated using an array of different methods. This made it difficult to determine the relative merits of one CPD programme against

another. However, publicly funded CPD programmes increasingly require evaluation of their effectiveness to make value for money judgements, and schools are all anxious to understand the return of what is often a large investment. Ofsted (2006) pointed to the lack of effective evaluation as the weakest link in the chain.

Is there scope for researchers to come together to share the relative merits of different evaluation processes as a basis for further methodological development in this area? How can the research community support practitioners in developing practice and effective ways of evaluating the impact of professional development programmes in their schools?

The CPD programmes described in the review were resource intensive in terms of the time the specialists spent arranging and facilitating the programmes, yet none of the studies provided an indication of the financial costs of the programmes. This may in part be due to the fact that they were incorporated into a broader research programme. However, this information is important for professionals who are looking to replicate or adapt approaches to CPD so they have a clearer idea of its value for money.

In what ways can researchers provide information on the resources required for a particular programme in a way which gives a clear indication of the costs of a particular approach? Is it feasible to separate the costs of providing the CPD from the overall research budget within intervention programmes?

Relatively few of these studies focused upon CPD involving internal specialist, but, in England at least, there is a significant growth in school based and school supported CPD.

How can CPD research be developed that focuses upon CPD involving internal specialists and, ideally, compares the relative benefits of internal and external specialists?

CHAPTER SIX
References

6.1 Studies included in the in-depth review and synthesis

6.1.1 Studies included in synthesis

Boudah D, Blair E, Mitchell V (2003) Implementing and sustaining strategies instruction: authentic and effective professional development or 'Business as Usual'? *Exceptionality* 11: 3–23.

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

Cho J (2002) The development of an alternative in-service programme for Korean science teachers with an emphasis on science-technology-society. *International Journal of Science Education* 24: 1021-1035.

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

Fine J, Kossack S (2002) The effect of using rubric-embedded cognitive coaching strategies to initiate learning conversations. *Journal of Reading Education* 27: 31-37.

Greenwood C, Tapia Y, Abbott M, Walton C (2003) A building-based case study of evidence-based literacy practices: implementation, reading behavior, and growth in reading fluency, K-4. *The Journal of Special Education* 37: 95-100.

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

Jacobsen D (2001) Building different bridges: technology integration, engaged student learning, and new approaches to professional development. Paper presented at: *Annual Meeting of the American Educational Research Association*, Seattle, WA: April 10-14.

Klingner J, Vaughn S, Arguelles M, Tejero Hughes M, Leftwich S (2004) Collaborative strategic reading: 'real-world' lessons from classroom teachers. *Remedial and Special Education* 25: 291-302.

Lin S (2002) Improving science teaching through teacher development group: a case study of elementary teachers. Paper presented at: *Annual Meeting of the National Association for Research in Science Teaching*, New Orleans, LA: April 7-10.

Martin D, Craft A, Sheng Z (2001) The impact of cognitive strategy instruction of deaf learners: an international comparative study. *American Annals of the Deaf* 146: 366-378.

McCutchen D, Abbott R, Green L, Beretvas S, Cox S, Potter N, Quiroga T, Gray A (2002) Beginning literacy: links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities* 35: 69-86.

Mink D, Fraser B (2002) Evaluation of a K-5 mathematics program which integrates children's literature: classroom environment, achievement and attitudes. Paper presented at: *Annual Meeting of the American Educational Research Association*, New Orleans, LA: April 7-10.

Reis S, Gentry M, Maxfield L (1998) The application of enrichment clusters to teachers' classroom practices. *Journal for the Education of the Gifted* 21: 310-334.

Sandholtz J (2001) Learning to teach with technology: a comparison of teacher development. *Journal of Technology and Teacher Education* 9: 349-374.

Sawka K, McCurdy B, Mannella M (2002) Strengthening emotional support services: an empirically based model for training teachers of students with behavior disorders. *Journal of Emotional and Behavioral Disorders* 10: 223-232.

Swafford J, Jones G, Thornton C, Stump S, Miller D (1999) The Impact on instructional practice of a teacher change model. *Journal of Research and Development in Education* 32: 69-82.

Wilkins C (1997) *Effects of a resident mentor teacher*

on student achievement in mathematics. Report of a study carried out with the support of the Mid-South Educational Research Foundation. ERIC Online No. ED311564

Zetlin A, MacLeod E, Michener D (1998) Professional development of teachers of language minority students through university-school partnership. Paper presented at: *Annual Meeting of the American Educational Research Association*, San Diego, CA: April 14-16.

6.1.2 Studies included in map and in-depth review but not synthesis

Fortino C, Gerretson H, Button L, Johnson S (2002) *Using literacy integration for communicating scientifically: research results on teacher efficacy and student achievement*. Report of a study carried out to evaluate the effectiveness of Using Literacy Integration for Communicating Scientifically program. ERIC Online No. ED470660

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

Rodrigues S, Marks A, Steel P (2003) Developing science and ICT pedagogical content knowledge: a model of continuing professional development. *Innovations in Education and Teaching International* 40: 386-394.

6.2 Studies included in the map but not in the in-depth review

Alouf J (2003) Assessing the impact of inquiry-based science teaching in professional development activities, PK-12. Paper presented at: Annual Meeting of the Association of Teachers Educators. ERIC Online No ED 475577.

Atay D (2004) Collaborative dialogue with student teachers as a follow-up to teacher in-service education and training. *Language Teaching Research* 2: 143-162.

Bainer D (1995) The impact of reform-based partnerships on attitudes toward environmental science and partnering and on classroom instruction. Paper presented at: *American Educational Research Association*: 2-34.

Barnette J, Orletsky S, Sattes B (1995) QUILT: an innovative approach to effective instructional improvement. Paper presented at: *Annual Meeting of the Annual Meeting of American Educational Research Association*, San Francisco: April 18-22.

Boyle R, Skopp L (1998) Teachers as inquirers: constructing a model of best practice. ERIC Online No. ED417981.

Bradley-Klug K, Shapiro E, DuPaul G (1997) Attention deficit hyperactivity disorder and kids in the middle: A field test of a school-based consultation model. *Teacher Education and Special Education* 20: 179-188.

Brown C, Rojan A (2002) Teacher Leadership Project 2002: *evaluation report*. ERIC Online No. ED472676.

Bryant D et al (2001) The effects of professional development for middle schools general and special education teachers on implementation of reading

strategies in inclusive content area classes. *Learning Disability Quarterly* 4: 251-264.

Calderon (1995) Dual language programs and team-teachers' professional development. Paper presented at: *Annual Meeting of the American Research Association*, San Francisco: April 18-22.

Cleland J, Wetzel K, Zambo R, Buss R, Rillero P (1999) Science integrated with mathematics using language arts and technology: a model for collaborative professional development. *Journal of Computers in Mathematics and Science* Teaching 2: 157-172.

Cooney T, Shealy B (1995) Teachers' thinking and rethinking assessment practices. Paper presented at: *Annual Meeting of North American Chapter of the International Group for the Psychology of Mathematics Education*, Columbus: October 21-24..

Cuckle P, Shorrocks-Taylor D (2005) Evaluation of an initiative to raise reading attainment in key stage one national tests. *Journal of In-service Education* 1: 173-190.

Daigle M (2000) The learner-centred classroom: helping teachers apply constructivist principles to standards-based teaching and assessment. Proticumm ii Report. Florida, USA: Nova Southeastern University.

DeMulder E (2003) Teachers voices on reflective practice. *Reflective Practice* 3: 267-290.

Devlin-Scherer W, Spinelli A, Giamatteo D, Johnson C, Mayo-Molina S, McGinley P, Michalski C, Schmidek S, Tomaiuolo, Zisk L (1998) Action research in professional development schools: effects on student learning. Paper presented at: *Annual meeting of the American Association of Colleges for Teacher Education*, New Orleans: 25-28 February.

Donnelly F, Helion J, Fry F (1999) Modifying teacher behaviours to promote critical thinking in K-12 physical education. *Journal of Teaching in Physical Education* 2: 199-215.

Farmer J, Gerretson H, Lassak M (2003) What teachers take from professional development: cases and implications. *Journal of Mathematics Teacher Education* 4: 331-360.

Garcia P (1999) Helping teachers increase the use of multimedia instructional technology into the curriculum through staff development workshops. Masters Practicum Report, Nova Southeastern University, Miami, Florida. ERIC Online No. ED437017.

George M, (2001) Teachers learning together: faculty book clubs as professional development in an urban middle school. Paper Presented at: *Annual Meeting of the American Educational Research Association*, Seattle: April 10-14.

Greenwood A, Haury D (1995) Putting the science back into science education through the science education program and leadership (SEPAL) model. *Journal of Science Teacher Education* 3: 153-157.

Hamilton M, Richardson V (1995) Effects of the culture in two schools on the process and outcomes of staff development. *Elementary School Journal* 4: 367-385.

Heath M, Burns M, Dimock K, Burniske J, Menchaca M,

Ravitz J (2000) Applying technology to restructuring and learning. Final Research Report. Southwest Educational Development Lab., Austin, TX.

Henson R (2001) The effects of participation in teacher research on teacher efficacy. *Teaching and Teacher Education* 17: 819-836.

Hodson D (1998) Becoming critical about practical work: changing views and changing practice through action research. *International Journal of Science Education* 20: 683-694.

Hruskocy C, Ertmer P, Johnson T, Cennamo K (1997) Students as technology experts: a 'bottom-up' approach to teacher technology development. Paper presented at: *Annual Meeting of the American Educational Research Association,* Chicago: 24-28 March.

Hurst R (1999) Assessing the impact of a teacher enhancement program on classroom environment. ERIC Online No. ED442645.

Johnson, C (2002) The Wright State model school initiative: a summary of efforts made to scale up reform in mathematics and science. Paper presented at: *Annual Meeting of the National Association for Research in Science Teachers,* Philadelphia: March 23-26.

Kimmel H, Deek F, Farrell M, O'Shea M (1999) Meeting the needs of diverse student populations: comprehensive professional development in science, math, and technology for teachers of students with disabilities. *School Science and Mathematics* 5: 99.

Lacey C, Enger J, Maldonado N (2002) Sharing a model of accountability: the Tri-County Charter School Partnership evaluation. Paper presented at: *Annual Meeting of the American Educational Research Association*, Chicago: April 21-25

Lee C, Chew J, Hing T (1999) Teachers' use of cooperative learning in their classrooms: case studies of four elementary school teachers. *American Educational Research Association* 2-21.

Lin P (2002) On enhancing teachers' knowledge by constructing cases in classrooms. *Journal of Mathematics Teacher Education* 4: 317-349.

Lloyd J, Braund M, Crebbin C, Phipps R (2001) Primary teachers' confidence about and understanding of process skills. *Teacher Development* 4: 353-369.

Luft J (2001) Changing inquiry practices and beliefs: the impact of an inquiry-based professional development programme on beginning and experienced science teachers. *International Journal of Science Education* 5: 517-534.

Luft J, Pizzini E (1998) The demonstration classroom in-service: Changes in the Classroom. *Science Education* 2: 147-162.

MacArthur C (1995) Mentoring: An approach to technology education for teachers. *Journal of Research on Computing in Education* 28: 46-62.

Martin D (1997) Teachers of thinking: a cross-cultural study of effects on professionals. ERIC Online No. ED461629

Martin P, Baxter A (2001) Mentoring African American middle school students: applying principles of antiracism education to the problem of closing the Black-White achievement gap. Paper presented at: *Annual National Conference of the National Association of African American Studies*, Houston: February 21-16.

McLymont E, Costa J (1998) Cognitive coaching and the vehicle for professional development and teacher collaboration. Paper presented at: *American Educational Research Association,* San Diego: April 13-17.

Morin F (1998) The effects of professional development on teachers' abilities to implement planned educational change in the context of Sherwood School's Project Learn: a report on year one of the study. ERIC Online no ED 467750.

Murphy C, Beggs J, Carlisle K (2003) The impact of co-teaching between science student teachers and primary classroom teachers on children's enjoyment and learning of science and student teacher confidence. ERIC Online No. ED475480.

Nover S, Andrews J, Everhart V (2001) Critical pedagogy in deaf education: teachers' reflections on implementing ASL/English bilingual methodology and language assessment for deaf learners. Year 4 Report (2000-2001). USDLC Star Schools Project Report.

O'Shea M (2002) Implementing state academic content standards in the classroom. ERIC Online No. ED471094.

Pligge M, Kent L, Spence M (2000) Examining teacher change within the context of Mathematics Curriculum Reform: views from middle school teachers. Paper presented at: *Annual meeting of the American Association of Colleges for Teacher Education*, New Orleans: 24-28 April.

Race K, Ho E, Bower L (2002) Documenting in-classroom support and coaching activities of a professional development program directed toward school-wide change: an integral part of an organization's evaluation efforts. Paper presented at: *Annual Meeting of the American Research Association*, New Orleans: April 1-5.

Shapiro E, Miller D, Sawka K (1999) Facilitating the inclusion of students with EBD into general education classrooms. *Journal of Emotional and Behavioural Disorders* 7: 83-93.

Shepardson D, Harbor J (2003) The effectiveness of the Envision Professional Development Model. *Environmental Education Research* 10: 471-492.

Stein M (1997) Assessing the impact of an urban systemic professional development program on classroom practice. Paper presented at: *Annual Meeting of the National Association for Research in Science Teaching*, Oak Brook: 21-24 March.

Taber S (1998) Learning to teach math differently: The Effect of 'Investigations' Curriculum on Teachers' Attitudes and Practices. Reports - Research, Speeches/ Meeting Papers: 27

Turner-Bisset R, Nichol J (1998) A sense of professionalism: the impact of 20-day courses in subject knowledge on the professional development of teachers. Teacher Development 3: 433-454.

Turvey P (1996) Providing inservice strategies to motivate and improve middle school teachers' use of inclusion

teaching. Master's Practicum Report, Nova Southeastern University. ERIC Online No. ED400974.

Vaughn S, Hughes M, Schumm J, Klingner J (1998) A collaborative effort to enhance reading and writing instruction in inclusion classrooms. *Learning Disability Quarterly* 21: 57-74.

Veenman S, Raemaekers J (1995) Long-term effects of a staff-development program on effective instruction and classroom management for teachers in multi-grade classes. Paper Presented at: *Conference for Research on Learning Institution*, Nijmegen: August 26-31.

Wang J (2001) Improving elementary teachers' understanding of the nature of science and instructional practice. *Teaching and Teacher Education* 17: 51-73.

Wiliam D (2002) Linking research and practice: knowledge transfer or knowledge creation? ERIC Online No ED477107.

6.3 Other references used in the text of the report

Adey P, Shayer P (1994) Really raising standards: cognitive intervention and academic achievement. London: Routledge.

Askew M, Brown M, Rhodes V, Johnson D, Wiliam D (1997) Effective teachers of numeracy: report of a study carried out for the Teacher Training Agency. London: King's College, University of London.

Bell M, Jopling M, Cordingley P, Firth A, King E, Mitchell H (2006) *What is the impact on pupils of networks that include at least three schools? What additional benefits are there for practitioners, organisations and the communities they serve?* Nottingham: National College for School Leadership.

Bolam R (2003) Presidential address. Paper presented at: *International Professional Development Association Conference*, Birmingham: 31 October -1 November.

Bolam R, McMahon A, Stoll L, Thomas S, Wallace M (2005) *Creating and sustaining effective professional learning communities*. Nottingham: Department for Education and Skills.

Cordingley P, Bell M (2002) *Literature and evidence search: teachers' use of research and evidence as they learn to teach and improve their teaching*. London: Teacher Training Agency.

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

Day C (1999) *Developing teachers: the challenges of lifelong learning*. London: Falmer Press.

Desforges C (1995) How does experience affect theoretical knowledge for teaching? *Learning and Instruction* 5: 385–400.

Earl L, Watson L, Levin B (2003) *Watching and learning 3: final report of the external evaluation of England's National Literacy and Numeracy Strategies*. London: DfES.

Elliott J (1991) *Action research for educational change*. Milton Keynes: Open University Press.

EPPI-Centre (2002) *Core keywording strategy: data collection for a register of educational research*. Version 0.9.7. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

EPPI-Centre (2003) *Review guidelines for extracting data and quality assessing primary studies in educational research*. Version 0.9.7. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

Fielding M, Bragg S, Craig J, Cunningham I, Eraut M, Gilinson, Horne M, Robinson C, Thorp J (2005) *Factors influencing the transfer of good practice*. Research Report RR615. Annesley, Nottingham: DfES Publications.

Goodall J, Day C, Harris A, Lindsay G, Muijs D (2005) *Evaluating the impact of continuing professional development (CPD)*. London: DfES.

Guskey T (2000) *Evaluating professional development*. Thousand Oaks, CA: Corwin.

Harland J, Kinder K (1997) Teachers' continuing professional development: Framing a model of outcomes. *Journal of In-service Education* 23: 71-84

Hargreaves DH (1993) A common-sense model of the professional development of teachers. In: Elliot J (ed.) *Reconstructing teacher education: teacher development*. London: Falmer, pages 86–92.

Joyce B, Showers B (1988) *Student achievement through staff development*. London: Longman.

National College for School Leadership (NCSL) (2004) *Learning-centred leadership: a new suite of materials to help improve learning and teaching in your school*. Available at: http://www.reservoir.uk.com/clients/ncsl/lcl/home.htm

Ofsted (2006) *The logical chain: continuing professional development in effective schools*. London: HMI.

Rich I (1993) Stability and change in teacher expertise. *Teachers and Learning* 9: 137–141.

Sainsbury, M (1998) *Evaluation of the National Literacy Project: Cohort 1 (1996-1998)*. Slough: NFER

Shayer M, Johnson DC, Adhami M (1999) Does 'CAME' work? Report on Key Stage 3 results following the use of Cognitive Acceleration in Mathematics Education, CAME Project in Years 7 and 8. Paper presented at: *British Society for Research into Learning Mathematics Conference*, St Martin's College, Lancaster: 5 June.

Shulman LS (1986) Those who understand: knowledge growth in teaching. *Educational Researcher* 15: 4-14.

Stenhouse L (1980) *Curriculum research and development in action*. London: Heinemann.

Timperley H, Fung I, Wilson A, Barrar H (2006) Professional learning and development: a best evidence synthesis of impact on student outcomes. Paper presented at: *AERA Annual Conference*. San Francisco, California: April 7-11.

Appendix 1.1: Advisory Group membership

Philippa Cordingley	CUREE, Chair
Alison Kitson	Training and Development Agency for Schools (TDA)
Anthony Wilson	Department for Education and Skills (DfES)
Chris Day	University of Nottingham
Colin Isham	CUREE
Harriet Marland	Bishop Grosseteste College
Hazel Hagger	University of Oxford
Jacqueline Naylor	Department for Education and Skills (DfES)
Janet Draper	University of Exeter
Janet Sturgis	National Union of Teachers (NUT)
John Bangs	National Union of Teachers (NUT)
Karen Robinson	National Union of Teachers (NUT)
Lesley Saunders	General Teaching Council (GTC)
Miranda Bell	CUREE
Pauline Round	Worcestershire Local Authority
Robin Bevan	King Edward VI Grammar School, Chelmsford
Sally Pemberton	Sweyne Park School, Rayleigh

Advisory Group: correspondent membership

Adrienne Alton-Lee	Ministry of Education, New Zealand

Appendix 2.1: Inclusion and exclusion criteria

Stage 1 criteria

1   Focus on CPD which involves specialist input
2   Have set out to measure impact on teaching and/or pupil learning
3   Focus on CPD designed to sustain learning for three months, one term, or more
4   Clearly describe the methods of data collection and analysis
5   Focus on CPD which is designed to meet explicit learning objectives
6   Focus on teachers of the 5-16 age range
7   Were published after 1994
8   Are written in English
9   Report on the aims and objectives for the research
10 Can show how they have used what is known already

Stage 2 criteria

11 Provide evidence of impact on teacher behaviour and/or pupil learning (positive or negative)
12 Describe the processes of the CPD intervention in some detail, including the nature and content of the CPD activities, the role of the specialist and classroom interventions
13 Evidence of attempts made to establish the reliability and validity of data analysis

Stage 3 criterion

14 Provide evidence of impact on pupil learning (positive or negative)

Appendix 2.2: Search strategy for electronic databases

The following databases were searched for potential studies:

BEI
CERUK
ERIC
Ingenta

The following websites were also searched:

American Educational Research Association (AERA)
Association for the Advancement of Educational Research (AAER)
Australian Council for Educational Research (ACER)
Scottish Research in Education Centre (SCRE)
National Foundation for Educational Research (NFER)
Office for Standards in Education (OFSTED)
Department for Education and Skills (DfES)
British Educational Research Association BERA

Search terms used in the fourth CPD review

We included combinations and permutations of key terms, based on individual database thesauri.

specialists	participants	activities	effects
specialist	learner	intervention	practice
expert*	teacher	learn*	belief*
coach	student	professional	attitud*
mentor	pupil	develop*	motivat*
researcher	school	train*	behav*
academic		lead*	learn*
trainer		advise*	attain*
tutor		educational change	achieve*
consultant			
adviser			
facilitator			

* and $ indicate truncation

Database	Search strategy	Number of hits
BEI	Trainers OR professional development OR professional growth OR collegiality OR consultants AND mentors	176
BEI	Expert AND professional development	4
BEI	Training AND professional development NOT preservice	133
BEI	Inservice AND professional development NOT preservice	125
BEI	Collaboration OR partnership AND professional development	36
BEI	Coaching NOT athletics AND professional development	0
BEI	Coaching NOT athletics NOT sport	29
CERUK	Professional development AND professional education	24
CERUK	Inservice teacher education OR staff development	50
CERUK	Professional development AND professional education AND training	11
ERIC	Specialist AND teacher education / or professional education / or competency based teacher education / or English teacher education / or inservice teacher education / or cooperating teachers / or extended teacher education programs / or knowledge base for teaching / or master teachers / or methods courses / or professional development schools/ or reflective teaching / or teacher background / or teacher centers / or teacher certification / or teacher education programs / or teacher knowledge / or teacher qualifications / or teacher supervision / or teachers / or 'teaching (occupation)' /	44
ERIC	Teaching methods OR teaching skills AND training	259
ERIC	Professional development AND mentors OR trainers	281
ERIC	Educational change AND consultants OR mentors OR trainers	95
ERIC	Knowledge base for teaching AND modeling (psychology)	8
ERIC	Inservice teacher education AND modeling (psychology)	1
ERIC	Modeling (psychology) AND professional development	8
ERIC	Coach$ NOT athletics or athletic coaches AND professional development	116
ERIC	Advisor OR adviser AND professional development	5
ERIC	Expert AND professional development	193
ERIC	Educational change AND professional development	848
ERIC	Teaching methods AND professional development	692
ERIC	Collab$ AND professional development	893
INGENTA	Professional development AND teach* AND expert	18
INGENTA	Teacher AND inservice AND consultant OR instruction	6
INGENTA	Mentor and professional development AND teacher	18
INGENTA	Collab* AND professional development AND teacher	124

Appendix 2.3: Journals handsearched

Most journals which regularly cover CPD research were available on electronic databases. However we handsearched the editions of *Teachers and Teaching: Theory and Practice*, which appeared between 1995 and 2000, as these were not available electronically.

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

V0.9.7   *Bibliographic details and/or unique identifier*

A1. Identification of report
Citation
Contact
Handsearch
Unknown
Electronic database (please specify) . . . .

A2. Status
Published
In press
Unpublished

A3. 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)
. . . .
. . . .
. . . .

A4. Language (please specify)
. . . .

A5. In which country/countries was the
study carried out? (please specify)
. . . .
. . . .

A6. 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) . . . .

A7. Curriculum
Art
Business studies
Citizenship
Cross-curricular
Design and technology
Environment
General
Geography
Hidden
History
ICT
Literacy – first language
Literacy further languages
Literature
Mathematics
Music
PSE
Physical education
Religious education
Science
Vocational
Other (please specify) . . . .

A8. Programme name (please specify)
. . . .
. . . .

A9. 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) . . . .

A10. Age of learners (years)
0–4
5–10
11–16
17–20
21 and over

A11. Sex of learners
Female only
Male only
Mixed sex . . . .

A12. 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)
. . . .

A13. 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

* 14. To assist with the development of a trials register, please state if a researcher-manipulated evaluation is one of the following:

Controlled trial (non-randomised)

Randomised controlled trial (RCT)

**Is the CPD

a. individual (i.e. the CPD was designed to support individual teachers)

b. collaborative (i.e. the CPD was designed to facilitate collaboration)?

** Refers to review-specific keywords

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

………………………………………………………………

………………………………………………………………

Type of specialist

External: HEI

External: LA

External: commercial not LA

External: other please specify

Internal: senior manager

Internal: AST

Internal: SEN co-ordinator

Internal: ESOL/EAL co-ordinator

Internal: gifted and talented co-ordinator

Internal: subject specialist

Internal: CPD co-ordinator

Internal: other please specify

**Type(s) of practice/intervention

Action research

Coaching: peer

Coaching: specialist

Counselling

Experimentation

Literature /previous evidence

Mentoring

Modelling

Observ: dissemination peers

Observ: dissemination spec

Observ: exploratory peer

Observ: exploratory spec

Online courses

Peer support

Planning schemes of work

Post graduate education

Role play

Sharing practice

Study groups

Team teaching

Training

Workshops

Other (Please specify.)

**Outcomes

Teacher attitudes

Teacher behaviour

Teacher beliefs

Teacher knowledge

Teacher morale

Teacher motivation

Teacher skills

Teacher understanding

Student /pupil achievement

Student /pupil learning

Student/pupil motivation

Student/pupil self-esteem

Subject knowledge

Other (please specify)

Appendix 2.5: Definitions of CPD review-specific keywords

Coaching: specialist

Use this keyword if the intervention involves activities which promote and enhance the development of a specific aspect of teaching and learning or leadership practice, including the following:

- support to clarify learning goals
- reinforcing learners' control over their learning
- active listening
- modelling, observing, articulating and discussing practice to raise awareness
- shared learning experiences (e.g. via observation or video)
- shared planning of learning and teaching or leadership, supported by questioning
- supported review and action planning
- reflection on and debriefing of shared experiences

Coaching: peer / collaborative (co-)coaching

Use this keyword if the intervention involves activities which promote and enhance reflective practice, including the following:

- developing mutual understanding of specific goals
- sustaining learners' control over their learning
- active listening
- observing, articulating and discussing practice to raise awareness
- shared learning experiences (e.g. via observation or video)
- shared planning of learning and teaching or leadership, supported by reciprocal questioning

- reciprocal action planning
- shared analysis of learning experiences, evidence, research or alternative examples of practice

Counselling

Use this keyword if the intervention involves giving personal advice or support by someone who has been trained to provide such support.

Experimentation

Use this keyword if the intervention involves trying out and evaluating methods and/or materials which are new to the teacher.

External specialist

Use this keyword if the intervention involves the use of individuals or groups from outside of the school who have extensive and/or deep knowledge of an aspect of practice, the curriculum or the development process in play, and use this knowledge to inform professional development activities.

External specialist: local authority (LA)

An external specialist employed or contracted by the local authority to assist in the implementation of a local authority educational initiative.

External specialist: commercial not LA

An external specialist working for a commercial organisation, contracted by the school/ network of schools to provide advice and/or training to address an identified issue.

Internal specialist

Use this keyword if the intervention involves the use of individuals or groups from within the school who have extensive and/or deep knowledge of an aspect of practice, the curriculum or the development process in play, and use this knowledge to inform professional development activities.

Literature/previous evidence

Use this keyword if the intervention involves building on existing research and/or involves teachers in accessing research to inform their professional development.

Mentoring

Use this keyword if the intervention involves activities which promote and enhance effective transitions between professional roles, including the following:

- identifying learning goals and supporting progression
- developing increasing learners' control over their learning
- modelling, observing, articulating and discussing practice to raise awareness
- shared learning experiences (e.g. via observation or video)
- providing guidance, feedback and, when necessary, direction
- review and action planning
- brokering a range of support

Modelling

Use this keyword if the intervention involves a process in which behaviours are presented to the participant by another individual to support them in acquiring such characteristics, thereby enabling them to become familiar with the potential of the intervention and to give first-hand experience of active participation.

Observation: dissemination peer

Observation conducted by a colleague who is either a reciprocal learner or a colleague who has no line-manager responsibility for their partner with the aim of giving feedback on performance.

Observation: exploratory peer

Observation conducted by a colleague who is either a reciprocal learner or a colleague who has no line-manager responsibility for their partner with the aim of learning from others' classroom practice.

Observation: dissemination specialist

Observation conducted by an internal or external specialist with the aim of giving feedback on performance.

Observation: exploratory specialist

Observation conducted by an internal or external specialist with the aim of learning from others' classroom practice.

Online courses

Use this keyword if the intervention involves participation in an electronically supported distance learning programme of activities which can include 'mixed-mode' and/or 'blended' provision.

Peer support

Use this keyword if the intervention involves the provision of mutual assistance by pairs or groups of teachers involved in professional learning.

Planning schemes of work

Use this keyword where teachers are involved in medium- and long-term development of curriculum materials, learning activities and/or learning objectives.

Postgraduate education

Use this keyword if the intervention involves working towards a postgraduate qualification, including Graduate Certificates and Graduate Diplomas (H level) and Masters degrees, Postgraduate Certificates and Postgraduate Diplomas (M level).

Role play

Use this keyword if the intervention involves the type of simulation activities to focus attention on the interaction of people with one another; it emphasises the functions performed by different people under various circumstances.

Sharing practice

Use this keyword if the intervention involves presenting information about practice in order to enable teachers to benefit from someone else's experiences, ideas and resources in a reciprocal manner.

Specialist expertise

Use this keyword for individuals or groups with deep and/or extensive knowledge of a given area, including the following:

- the aspect of teaching, learning or the curriculum or skills being explored
- working on a consultancy basis with teachers
- supporting professional learning

Study groups

Use this keyword if the intervention involves a small group of professionals who work together as learners on a regular basis on a specific topic of interest. The purpose of forming a study group is to cultivate collegiality and expand the knowledge and expertise of the members.

Team teaching

Use this keyword if the intervention involves a system whereby two or more teachers pool their skills, knowledge, etc., to jointly develop, plan and teach combined classes.

Training

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

Appendix 4.1: Aims, designs and findings of the studies in the in-depth review

Boudah et al. (2003)

What are the broad aims of the study?

The purpose of this study was threefold: to develop and implement a successful alternative in-service professional development model for teachers; to facilitate the use of research-based instructional strategies in classroom practice by using the model; and to measure the impact on teacher performance and satisfaction as well as student academic outcomes.

Which variables or concepts, if any, does the study aim to measure or examine?

The experimental group received authentic professional development (APD) training and the control group received traditional training.

APD is based on four principles translated into a set of staff development activities. It is characterised by teachers actively setting the agenda for the change process, addressing relevant classroom issues, and individualised teacher follow up and collegial coaching as teachers implement new practice.

The traditional training comprised off-site, one-day staff development, consisting of a description of the instructional strategy and how it can be used, teacher practice with observation, feedback or follow up. All teachers in both groups learned the same strategies instructional model (SIM) procedures (the unit organiser routine).

What are the results of the study as reported by authors?

Most teachers who participated in the APD training implemented the unit organiser routine in which they had been trained, whereas not all teachers who participated in traditional in-service training did so.

Overall, student engagement rates and in-class assignments had improved as a result of using the unit organiser routine. Some teachers thought that overall test scores had been affected by use of the strategy. Most responses to the training evaluation questionnaire were positive and supportive of the APD model. Teachers were enthusiastic about the opportunity to observe classroom modelling of unit organiser implementation as a part of the training. The hands-on involvement of the trainer in classrooms was cited most often as an APD model asset. In addition, teachers liked the convenience of participating in the training during the school day and not having the burden of preparing for a substitute teacher.

Bryant et al. (2001)

What are the broad aims of the study?

The purpose of the study was to examine general and special education teachers' personal knowledge about their struggling readers and reading strategies, to learn about the teachers' views of the professional development activities, and to examine the implementation of three reading strategies in context area classes.

Which variables or concepts, if any, does the study aim to measure or examine?

The researchers reported on the teachers' personal knowledge, opinions of staff in-service training, and the implementation of the strategies. The researchers also reported on each of the strategies:

• word identification

• partner reading

• collaborative strategic reading

and how each of these impacted on teacher practice and pupil learning.

What are the results of the study as reported by authors?

All the teachers thought the word identification strategy was useful for their low-achieving students and observed improvement in their struggling students' ability to breakdown multisyllabic words into smaller parts and recognise prefixes and suffixes.

The incidence of partner reading strategies was high, but this strategy was not well received by the students. Teachers noted improvement in their lower readers' fluency ability, particularly when the teacher served as the partner.

Teachers generally found the collaborative strategic reading (CSR) difficult to implement. The special education teachers viewed CSR as beneficial for their lower readers.

Although most teachers said that they had to prompt students frequently to use the strategies and work cooperatively, they viewed this strategy most favourably for integrating into content area reading.

Time was considered a major issue by the teachers in terms of preparing for, and teaching, the strategies.

Teachers expressed a need for more materials that could better match their students' reading abilities. Teachers began to notice the effects of the strategies on students' learning through overt student behaviour. Teachers noticed students with special needs were using the strategies without prompting.

Cho (2002)

What are the broad aims of the study?

This study was designed to change teachers' awareness and practice of science-technology-society (STS) / constructivist approaches, while also focusing on students' understandings and changes of perceptions of the constructivist learning environments.

Which variables or concepts, if any, does the study aim to measure or examine?

- Effect of the STS on students'
  - concept acquisition
  - creativity
  - ability to apply
- Students' perceptions on features characterising STS and constructivist approach in their science classes
- Teachers' awareness and practices of science education reforms (need of science education reform, practices of science education reform)

What are the results of the study as reported by authors?

Students from the three classes could write on average 48% of the 35 key concepts and 6.6 additional non-key concepts after the unit was finished.

On the creativity test, the mean relevant responses for the strong acid rain situation increased from 4.69 to 6.13, 3.25 to 4.25, and 5.88 to 6.23 between pre-test and post-test in the three tasks of making questions, explaining and predicting, respectively. Mean creative responses also increased from 1.08 to 1.71, 0.58 to 1.02, and 1.30 to 2.35 in the three tasks, respectively. For the no food inspection standards situation, the mean relevant responses increased from 5.07 to 5.47, 0.89 to 1.18 and 1.33 to 1.40. The mean creative responses for the situation made small improvements between pre-test and post-test.

On the application test, students of two schools scored over 1.65 and 1.34 out of 2 on average, in examples of acidic and basic food, and neutralisation reaction respectively. Students of one school scored 3.25 out of 5 on average in examples of acidic and basic food task. For use of acids and bases in our life tasks, students scored 2.56 and 2.51 out of 3 on average, respectively.

The effect sizes for the science education reform inventory (SERI), a measure designed to assess teachers' awareness and practice of science education reforms, were 0.76 for the practice scale, and 0.26 for the awareness scale.

The effect sizes of changes in students' perceptions of constructivist learning environments between pre-test and post-test ranged between 0.18 and 0.35. The values were about the same as scores of students from Australia and Taiwan in the scales of personal relevance and critical voice, and lower in the scale of uncertainty (Aldridge et al., 2000). T tests used to ascertain whether differences in scale scores between pre-test and post-test were statistically significant showed that there were differences in the personal relevance scale ($p < 0.01$), scientific uncertainty scale ($p < 0.05$) and critical voice scale ($p < 0.01$).

Ertmer and Hruskocy (1999)

What are the broad aims of the study?

To support teachers' technology integration efforts at Midland Elementary School.

Which variables or concepts, if any, does the study aim to measure or examine?

To find out how collaborative CPD involving instructional and technical support in the use of computers affected knowledge of, and use of, computers by teachers, a group of student 'experts' and pupils involved with learning in the classes of these participants.

What are the results of the study as reported by authors?

Staff reported feeling more at ease with computers, less apprehensive about trying new things, and more willing to explore. They used computers more for professional use and instructional purposes. Teachers reported making a conscious effort to include the computer in their curricula in whatever ways fitted their teaching styles best, without, however, major changes in instructional approaches or processes.

Teachers reported their pupils increasing their use of instructional games, drill and practice programmes; word processing for creative writing; and graphics tools for projects and reports.

Student-trainers showed increased confidence, improvement in technology skills and self-esteem. Some were able to serve as effective training resources for the teachers particularly in grades 4 and 5, but their use tended to be limited as reported by seven participants.

Teachers noted that 'at risk' students, who were part of the training group, had excelled in the programme and had experienced increased self-esteem.

Fine and Kossack (2002)

What are the broad aims of the study?

How can teachers renew their knowledge and perfect their practice on an ongoing basis as they teach into their fifth, tenth, twentieth year? Can professional learning conversations facilitate this renewal? Will using rubrics within cognitive coaching to explore lesson structure, student reaction, and alternative applications capitalise on Pearson's transformation? Will such discussions about practice move teachers away from surface conversations about strategy to create Darling-Hammond's more deliberate, focused analysis and reflection?

Which variables or concepts, if any, does the study aim to measure or examine?

Data was collected as a means of gauging the effect of teaching a variety of strategies and targeted cognitive peer coach on teacher perception of the process and student comprehension.

What are the results of the study as reported by authors?

Students showed significant gains in their reading performance: third-grade groups showed insignificant initial differences but substantial post-test gains (p < 0.001); fourth-grade groups showed significant initial differences, but this did not offset equally substantial post-test gains (p < 0.001).

Over time, as graduate students became more comfortable with the rubric-driven cognitive coaching, there was a shift to appreciate the simulated clinical situation. There were several patterns that emerged from the peer coaching interaction and reflection, which revealed both the evolution of the disposition for participation in such professional growth experiences with learning discussions and growth in professional performance.

Greenwood et al. (2003)

What are the broad aims of the study?

To test the hypothesis that teachers would implement and sustain their use of a range of new evidence-based practices and that these practices would produce accelerated levels and rates of growth in classroom reading behaviours.

Which variables or concepts, if any, does the study aim to measure or examine?

Students' curriculum based measurement (CBM) reading fluency, reading aloud and silent reading behaviours

Exposure to evidence-based practice

Disability/minority language issues

Student grouping and mode of teaching.

Process measures of the changes in teacher practices included:

(a) number of new strategies implemented by teachers

(b) direct observations of classroom ecology, teacher, and student behaviour during reading instruction.

The outcome measure was a reading CBM. CBM reading fluency assessments began in November 1996 and continued to February 1997.

What are the results of the study as reported by authors?

Over the entire project, teachers implemented a total 13 different evidence-based strategies in collaboration with the researchers. The cumulative mean number of strategies actually experienced by students over three years was 7 per student (SD = 1.5) The cumulative mean number of strategies received per student per cohort was 8, 6 and 6 for cohorts 1, 2, and 3, respectively. Students in cohort 1 received an additional two strategies over the life of the project.

Although most teachers continued using practices in Year 3 that had been implemented in prior years, they did not increase the use of new strategies in the face of a reduced presence by researchers in that year. In addition, efforts to create a research lead teacher role in the building from among the existing school faculty were not successful.

Results generally showed reading aloud emerging in kindergarten and first grade, declining thereafter as increases in silent reading in grades 2, 3, and 4 were observed. Also declining in later grades was the total time that students were observed reading aloud and in silent reading.

All three students in the disability/LEP category were engaged in reading behaviours during instruction that were at, or above, the levels for their cohort.

Children were more likely to be engaged in reading activities in a one-on-one situation with the teacher (cohort 1) or a peer tutor (cohorts 2 and 3), yielding reading aloud probabilities of 0.53, 0.57 and 0.61, respectively. The next best instructional arrangements for promoting reading aloud were small groups and the classroom teacher. Only occasionally was reading aloud promoted by worksheets, other media tasks or whole class grouping.

Students were more likely to be engaged in silent reading if the following approaches were used during reading instruction (a) workbooks and whole-class instruction led by the regular teacher, yielding a probability of silent reading (p) of 0.32 (cohort 1), (b) workbooks and whole-class instruction with the regular teacher, p = 0.26 (cohort 2), and readers and whole-class instruction led by a student teacher, p = 0.72 (cohort 3). The other significant promoters of silent reading were small group, independent, or one-on-one with readers, workbooks, and worksheet tasks/materials.

Overall, students' reading fluency was growing, but more slowly over three years. There were no significant cohort differences in growth parameters, suggesting that relative to the mean level of cohort 3, the early interventions experienced by the younger cohorts (1 and 2) had not differentially accelerated their reading fluency levels by second grade. However, the growth of silent reading did accelerate more for the earlier cohorts than for cohort three in the second grade.

In general, high-risk students had the lowest mean level of reading fluency at second grade, and they were making the lowest monthly progress, compared with average- and low-risk group students. However, the shape of their trajectory over time was more linear and accelerating compared with those of the other two groups.

Harvey (1999)

What are the broad aims of the study?

To present evidence relevant to the development of more effective models of INSET where activity-based teaching methods are being introduced. To compare the teaching methods employed by primary science teachers who were provided with coaching with those who received only centre-based workshops and a control group who received no inset.

Which variables or concepts, if any, does the study aim to measure or examine?

The study set out to establish whether:

- teachers that have participated in the Primary Science Programme (PSP) InSET use different methods to those that have not;

- teachers change methods more readily if they participate in both classroom support and workshops, than if they participate in workshops only; and

- changes in teaching methods are sustainable after support is withdrawn.

What are the results of the study as reported by authors?

PSP teachers were more focused in their aims and more versatile. More activity-based learning took place, more complex activities were introduced, and pupils contributed more of their own experience and knowledge. There was more attention paid to developing English skills and more relevant lesson content. However, pupils still rarely asked the teacher questions and rarely showed any other forms of initiative.

Teachers changed their teaching methods more readily if they participated in both classroom support and workshops than if they had workshops only. Pupils were not more likely to ask questions or show other kinds of initiative and there was no evidence of an overall increase in group work. Teachers were clearer in their planning, more

logical in their progression and used a wider range of teaching methods. Pupils were more likely to learn through self-activity, presentation was likely to be more relevant and they were likely to contribute more to lessons.

The study provided only limited evidence for sustainability of changes attributable to PSP INSET.

Jacobsen (2001)

What are the broad aims of the study?

The investigation aimed:

(a) to examine what effective technology integration looks like;

(b) to find out the extent to which children can be engaged in authentic learning tasks with ICT;

(c) to explore how professional development can effectively support teachers to effectively integrate technology into teaching and learning;

(d) to explore the resulting impacts on student learning when teachers take advantage of technology for their teaching tasks.

Which variables or concepts, if any, does the study aim to measure or examine?

Whether a particular form of CPD was effective in helping to achieve technology integration and whether this integration had an impact on student learning.

The work of the Galileo Educational Network was measured, using interviews and observational data, and analysed using the published checklists of 26 indicators of engaged learning and 22 indicators of high technology performance.

This framework for measuring effective learning with technology is organised into eight categories of learning and instruction: vision of learning, tasks, assessment, instruction, learning context, grouping, teacher roles, and student roles.

What are the results of the study as reported by authors?

Teacher behaviour changed so that they became more of a facilitator, guide, co-learner and co-investigator. Tasks were designed to be authentic and engaging, and built on students' interests, ideas and active questioning, rather than dispensed as photocopied sets of present questions for students to fill in.

When presented with opportunities to explore and enquire into essential questions and enduring ideas that were meaningful to them, students'

work exceeded expectations for level and quality of scholarship. Student engagement was sustained, and at higher levels of thinking and reasoning.

Teachers implemented both fundamentally different teaching and learning strategies, and also integrated new technologies with the support of the Galileo Network teachers. Many teachers admitted that they would not have pushed themselves and their students as far without the onsite access to sustained professional dialogue, pedagogical and technological support and reassurance of Galileo Network teachers.

Klingner et al. (2004)

What are the broad aims of the study?

In this year-long, quasi-experimental study of collaborative strategic reading (CSR), the authors sought to determine:

(a) the relative effectiveness of CSR, in comparison with no CSR implementation, for enhancing the reading comprehension of students with LD, average- and high-achieving students, and low-achieving students;

(b) the strategic knowledge acquired by students with LD in CSR classes compared with students with LD in control classrooms;

(c) teachers' implementation of CSR given the real world challenges they faced; and

(d) the ways in which teacher characteristics influenced their learning and use of a complex set of comprehension strategies.

Which variables or concepts, if any, does the study aim to measure or examine?

Researchers set out to measure:

- students' comprehension of expository, narrative and setting passages

- how students applied comprehension strategies on a transfer task

- teacher classroom management

- students' engagement

- which comprehension strategies were taught

- how teachers implemented CSR

- how students were grouped

- how texts were read (silently, aloud by teacher, aloud by student)

Students were identified as low achieving (LA), LD,

or average/high achieving (AA/HA).

What are the results of the study as reported by authors?

Students in CSR classrooms showed greater improvement in reading comprehension than comparison groups. When scores were compared by achievement level (i.e. high/average, low, or LD) and condition, students in CSR classrooms demonstrated higher gains; only those gains made by the high/average-achieving group were different at a statistically significant level. Students with LD in CSR classes showed more gains in strategic knowledge than their peers in control classes.

In both conditions, there was wide variation across classrooms in students' comprehension gains. In general, CSR teachers with higher levels of CSR implementation (in quantity and quality) yielded greater gains than CSR teachers with lower levels of implementation.

Students in the CSR condition showed significantly greater gains than control students on the Gates-MacGinitie Reading Tests. In general, the LA students in both conditions made greater gains in comprehension than students in other achievement groups, with the LA students in CSR classes showing the greatest actual gain.

Lin (2002)

What are the broad aims of the study?

The purposes of this study were to investigate changes of science teaching and to explore the factors which influenced changes of three first-grade teachers when implementing an in-service project.

How can elementary science teachers improve the effectiveness of their teaching and increase student learning of science concepts (using a constructivist approach)?

Which variables or concepts, if any, does the study aim to measure or examine?

The researcher sought to explore changes in the teachers' science teaching resulting from the intervention and also factors which influenced these changes.

Teaching strategies: Within the 5E instructional sequence, several different instructional strategies were used in the three first-grade teachers' classes, with each being matched to the nature of constructivism.

What are the results of the study as reported by authors?

Students were more able to take a more active role in the construction of the practical experiments, and reported enjoying science more and finding it easier. Students felt they had more input and involvement in lessons than previously, and were able to discuss their ideas more openly. Some students expressed difficulties with the constructivist approach: for example, by saying they preferred being given notes or found too many different views confusing.

There are three groups of factors that seem to influence teacher development: personal factors, intervention factors and contextual factors. These three factors interact in a complex manner, affecting each other and in turn influencing teacher development.

In general, the teachers showed positive attitudes toward the new approach. In addition, the insights offered by research provided teachers with a rationale for thinking about teaching and learning. It was the first time for the teachers since their initial teacher training that they had looked at practice from a reflective and theoretical stance. The opportunity to be involved in the experiment was valued by all interviewed students and they were able to take a more active role in the construction of the practical experiments.

Martin et al. (2001)

What are the broad aims of the study?

The primary objective of the present investigation was to determine the degree to which the positive effects of cognitive strategy instruction on deaf learners are international or cross-cultural, given similar conditions of teacher training, application of methodologies, and application of specific material.

Which variables or concepts, if any, does the study aim to measure or examine?

A series of pre-intervention and post-intervention measures was carried out as follows, with experimental and control classes:

- creative and thinking behaviours

- a randomly selected group of five students in each experimental and control classroom taking Raven's Standard Progressive Matrices (1959) test to measure reasoning skills

- creative skills tested by a narrative task in problem-solving

What are the results of the study as reported by authors?

Students in both countries used critical and creative thinking habits more, and improved their reasoning skills. Student attentiveness in the classroom increased in both countries, and began to use cognitive vocabulary on a regular basis in the classroom. They also appeared to take others' viewpoints during the discussions more easily than prior to the study, and improved their ability to explain a problem in their own words.

Chinese teachers carried out the instruction in a more sequenced and invariant approach than the English, who adapted the activities to specific children and their characteristics. Teachers in both countries increased their use of higher level questioning in classroom discussions.

McCutchen et al. (2002)

What are the broad aims of the study?

To help teachers understand the phonology represented in spelling patterns in English, and to be familiar with ways to help foster the development of their students' phonological awareness and word-reading skills. Teachers were then to assess the effect of that knowledge on their classroom practice and their students' learning.

Which variables or concepts, if any, does the study aim to measure or examine?

The study aimed to measure teachers' knowledge and beliefs about teaching reading, their knowledge of phonology and orthography, their role in broader literacy instruction, and their general knowledge.

Teachers: Codes comprised four broad categories: the knowledge afforded by the instructional activity; the literacy activity in which the class was engaged; textual context; and group context.

Students' literacy development in experimental and control classrooms was assessed many times during the school year. Measures of assessment: phonological awareness; ability to analyse spoken words for initial sounds; and orthographic fluency, listening comprehension, word-reading and word-sound/word-spelling.

What are the results of the study as reported by authors?

Teachers' phonological knowledge deepened after instruction and they spent significantly more time on activities directed toward phonological awareness than control group teachers. Experimental group teachers were more explicit than control teachers in some aspects of literacy instruction. Although all teachers spent considerable time on orthographic activities, no significant differences across conditions emerged.

Kindergarten pupils' phonological awareness increased in relation to teacher's use of strategies. The experimental group gained an average 50% more in letter production than children in control classrooms. Listening comprehension grew, but there was no significant difference in starting point or growth between experimental and control classrooms. Students in the experimental group did not perform statistically differently in word reading from those in the control group.

For Year 1 pupils:

- Phonological awareness increased 36% on average.
- Orthographic fluency: there was no significant effect.
- Reading comprehension increased 60% on average.
- Reading vocabulary increased 29% on average.
- Spelling increased 37% on average.
- Composition fluency increased 100% on average.

Mink and Fraser (2002)

What are the broad aims of the study?

The purpose of the study was to determine the extent to which the classroom implementation of project SMILE positively influenced the classroom environment and student attitudes towards reading, writing and mathematics. SMILE is a programme which involves changing the classroom environment and approaching the teaching of mathematics through children's literature.

Which variables or concepts, if any, does the study aim to measure or examine?

The study aimed to examine the difference, if any, between students' perceptions of actual and preferred learning environments. Also students' attitudes to reading, writing and mathematics before and after the intervention.

Case studies were used to supply qualitative data.

What are the results of the study as reported by authors?

Students' attitudes to writing and mathematics improved to a statistically significant degree. Attitudes towards reading did not show a statistically significant change.

Levels of classroom satisfaction that were actually

created by the teachers were very similar to the levels preferred by the students, although they felt there was too much friction and competition, and too little cohesiveness. There were no significant associations between classroom environment and attitudes to reading, writing or mathematics. In all, cohesiveness was the strongest predictor of student satisfaction.

The case study teacher changed her attitude towards the teaching of reading and writing. She wanted to continue to teach reading and writing through mathematics. She suggested to the principal that all the teachers take the SMILE programme during the next year. She thought that the SMILE programme had contributed to raising school test scores from 'C' to 'A', and that the most significant changes were in students' attitudes towards learning mathematics and the classroom environment.

Reis et al. (1998)

What are the broad aims of the study?

The study aimed to investigate the impact of providing one type of gifted education pedagogy, enrichment clusters, to the entire population of two urban elementary schools.

Which variables or concepts, if any, does the study aim to measure or examine?

Content, methodologies, products and processes of enrichment clusters.

What are the results of the study as reported by authors?

In 80% of the clusters students developed products, performances and services. In every cluster offered for 12 or 10 weeks, products were developed. Many students (65%) learned advanced vocabulary as a result of their involvement in the enrichment clusters. Advanced thinking skills, such as problem solving and creative thinking were also evident in many enrichment clusters - 44% problem solving and advanced thinking, 43% creative thinking.

Facilitators in 55% of the clusters used advanced resources and reference materials with the students and, as a result, they learned to identify, classify and categorise their finds in relation to the field. 59% and 57% respectively in each school reported that the enrichment clusters influenced what happened in their classrooms.

The increase in strategies used in the classroom were mainly in the following areas:

- responding to students' interests
- using hands-on activities
- encouraging students to complete products and

independent work
- using interest groups in the classroom
- increasing concentration on thinking skills of various types

58% of teachers indicated that clusters had directly influenced their classrooms, with 42% indicating that their teaching had not directly been changed (although four of these qualified it with reasons due to current situations e.g. not yet influenced as the strategies were too new).

Sandholtz (2001)

What are the broad aims of the study?

The purpose of the study was to investigate the nature of effective CPD programmes which promote technology use in classrooms through a comparison of two different programmes: one provided by a private computer company and the other by a local education authority.

Which variables or concepts, if any, does the study aim to measure or examine?

The following key features of the two programmes were described and compared:

- teacher input into design
- teacher choice
- administrator involvement
- situated teacher development
- participant collaboration
- constructivist environment
- flexibility
- adequate funding

The outcomes of the two programmes were explored and compared in relation to the following:

- access to equipment
- administrative support
- technical support
- collegial support
- classroom implementation
- Teachers at district level and in an ACOT grouping

What are the results of the study as reported by authors?

Students used technology for practising basic skills, word-processing, researching on the Internet, compiling information, and creating presentations. Students working on an individualised literacy and mathematics programme could usually do so without assistance, progress at their own pace, and

receive rapid feedback.

Some students became experts and taught peers across classes. Some became adept at using hypermedia and multimedia applications, and most teachers reported their students using technology for word-processing, researching on the internet, compiling information and making presentations.

Support from principals improved and they had more reasonable expectations of teachers' use of technology. The greater the degree of risk-taking accepted by principals, the more quickly teachers integrated technology into classroom use.

Lack of technical support in some instances impeded teachers' ability to put what they had learned into practice. When barriers, such as limited access to computers and lack of support, were overcome, teachers did make changes to their practice involving technology.

Sawka et al. (2002)

What are the broad aims of the study?

This study reports on the Strengthening Emotional Support Service project that was designed to build capacity in special educational classrooms serving students with Education and Behavioural Difficulties (EBD).

Which variables or concepts, if any, does the study aim to measure or examine?

- Staff knowledge
- Consumer satisfaction - how much interest they had, how much value they received and the effectiveness of presentation
- Teacher implementation of procedures
- Student classroom behaviour - to assess student academic engagement and disruptive behaviour

What are the results of the study as reported by authors?

Student academic engagement in the classrooms increased (from 47% to 70%) and disruptive behaviour decreased (from 70% to 37%).

Staff knowledge improved: the average percentage correct on pre-tests was 36% and this increased to 83%, showing an average gain of 46%.

Teacher implementation of procedures improved: one week following the training 43% of the task analysed steps were correctly implemented. Following on site consultative support, this increased to average of 87%.

Swafford et al. (1999)

What are the broad aims of the study?

The purpose of this study was to design a professional development programme incorporating the components that theory and research indicated were salient in producing change and chart the impact of this programme as an agent for change. The study examined the effects of a three-year professional development programme on teachers' instructional practice.

Which variables or concepts, if any, does the study aim to measure or examine?

The researchers set out to assess the impact on the following:

- teacher knowledge of mathematics
- teacher knowledge of mathematics teaching and learning
- the impact of CPD which incorporated opportunities for reflection and collaboration

What are the results of the study as reported by authors?

Students formulated their own mathematical thinking and assessed the quality of their classmates' thinking. Students worked in groups to construct games where the probability of winning was more than one half … their solution … led to some creative thinking and forged connections with an earlier problem solving process.

Teachers improved their content knowledge for each of the areas covered by the project (probability, statistics, geometry and algebra), as well as their professional knowledge, confidence in teaching and effectiveness in teaching mathematics. Teachers spent more time on problem solving, mathematical thinking and reasoning, and on communication. They focused more on increasing students' interest in, and understanding of, mathematical applications and having them explore problems and their extensions in different ways. They used broader assessment techniques.

67% of all participants identified new content as one of the major instructional changes they had made during the project and more than 91% of all participants perceived increased technology use as a major instructional change.

The teachers perceived themselves to be more confident and more willing to take risks. Of the participants, 48% mentioned increased self-confidence as a perceived change resulting from project participation.

Wilkins (1997)

What are the broad aims of the study?

The purpose of this study was to determine the effects of a resident mentor teacher on student achievement in mathematics.

Which variables or concepts, if any, does the study aim to measure or examine?

The study primarily aimed to measure student achievement in mathematics.

What are the results of the study as reported by authors?

Students in treatment schools made overall statistically significant improvements over a two-year period in their mathematical skills in comparison with control schools. 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. 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.

Participating teachers reported increases in their perceptions of their ability to teach, in their enthusiasm, and increases in their desire to incorporate additional performance-based instruction and assessment activities into their lessons. All teachers viewed the use of portfolios and journals as beneficial practice in mathematics instruction and planned to continue using these assessment techniques. Teachers were surprised to discover that inclusion projects and activities did not negatively impact upon instructional time.

Zetlin et al. (1998)

What are the broad aims of the study?

The study aimed to investigate whether a comprehensive and collegial approach to professional development would result in changes in teachers' practice and behaviour which enhance literacy development in language minority (ESL) students.

Sustaining the training over an extended period was a fundamental aspect of the project.

Which variables or concepts, if any, does the study aim to measure or examine?

The study measured teachers self-perceived changes in teaching practices and effectiveness, and additional qualitative data on the effect on teacher behaviour, impact on student achievement and barriers that impeded professional development.

What are the results of the study as reported by authors?

Students with few skills, who were significantly behind their peers, benefited from the individual conferencing in writing and reading centers, and showed growth. Students, who were reluctant to read or write at the start of the year due to very low ability, became enthusiastic in the writing and library centres once they began experiencing success. Teachers found students enjoyed instruction and took responsibility for learning.

Students gained confidence, developed skills for relating to peers, and developed as leaders in the centre-based environment. Students, who had exhibited behaviours that would have led to retention or referral to special education in the past, thrived in the restructured classrooms.

Teachers emphasised the increase in collegial interaction and formation of peer teams. More time was devoted to individualised reading and writing due to the shift to centre based activities. Teachers also gained a greater understanding of learning processes as well as a growing awareness of a variety of approaches and materials for language arts instruction.

Appendix 4.2: Conclusions with regard to CPD from the individual studies

Boudah et al. (2003)

The researchers in the Boudah study concluded that their results 'provide some direction in addressing the question, 'What makes teacher professional development successful?' They highlighted (p 15) in particular:

- on-site training
- engaging teachers as active learners and enabling them to observe new techniques
- demonstration, practice and feedback
- modelling in the real-world environment of the classroom and in addressing actual instructional issues

Bryant et al. (2001)

First, when teachers have a shared understanding of goals for their students, teaming is an effective model for promoting collaboration and planning among general and special education teachers. Time must be allocated for teachers to share their personal knowledge about their students and teaching and to receive guidance from 'experts' on topics … Third, student progress monitoring should be included as part of strategy training to ensure that students are benefiting from the instruction … Finally, professional development activities require time … for in-class modelling, preparing for instruction and teacher planning. (pp 262–263)

Cho (2002)

'Throughout the programme, teachers had unique opportunities to develop the STS units, to work together, to teach units in their classrooms, and to reflect upon their teaching using videotapes and comments from peer teachers. The units that they developed were shared with each other, and as a result the participating teachers were provided with materials covering several units in the curriculum.' (p 1032)

Ertmer and Hruskocy (1999)

'Despite (or maybe because of) limited resources, teachers and university personnel developed some resourceful ways to provide Midland teachers and students with time, training and support to begin the implementation process. Teachers' current levels of enthusiasm may prove instrumental over the next year as they begin tackling some of the more difficult barriers to technology use.' (p 93)

Fine and Kossack (2002)

'The implications for university teacher development courses are profound. In this era of standards-based change, anxious practitioners are grasping at the straws of out-of-context test preparation in lieu of maintaining public and educator confidence in the solid benefits of quality teaching… The results of this study suggest that if universities re-orient methods courses in ways that demonstrate the positive change that is associated with improved teacher practice, in this case the effect on attitude and student performance of rubric-driven Cognitive Peer Coaching on teachers' professional practice, change, and growth, and student achievement, the university can, once again, establish itself as a significant player in this era of change: both as an effective agency for teacher development, while at the same time a proactive agent of change.' (pp 36-37)

Greenwood et al. (2003)

'The current findings support the effectiveness of professional development approaches that extend beyond in-service work to include sustained classroom consultation to effect changes in classroom practice. Also supported were features of collaboration focused on the interests and concerns of classroom teachers as related to their continuing participation in, planning of, implementation of, and evaluation of new practices.' (p 109)

Harvey (1999)

The findings support the applicability of the conclusions of Joyce and Showers (1988) to South Africa. Effective INSET needs to offer an appropriate social context for the collaborative testing, validation and adoption of new teaching methods. Harvey also draws the conclusion that coaching may be a prerequisite for change alarming in the South African context because of the resource implications. He goes on to explore alternative models, including peer coaching and leader teachers.

Sandholtz (2001)

Features of successful professional development (p 372) include the following:

- teacher input into the design
- participant choice
- administrator support
- learning in real situations
- teacher collaboration
- adequate funding

Sawka et al. (2002)

Skills training did not 'spontaneously generalise' to effective implementation at the classroom level. Consultative support was successful at facilitating the transfer of learning from the training setting to the classroom setting… Prior to the training teachers only possessed about 1/3 of the knowledge necessary to implement the validated procedures for implementing CPD…This supports the need for providing additional skills based training to teaching staff… Adult learners prefer skills based, how to instruction with opportunities to practise skills in the training setting. (pp 227-229)

Swafford et al. (1999)

'This study demonstrates that a carefully planned program of professional development grounded in the teacher change literature can significantly impact instructional practice. More specifically, it shows that a long-term program which enhances teachers' content and pedagogical knowledge and provides the infrastructure for collaboration and reflection can influence what is taught and how it is taught…The project evaluation demonstrates that a combination of enhancing teachers' knowledge and providing an infrastructure for collaboration and reflection is a powerful change model… teachers are willing and indeed able to change their classroom practices when they are given extensive and on-going exposure to a culture of reform, time to build new knowledge and reflect on current practice and continuing opportunities for collaboration and collegial support.

'The major implication of this study is that professional development programs for teachers need to embody an infrastructure that enhances teachers' content and pedagogical knowledge in an environment that supports collaboration and reflection. Content knowledge impacts teachers' instructional practice and the participants in this study showed significant gains in content knowledge that was reflected in their classroom practice.' (pp 79-80)

Wilkins (1997)

The mentor model used in the study appears to be an effective method of offering teacher training to large numbers of teachers. The method of teacher training (used in the school district) at the time of the study (1996-97) was to train one or two teachers and have them offer a staff development session to other teachers in the district. The author suggests that a more effective method could be to have those one or two teacher specialists train a resident mentor teacher from each school and have the mentor teachers train school staff. The programme specialists would act as mentors to the local school specialists, who in turn would mentor the members of their staff.

Zetlin et al. (1998)

Involvement in this comprehensive professional development model over an extended period of time gave participating teachers an opportunity to practice new ideas with collegial support, and to increase knowledge regarding teaching, curriculum and learning. The individualised nature of this approach helped overcome teacher resistance and offered ongoing support to teachers who differed in their predispositions and readiness to change. …As teachers perceived gains in students learning and motivation, their change efforts were reinforced.

Researchers too underwent changes. They increased their understanding and knowledge of 'real world' problems facing teachers in today's classrooms, which enhanced their initial teacher training. (pp. 23-24)

The results of this systematic review are available in four formats:

SUMMARY — Explains the purpose of the review and the main messages from the research evidence

REPORT — Describes the background and the findings of the review(s) but without full technical details of the methods used

TECHNICAL REPORT — Includes the background, main findings, and full technical details of the review

DATABASES — Access to codings describing each research study included in the review

These can be downloaded or accessed at **http://eppi.ioe.ac.uk/reel/**

The **Evidence for Policy and Practice Information and Co-ordinating Centre** (EPPI-Centre) is part of the Social Science Research Unit (SSRU), Institute of Education, University of London.

The EPPI-Centre was established in 1993 to address the need for a systematic approach to the organisation and review of evidence-based work on social interventions. The work and publications of the Centre engage health and education policy makers, practitioners and service users in discussions about how researchers can make their work more relevant and how to use research findings.

Founded in 1990, the Social Science Research Unit (SSRU) is based at the Institute of Education, University of London. Our mission is to engage in and otherwise promote rigorous, ethical and participative social research as well as to support evidence-informed public policy and practice across a range of domains including education, health and welfare, guided by a concern for human rights, social justice and the development of human potential.

The views expressed in this work are those of the authors and do not necessarily reflect the views of the funder. All errors and omissions remain those of the authors.

This document is available in a range of accessible formats including large print. Please contact the Institute of Education for assistance:

telephone: +44 (0)20 7947 9556   email: info@ioe.ac.uk